GONDWANA UNIVERSITY
GADCHIROLI

SYLLABUS
For

M. Sc.
BOTANY
SEMESTER I & II

Under
Choice Based Credit System
(CBCS)

(With effect from : 2016-17)

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Botany.

Semester I

Core	Theory / Practical	Teaching Scheme			Credit	Examination Scheme					
		Hrs/ week				Duration in hrs.	Max. Marks		Total	Minimum Marks	
		Theory	Practical	Total			External	Internal		Theory	Practical
PSCBOTT01	Paper - I	4	-	4	4	3	80	20	100	40	
PSCBOTT02	Paper - II	4	-	4	4	3	80	20	100	40	
PSCBOTT03	Paper -III	4	-	4	4	3	80	20	100	40	
PSCBOTT04	Paper - IV	4	-	4	4	3	80	20	100	40	
Pract. – I PSCBOTP01	Practical - I	-	8	8	4	6	80	20	100	40	40
Pract. – II PSCBOTP02	Practical - II	-	8	8	4	6	80	20	100	40	40
Seminar - I	Seminar - I	2	-	2	1			25	25	10	
TOTAL		**18**	**16**	**34**	**25**		**480**	**145**	**625**	**170**	**80**

Semester II

Core	Theory / Practical	Teaching Scheme			Credit	Examination Scheme					
		Hrs/ week				Duration in hrs.	Max. Marks		Total	Minimum Marks	
		Theory	Practical	Total			External	Internal		Theory	Practical
PSCBOTT05	Paper - V	4	-	4	4	3	80	20	100	40	
PSCBOTT06	Paper - VI	4	-	4	4	3	80	20	100	40	
PSCBOTT07	Paper -VII	4	-	4	4	3	80	20	100	40	
PSCBOTT08	Paper -VIII	4	-	4	4	3	80	20	100	40	
Pract. – III PSCBOTP03	Practical - III	-	8	8	4	6	80	20	100	40	40
Pract.- IV PSCBOTP04	Practical - IV	-	8	8	4	6	80	20	100	40	40
Seminar - II	Seminar - II	2	-	2	1			25	25	10	
TOTAL		**18**	**16**	**34**	**25**		**480**	**145**	**625**	**170**	**80**

Project Work/Dissertation Scheme / Guidelines for the Students, Supervisors and Examiners

Every student is required to carry out a project work in semester IV. The project can be of following types. A) Experimental Project Work; OR B) Field Based Project Work; OR C) Review writing based Project Work.

Experimental Project Work and Field Based Project Work:

Student can carry out Experimental / Field Based Project Work on a related research topic of the subject /course. It must be an original work and must indicate some degree of experimental work / Field work. On the basis of this work, student must submit the Project Report (typed and properly bound) in two copies at least one month prior to commencement of the final Practical / lab Examination of Semester IV. The project report shall comprise of Introduction, Material and Methods, Results, Discussion, Summary, Conclusion and, References along with the declaration by the candidate that the work is original and not submitted to any University or Organization for award of the degree and certificate by the supervisor and forwarded through Head / Course-coordinator / Director of the Department / Centre or the Principal of the College.

Review writing based Project Work.

Student can carry out review writing Based Project Work on a related topic of the subject / course. It must be a review of topic based on research publications. Student shall refer peer reviewed original research publications and based on findings, write a summary of the same. The pattern of review writing shall be based on reputed reviews published in a standard, peer reviewed journals. On the basis of this work, student must submit the Project Report (typed and properly bound) in two copies at least one month prior to commencement of the final Practical / lab Examination of Semester IV. The project report shall comprise of Abstract, Introduction, detailed review, Discussion, Summary, Conclusion and, References along with the declaration by the candidate that the work is original and not submitted to any University or Organization for award of the degree and certificate by the supervisor and forwarded through Head / Course-coordinator / Director of the Department / Centre or the Principal of the College.

*The supervisors for the Project Work shall be from the following.

A person shall be an approved faculty member in the relevant subject.
OR

Scientists of National Laboratories / Regional Research Laboratories/ Experts from R&D in Industry who are approved by competent authority in such facilities by the Union Government / the State Government / Gondwana University / Other Universities recognized by UGC.

The Project Work will carry total 100 marks and will be evaluated by both external and internal examiner in the respective Department / Center / Affiliated College.

The examiners will evaluate the Project Work/Dissertation taking into account the coverage of subject matter, arrangement and presentation, references, etc.

For written Project work	**40**	**Marks – Evaluated jointly by External & Internal examiner**
Oral Presentation	20	Marks – Evaluated jointly by External & Internal examiner
For Viva-Voce	20	Marks – Evaluated by External examiner
Internal Assessment	20	Marks – Evaluated by Internal examiner
Total	100	

Seminar
Guidelines for Students, Supervisors and Examiners

In each semester, the student will have to deliver a seminar on any topic relevant to the syllabus / subject encompassing the recent trends and development in that field / subject. The topic of the seminar will be decided at the beginning of each semester in consultation with the supervising teachers. The student has to deliver the seminar which will be followed by discussion. The seminar will be open to all the teachers of the department, invitees, and students.

The students should submit the seminar report typed and properly bound in two copies to the head of the department. The said shall be evaluated by the concerned supervisor / head of the department. The marks of the seminar shall be forwarded to the university within due period through head of the Department. The record of the seminar should be preserved till the declaration of the final result.

Internal Assessment:

1. The internal assessment marks shall be awarded by the concerned teacher.
2. The internal assessment marks shall be sent to the University after the Assessment in the prescribed format.
3. For the purpose of internal assessment the University Department / College shall conduct any three assignments described below. Best two scores of a student in these tests shall be considered to obtain the internal assessment score of that student.

4. If the student does not appear for the Practical Exam he shall be declared failed in Practical Examination irrespective of marks obtained in Internal Practical Assessment. However the Internal Practical Assessment marks will be carried forward for his next supplementary Practical Exam.

5. General guidelines for Internal Assessment are:
   a) The internal assessment marks assigned to each theory paper as mentioned in Appendix 1 shall be awarded on the basis of assignments like class test, attendance, home assignments, study tour, industrial visits, visit to educational institutions and research organizations, field work, group discussions or any other innovative practice / activity.
   b) There shall be three assignments (as described above) per course.
   c) There shall be no separate / extra allotment of work load to the teacher concerned. He/ She shall conduct the Internal assessment activity during the regular teaching days / periods as a part of regular teaching activity.
   d) The concerned teacher / department / college shall have to keep the record of all the above activities until six months after the declaration of the results of that semester.
   e) At the beginning of each semester, every teacher / department / college shall inform his / her students unambiguously the method he / she proposes to adopt and the scheme of marking for internal assessment. (Prescribed in syllabus of respective Subjects).
   f) Teacher shall announce the schedule of activity for internal assessment in advance in consultation with HOD / Principal.

Practical Examination

1. Each practical carries 100 marks. The scheme of marking shall be as per given in the syllabi of respective subjects.
2. Practical performance shall be jointly evaluated by the External and Internal Examiner. In case of discrepancy, the External Examiner's decision shall be final.
3. Duration of practical examination will be as per given in the syllabi of respective subjects.
4. The Practical Record of every student shall carry a certificate as shown below, duly signed by the teacher-in-charge and the Head of the Department. If the student fails to submit his / her certified Practical Record duly signed by the Teacher-In-Charge and the Head of the Department, he / she shall not be allowed to appear for the Practical Examination and no Marks shall be allotted to the student.

5. The certificate template shall be as follows:

C E R T I F I C A T E

Name of the college / institution _
Name of the Department: _

This is to certify that this Practical Record contains the bonafide record of the Practical work of Shri / Shrimati / Kumari _ of M. Sc. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ Semester _ _ _ _ _ _ _ _ _ _ during the academic year _ _ _ _ _ _ _ _. The candidate has satisfactorily completed the experiments prescribed by Gondwana University Gadchiroli for the subject _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Dated _ _ _ / _ _ _ / _ _ _ _ _

Signature of the teacher who taught the examinee — Head of the Department

1. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
2. _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

SEMESTER I

PRACTICAL I **Course code : PSCBOTP01** **Credit - 04**

Time : 6 Hours	Full marks : 80
Q. 1 To identify the given Cyanobacterial material **A**.	06
Q.2 To identify two algal forms **B, C**, from the given mixture.	06
Q.3 To identify the given fungal culture **D**	06
Q. 4 To identify the given pathogen in the given material **E**.	06
Q. 5 To prepare a Temporary microprepration of the given Bryophytic **F** material and identify it.	12
Q 6. To prepare a Temperory microprepration of the given Pteridophytic **G** material and identify it.	12
Q. 7 Comment on the given spot **H** (Cyanobacteria/Bacteria), **I** (Algae), **J** (Fungi), **K** (Plant Pathology) **L** (Bryophyte) , **M** (Pteridophyte).	12
Q.8 Viva-voce	10
Q. 9 Practical Record and tour report	10

SEMESTER I

PRACTICAL II Course code : PSCBOTP02 **Credit - 04**

Time : 6 Hours Full marks : 80

Q. 1 To prepare a double stained microprepration of the given gymnospermic material **A** and identify it.	12
Q.2 Comment on the given fossil specimen **B**	12
Q.3 One experiment from Cytology **C**	12
Q. 4 One experiment from Genetics **D**	12
Q. 5 Comment on the given spot **E** (Gymnosperm) **F** (Paleobotany), **G** (Cytology), **H** (Genetics)	12
Q.6 Viva-voce	10
Q. 7 Practical Record and tour report	10

SEMESTER II

PRACTICAL III Course code : PSCBOTP03 **Credit - 04**

Time : 6 Hours Full marks : 80

Q. 1 To perform the given physiological experiment A and report The findings	15
Q.2 To quantify the given metabolite in the given sample B	10
Q.3 To study the cytohistological zonation in SAM of given material C	10
Q. 4 To perform the given exercise based on plant development D	10
Q. 5 Write a note on given stage of micro- or megasporogenesis E	06
Q. 6 Spotting: F (Physiology), G (Plant development), H (Reproduction)	09
Q. 7 Viva-voce	10
Q. 8 Practical Record	10

SEMESTER II

PRACTICAL IV Course code : PSCBOTP04 **Credit - 04**

Time : 6 Hours **Full marks : 80**

Q. 1 One experiment from paper VII A	14
Q.2 One experiment from paper VII B	10
Q.3 One experiment from paper VIII C	14
Q. 4 One experiment from paper VIII D	10
Q. 5 Spotting: E (Paper VII), F (Paper VII), G (Paper VIII), H (Paper VIII)	12
Q. 6 Viva-voce	10
Q. 7 Practical Record and field diary	10

M. Sc. Botany Syllabus
Semester I
Course code- PSCBOTT01 **Credit - 04**
PAPER –I: Microbiology, Algae and Fungi

UNIT – I

General Microbiology :
History – Contributions made by Leeuwenhoek, Pasteur, Robert Hook, Jenner, Waksman, Iwanowsky. Koch‟ s Postulate.
Bacteria – Structure, morphology, reproduction.
Viruses – General account; Morphology and ultrastructure of TMV, Bacteriophage; Introduction to viroids, prions and interferon.
Archaebacteria and eubacteria: General account; ultrastructure, nutrition and reproduction, biology and economic importance; **Cyanobacteria:** *Microcystis, Lyngbya, Nostoc, Scytonema, Gloeotrichia and Stigonema*.

UNIT - II

Phycology:

Criteria for classification of algae: Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Pheophyta and Rhodophyta; pigments, reserved food, flagella
Algae in diversified habitats (terrestrial, freshwater, marine), thallus organization; cell ultrastructure; reproduction (vegetative, asexual, sexual); algal blooms, algal biofertilizers; algae as a food, feed and uses in industry.

UNIT –III

General account: Classification of Fungi (recent trends and criteria used in classification); Physiology of Fungi (with reference to biotrophs, hemibiotrophs, symbionts); Fungal Cytology : Heterothallism, heterokaryosis, parasexual cycle.
Comparative study, classification and evolutionary trends in the following:
Myxomycota: Protist characters and general account with special reference to *Physarium* and *Plasmodiophora*
Eumycota: i. Oomycetes : *Saprolegnia, Synchytrium, Phytophthora, Peronospora,* ii. Zygomycetes : *Mucor, Rhizophus, Syncephalastrum, Cunninghamella*

UNIT – IV

Comparative study, classification and evolutionary trends in the following: iii. Ascomycetes: *Saccharomyces, Phyllactinia, Chaetomium, Xylaria*, iv. Basidiomycetes: *Melampsora, Puccinia, Ravenelia, Ustilago, Polyporus*, v. Deuteromycetes: *Helminthosporium, Fusarium, Colletotrichum, Phoma*

Plant Pathology : Symptomology, histopathology, etiology and identification of diseases with reference to following fungal, bacterial and viral diseases (Paddy blast, wheat rust, bunt of wheat, smut of jowar, black arm of cotton, red rot of sugarcane, citrus canker, gummosis, leaf curl of papaya, potato blight.)

Laboratory Exercises:

Classification and type study of the following classes

Cyanobacteria: *Microcystis, Lyngbya, Nostoc,*

Scytonema, Gloeotrichia and Stigonema.

Prochlorophyta : *Prochloron*

Chlorophyta: *Pandorina, Eudorina, Stigeoclonium, Ulva, , Chlorella, Scenedesmus,*

Caulerpa, Valonia, Acetabularia.

Phaeophyta : *Spacelaria, Padina, , Turbinaria.*

Rhodophyta :, *Nemalion, Gelidium, Gracilaria, Corallina, Polysiphonia.*

Euglenophyta :, *Euglena, Phacus.*

Bacillariophyta : *Cyclotella, Synedra, Cymbella, Navicula, Gomphonema.*

Morphological Studies of Fungi (any 15 of the following)

Stemonities, Perenospora, Phytopthora, Albugo, Mucor, Rhizopus, Yeast, Aspergillus, Penicillium, Chaetomium, Taphrina, Peziza, Erisyphe, Phyllactenia, Uncinula, , Melamosora, Uromyces, Drechslera,Ravenallia, Ustilago, Polyporus, Morchella, Cyathus, , Alternaria, Helminthosporium, Curvularia, Colletotrichum, Phoma, Plasmodiophora, Cercospora, Fusarium, Claviceps.

Symptomology of some diseased plants (any 7 of the following).

White rust of Crucifers, Downy mildew, powdery mildew, Rusts, Smuts, Ergot, Groundnut leaf spot (Tikka disease), False smut of paddy, red rot of Sugarcane, Wilt disease, Citrus canker, Angular leaf spot of cotton, Potato blight, Leaf mosaic of bhindi/ papaya, Leaf curl of tomato/Potato/Papaya, Little leaf of brinjal.

Identification of Fungal cultures (Any 5)

Rhizopus, Mucor, Aspergillus, Penicillum, Drechslera, Curvularia. Phoma, Colletotrichum, Alternaria, Helminthosporium.

Field study: For collection and studying fungal flora

Suggested Readings:

1. Kumar HD (1988) Introductory Phycology. Affiliated East-West Press Ltd. New Delhi
2. Morris I (1986) Introduction to the Algae. Cambridge University Press, UK
3. Round FE 1986 The Biology of Algae. Cambridge University Press, UK
4. Mandahar CL 1978 Introduction to Plant Viruses. Chand & Co. Ltd., New Delhi
5. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
6. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.
7. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.
8. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.
9. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc.Wiley, New York
10. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
11. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.
12. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.
13. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.
14. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S. Chand & Co. Ltd.
15. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology - S.Chand & Co. Ltd.
16. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.
17. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.
18. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.
19. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermidiate Press.
20. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.
21. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.
22. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.
23. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.
24. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.
25. Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.
26. On line Journals available on UGC -VSAT

M. Sc. Botany Syllabus
Semester I
Course code : PSCBOTT02 **Credit - 04**
PAPER –II: Bryophytes & Pteridophytes

UNIT - I

General characters, distribution, classification, ecology of Bryophytes, Bryophytes as ecological indicators, morphogenesis in bryophytes, fossil history of bryophytes, cytology of bryophytes, regeneration in bryophytes, modern trends in taxonomy.

UNIT - II

General account in-
Hepaticopsida: Sphaerocarpels, Takakiales
Anthocerotopsida: Anthocerotales,
Bryopsida: Sphagnales, Polytrichales..

UNIT - III

General characters, distribution, classification, evolution of stele, heterospory and seed habit, apospory and apogamy; Important contributions of Indian Pteridologists, General account of Ryniopsida, Psilopsida, Lycopsida [protolepidodendrales, Lycopodiales, Selaginales, Isoetales.

UNIT - IV

General account of Sphenopsida [Hyeniales, Equisetales], Filicopsida [Ophioglossales, Filicales, Salvinales, Marsileales], Tracheophyta [Progymnospermosida].

BRYOPHYTES:

Laboratory Exercises:-

Study of morphological and reproductive characters of representative members mentioned in the syllabus using cleared whole mount preparations, dissections and sections. Preparation of permanent slides is necessary. Study of bryophytes in their natural habitats.
Botanical excursion outside the state is compulsory to study the bryophytes in their natural conditions.

PTERIDOPHYTES:

Laboratory Exercises:-

Pteridophytes-

Study of fossil forms (specimens and permanent micropreparations).
Study of living forms: Morphological, anatomical and reproductive characters of the forms mentioned in the syllabus. Anatomical characters to be studied either by taking free hand sections (t.s./ l.s.) and by observing the permanent micropreparations. Preparations of permanent slides are essential.

Suggested Readings

1. Andrews H.N. Jr. (1961) Studies in Paleobotany (Jonh Wiley & Sons, New York)
2. Arnold C.A. (1947) An introduction to Paleobotany (McGraw Hill, New York) 13
3. Banks H.P. (1968) The early history of Land plants. In evolution and environment, ed. E.T. Drake. New Haven: Yale Univ. Press, pp, 73-107.
4. Banks H.P. (1970) Evolution and plants of past. (Belmont, California, Wadsworth).
5. Banks, H. P. (1975). Reclassification of Psilophyta, Taxon. 24, 401-13.
6. Berrie, G. K. (1963). Cytology and Phylogeny of liverwoets. Evolution 17, 347-357.
7. Bierhorst D.W (1971) Morphology of vascular plants, New York (Mac Millan)
8. Campbell, D. H. (1961). The evolution of the Land Plants (central Book Depot, Allahabad)
9. Cavers, F. (1910). The interrelationship of Bryophyta I-IV. New Phytologist. 9
10. Cavers, F. (1911). The interrelationship of Bryophyta VII-IX. New Phytologist. 10.
11. Chrysler M.A. (1910) The fertile spike in Ophioglossaceae. Ann. Bot. 24:1-18.
12. Delevoryas T. (1962) Morphology and Evolution of fossil plants (Holt, Rinehart and Winston, New York).
13. Eames A.J (1936) Morphology of vascular plants, lower groups (McGraw Hill, New York).
14. Foster A.S.and E.M Gifford Jr. (1959) Comparative morphology of vascular plants Freeman, San Fransisco.
15. Grolle, R. (1963). Takakia in Himalayas, Ost. Bot. Zeitscher, 110:444-447.
16. Gupta K.M. (1962) *Marsilea,* Botanical monograph no. 2 (CSIR, New Delhi).
17. Ingold, C. T. (1939). Spores discharge in land plants (Oxford London)
18. Kashyap S.R. (1929). Liverworts of the western Himalayas and The Punjab Plain1(Chronica Botanica)
19. Kashyap S.R. (1933). Liverworts of the western Himalayas and The Punjab Plain2(Chronica Botanica)
20. Lacey, W. A. (1969). Fossil Bryophytes. Biological Reviews, 44,189-205.
21. Mehra , P.N. and O. N. Handoo (1953). Morphology of Anthoceros erectus and A. himalayensis and the phylogeny of the anthocerotales. Bot. Gaz.114:371-382.
22. Parihar N. S. (1976). An introduction to Embriyophyta, Bryophyta (Centaral Book House,

Allahabad)
23. Parihar N.S. (1977) The biology and morphology of the Pteridophytes (Central Book Depot, Allahabad).
24. Pichi- Sermolli REG (1959) Pteridophyta in vistas in botany, WB Turrill, ed. (Pergamon Press, London) pp 421-493.
25. Proskauer J. (1951). Study in Anthocerotales, III, The Bryologist 53,165-172.
26. Puri Prem (1985) Bryophytes- A broad perspective.
27. Ramanujam CGK (1992) Origin and evolution of lycopods Paleobotanist 41, 51-57.
28. Rashid A. (1982) (4th edn) An introduction to pteridophyta (Vikas Publ House Pvt Ltd.)
29. Schuster R. (1966). The Hepaticae and Anthocerotae of North America. East of the Hundredth meridian, Newyork (Colombia University Press).
30. Scott D.H. (1908) Studies in fossil botany. London, Black Part 2.
31. Scott D.H. (1920-1923) Studies in fossil botany. (A & C Black London.)
32. Sharma O.P (1996) Textbook of pteridophyta (Mac Millan India Ltd, New Delhi)
33. Smith A. J. E. (1986). Bryophyte phylogeny fact or Fiction? Journal of Bryology, 14,83-
34. Smith G. M. (1955). Cryptogamic Botany-vol. 2 Bryophyta and Pteridophyta (McGraw Hill Book compony, Newyork)
35. Smith W. N. and G. W. Rothwell (1993). Paleobotany and the evolution of plants (Cambridge Univ. press)
36. Sporne K.R. (1962) The morphology of pteridophyta (Hutchinson Univ. Library, London)
37. Steil W.N. (1939) Apogamy, Apospory and Parthenogenesis in the pteridophyta, Bot. rev, 5, 433-453.
38. Steward W.N. (1983) Paleobotany and the evolution of plants. 1st ed. New York, (Cambridge Univ. press)
39. Surange K.R and S. Chandra (1972) Fructification of Glossipteridae from India, Paleobotanist 21, 1-17.
40. Taylor T.N. (1988) the origin of land plants- Some answers more questions, Taxon, 37, 805-33.
41. Udar ram (1970) An introduction to bryophyte (Shashidhar malviya Prakashan, Lucknow)
42. Udar Ram, Srivastava S.C. and Kumar Dinesh (1970) Genus *Buxbaumia* in India, Curr. Sci. (India) 39, 14-15.
43. Walton J. (1925) Carboniferous Bryophyta I. Hepaticae. Annals of Botany, 39, 563-72.
44. Walton J. (1928) Carboniferous Bryophyta II. Hepaticae & Musci. Annals of Botany, 42, 707-16.
45. Walton J. (1940) An introduction to the study of fossil plants. A& C Black, London.
46. Watson E.V. (1967) The structure and life of Bryophytes, 2nd ed, London, Hutchinson.
47. Wilson C.W. (1942) The telome theory and the origin of the stamen. Am. J Bot., 29, 759-764.
48. Zimmermann W. (1952) Main results of the "Telome theory". The Paleobotanist, Birbal Sahni Memorial Volume, 456-70.

M. Sc. Botany Syllabus

Semester I

Course code ; PSCBOTT03 **Credit - 04**

PAPER –III: Gymnosperms and Paleobotany

UNIT - I – Paleobotany

Introduction : Plant fossils – Preservation, preparation, age determination, geological time scale; Fossil record – systematic, reconstruction and nomenclature; Applied aspects of paleobotany.

UNIT - II – Gymnosperms

General account, distribution (living, Fossil), origin, systems of classification, economic importance.

Comparative morphology and evolutionary tendencies of

1. Pteridospermales – Lyginoptridaceae (*Calymotheca hoeninghausii, Hetarngium, Spherostoma*) Medullosaceae (*Medullosa, Trignocarpus*)
2. Cycadales – Cycadaceae; Fossil history (*Baenia, Nilssonia, Androstrobus*)
3. Cycadeoidales – Williamsoniaceae, Cycadoeoidaceae

UNIT - III

4. Cordaitales (General account and relationships)
5. Caytoniales (General account and relationships)
6. Glossopteridales (General account and relationships)
7. Pentoxylales (General account and relationships)
8. Gnetales (General account and relationships)

UNIT - IV

9. Ginkgoales – *Ginkgo, Baiera, Trichopitys*
10. Coniferales – (Morphology, reproductive organs, gametophytes, embryo)
11. Taxales – *Taxus*

Laboratory Exercises:-

Comparative Study of vegetative and reproductive parts of – *Cycas, Zamia, Cedrus, Abies, Pinus, Cupressus, Cryptomeria, Taxodium, Podocarpus, Agathis, Thuja, Gnetum, Ephedra, Juniperus,*
Cephalotaxus, Taxus
Permanent micropreparatious to be submitted by the students.
***Ginkgo*:** Morphology to be studied from Museum specimens & anatomy from permanent slides only.
Study of important fossil gymnosperms from material and permanent slides.
Visit to palaeobotanical Institutes, localities and collection of specimens.
Field visits to ecologically different localities to study living gymnosperms.

Suggested Readings:

1. Stewart, W.N. and Rothwell G.W. (1993), Palaeobotany and the Evolution of Plants, Cambridge University Press.
2. Foster A.S. & Gifford F.M. (1967): Comparative morphology of vascular plants, Freeman Publishers, San Fransisco.
3. Eames, A.J.(1974): Morphology of Vascular Plants- lower groups, Tata Mc-Graw Hill publishing Co., New Delhi.
4. Arnold, C.A. (1947): Introduction to Palaeobotany, Mc-Graw Hill Book Co. Inc., New York and London.
5. Kubitzki K. (1990), The families and genera of vascular plants Pteridophytes and Gymnosperms, Springer Verlag, New York
6. Agashe, S.N. (1995), Palaeobotany, Oxford & IBH, New Delhi.
7. Biswas, C & Johri, B.N. (2004), The Gymnosperms, Narosa Publishing House, New Delhi.
8. Coulter J.M. & Chamberlain C.J.(1978): Morphology of Gymnosperms, Central Book Depot, Allahabad.
9. Kakkar, R.K.and Kakkar, B.R. (1995), The Gymnosperms (Fossils & Living), Central Publishing House, Allahabad.
10. Sharma O.P. (2002) Gymnosperms, Pragati Prakashan, Meerut.
11. Siddiqui, K.A. (2002) Elements of Palaeobotany, Kitab Mahal, Allahabad.
12. Bhatnagar, S.P. and Moitra A. (1996), Gymnosperms, New Age International Pvt. Ltd., New Delhi.
13. Singh, H. (1978), Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X, Gebryder, Bortragear, Berlin.
14. Pant, D.D. (2003): Cycas and allied Cycadophytes, BSIP, Publications.
15. Bierhorst D.W. (1971): Morphology of vascular plants McMillan, New York.
16. Thomas, B.A. & Spicer R.A. (1987): The Evolution and Palaeobiology of land plants. Discordies Press, Fortland, USA.
17. Spicer, R.A. & Thomas, B.A. (1986) Systematic and taxonomic approaches in Palaeobotany. Systematic Association Special Volume.
18. Chamberlain C.J. (1986); Gymnosperms, structure and Evolution, CBS publishers and distributors, New Delhi. On line Journals available on UGC -VSAT

M.Sc. Botany Syllabus
Semester I
Course code : PSCBOTT04 **Credit - 04**
Paper- IV Cytology and Genetics

UNIT - I

Mendel‟ s laws of inheritance; chromosome theory of inheritance; deviations from Mendel‟ s findings; Penetrance and expressivity; Modifiers, suppressors and pleiotrpic genes; multiple alleles and isoalleles (example Corn, *Drosophila* and *Nicotiana*); multigene families (globin and immuniglobin genes); sex determination and dosage compensation in plants, *Drosophila*, *C. elegans*.

UNIT – II

Chromatin organization: Chromosome structure and packaging of DNA; molecular organization of centromere and telomere, rRNA genes, euchromatin and heterochromatin; Karyotype analysis and evolution, banding patterns; specialized types of chromosomes: polytene, lampbrush, B-chromosome, sex chromosome; molecular basis of chromosome pairing, C- value paradox, Cot curve and its significance.

UNIT – III

Structural and numerical changes in chromosomes; origin, breeding behavior of duplications, deficiency, inversion and translocation heterozygotes; effect of aneuploidy on plants; transmission of trisomics and monosomics and their use in chromosome mapping; complex translocation heterozygotes, translocation tester sets; Robertsonian translocation.

UNIT – IV

Mutations: Spontaneous and induced; physical and chemical mutagens; molecular basis; transposable genetic elements; site directed mutagenesis; role of mutations in crop improvement; induction of polyploidy
Epigenetics: Introduction; paramutations in maize; Callipygh sheep; role of histones; DNA methylation; Epigenetics and Lamarckism; Epigenome and epigenomics.

Laboratory Exercises:-
1. To study the effect of mutagen treatment on germination, seedling height and cell division.
2. To study the spontaneous and induced chromosomal aberrations in pollen mother cells.
3. To study the effect of mutagen treatment on pollen fertility.
4. To study the karyotype of given organism.
5. To study the chiasma frequency in the given material.
6. To study linear differentiation of chromosomes by chromosome banding.
7. To perfom the site directed mutagenesis in the given system.

Suggested Reading

Gupta P K 2007 Genetics: Classical to Modern. Rastogi Publications, Meerut.
18
Hexter W and Yost Jr. H T 1977 The Science of Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
Hartl D L and Jones E W 1998 Genetics: Principles and Analysis (4th ed.). Jones and Barflett Publishers, USA.
Khush G S 1973 Cytogentics of Aneuploids. Academic press, New York.
Snustad D P and Simmons M J 2000 Principles of Genetics (2nd ed.) John Wiley and Son Inc., USA.

M. Sc. Botany Syllabus
Semester II
Course code : PSCBOTT05 **Credit - 04**
Paper- V Plant Physiology and Biochemistry

UNIT – I

1) The Scope of plant physiology
2) Photosynthesis: Evolution of photosynthetic apparatus, pigments, Light, light harvesting complex, Mechanism of electron transport, Photo protective mechanism, CO_2 fixation, C_3, C_4 and CAM pathway, Photorespiration, photosynthesis Physiological and ecological consideration (photosynthetic responses to light by the intact leaf, photosynthetic responses to carbon dioxide and temperature) coupled reaction and ATP Synthesis, the chemiosmatic-coupling hypothesis, ATP Synthesis in chloroplast and in mitochondria

UNIT –II

Respiration:- introduction, the respiratory substrate, fermentation, anaerobic and aerobic respiration, mechanism of respiration ,Glycolysis, Citric acid cycle, oxidative pentose phosphate pathway, Plant mitochondrial electron transport, alternative pathway of electron transport chain, cyanide resistant chain, metabolic pool, respiratory ratio, measurement of R.Q., Regulation of respiration ,respiratory enzymes, the non oxidat ive enzymes, the oxidative enzymes, factor affecting the rate of respiration

UNIT –III

1) Carbohydrates Metabolism
General classification and properties of carbohydrates, synthesis of starch and Sucrose, catabolism (degradation) of starch and sucrose
2) **Lipids Metabolism**
General classification and properties of lipids, fatty acid biosynthesis, synthesis of membrane

lipids, synthesis of structural lipids, synthesis and catabolism of storage lipids.

3) **Metabolism of amino acids**

General claqssification and properties of amino acids, amino acid biosynthesis in plants, assimilation of inorganic nitrogen in to n-transport amino acids, GS/GOGAT Cycle

4) **Nitrogen metabolism**

Nitrogen cycles, Biological Nitrogen fixation by free-living and symbiotic bacteria, nif genes

5) **Sulfur and Phosphate assimilation by the plants**

UNIT -IV

Enzymes: - nomenclature and classification of Enzymes, Isoenzymes, Allosteric Enzymes, Multienzymes, Ribozymes, Lysozymes, Ribozymes & Abyzymes and Coenzymes enzyme kinetics, mode and mechanism of Enzyme action (Regulation of Enzyme activity), Activators & Inhibitiors, properties of Enzymes, factors affecting Enzyme activity pH, Buffer, reaction kinetics, colligative properties

Solute transport and photo-assimilate translocation:- Mechanism of water transport through xylem; Pathway of translocation patterns of Translocation through phleom;

Source and sink, Materials Translocated in the Phloem i.e. Sucrose, Amino acids, Hormones and some inorganic ions, Rate of Movement, Phloem loading: from chloroplast to sieve elements, Phloem Unloading: sink-to-source Transition, mechanism of translocation in the phloem

Laboratory Exercises:-

To study the effect of time and enzyme concentration on the rate of reaction of enzyme (e.g. phosphatase, nitrate reductase).

To study the effect of substrate concentration on activity of enzyme and determination of its Km value.

Demonstration of the substrate inducibility of the enzyme nitrate reductase.

Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.

To determine the total carbohydrate content in the given sample

Estimation of Pectic Substances-gravitic mthod

To prove Berr-Lambert‟ s law using a suitable solution.

Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophyll and carotenoids.

To determine the chlorophyll a/ cholorophyll b ratio in C3 and C4 plants.

Isolation of intact chloroplasts and estimation of choloroplast proteins by spot protein assay.

Preparation of standard curve of protein (BSA) and estimation of protein content in extracts of plant material by Lowry‟ s or Bradford‟ s method.

Preparation of Leaf Protein Concentrates from green vegetables.

Determination of reducing sugars by Nelson – Somogyi Method

Suggested Readings (for laboratory exercises):

1 **Bajracharya, D. 1999.** Experiments in Plant Physiology: A Laboratory Manual. Narosa Publishing House, New Delhi.

2 **Cooper, T.G. 1977.** Tools in Biochemistry. John Wiley, New York, USA.21

3 **Copeland, R.A. 1996.** Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis. VCH Publishers, New York.

4 **Dennison C. 1999.** A guide to Protein Isolation. Kluwer Academic Publishers, Dordrecht, The Netherland.

5 **Devi, P. 2000.** Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios, Jodhpur, India.

6 **Dryer, R. L. and Lata, G. F. 1989.** Experimental Biochemistry. Oxford University Press, New York.

7 **Hames, B.D.(Ed.).1998.** Gel Electrophoresis of Proteins: A Practical Approach, 8th edition. PAS, Oxford University Press, Oxford, UK.

8 **Harborne, T.C. 1981.** Phytochemical Methods: A Guide to Modern Techniques of Plants Analysis. Chapman& Hall, London.

9 **Moore, T.C. 1974.** Research Experiences in Plant Physiology: A Laboratory Manual. Springer-Verlag, Berlin.

10 **Ninfa, A. J. and Ballou, D. P. 1998.** Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Fitzgerald Science Press, Inc., Maryland, USA.

11 **Plummer, D.F. 1988.** An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

12 **Scott, R.P.W. 1995.** Techniques and Practice of Chromatography. Marcel Dekker, Inc., New York.

13 **Wilson, K. and Goulding, K.H.(Eds), 1986.** A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London,UK.

14 **Wilson, K. and Walker, J. 1994.** Practical Biochemistry: Principles and Techniques, 4th edition. Cambridge University Press, Cambridge, UK.

15 Sadasivam and Manikum: Biochemical Methos , New Age International (p) Limited Publishers 4835/24, Ansari Road, Daryaganj, New Delhi- 110002

SUGGESTED READINGS (FOR THEORY):

1 **Buchanan, B. B., Gruissem, W. and Jones, R.L. 1989.** Biochemistry and Molecular Biology of plants. American Society of Plant Physiologists, Maryland, USA.

2 **Dennis, D.T., Turpin, D. H., Lefebvrc, D.D. and Layzell, D.B. (eds).1997.** Plant Metabolism (2nd Ed.) Longman, Essex, England.

3 **Gaiston, A.W.1989.** Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.

4 **Hooykass P.J.J., Hall, M. A. and Libbenga, K.R.(eds).1999.** Biochemistry and Molecular Biology of plant Horm. Elsevier, Amsterdam, The Netherlands.
5 **Hopkins, W.G. 1995.** Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
6 **Lodish, H., Berk, A., Zipursky S.L., Matsudaira, P., Baltimore, D and Darnell, J. 2000.** Molecular Cell Biology (4th ed). W. H. Freeman and Company. New York ,USA.
7 **Moore, T.C. 1989.** Biochemistry and Physiology of Plant Hormones (2nd ed). Springer-Verlag, New York, USA.
8 **Nobel, P.S.1999**. Physicochemical and Environmental Plant Physiology (2nd ed). Academic Press, Diego, USA.
9 **Salisbury, F.B. and Ross, C.W.1992:** Plant Physiology (4th ed). Wadsworth Publishing Co., California, USA.
10 **Singhal G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee.1999:** Cocepts in Photobiol Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.
11 **Taiz, L. and Zeiger, E. 1998:** Plant Physiology. Sinaucr Associates, Inc., Publishers, Massachus, USA.
12 **Thomas,B. and Vince-Prue,D.1997:** Photoperiodism in Plants (2nd ed). Academic Press, San Diego, USA.
13 **Westhoff, P.1998:** Molecular Plant Development: From gene to plant. Oxford University Press, Oxford, UK.
14 **Dey, P. M. And Harborne, J. B. 2000:** Plant Biochemistry ,Harcourt Asia PTE Ltd. A Harcourt Publishers International Company, 583 Orchard Road 09-01 Forum Singapore-238884
15 **Ranjan, purohit, Prasad 2003:** Plant Hormones Action and Application, Agrobios(India), agro house, behind Nasrani cinema Chopasani Road, Jodhpur -34

M. Sc. Botany Syllabus
Semester –II
Course code : PSCBOTT06 **Credit - 04**
Paper- VI: Plant Development and Reproduction

UNIT - I

Plant growth
Kinetics and pattern of growth
Shoot Development – Organization of shoot apical meristem (SAM); cytological and molecular analysis of SAM; control of cell division and cell communication; control of tissue differentiation.
Phytohormones: Classification, chemical nature and their role in plant development.

UNIT - II

Leaf growth and differentiation – Determination; phyllotaxy; control of leaf form; differentiation of epidermis (with special reference to stomata & trichomes) and mesophyll.
Root Development – Organization of root apical meristem (RAM); vascular tissue differentiation; lateral root hairs; root microbe interactions.
Flower Development – Physiology of flowering, florigen concept and photoperiodism, Genetics of floral organ differentiation; homeotic mutants in *Arabidopsis* and *Antirrhinum*. Pollination mechanisms and vectors

UNIT - III

Male Gametophyte – Structure of anther, microsporogenesis, tapetum; pollen development and gene expression; male sterility; sperm dimorphism; pollen germination; pollen tube growth and guidance.
Female Gametophyte – Ovule types; megasporogenesis; organization of embryo sac; structure of embryo sac cells.
Pollen – pistil interaction and fertilization; Structure of the pistil; pollen – stigma interactions, double fertilization; *in vitro* fertilization.

UNIT - IV
Seed Development and fruit growth – Endosperm development; embryogenesis; ultrastructure and nuclear cytology; storage proteins of endosperm and embryo; polyembryony; apomixes; embryo.
Germination of seed: Biochemical and hormonal control.
Latent life – **Dormancy** : Importance and types of dormancy; seed dormancy; overcoming seed dormancy; bud dormancy.
Senescence and Programmed Cell Death (PCD) – Basic concepts; types of cell death, PCD in life cycle of plants; metabolic changes associated with senescence and its regulations; influence of hormones and environmental factors on senescence.

Laboratory Exercises/ Field Exercises (Any 12):

1. Tissue systems, meristem, vascular and cork cambium
2. Internal structure of root, stem and leaf (dicot and monocot), advanced secondary growth in dicot stem and root.
3. Anomalies in primary and secondary structure of stem
4. Study of living shoot apices by dissections using aquatic plants such as *Ceratophyllum* and *Hydrilla*.
5. Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double-stained permanent slides of a suitable plant such as *Coleus, Kalanchoe, Tobacco.* Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.
6. Study of alternate and distichous, alternate and superposed, opposite and superposed; opposite and decussate leaf arrangement.
7. Examination of rosette plants (*Launaea, Mollugo, Raphanus, Hyoscyamus* etc) and induction of bolting under natural conditions as well as by GA treatment.
8. Microscopic examination of vertical sections of leaves such as *Cleome, Nerium,* Maize and Wheat to understand the internal structure of leaf tissues and trichomes, glands etc. Also study the C3 and C4 leaf anatomy of plant.
9. Study of epidermal peels of leaves such as *Coccinia, Gaillardia, Tradescantia, Thunbergia,* etc. to study the development and finalstructure of stomata and prepare stomatal index. Demonstration of the effect of ABA on stomatal closure.
10. Study of whole roots in monocots and dicots. Examination of L.S. of root. from permanent preparation to understand the organization of root apical meristem and its derivatives. (use maize, aerial roots of banyan, Pistia, Jussieua etc.). Origin of lateral roots. Study of leguminous roots with different types of nodules.
11. Study of microsporogenesis and gametogenesis in sections of anthers.
12. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (Maize, Grasses, *Crotolaria, Tradescantia, Brassica, Petunia, Solanum melongena*, etc.)
13. Tests for pollen viability using stains and *in vitro* germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface culture.
14. Estimating percentage and average pollen tube length *in vitro.*
15. Role of transcription and translation inhibitors on pollen germination and pollen tube growth.
16. Pollen-pistil interaction, self-incompatibility, *in vitro* pollination.
17. Study of ovules in cleared preparations; study of monosporic, bisporic and tetrasporic types of embryo sac development through examination of permanent stained serial sections.
18. Field study of several types of flower with different pollination mechanisms (wind pollination, thrips pollination, bee/butterfly pollination, bird pollination).
19. Emasculation, bagging and hand pollination to study pollen germination, seed set and fruit development using self compatible and obligate outcrossing systems. Study of cleistogamous flowers and their adaptations.
20. Study of nuclear and cellular endosperm through dissections and staining.
21. Isolation of zygotic globular, heart-shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun (*Syzygium cumini*) etc. by dissections.

22. Study of seed dormancy and methods to break dormancy.

Suggested Readings:

1) Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
2) Fageri, K. and Van der Pol, L. 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.
3) Fahn, A. 1982. Plant Anatomy, (3rd edition). Pergamon Press, Oxford.
4) Fosket, D.E. 1994. Plant Growth and Development. A molecular Approach. Academic Press, San Diego.
5) Howell, S.H. 1998, Molecular Genetics of Plant Development. Cambridge University Press, Cambridge.
6) Leins, P., Tucker, S.C. and Endress, P.K. 1988. Aspects of Floral Development. J. Cramer, Germany.
7) Lyndon, R.F., 1990. Plant Development. The Cellular Basis. Unnin Hyman, London.
8) Murphy, T.M. and Thompson, W.F. 1988. Molecular PlantDevelopment. Prentice Hall, New Jersey.
9) Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
10) Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
11) Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
12) Raven, P.H., Evert, R.F. and Eichhorn, S.E. 1992. Biology of Plants (5th Edition). worth, New York.
13) Steeves, T.A. and Sussex, I.M. 1989. Patterns in Plant Development (2nd edition). Cambridge University Press, Cambridge.
14) Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London.
15) Waisel, Y., Eshel, A. and Kafkaki, U. (eds) 1996. Plant Roots: The Hidden Hall (2nd edition.) Marcel Dekker, New York.
16) Shivanna, K.R. and Sawhney, V.K. (eds) 1997. Pollen Biotechnology for Crop Production and Improvement, Cambridge University Press, Cambridge.
17) Shivana, K.R. and Rangaswamy, N.S. 1992. Pollen Biology: A Laboratory Manual. Springer-Verlag, Berlin.
18) Shivana, K.R. and Johri, B.M. 1985. The Angiosperm Pollen: Structure and Function. Wiley Eastern Ltd., New York.
19) The Plant Cell. Special issue on Reproductive Biology of Plants, Vol. 5(10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.
20) On line Journals available on UGC -VSAT

M. Sc. Botany Syllabus
Semester II
Course code : PSCBOTT07 **Credit - 04**
Paper- VII Cell and Molecular BiologyBiology- I

UNIT - I

Cell wall: Structure; function; biogenesis and growth; cell differentiation
Plasma membrane: Membrane architecture (fluid mosaic model); sites for ATPases; membrane transport - ion carriers, channels, pumps and aquaporins; receptors.
Plasmodesmata: Structure, role in movement of molecules and macromolecules; comparison with gap junction.

UNIT – II

Cellular organelles: Ultra-structure and function of golgi complex, lysosomes, peroxisomes, **endoplasmic** reticulum, mitochondria, chloroplast and plant vacuoles.
Cell shape and motility: The cytoskeleton; organization and role of microtubules and microfilaments; motor movements, implications in flagellar & other movements, cell division.

UNIT – III

Nucleus: Ultrastructure, nuclear pores, nucleolus, DNA structure A, B and Z forms, replication in prokaryotic and eukaryotic cells, DNA replication proteins, damage and repair.

UNIT – IV

Molecular biology of stress responses: Defination and classification of stress; Plant defence mechanism (passive and active); HR and SAR; modulation of plant metabolism in response to biotic stress: early and late response; production of ROS, induction of enzymes, induction of genes involved in phenylpropenoid metabolism; PR proteins and R- genes

Suggested Readings:

Atherly, A.G., Griton, J.R. and Mc Donald, J. F. 1999. The Science of Genetics.

Saunders College Pub. Fort Worth, USA

Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 Biochemistry and Molecular

Biology of Plants. American Soc. Of Plant Physiologists, Maryland, USA.

Bush, H. Rothblum, L. 1982. Vol. X. The Cell Nucleus RDNA part A. Academic

Press.

Dc, D. N. 2000 Plant cell vacuoles: An introduction. CSIRO Publication, Collingwood, Australia.

De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.

Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.

Kleinsmith, L.J. and Kish, V.M. 1995 Principles of Cell and Molecular Biology (2nd Edi.) Harper Collins Coll. Publisher, New York, USA.

Krishnamurthy, K.V. 2000 Methods in Cell wall Cyto-chemistry. CRC Press, Boca Raton, Florida

Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA

Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA

Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Practicals

Orcein staining of the salivary gland chromosomes of *Chironomus* and *Drosophila*.

Cell fractionation & isolation of Chloroplast and mitochondria.

Isolation of plant DNA and its quantification by spectrophotometric method.

To perform flagellary staining.

Isolation of DNA and preparation of Cot-curve.

Demonstration of vital structure and functions of cell

To study the induction of defence genes by elicitors.

Suggested Readings (for laboratory exercises):

Fukui, K. and Nakayama, S. 1996. Plant Chromosomes: Laboratory Methods. CRS Press, Boca Raton, Florida.

Glick, B. R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology and

Biotechnology. CRC Press, Boca Raton, Florida USA.
Goswami, H. K. 1986. Practical cytology – Applied Genetics and Biostatistics Himalaya Pub. House, Bombay.
Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology: Structure and Function. Jones and Barlett Publishers, Boston, Massachusetts.
Hall, J.L. and Moore, A.L. 1983.Isolation of Membranes and Organelles from Plant Cells Academic Press, London, U.K.
Harris,N. and Oparka, K.J. 1994. Plant Cell Biology: A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering. Har Academic Publishers, Australia.
Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press, Oxford.Techniques, 2nd edition. PAS, IRL Press at Oxford University Press, Oxford.

References: Online journals available on UGC V-SAT programme.

Review Journals:

Annual Review of Plant Physiology and Molecular Biology
Biochemistry and Cell Biology
Cell
Cell Biology International -
Cell Death and Differentiation -
Cell Motility and the Cytoskeleton -
Cellular Physiology and Biochemistry
Current Advances in Plant Sciences
Cytokine -
European Journal of Cell Biology -
Journal of Cell Science
Nature Reviews: Molecular and Cell Biology
Protoplasma- An International Journal of Cell Biology -
Trends in Cell Biology
Trends in Plant Sciences

M. Sc. Botany Syllabus
Semester II
Course code : PSCBOTT08 **Credit - 04**
Paper- VIII Angiosperms- I

UNIT - I

Angiosperm Morphology, structural units and floral symmetry, dicot and monocot flower; structure, diversity origin and evolution of stamen, carpels; placentation types and evolution. Floral adaptation to different pollinators

UNIT - II

Angiosperm Taxonomy: Scope, aims, principles of taxonomy, historical development of plant taxonomy, relative merits and demerits of major systems of classifications. Taxonomic structure: taxonomic hierarchy, concept of taxa, concept of species, concept of genus and family; Taxonomic character: HETEROBATHMY, ANALYTIC Vs. synthetic character, qualitative Vs quantitative characters.

UNIT - III

Taxonomic evidence: Morphology, anatomy, embryology, palynology, cytology, phytochemistry, genome analysis.
Taxonomic tools: herbarium, floras, monographs, botanical gardens, biochemical and molecular techniques, computers and GIS.

UNIT - IV

Biosystematics: The population concept phenotypic plasticity, biosystematic categories, methods of biosystematics studies. Numerical taxonomy: principles, aims and objectives, cladistics in taxonomy, polarity of characters, homology, homoplasy, monophyly, polyphily. Plant nomenclature: Salient features of ICBN

Laboratory Exercises:-
1. To study the floral symmetry in various taxa.
2. To study and work out the differences in dicot and monocot flower.
3. To study the variation in stamens and carpels.
4. To study placentation types in various taxa.
5. To study the floral adaptations for pollination.
6. To study anatomical features of various taxa.
7. To study embryological features of various taxa.
8. To study palynological features of various taxa.
9. To study cytological features of various taxa.
10. To prepare a cladogram on the basis of various morphological features of the species belonging to a genus.

Suggested Readings

Devis, P.H. and Heywood, V. H. 1973. Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.

Grant, V. 1971. Plant Speciation, Columbia University press, London.

Grant W. F. 1984**.** Plant Biosystematics. Academic press, London.

Harisson, H.J. 1971. New concept in flowering plant Taxonomy. Hickman educational books Ltd. London.

Hislop-Harisson, J. 1967. Plant Taxonomy. English Language Book Sco. And Edward Arnold Pub. Ltd, UK.

Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.

Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co. New York.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw- Hill Book Co., New York.

Nordentam, B., El Gazaly, G. and kassas, M. 2000. Plant systematic for 2ft century. Portlant press. Ltd, London.

Radford, A. E. 1986. Fundamentals of plant systematic. Harper and Raw publication, USA.

Solbrig, O.T. 1970. Principles and methods of plant Sytematics. The Macmillan Co. Publication Co. Inc., USA.

Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.

Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.

Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edvard Arnold Ltd, London.

Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.

Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., Newer RH 1975 Communities and Ecosystems (2nd ed) MacMillan, New York.

GONDWANA UNIVERSITY, GADCHIROLI

M.Sc.-I Semester I, II (Chemistry)

(Effective from 2016-17)

1. There will be four theory papers in every semester which will carry 80 marks each of 3 hrs. duration.

2. There will be internal assessment of 20 marks per paper per semester.

3. Each paper per semester with total of 100 marks(80+20 i.e. theory+internal assessment) will carry 4 credits.

4. The internal assessment will be based on Attendance, Home assignment, Unit test Terminal test and participation in departmental activities.

5. There will be two practical examinations in each semester i.e. Pract I and Pract II of 6-8 hours duration of 80 marks with 4 credits each.

6. In each semester, the student will have to deliver a seminar on any topic relevant to the syllabus / subject encompassing the recent trends and development in that field / subject. This will carry 25 marks per seminar with one credit.

7. So, the total marks allotted to the Chemistry subject per semester is 625 marks: Theory (320 marks) + Internal assessment (120 marks) + Practicals (160 Marks)+ Seminar (25Marks)= 625marks (total)

8. Each theory paper consists of four units of fifteen hours per unit.

The following syllabi are prescribed on the basis of four hours per week of each paper and nine practical periods per batch per week.

Scheme of Examination for M.Sc. (Chemistry)

Semester I	Internal Assessment	Total Marks	Credits
PSCChT01: Paper I (Inorganic Chemistry)	20 Marks	80 Marks	4 Credits
PSCChT02: Paper II (Organic Chemistry)	20 Marks	80 Marks	4 Credits
PSCChT03: Paper III (Physical Chemistry)	20 Marks	80 Marks	4 Credits
PSCChT04: Paper IV (Analytical Chemistry)	20 Marks	80 Marks	4 Credits
PSCChP01: Practical-I (Inorganic Chemistry)	20 Marks	80 Marks	4 Credits
PSCChP02: Practical-II (Organic Chemistry)	20 Marks	80Marks	4 Credits
PSCChP03: Seminar-I	---- --	25 Marks	1 Credits
Total:	**120 Marks**	**505 Marks**	**25 Credits**

Semester II			
PSCChT05: Paper V (Inorganic Chemistry)	20 Marks	80 Marks	4 Credits
PSCChT06: Paper VI (Organic Chemistry)	20 Marks	80 Marks	4 Credits
PSCChT07: Paper VII (Physical Chemistry)	20 Marks	80 Marks	4 Credits
PSCChT08: Paper VIII (Analytical Chemistry)	20 Marks	80 Marks	4 Credits
PSCChP04: Practical-III (Physical Chemistry)	20 Marks	80 Marks	4 Credits
PSCChP05: Practical-IV (Analytical Chemistry)	20 Marks	80 Marks	4 Credits
PSCChP06: Seminar-II	----	25 Marks	1 Credits
Total:	**120 Marks**	**505Marks**	**25 Credits**

General scheme for distribution of marks in practical examination

Time : 6-8 h (One day Examination) Total Marks : 80)
Exercise-1 - 30 Marks
Exercise-2 - 20 Marks
Viva-Voce -15Marks
Record -15 Marks

Question Paper Pattern: Each paper comprising of Max marks 80 of 3 hours duration

Que.-1 (From Unit I) – (A-8 Marks + B-8 Marks) = 16 Marks or (a-4 + b-4 + c-4 + d-4) = 16 Marks

Que.-2 (From Unit II) – (A-8 Marks + B-8 Marks) = 16 Marks or (a-4 + b-4 + c-4 + d-4) = 16Marks

Que.-3 (From Unit III) – (A-8 Marks + B-8 Marks) = 16 Marks or (a-4 + b-4 + c-4 + d-4) = 16Marks

Que.-4 (From Unit IV) – (A-8 Marks + B-8 Marks) = 16 Marks or (a-4 + b-4 + c-4 + d-4) = 16Marks

Que.-5 Short answer question each carry two marks (2 short questions from each unit)= 16 marks

Total: 80 marks

Syllabus prescribed for M.Sc. Chemistry Semester I

PSCChT01: Paper I (Inorganic Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I

A) **Stereochemistry and Bonding in Main Group Compound**: **5h**

VSEPER-Shape of simple inorganic molecules and ions containing lone pairs, various stereo chemical rules and resultant geometry of the compounds of non-transitional elements, short comings of VSEPR model. Bent's rule and energetics of hybridization.

B**) Metal – Ligand Bonding**: **10h**

Crystal Field Theory: Splitting of d-orbital in tetragonal, square planar and trigonal bipyramid complexes. John teller effect, spectrochemical series, nephelauxetic effect. Limitaion of crystal field theory. M.O.theory for octahedral, tetrahedral & square planar complexes with and without π-bonding.

Unit-II

A) **Metal – Ligand Equilibria in Solution**: **5h**

Stepwise and overall formation constants; trends in stepwise formation constants; factors affecting stability of metal complexes with reference to nature of metal ion, ligand, chelate effect and thermodyanamic origin. Determination of formation constant by : (1)spectrophotometric method (Job's and Mole ratio method) (2) Potentiometric method (Irving-Rossotti Method) B) Reaction Mechanism of Transition metal complexes: 10h

Energy Profile of a reaction, reactivity of metal complexes, Inert and Labile complexes, Kinetics of Octahedral substitution: Acid hydrolysis, factors affecting acid hydrolysis, Stereochmistry of intermidiates in SN1 & SN2 , Base hydrolysis, Conjugate base mechanism, Direct and indirect evidences in favour of conjugate mechanism, Annation reaction, reaction without metal-ligand bond breaking.

Unit-III:

Cluster- I 15h

Boron hydrides: Classification, nomenclature, structure, bonding and topology of boranes, 4-digit coding (s, t, y, x) numbers for higher boranes and their utilities. Chemistry of

diboranes: Study of Metalloboranes, Carboranes and Metallocarboranes with reference to preparations and structures.

Unit – IV

A**) Metal-Metal bonds: 10h**

Occurrence of metal-metal bond, Classification of metal clusters, Binuclear, trinuclear, tetranuclear, pentanuclear and hexanuclear with reference to halide, oxide, alkoxide and acetate clusters.

B) **Isopoly, Heteropoly acids and their anions. 5h**

List of Books

1) S. F. A. Kettle, J. N. Murral and S. T. Teddler: Valency Theory

2) C. A. Coulson: Valency

3) J. E. Huheey :Inorganic Chemistry

4) F .A. Cottonand G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5thand 6th Editions.

5) A. F. Willims: Theoretical Approach in inorganic chemistry.

6) A. Mannas Chanda: Atomic Structure and chemical Bonding

7) L. E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Ed.

8) J. J. Logowski: Modern Inorganic Chemistry

9) B.Durrant and P.J.Durrant: Advanced Inorganic Chemistry

10) J. C. Bailar: Chemistry of coordination compounds.

11) W. L. Jolly: Modern Inorganic Chemistry

12) R. S. Drago: Physical methods in inorganic chemistry.

13) Waddington: Nonaqueous solvents.

14) Sisler: Chemistry of nonaqueous solvents.

15) A. K. Barnard: Theoretical Inorganic Chemistry

16) Emeleus and Sharpe: Modern Aspect of Inorganic Chemistry.

17) F. A. Cotton: Chemical Applications of Group theory.

18) Jones: Elementary Coordination chemistry.

19) B. N. Figgis: Introduction to Ligand field.

20) S. F. A. Kettle: Coordination chemistry.

21) M.C.Day and J.Selbin: Theoretical Inorganic Chemistry.

22) J. Lewin and Wilkins: Modern Coordination Chemistry.
23) Gowarikar, Vishwanathan and Sheedar: Polymer science.
24) H. H. Jattey and M. Orchin: Symmetry in chemistry.
25) D. Schonaland: Molecular Symmetry in chemistry.
26) L. H. Hall: Group theory and Symmetry in chemistry
27) H. H. Jattey and M. Orchin: Symmetry in chemistry
28) R.L.Dutta and A.Symal: Elements of magneto chemistry
29) Inorganic Chemistry 4th Edition, P.Atkins, Oxford University Press.
30) Essential Trends in Inorganic Chemistry, D.M.P.Mingos, Oxford University Press

PSCChT02: Paper II (Organic Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: 15 h

A] **Nature and Bonding in Organic Molecule**

Delocalized chemical bonding, conjugation, cross conjugation, resonance, hyper-conjugation, bonding in fullerenes. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons Huckel's rule, energy level of π-molecules orbitals, annulenes, antiaromaticity, homoaromoaticity. Aromatic character and chemistry of cyclopentadienyl anion, tropylium cation, tropone and tropolone. Bonds weaker than covalent-addition compounds, crown ether complexes and cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes

B] Synthetic applications of enamines and imines anions in organic synthesis, phase transfer catalysis, crown ethers and graphene.

Unit-II: 15 h

A] **Streochemistry**

Conformational analysis of cycloalkanes (5 – 8 membered rings), substituted cyclohexanes , mono substituted, disubstituted and trisubstituted cyclohexanes, decalines, effect of conformation on reactivity, Cahn-Ingold-Prelog System to describe configuration at chiral centers . Elements of symmetry, chirality, molecules with more than one chiral center, meso compounds, threo and erythro isomers, method of resolution, optical purity, enantiotopic and distereotopic atoms, groups and faces, prochirality, addition-elimination reactions, stereospecific and steroselective synthesis. Asymmetrical synthesis, optical activity in absence of chiral carbon (biphenyl and allenes)

B] **Reactive Intermediates**

Generation, structure, stability and chemical reactions involving classical and non-classical carbocations, carbanions, free radical, carbenes, nitrenes and arynes. Singlet oxygen, it's generation and reactions with organic substrates.

Unit-III: 15 h

A] **Reaction mechanism: Structure and Reactivity**

Types of mechanism, Types of reaction, thermodynamics and kinetics requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammeett principle, Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects. Hard and soft acids and bases.

Effect of Structure on reactivity: Resonance and field effects, Steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft Equation.

B] Concept of neighboring group participation (anchimeric assistance) with mechanism, neighboring group participation by π and σ bonds, classical and non classical carbocations, Intramolecular displacement by hydrogen, oxygen, nitrogen, sulphur and halogen. Alkyl, cycloalkyl, aryl participation, participation in bicyclic system, migartory aptitude, carbocation rearrangements and related rearrangements in neighboring group participation.

Unit IV: 15h

A] **Aliphatic nucleophilic substitution**

The SN1, SN2, mixed SN1, SN2 and SET and SNi mechanisms. Nucleophilicty, effect of leaving group, ambient nucleophiles and ambient substrates regiospecificity, substitution at allylic and vinylic carbon atoms.

B] **Aromatic electrophilic substitution**

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The o/p ratio, ipsoattack, orientation in benzene ring with more than one substituents, orientation in other ring system. Diazonium coupling, Vilsmeir reaction, Gatterman-Koch reaction, Pechman reaction, Reimer-Tieman reaction, Diazonium coupling.

C] **Aromatic Nucleophilic Substitution**

A general introduction to different mechanisms of aromatic nucleophilic substitution SNAr, SN1, benzyne and SRN1 mechanisms. Reactivity - effect of substrate structure leaving group and attacking nucleophile. The Von Richter, Sommlet-Hauser and Smiles rearrangements.

List of books

1] Advanced Organic Chemistry –Reaction mechanism and structure. Jerry March, John Wiley

2] Advanced Organic Chemistry- F.A. Carey and R. J. Sunberg, Plenum

3] A Guidebook to Mechanism in Organic Chemistry-Peter Skyes, Longman

4] Structure and Mechanism in Organic Chemistry-C.K. Gold, Cornell University Press

5] Organic Chemistry, R.T. Morrison Boyd. Prentice Hall

6] Modern Organic Chemistry-H.O. House, Benjamin

7] Principal of Organic Chemistry-R.O.C. Norman and J.M. Coxon, Blackie Academic and Professional

8] Reaction Mechanism in Organic Chemistry-S.M. Mukharji and S.P. Singh, Macmilan

9] Stereochemistry of Organic Compounds- D. Nasipuri, New Age International

10] Stereochemistry of Organic Compounds- P. S. Kalsi, New Age International

11] Frontier Orbitals and Organic Chemical Reactions-I. Fleming

12] Orbital Symmetry – R. E. Lehr and A. P. Marchand

13] Reactive Intermediate in Organic Chemistry-N. S. Isaacs

14] Stereochemistry of Carbon Compounds- E. L. Eliel

15] Physical Organic Chemistry-J. Hine

16] Name Reaction in Organic chemistry –Surrey

17] Advanced Organic Chemistry – L. F. Fieser and M. Fieser.

18] Organic Chemistry Vol. I and II - I. L. Finar

19] Modern Organic Chemistry- J.D. Roberts and M. C. Caserio

20] The Search for Organic Reaction Pathways (Longmann), Peter Skyes

21] Organic Chemistry 5th Edition (McGraw Hill), S. H. Pine

22] Organic Chemistry (Willard Grant Press Botcon), John Mcmurry

23] A Textbook of Organic Chemistry- R. K. Bansal New Age International

24] New Trends in Green Chemistry –V. K. Ahluwalia and M. Kidwai, Anamaya publishers

25] Organic Chemistry, J. Clayden, N. Greeves, S. Warren and P. Wothers, Oxford University Press

26] Organic Chemistry, 4th Edition, G Marc Loudon, Oxford University Press

27] Nano Materials 2007, A. K. Bandyopadhyay, New Age International

PSCChT03: Paper III (Physical Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

UNIT I: FORMULATION OF QUANTUM MECHANICS 15h

A] Introduction of quantum mechanics, wave function, acceptability of wave functions, normalized and orthogonal wave functions, operators, properties of operators, eigen functions and eigen values, Hermitian operators, orbital and generalized angular momentum, eigen function and eigen values of angular momentum, postulates of quantum mechanics, (problems on operators, eigen values and average value)

B] Application of Schrodinger wave equation to simple systems: degeneracy in 3-dimensional box, rigid rotator, potential well of finite depth (tunneling effect), simple harmonic oscillator, the Hydrogen atom.

UNIT II: CLASSICAL THEMODYNAMICS 15h

A] Exact and inexact differentials, condition of exactness, Pfaff differential expression, derivation of thermodynamic equation of state, extensive and intensive properties. Homogeneous functions of degree 0 and 1. Maxwell's relations.

B] Third law of thermodynamics, unattainability of absolute zero, calculation of entropy, residual entropy and its application. Varial equation, fugacity, determination of fugacity.

C] Partial molar quantities: Determination of partial molar quantities, chemical potential, escaping tendency, partial molar volume, Gibbs Duhem equation, Gibbs Duhem Mergules equation, reaction potential, Extent of reaction (Xi).

UNIT III: PHASE EQUILIBRIA 15h

Phase rule, calculation of degrees of freedom, reduced phase rule, construction of phase diagram, one component systems: Helium, carbon, two component systems forming solid solutions having congruent and incongruent melting point, partially miscible solid phase, three component systems, graphical presentation, influence of temperature, systems with 1, 2, 3 pairs of partially miscible liquids, transition points, 1st and 2nd order phase transition, lambda line

UNIT IV: CHEMICAL KINETICS 15h

A] Theories of reaction rates: Unimolecular reactions, bimolecular reactions, collision theory, steric factor, temperature effect on reaction rates, Arrhenius equation and its

limitations, activation energy, transition state theory, steady state approximation, Lindeman-Hinshelwood mechanism, RRKM theory

B] Photochemistry: Introduction, quantum yield, photosensitizers, quenching, kinetics of anthrascene reactions, H_2-Br_2 and H_2-I_2 reactions.

C] Catalysis: Acid- base enzymes, enzyme catalysis, Michaelis Menten equation, effect of pH and temperature.

List of books

1. Ira .N. Levine, Quantum Chemistry, 5th edition(2000), Pearson educ., Inc.New Delhi
2. A.K.Chandra, Introductory Quantum Chemistry, 4th edition (1994), Tata Mcgraw Hill, New Delhi.
3. S.K.Dogra, S.Dogra, Physical Chemistry Through Problems.
4. M.W.Hanna, " Quantum Mechanics in Chemistry", Benjamin
5. L. Pualing and E. B. Wilson, Introduction to Quantum Mechanics with Applications to Chemistry, McGraw Hill, New York (1935).
6. R.P.Rastogi R.R. Mishra 6th revised edition An Introduction to Chemical Themodynamics.
7. Principles of Physical Chemistry by Puri, Sharma and Pathania,
8. P.W.Atkins.Physical chemistry. ELBS
9. E.N.Yenemin, " Fundamentals of Chemical Thermodynamics", MIR Publishers.
10. F.W.Sears, " Introdction to Thermodynamics, Kinetic Theory of Gases and statistical mechanics".Addison Wesley
11. G.M.Panchenkov and V.P.Labadev, " Chemical Kinetics and catalysis", MIR Publishing
12. E.A. Moelwyn- Hughes, " Chemical Kinetics and Kinetics of Solutions", Academic
13. K.J.Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York
14. J.Raja Ram and J.C.Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan Indian Ltd., New Delhi (1993)
15. R.K.Prasad," Quantum Chemistry", Wiley.

PSCChT04: Paper IV (Analytical Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: Introduction and statistical analysis 15h

Introduction to analytical chemistry: Types of analysis-qualitative and quantitative. Classification of analytical methods- classical and instrumental, basis of their classification with examples. Statistical analysis and validation: Errors in chemical analysis. Classification of errors- systematic and random, additive and proportional, absolute and relative. Accuracy and precision. Mean, median, average deviation and standard deviation. Significant figures and rules to determine significant figures. Calculations involving significant figures. Confidence limit, correlation coefficient and regression analysis. Comparison of methods: F-test and T-test. Rejection of data based on Q-test. Least squares method for deriving calibration graph. Application of Microsoft Excel in statistical analysis (statistical functions and spreadsheets in MS-Excel). Validation of newly developed analytical method. Certifiedreference materials (CRMs). Numerical problems.

Unit II: Separation techniques 15h

Chromatography: Definition and Classification. Techniques used in Paper, Thin Layer and Column chromatography. Applications in qualitative and quantitative analysis.

Ion exchange: Principle and technique. Types of ion exchangers. Ion exchange equilibria. Ion exchange capacity. Effect of complexing ions. Zeolites as ion-exchangers. Applications.

Solvent extraction: Principle and techniques. Distribution ratio and distribution coefficient. Factors affecting extraction efficiency: Ion association complexes, chelation, synergistic extraction, pH. Numericals based on multiple extractions. Role of chelating ligands, crown ethers, calixarenes and cryptands in solvent extraction. Introduction to Solid phase extraction (SPE) and Microwave assisted extraction (MAE). Applications.

Unit III: Classical methods of analysis 15h

Volumetric analysis: General principle. Criteria for reactions used in titrations. Primary standards and secondary standards. Theory of indicators. Types of titrations with examples- Acid-base, precipitation, redox and complexometric. Titration curves for monoprotic and polyprotic acids and bases. Indicators used in various types of titrations. Masking and demasking agents. Gravimetric analysis: General principles and conditions of precipitation. Concepts of solubility,solubility product and precipitation equilibria. Steps

involved in gravimetric analysis. Purity of precipitate: Co-precipitation and post-precipitation. Fractional precipitation. Precipitation from homogeneous solution. Particle size, crystal growth, colloidal state, aging and peptization phenomena. Ignition of precipitates.

Unit IV: Optical methods of analysis-I 15h

Spectrophotometry and Colorimetry: Principle of colorimetry. Beer's law, its verification and deviations.Instrumentation in colorimetry and spectrophotometry (single and double beam). Sensitivity and analytical significance of molar extinction coefficient and λmax. Comparison method, calibration curve method and standard addition method for quantitative estimation. Role of organic ligands in spectrophotometric analysis of metal ions. Ringbom plot and Sandell's sensitivity. Photometric titrations. Determination of pK value of indicator. Simultaneous determination. Composition and stability constant of complex by Job's and mole ratio methods. Derivative spectrophotometry. Numerical problems.

List of books:

1. Quantitative analysis: Day and Underwood (Prentice-Hall of India)
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry: Gary D. Christian (Wiley, India).
4. Instrumental Methods of Analysis: Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
6. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
7. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
8. Analytical Chemistry: Problems and Solution- S. M. Khopkar (New Age International Publication)
9. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
10. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)
11. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (Wiley Interscience)
12. Fundamentals of Analytical Chemistry: S. A. Skoog and D. W. West
13. Instrumental Methods of Chemical Analysis: G. W. Ewing

PSCChP01: Practical-I (Inorganic Chemistry)

9 h /week Marks: 80

I. Preparation of Inorganic Complexes and their characterization by:

Elemental analysis and physico-chemical methods (Electronic and IR Spectra, magnetic susceptibility measurements, Thermal analysis and Molar conductance studies).

1. K_3 [Al $(C_2O_4)_3$]$(H_2O)_3$ 2. [VO $(acac)_2$] 3. Na [Cr $(NH_3)_2(SCN)_4$]

4. K_3[Cr$(SCN)_6$]. 5. [Mn $(acac)_3$] 6. K_3 [Fe $(C_2O_4)_3$]

7. Hg [Co $(SCN)_4$] 8. [Co $(Py)_2$ Cl_2] 9. [Cu_2 $(CH_3COO)_4(H_2O)_2$]

10. [Ni $(DMG)_2$] 11.[Ni$(NH_3)_6$]Cl_2 12. [Cu$(NH_3)_4(H_2O)_2$]SO_4

II. Quantitative Analysis:

Separation and determination of two metal ions from the following alloys involving:

Volumetric, Gravimetric and Spectrophotometric methods

i) Copper (II) and Nickel (II)

ii) Copper (II) and Zinc (II)

iii) Nickel (II)—Zinc (II) and

iv) Copper (II)—Iron (III)

III. Qualitative analysis of radicals:

Semi-micro Analysis of inorganic mixture containing four cations out of which two will be rare metal ions such as W, Mo,Se,Ti,Zr,Ce,Th,V and U.(Spot Test for individual cations should be performed)

PSCChP02: Practical-II (Organic Chemistry)

9 h /week Marks: 80

[A] Qualitative Analysis

Separation, purification and identification of the mixture of two organic compounds (binary mixture with two solid, one solid one liquid and two liquids) using chemical methods or physical techniques. Minimum 8-10 mixtures to be analyzed.

Purification of the compounds by crystallization, TLC and chromatographic techniques.

[B] Organic preparations:

Student is expected to carry out minimum of 5-6 two stage organic preparation and 5-6 single stage preparation from the following lists.

[1] Oxidation: Adipic acid by chromic acid oxidation of cyclohexanol.
[2] Benzophenone →benzhydrol
[3] Aldol condensation: Dibenzal acetone from benzaldehyde.
[4] Sandmeyer reaction: p- chlorotoluene from p-toluidine
[5] Cannizzaro reaction
[6] Friedel Crafts Reaction: β-Benzoyl propionic acid from succinic anhydride and benzene.
[7] Benzil _ 2,4,5-triphenyl imidizole
[8] Sucrose _ Oxalic acid
[9] Cyclohexanol_ Adipic acid
[10] Benzaldehyde _ Dibenzal acetone
[11] Phenol formaldehyde resin
[12] Urea formaldehyde resin
[13] Methyl acetoacetate _ 5-methyl-isoxazol-3-ol
[14] Ethyl acetoacetate →4-aryl-6-methyl-3,4-dihydro-2(1H)-pyrimidinone ester
[15] Ethyl acetoacetate →Diethyl 1,4-dihydro-2,6-dimethyl-4-phenylpyridine-3,-5dicarboxylate
[16] Dye prepartion : Sulphanilic acid →Methyl orange
[17] Dye prepartion : p-nitroaniline _ p-red
[18] Acetanilide →p-nitroacetanilide →p-nitroaniline
[19] Aniline →2,4,6-tribromo aniline →2,4,6-tribromoacetanilide
[20] Nitrobenzene →m-dinitrobenzene →m-nitroaniline
[21] toluene →p-nitrotoluene →p-nitrobenzoic acid
[22] Glycine →Benzoyl glycine →4-benzilidene-2-phenyl oxazole
[23] Phathalic anhydride →Phthalimide →Anthranilic acid
[24] Resorcinol →fluoroscein →Eosin

PSCChP03: Seminar-I

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

Syllabus prescribed for M.Sc. Chemistry Semester II

PSCChT05: Paper V (Inorganic Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: A**) Electronic spectra of Transition Metal complexes 10h**

Determining the Energy terms, Spin-orbit (L-S) coupling scheme, Hund's rule, Hole Formulation, Derivation of the term symbol for a d^2 configuration, Electronic spectra of transition metal complexes – Laporte 'orbital' selection rule,spin selection rule. Orgel diagrams for octahedral metal complexes. Charge transfer spectra, Racah parameters, calculations of 10 Dq, B, β parameters. Tanabe- Sugano Diagrams of octahedral complexes with d^2 & d^8 configuration.

B**) Magnetic Properties of Transition Metal complexes 5h**

Abnormal magnetic properties, orbital contributions and quenching of orbital angular momentum, spinorbit coupling. Magnetic moment, electronic spectra and structure of tetrahalocobalt(II) complexes, tetrahedral and octahedral Ni(II) complexes. High spin-low spins crossover.

Unit – II 15h

Reaction mechanism of Transition Metal Complexres-II

Substitution reaction in square planer complexes: the trans effect, cis effect, steric effect, solvent effect, effect of leaving group, effect of charge, effect of nucleophile, effect of temperature. Trans effect theories, uses of trans-effect, mechanism of substitution reactions in Pt(II) complexes.Electron transfer reactions. Types of electron transfer reactions, conditions of electron transfer, and mechanism of oneelectron transfer reactions, outer sphere and inner sphere mechanisms, two electron transfer reactions complimentary and non-complimentary reactions. Tunneling effect, cross-reaction, Marcus-Hush theory, bridged activated mechanism.

Unit-III: Metal pi-Complexes - I 15h

Metal carbonyls

Structure and bonding, vibrational spectra of metal carbonyls for bonding and structure elucidation, important reaction of metal carbonyls.Metal carbonyl clusters with reference to classification, EAN rule, synthesis and structures.

Unit – IV: Metal pi-Complexes – II 15h

Metal nitrosyls

Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and X-ray diffraction studies of transition metal nitrosyls for bonding and structure

elucidation, important reactions of transition metal nitrosyls, structure and bonding. Dinitrogen and dioxygen complexes. Wilkinson's catalyst and Vaska's compound.

List of Books

1. J.E.Huheey :Inorganic Chemistry
2. F.A.Cotton and G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5th and 6th Editions.
3. A.F. Willims: Theoretical Approach in inorganic chemistry.
4. Mannas Chanda: Atomic Structure and chemical Bonding
5. L. E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Edition.
6. J. J. Logowski: Modern Inorganic Chemistry
7. B.Durrant and P.J.Durrant: Advanced Inorganic Chemistry
8. J C. Bailar: Chemistry of coordination compounds.
9. W. L. Jolly: Modern Inorganic ChemistryJones: Elementry Coordination chemistry.
10. B. N. Figgis: Introduction to Ligand field.
11. M.C.Day and J.Selbin: Therotical Inorganic Chemistry.
12. J. Lewin and Wilkins: Modern Co-ordination chemistry.
13. Purcell and Kotz: Inorganic Chemistry.
14. D. Banerjea: Co-ordination chemistry, Tata Mc. Graw. Pub.
15. A.F. Wells: Structural inorganic chemistry, 5th Edition, Oxford.
16. S. G. Davies: Organotransition metal chemistry applications to organic synthesis.
17. R. C. Mehrotra: Organometallic chemistry Tata McGraw Hill. Pub.
18. G. S. Manku: Thereotical priciples of inorganic chemistry
19. A. B. P. Lever: Inorganic electronic spectroscopy.
20. R.C.Maurya:Synthesis and charecterisation of novel nitrosyls compounds, Pioneer Pub. Jabalpur 2000.

21. R.H.Crabtree:The Organometalic chemistry of Transition metals, John Wiley.
22. D.N.Styanaryan:Electronic Absorption Spectroscopy and related techniques, University Press.
23. R. S. Drago: Physical methods in inorganic chemistry
24. F.Basolo and G.Pearson: Inorganic Reaction Mechanism
25. Organometallics II and I complexes with transition metal- carbon bonds: Manfred Bochmann-Oxford Press.
26. Advanced Inorganic Chemistry Vol I and II – Satyaprakash, Tuli, Bassu and Madan- S Chand.
27. M.Tsusui,M.Nlevy,M.Ichikwa and K.Mori:Introduction to metal pi-complexe chemistry,Plenum press,NY
28. A.E.Martel;Coordination Chemistry-VolIandII,VNR.

PSCChT06: Paper VI (Organic Chemistry)

60 h (4 h per week): 15 h per unit 80Marks

Unit-I 15 h

A] **Addition to carbon-carbon multiple bond**

Mechanistic and stereochemical aspects of addition reaction involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, Orientation and stereochemistry, Addition to cyclopropanes, Hydrogenation of double bond and triple bonds. Hydrogenation of aromatic rings, hydroboration, Michael reaction.

B] **Addition to carbon-hetero atom multiple bond**

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters, and nitriles, Addition of Grignard reagents, organozinc and organolithium reagents to carbonyls and unsaturated carbonyl compounds, Wittig reaction, Mechanisms of condensation reactions involvingenolates- Aldol, Knoevengel, Claisen, Mannich, Benzoin, Perkin, Stobbe reaction, Hydrolysis of esters and amide, ammonolysis of esters.

Unit-II 15 h

A] **Mechanism of molecular rearrangement**

Classification and General mechanistic treatment of electrophilic, nucleophilic and free radical moleculer rearrangement. Mechanism of the following rearrangement –Wagner-Meerwin, Pinacol-Pinacolone, Tiffenev –Demjnov ring expansion, benzil-benzilic acid, Arndt-Eistert synthesis, Curtius Lossen, Beckman, Hoffman, Schmidt rearrangement.

B**] Free radical reactions-I**

Type of free radical reactions, free radical substitution mechanism at an aromatic substrate, aliphatic substrate, reactivity at a bridgehead position. Neighbouring group assistance, reactivity for aliphatic and aromatic substrates, reactivity in attacking radicals, effect of solvent on reactivity.

UNIT-III

A**] Free radical reactions-II 15 h**

Halogenation at an alkyl carbon, allylic carbon (NBS), hydroxylation at an aromatic carbon by means of Fenton's reagent. Auto-oxidation, chlorosulphonation (Reed Reaction) Coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction, Free radical rearrangement, Hunsdiecker reaction.

B] **Elimination reactions**

The E1, E2 and E1CB mechanisms and orientation of the double bond. Saytzeff and Hoffman's rule. Effect of substrate structure, attacking base, leaving group and medium. Mechanism and orientation in pyrolytic elimination.

Unit IV: Green chemistry 15 h

Introduction, Education and need of Green chemistry, Basic principles of green chemistry. Prevention or minimization of hazardous products , choice of solvents. Sonochemistry, microvave induced reactions, polymer supported reagents, reactions in aqueous medium, zeolites and ionic liquid supported reaction, Solvent free reactions, Multi-component reactions (Biginelli, Ugi and Passereno reaction), Rearrangements reaction, Addition reaction, substitution, elimination reaction, photochemical and electrochemical reactions, Biocatalysts in Organic synthesis. Synthesis involving basic principles of green chemistry- Synthesis of paracetamol and Ibuprofen, styrene, urethanes, Free radical bromination, Green chemistry for drug development, Synthesis of. Introduction to nanochemistry, nanorods and nanotubes.

List of books

1] Books as Suggested in Semester I for Organic Chemistry
2] A Textbook of organic chemistry- R.K. Bansal
3] New trends in green chemistry –V.K. Ahluwalia and M. Kidwai, Anamaya publishers New Delhi
4] Heterocyclic Chemistry, John Joule, Oxford University Press

PSCChT07: Paper VII (Physical Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

UNIT I: APPLICATION OF QUANTUM MECHANICS 15h

A] Approximate methods, variation principle, MO theory applied to H_2+ molecule and H_2 molecule (calculation of energy), perturbation theory, application of perturbation theory to helium atom .

B] Electronic structure of atoms: Russel Sanders terms and coupling schemes, Slater-condon parameters,term separation energies of the pn configuration, term separation energies for dn configuraconfiguration, magnetic effects: spin orbit coupling and Zeeman splitting.

C] Hybridization, hybrid orbitals in terms of wave functions of s and p orbitals, sp and sp^2 hybridizations, Simple Huckel theory applied to: ethylene, butadiene, cyclobutadiene, cyclopropenyl radical.

UNIT II: THERMODYNAMICS 15h

A] Non-ideal Systems: Excess functions for non ideal solutions, Entropy of mixing, Enthalpy of mixing, Activity, activity coefficients, Debye Huckel theory for activity coefficients of electrolytic solutions, determination of activity and activity coefficients, ionic strength.

B] Statistical thermodynamics: Stirling Approximation, Maxwell Boltzmann, Bose Einestein, Fermi Dirac statistics, comparison between three statistics.

C] Irreversible Thermodynamics: Thermodynamic criteria for non equilibrium states, Le Chatelier principle, Conservation of mass and energy in closed and open systems, entropy production.

UNIT III: SOLID STATE CHEMISTRY 15h

A] Crystal Defects and Non-stiochiometry: Perfect and imperfect crystals, Electronic structure of solids— band theory intrinsic and extrinsic defects- point defects, line and plane defects, vacancies- Schottky defects and Frenkel defects, p-n junction. Thermodynamics of Schottky and Frenkel defects, colour centres, non-stiochiometric defects. Superconductors—Meissner effect, BCS theory.

B] Solid State Reactions: General Principles, experimental procedures, co-precipitation as a precursor to solid state reactions, kinetics of solid state reactions.

UNIT IV: NUCLEAR CHEMISTRY 15h

A] Introduction, radioactive decay and equilibrium, thermonuclear reactions, photonuclear reactions, Radiometric titration, isotopic dilution analysis, NAA.

B] Nuclear models: Fermi gas model, shell model, liquid drop model, application of liquid drop modelsemiempirical mass equation.

C] Counters: proportional counter, GM counter, scintillation counter, ionization chamber counter.

List of books

1. Ira N. Levine, Quantum Chemistry, 5th edition(2000), Pearson educ., Inc.New Delhi
2. A.K.Chandra, Introductory Quantum Chemistry, 4th edition (1994), Tata Mcgraw Hill, New Delhi.
3. S.K.Dogra, S.Dogra, Physical Chemistry Through Problems.
4. M.W.Hanna, " Quantum Mechanics in Chemistry", Benjamin
5. L. Pualing and E. B. Wilson, Introduction to Quantum Mechanics with Applications to Chemistry, McGraw Hill, New York (1935).
6. R.P.Rastogi R.R. Mishra 6th revised edition An Introduction to CHEMICAL THERMODYNAMICS
7. Principles of Physical Chemistry by Puri, Sharma and Pathania,
8. Physical chemistry. P.W.Atkins.ELBS
9. E.N.Yenemin, "Fundamentals of Chemical Thermodynamics", MIR Publishers.
10. F.W.Sears, " Introdction to Thermodynamics, Kinetic Theory of Gases and statistical mechanics".Addison Wesley
11. M.C.Gupta, Statistical Mechanics
12. I.Prigoggine, " An Introduction to Thermodynamics of Irreversible Processes," Interscience
13. Andrew Maczek, Statistical Thermodynamics, Oxford University Press Inc., New York (1998).
14. C.N.Rao. Nuclear Chemistry
15. B. G. Harvey, Introduction to Nuclear Physics and Chemistry, Prentice Hall, Inc. (1969).
16. H.J. Arnikar, Essentials of Nuclear Chemistry, 4th Edition (1995), Wiely-Eastern Ltd., New Delhi.
17. C.Kittel, " Introduction to solid state Physics",Wiley
18. L.V.Azaroff, " Introduction to solids", McGraw Hill

PSCChT08: Paper VIII (Analytical Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Sampling and quantification 15h

Sampling and sample treatment: Criteria for representative sample. Techniques of sampling of gases (ambient air and exhaust gases), liquids (water and milk samples), solids (soil and coal samples) and particulates. Hazards in sampling. Safety aspects in handling hazardous chemicals. Sample dissolution methods for elemental analysis: Dry and wet ashing, acid digestion, fusion processes and dissolution of organic samples.

Detection and quantification: Concepts and difference between sensitivity, limit of detection and limit of quantification, role of noise in determination of detection limit of analytical techniques. Units in chemical analysis and their interconversion. Stoichiometry: Stoichiometric and sub-stoichiometric reactions and calculations.

Unit-II: Modern separation techniques 15h

Gas Chromatography: Principle including concept of theoretical plates and van-Deemter equation. Instrumental set up- carrier gas, sampling system, column and detector. Types of columns, their advantages and limitations. Detectors in GC analysis. Temperature programmed GC. Factors affecting retention, peak resolution and peak broadening.

Liquid chromatography: Principle, Instrumentation, Advantages and applications of HPLC. Types of columns and detectors. Principle and applications of size exclusion, gel permeation, ion retardation, normal phase and reverse phase chromatography.

Supercritical fluid chromatography: Introduction and applications.

Unit-III: Optical methods of analysis-II 15h

Fluorometry and phosphorimetry: Principles of fluorescence and phosphorescence. Jablonski diagram. Concentration dependence of fluorescence intensity. Fluorescence quenching. Instrumentation. Applications.

Flame photometry: Principle. Instrumentation and types of burners. Factors affecting flame photometric determination. Limitations of flame photometry. Interferences in flame photometry. Applications. Nephelometry and turbidimetry: Theory, instrumentation and applications. Optical sensors: Fibre-optic properties, Fibre-optic sensors.

Unit-IV:Electrochemical methods of analysis-I 15h

Polarography: Principle of DC polarography. Instrumentation in polarography. Advantages and limitations of DME. Types of currents- residual current, migration current, diffusion current, limiting current, adsorption current, kinetic current and catalytic current. Ilkovic equation-diffusion current constant and capillary characteristics. Derivation of equation of polarographic wave and half wave potential. Experimental determination of half wave potential. Reversible, quasi reversible and irreversible electrode reactions. Polarographic maxima and maximum suppressor. Oxygen interference and deaeration. Introduction to pulse, a.c. and oscillographic techniques and their advantages. Applications of polarography in determination of dissolved oxygen, metal ion quantification and speciation, simultaneous determination of metal ions, analysis of organic compounds. Limitations of polarography. Amperometric titrations- Principle, types and applications in analytical chemistry.

List of books:

1. Quantitative analysis: Day and Underwood (Prentice-Hall of India)
2. Vogel's Text Book of Quantitative Inorganic Analysis-Bassett, Denney, Jeffery and Mendham (ELBS)
3. Analytical Chemistry: Gary D. Christian (Wiley India).
4. Instrumental Methods of Analysis: Willard, Merrit, Dean, Settle (CBS Publishers, Delhi, 1986)
5. Sample Pre-treatment and Separation: R. Anderson (John Wiley and Sons)
6. Stoichiometry: B.I.Bhatt and S.M. Vora, 2nd Edition (Tata Mc-Graw Hill publication)
7. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
8. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
9. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
10. Analytical Chemistry: Problems and Solution- S. M. Khopkar (New Age International Publication)
11. Basic Concepts in Analytical Chemistry: S. M. Khopkar (New Age International Publication)
12. Advance Analytical Chemistry: Meites and Thomas: (Mc Graw Hill)

13. An Introduction to Separation Science: L. R. Shyder and C. H. Harvath (WileyInterscience)
14. Fundamental of Analytical Chemistry: S. A. Skoog and D. W. West
15. Instrumental Methods of Chemical Analysis: G. W. Ewing
16. Polarography: Koltoff and Ligane
17. Electroanalytical Chemistry: Sane and Joshi (Quest Publications)

PSCChP04: Practical-IV (Physical Chemistry)

9 h /week Marks: 80

1. To study the variation of volume contraction with mole fraction of alcohol in alcohol - water system
2. To determine the activation parameters of viscous flow for a given liquid
3. Determination of molecular mass of a polymer by viscometry method.
4. To determine integral heat of KNO3, at two different conc. and calculation of heat of dilution.
5. Effect of 1% NaCl, 1% succinic acid, 0.5% naphthalene on CST in phenol-water systems.
6. Distribution of succinic acid in H2O- benzene, H2O-ether and comparison of distribution coefficient.
7. To construct the phase diagrams of two components system (phenol- urea, diphenyl aminebenzophenone; a-naphtyl amine-phenol) forming compounds with congruent melting points.
8. To study the mutual solubility of glycerol-m-toluidine and to determine congruent points.
9. To study kinetics of hydrolysis of an ester by NaOH reaction.
10. To determine equilibrium constant of the equation $KI+I_2=KI_3$ by distribution method.
11. To study the kinetics of the reaction between potassium persulphate and potassium iodide.
12. Determination of order of reaction of oxidation of ethyl alcohol by acid dichromate.
13. To titrate conductometrically monobasic and dibasic acids with NaOH and determine the strength of given acid.
14. To determine equivalent conductance of weak electrolyte at infinite dilution by kaulrausch's method.
15. Determination of heat of reaction, entropy change and equilibrium constant of the reaction between metallic zinc and Cu^{+2} ions in solution.
16. Determination of thermodynamic constants ΔG, ΔH, ΔS for $Zn^{+} H_2SO_4= ZnSO_4+ 2H$ by emf measurement.

PSCChP05: Practical-V (Analytical Chemistry)

9 h /week Marks: 80

Section (A): Classical methods and separation techniques

Calibration, validation and computers

1. Calibration of pipette and burette.
2. Statistical analysis of data.
3. Use of MS-Excel in statistical analysis of data and curve fitting.

Volummetry

1. Determination of Na_2CO_3 in washing soda.
2. Determination of NaOH and Na_2CO_3 in a mixture.
3. Estimation of nickel in given solution by direct complexometric titration with EDTA using bromopyrogallol red.
4. Estimation of nickel in given solution by complexometric back-titration with EDTA using murexide.
5. Estimation of chloride in given solution by Mohr's titration.
6. Estimation of chloride in given solution by Volhard's titration.
7. Determination of volume strength of commercial hydrogen peroxide by redox titration with $KMnO_4$.
8. Estimation of phenol/ aniline by bromination method.

Gravimetry

1. Estimation of barium as barium sulphate.
2. Estimation of calcium as calcium oxalate/ calcium carbonate/ calcium oxide.

Separation techniques

1. Qualitative separation of metal ions by paper chromatography for 2/3 components.
2. Determination of ion-exchange capacity of resin.

Section (B): Instrumental techniques

Electroanalytical techniques

1. Analysis of commercial vinegar by conductometric titration.
2. Determination of strength of HCl and CH_3COOH in a mixture conductometrically.
3. Determination of strength of HCl and oxalic acid in a mixture conductometrically.
4. Determination of strength of oxalic acid and CH_3COOH in a mixture conductometrically.

5. Determination of degree of dissociation and dissociation constant of acetic acid conductometrically.

6. Determination of strength of HCl and CH_3COOH in a mixture potentiometrically.

7. Determination of Fe(II) by potentiometric titration with $K_2Cr_2O_7$.

8. Determination of three dissociation constants of H_3PO_4 by pH-metric titration.

Optical Optical methods

1. Determination of pK of indicator by colorimetry.

2. To estimate the amount of NH_4Cl colorimetrically using Nesseler's Reagent.

3. To study the complex formation between Fe(III) and salicylic acid and find the formula and stability constant of the complex colorimetrically (Job's method).

4. To determine the dissociation constant of phenolphthalein colorimetrically.

Note: One experiment from each section should be performed in the examination

PSCChP03: Seminar-II

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

GONDWANA UNIVERSITY

GADCHIROLI

SYLLABUS

BOTANY

M. Sc. Part-I and II

(Semester with credit based Pattern)

(w.e.f. session 2012-13)

APPENDIX – 1

Scheme of teaching under credit based semester system for M. Sc. Program in BOTANY.

M.Sc. I

Sr. No.	Semester	Course code / Paper	Course / paper	Title of course/ paper	Teaching Scheme		
					Theory (Hrs.)	Practical (Hrs.)	No. of Credits
1	One	BOT T I	I	Microbiology Algae & Fungi	5	4	4
2	One	BOT T II	II	Bryophytes & Pteridophytes	5	4	4
3	One	BOT T III	III	Gymnosperms and Paleobotany	5	4	4
4	One	BOT T IV	IV	Cytology & Genetics	5	4	4
6	One	BOT P I	PRACT.I	Algae, Fungi, Bryophytes	--	-	4
7	One	BOT P II	PRACT.II	Pterido, Gymno-Paleo, Cytology, Genetics	--	-	4
8	One	**Seminar –I**					
8	Two	BOT T V	I	Plant Physiology and Biochemistry	5	4	4
9	Two	BOT T VI	II	Plant Development and Reproduction	5	4	4
10	Two	BOT T VII	IIII	Cell & Molecular Biology- I	5	4	4
11	Two	BOT T VIII	IV	Angiosperms - I	5	4	4
13	Two	BOT P III	PRACT. III	Plant Physiology , Biochemistry, and Growth & Dev.	--	-	4
14	Two	BOT P IV	PRACT. IV	Cell & Mol. Bio. I and Angio- I	--	-	4
	Two	**Seminar –II**					

Scheme of teaching under credit based semester system for M. Sc. Program in BOTANY.

M.Sc. II

Sr. No.	Semester	Course code / Paper	Course / paper	Title of course/ paper	Teaching Scheme		
					Theory (Hrs.)	Practical (Hrs.)	No. of Credits
15	Three	BOT T IX	I	Plant Ecology	5	4	4
16	Three	BOT T X	II	Cell and Molecular Biology - II	5	4	4
17	Three	BOT T XI	III	Plant Biotechnology	5	4	4
18	Three	BOT T XII	IV	Angiosperms - II	5	4	4
20	Three	BOT P V	PRACT. V	Ecology, Cell & Mol. Biology-II	--	-	4
21	Three	BOT P VI	PRACT. VI	Plant biotechnology & Taxonomy - II	--	-	4
	Three	**Seminar - III**					1
22	Four	BOT T XIII	I	Plant Conservation, IPR & Ethnobotany	5	4	4
23	Four	BOT T XIV	II	PRU, Biosafety, Bioethics, Biostat. & Pl. Breed.	5	4	4
24	Four	BOT T XV	III	Special paper-I	5	4	4
25	Four	BOT T XVI	IV	Special paper-II	5	4	4
27	Four	BOT P VII	PRACT. VII	Special I & II	--	--	4
28	Four	BOT P VIII	Project		--	-	4
		Seminar IV					1

1. In each semester student will have to give seminar on any topic relevant to the syllabus encompassing the recent trends and development in that field. The topic of the seminar will be decided at the beginning of each semester in consultation with supervising teachers. The students have to deliver the seminar on the hour duration which will be followed by discussion. The seminar will be open to all the teachers of the department invitees and students.
2. The students will have to carry out the research based project work in lieu of practical in the fourth semester in the department or depending on the avaibility of placement; he/she will be attached to any of the national/ regional/ private research institute / organization for the duration of the fourth semester. The student will be randomly allotted the priority number for the selection of the supervisor at the end of the third semester. The student in consultation with supervisor will finalize the topic of the project work at the third semester.
3. The regular full time teacher of the department / contributory teacher approved by university / scientist of government / private research laboratory appointed by university as a contributory teacher and having M.Phil. or Ph. D. degree can supervise the project work of the student .

SEMESTER I

PRACTICAL I

Time : 6 Hours		Full marks : 80
Q. 1	To identify the given Cyanobacterial material A.	8
Q.2	To identify two algal forms B, C, from the given mixture.	12
Q.3	To identify the given fungal culture D	8
Q. 4	To identify the given pathogen in the given material E.	10
Q. 5	To prepare a double stained microprepration of the given Bryophytic F material and identify it.	10
Q. 6	Comment on the given spot G (Cyanobacteria/Bacteria), H (Algae), I (Fungi), J (Bryophyte)	12
Q.7	Viva-voce	10
Q. 8	Practical Record and tour report	10

SEMESTER I

PRACTICAL II

Time : 6 Hours		Full marks : 80
Q. 1	To prepare a double stained microprepration of the given Pteridophytic A material and identify it.	10
Q.2	Write a monograph on the given gymnospermic material B	13
Q.3	Comment on the given fossil specimen C	10
Q. 4	One experiment from Cytology and Genetics D	15
Q. 5	Comment on the given spot E (Pteridophyte), F (Gymnosperm), G (fossils), H (Ecology)	12
Q.6	Viva-voce	10
Q. 7	Practical Record and tour report	10

SEMESTER II

PRACTICAL III

Time : 6 Hours		Full marks : 80
Q. 1	To perform the given physiological experiment A and report The findings	15
Q.2	To quantify the given metabolite in the given sample B	7
Q.3	To study the cytohistological zonation in SAM of given material C	10
Q. 4	To perform the given exercise based on plant development D	10
Q. 5	Write a note on given stage of micro- or megasporogenesis E	6
Q. 6	Spotting: F (Physiology), G (Plant development), H (Reproduction)	12
Q. 7	Viva-voce	10
Q. 8	Practical Record	10

SEMESTER II

PRACTICAL IV

Time : 6 Hours		Full marks : 80
Q. 1	One experiment from paper VII A	14
Q.2	One experiment from paper VII B	10
Q.3	One experiment from paper VIII C	14
Q. 4	One experiment from paper VIII D	10
Q. 5	Spotting: E (Paper VII), F (Paper VII), G (Paper VII), H (Paper VII)	12
Q. 6	Viva-voce	10
Q. 7	Practical Record and field diary	10

SEMESTER III

PRACTICAL V

Time : 6 Hours Full marks : 80

Q. 1	To perform the given Ecological exercise A	14
Q. 2	Soil analysis/Ecological adaptation B	10
Q. 3	One experiment from paper X C	14
Q. 4	One experiment from paper X D	10
Q. 5	Spotting: E (Paper IX), F (Paper IX), G (Paper X), H (Paper X)	12
Q. 6	Viva-voce	10
Q. 7	Practical Record	10

SEMESTER III

PRACTICAL VI

Time : 6 Hours Full marks : 80

Q. 1	One experiment from paper XI A	13
Q.2	One experiment from paper XI B	10
Q.3	To describe the given plant in technical language with floral formula and floral diagram C	13
Q. 4	To prepare the generic/family key D	10
Q. 5	To identify the species of the given plant using the standard flora	5
Q. 6	Spotting: E (Plant biotechnology), F (Plant biotechnology), G (Angiosperms)	09
Q. 7	Viva-voce	10
Q. 8	Practical Record and tour report	10

SEMESTER IV

PRACTICAL VII

Time : 6 Hours Full marks : 80

Q. 1	One experiment from paper XIII A	10
Q. 2	One experiment from paper XIV B	10
Q. 3	One experiment from paper XV C	10
Q. 4	One experiment from paper XVI D	10
Q. 5	Spotting: E (paper XIII), F (paper XIV), G (paper XV), H (paper XVI)	12
Q. 6	Viva-voce	14
Q. 7	Practical Record	14

M. Sc. Botany Syllabus
Semester I
Course code/name: PAPER –I: Microbiology, Algae and Fungi

MODULE-I:

General Microbiology :

History – Contributions made by Leeuwenhoek, Pasteur, Robert Hook, Jenner, Waksman, Iwanowsky. Koch's Postulate.

Bacteria – Structure, morphology, reproduction.

Viruses – General account; Morphology and ultrastructure of TMV, Bacteriophage; Introduction to viroids, prions and interferon.

Archaebacteria and eubacteria: General account; ultrastructure, nutrition and reproduction, biology and economic importance; **Cyanobacteria:** *Microcystis, Lyngbya, Nostoc, Scytonema, Gloeotrichia and Stigonema*.

MODULE-II

Phycology:

Criteria for classification of algae: Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Pheophyta and Rhodophyta; pigments, reserved food, flagella

Algae in diversified habitats (terrestrial, freshwater, marine), thallus organization; cell ultrastructure; reproduction (vegetative, asexual, sexual); algal blooms, algal biofertilizers; algae as a food, feed and uses in industry.

MODULE-III

General account: Classification of Fungi (recent trends and criteria used in classification); Physiology of Fungi (with reference to biotrophs, hemibiotrophs, symbionts); Fungal Cytology : Heterothallism, heterokaryosis, parasexual cycle.

Comparative study, classification and evolutionary trends in the following: Myxomycota: Protist characters and general account with special reference to *Physarium* and *Plasmodiophora*

Eumycota: i. Oomycetes : *Saprolegnia, Synchytrium, Phytophthora, Peronospora,* ii. Zygomycetes : *Mucor, Rhizophus, Syncephalastrum, Cunninghamella*

MODULE- IV:

Comparative study, classification and evolutionary trends in the following: iii. Ascomycetes: *Saccharomyces, Phyllactinia, Chaetomium, Xylaria*, iv. Basidiomycetes: *Melampsora, Puccinia, Ravenelia, Ustilago, Polyporus*, v. Deuteromycetes: *Helminthosporium, Fusarium, Colletotrichum, Phoma*

Plant Pathology : Symptomology, histopathology, etiology and identification of diseases with reference to following fungal, bacterial and viral diseases (Paddy blast, wheat rust, bunt of wheat, smut of jowar, black arm of cotton, red rot of sugarcane, citrus canker, gummosis, leaf curl of papaya, potato blight.)

PRACTICAL

Classification and type study of the following classes

Prochlorophyta :, *Prochloron*

Chlorophyta: *Pandorina, Eudorina, Stigeoclonium, Ulva, , Chlorella, Scenedesmus, Caulerpa, Valonia, Acetabularia.*

Phaeophyta : *Spacelaria, Padina, , Turbinaria.*

Rhodophyta :, *Nemalion, Gelidium, Gracilaria, Corallina, Polysiphonia.*

Euglenophyta :, *Euglena, Phacus.*

Bacillariophyta : *Cyclotella, Synedra, Cymbella, Navicula, Gomphonema.*

Morphological Studies of Fungi (any 15 of the following)

Stemonities, Perenospora, Phytopthora, Albugo, Mucor, Rhizopus, Yeast, Aspergillus, Penicillium, Chaetomium, Taphrina, Peziza, Erisyphe, Phyllactenia, Uncinula, , Melamosora, Uromyces, Drechslera,Ravenallia, Ustilago, Polyporus, Morchella, Cyathus, , Alternaria, Helminthosporium, Curvularia, Colletotrichum, Phoma, Plasmodiophora, Cercospora, Fusarium, Claviceps.

Symptomology of some diseased plants (any 7 of the following).

White rust of Crucifers, Downy mildew, powdery mildew, Rusts, Smuts, Ergot, Groundnut leaf spot (Tikka disease), False smut of paddy, red rot of Sugarcane, Wilt disease, Citrus canker, Angular leaf spot of cotton, Potato blight, Leaf mosaic of bhindi/ papaya, Leaf curl of tomato/Potato/Papaya, Little leaf of brinjal.

Identification of Fungal cultures (Any 5)

Rhizopus, Mucor, Aspergillus, Penicillum, Drechslera, Curvularia. Phoma, Colletotrichum, Alternaria, Helminthosporium.

Field study: For collection and studying fungal flora

Suggested Readings:

1. Kumar HD (1988) Introductory Phycology. Affiliated East-West Press Ltd. New Delhi
2. Morris I (1986) Introduction to the Algae. Cambridge University Press, UK
3. Round FE 1986 The Biology of Algae. Cambridge University Press, UK
4. Mandahar CL 1978 Introduction to Plant Viruses. Chand & Co. Ltd., New Delhi
5. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
6. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.
7. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.
8. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.
9. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York

10. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
11. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.
12. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.
13. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.
14. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S.Chand & Co. Ltd.
15. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology - S.Chand & Co. Ltd.
16. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.
17. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.
18. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.
19. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermidiate Press.
20. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.
21. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.
22. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.
23. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.
24. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.
25. Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.
26. On line Journals available on UGC -VSAT

M. Sc. Botany Syllabus
Semester I
Course code/name: PAPER –II: Bryophytes & Pteridophytes

Module I:
General characters, distribution, classification, ecology of Bryophytes, Bryophytes as ecological indicators, morphogenesis in bryophytes, fossil history of bryophytes, cytology of bryophytes, regeneration in bryophytes, modern trends in taxonomy.

Module II:
General account in-
Hepaticopsida: Sphaerocarpels, Takakiales
Anthocerotopsida: Anthocerotales,
Bryopsida: Sphagnales, Polytrichales..

Module III:
General characters, distribution, classification, evolution of stele, heterospory and seed habit, apospory and apogamy; Important contributions of Indian Pteridologists, General account of Ryniopsida, Psilopsida, Lycopsida [protolepidodendrales, Lycopodiales, Selaginales, Isoetales].

Module IV:
General account of Sphenopsida [Hyeniales, Equisetales], Filicopsida [Ophioglossales, Filicales, Salvinales, Marsileales], Tracheophyta [Progymnospermosida].

BRYOPHYTES:
Practicals:-
Study of morphological and reproductive characters of representative members mentioned in the syllabus using cleared whole mount preparations, dissections and sections. Preparation of permanent slides is necessary. Study of bryophytes in their natural habitats.
Botanical excursion outside the state is compulsory to study the bryophytes in their natural conditions.

PTERIDOPHYTES:
Practicals: Pteridophytes-
Study of fossil forms (specimens and permanent micropreparations).
Study of living forms: Morphological, anatomical and reproductive characters of the forms mentioned in the syllabus. Anatomical characters to be studied either by taking free hand sections (t.s./ l.s.) and by observing the permanent micropreparations. Preparations of permanent slides are essential.
Suggested Readings
1. Andrews H.N. Jr. (1961) Studies in Paleobotany (Jonh Wiley & Sons, New York)
2. Arnold C.A. (1947) An introduction to Paleobotany (McGraw Hill, New York)

3. Banks H.P. (1968) The early history of Land plants. In evolution and environment, ed. E.T. Drake. New Haven: Yale Univ. Press, pp, 73-107.
4. Banks H.P. (1970) Evolution and plants of past. (Belmont, California, Wadsworth).
5. Banks, H. P. (1975). Reclassification of Psilophyta, Taxon. 24, 401-13.
6. Berrie, G. K. (1963). Cytology and Phylogeny of liverwoets. Evolution 17, 347-357.
7. Bierhorst D.W (1971) Morphology of vascular plants, New York (Mac Millan)
8. Campbell, D. H. (1961). The evolution of the Land Plants (central Book Depot, Allahabad)
9. Cavers, F. (1910). The interrelationship of Bryophyta I-IV. New Phytologist. 9
10. Cavers, F. (1911). The interrelationship of Bryophyta VII-IX. New Phytologist. 10.
11. Chrysler M.A. (1910) The fertile spike in Ophioglossaceae. Ann. Bot. 24:1-18.
12. Delevoryas T. (1962) Morphology and Evolution of fossil plants (Holt, Rinehart and Winston, New York).
13. Eames A.J (1936) Morphology of vascular plants, lower groups (McGraw Hill, New York).
14. Foster A.S.and E.M Gifford Jr. (1959) Comparative morphology of vascular plants Freeman, San Fransisco.
15. Grolle, R. (1963). Takakia in Himalayas, Ost. Bot. Zeitscher, 110:444-447.
16. Gupta K.M. (1962) *Marsilea,* Botanical monograph no. 2 (CSIR, New Delhi).
17. Ingold, C. T. (1939). Spores discharge in land plants (Oxford London)
18. Kashyap S.R. (1929). Liverworts of the western Himalayas and The Punjab Plain 1(Chronica Botanica)
19. Kashyap S.R. (1933). Liverworts of the western Himalayas and The Punjab Plain 2(Chronica Botanica)
20. Lacey, W. A. (1969). Fossil Bryophytes. Biological Reviews, 44,189-205.
21. Mehra , P.N. and O. N. Handoo (1953). Morphology of Anthoceros erectus and A. himalayensis and the phylogeny of the anthocerotales. Bot. Gaz.114:371-382.
22. Parihar N. S. (1976). An introduction to Embriyophyta, Bryophyta (Centaral Book House, Allahabad)
23. Parihar N.S. (1977) The biology and morphology of the Pteridophytes (Central Book Depot, Allahabad).
24. Pichi- Sermolli REG (1959) Pteridophyta in vistas in botany, WB Turrill, ed. (Pergamon Press, London) pp 421-493.
25. Proskauer J. (1951). Study in Anthocerotales, III, The Bryologist 53,165-172.
26. Puri Prem (1985) Bryophytes- A broad perspective.
27. Ramanujam CGK (1992) Origin and evolution of lycopods Paleobotanist 41, 51-57.
28. Rashid A. (1982) (4^{th} edn) An introduction to pteridophyta (Vikas Publ House Pvt Ltd.)
29. Schuster R. (1966). The Hepaticae and Anthocerotae of North America. East of the Hundredth meridian, Newyork (Colombia University Press).
30. Scott D.H. (1908) Studies in fossil botany. London, Black Part 2.
31. Scott D.H. (1920-1923) Studies in fossil botany. (A & C Black London.)
32. Sharma O.P (1996) Textbook of pteridophyta (Mac Millan India Ltd, New Delhi)
33. Smith A. J. E. (1986). Bryophyte phylogeny fact or Fiction? Journal of Bryology, 14,83-89.

34. Smith G. M. (1955). Cryptogamic Botany-vol. 2 Bryophyta and Pteridophyta (McGraw Hill Book compony, Newyork)
35. Smith W. N. and G. W. Rothwell (1993). Paleobotany and the evolution of plants (Cambridge Univ. press)
36. Sporne K.R. (1962) The morphology of pteridophyta (Hutchinson Univ. Library, London)
37. Steil W.N. (1939) Apogamy, Apospory and Parthenogenesis in the pteridophyta, Bot. rev, 5, 433-453.
38. Steward W.N. (1983) Paleobotany and the evolution of plants. 1st ed. New York, (Cambridge Univ. press)
39. Surange K.R and S. Chandra (1972) Fructification of Glossipteridae from India, Paleobotanist 21, 1-17.
40. Taylor T.N. (1988) the origin of land plants- Some answers more questions, Taxon, 37, 805-33.
41. Udar ram (1970) An introduction to bryophyte (Shashidhar malviya Prakashan, Lucknow)
42. Udar Ram, Srivastava S.C. and Kumar Dinesh (1970) Genus *Buxbaumia* in India, Curr. Sci. (India) 39, 14-15.
43. Walton J. (1925) Carboniferous Bryophyta I. Hepaticae. Annals of Botany, 39, 563-72.
44. Walton J. (1928) Carboniferous Bryophyta II. Hepaticae & Musci. Annals of Botany, 42, 707-16.
45. Walton J. (1940) An introduction to the study of fossil plants. A& C Black, London.
46. Watson E.V. (1967) The structure and life of Bryophytes, 2nd ed, London, Hutchinson.
47. Wilson C.W. (1942) The telome theory and the origin of the stamen. Am. J Bot., 29, 759-764.
48. Zimmermann W. (1952) Main results of the "Telome theory". The Paleobotanist, Birbal Sahni Memorial Volume, 456-70.

M. Sc. Botany Syllabus
Semester I
Course code/name: PAPER –III: Gymnosperms and Paleobotany

Module I – Paleobotany

Introduction : Plant fossils – Preservation, preparation, age determination, geological time scale; Fossil record – systematic, reconstruction and nomenclature; Applied aspects of paleobotany.

Module II – Gymnosperms

General account, distribution (living, Fossil), origin, systems of classification, economic importance.

Comparative morphology and evolutionary tendencies of

1. Pteridospermales – Lyginoptridaceae (*Calymotheca hoeninghausii, Hetarngium, Spherostoma*) Medullosaceae (*Medullosa, Trignocarpus*)
2. Cycadales – Cycadaceae; Fossil history (*Baenia, Nilssonia, Androstrobus*)
3. Cycadeoidales – Williamsoniaceae, Cycadoeoidaceae

Module III

4. Cordaitales (General account and relationships)
5. Caytoniales (General account and relationships)
6. Glossopteridales (General account and relationships)
7. Pentoxylales (General account and relationships)
8. Gnetales (General account and relationships)

Module IV

9. Ginkgoales – *Ginkgo, Baiera, Trichopitys*
10. Coniferales – (Morphology, reproductive organs, gametophytes, embryo)
11. Taxales – *Taxus*

Laboratory Exercise

Comparative Study of vegetative and reproductive parts of – *Cycas, Zamia, Cedrus, Abies, Pinus, Cupressus, Cryptomeria, Taxodium, Podocarpus, Agathis, Thuja, Gnetum, Ephedra, Juniperus,*
Cephalotaxus, Taxus

Permanent micropreparatious to be submitted by the students.

***Ginkgo*:** Morphology to be studied from Museum specimens & anatomy from permanent slides only.

Study of important fossil gymnosperms from material and permanent slides.

Visit to palaeobotanical Institutes, localities and collection of specimens.

Field visits to ecologically different localities to study living gymnosperms.

Suggested Readings:

1. Stewart, W.N. and Rothwell G.W. (1993), Palaeobotany and the Evolution of Plants, Cambridge University Press.
2. Foster A.S. & Gifford F.M. (1967): Comparative morphology of vascular plants, Freeman Publishers, San Fransisco.

3. Eames, A.J.(1974): Morphology of Vascular Plants- lower groups, Tata Mc-Graw Hill publishing Co., New Delhi.
4. Arnold, C.A. (1947): Introduction to Palaeobotany, Mc-Graw Hill Book Co. Inc., New York and London.
5. Kubitzki K. (1990), The families and genera of vascular plants Pteridophytes and Gymnosperms, Springer Verlag, New York
6. Agashe, S.N. (1995), Palaeobotany, Oxford & IBH, New Delhi.
7. Biswas, C & Johri, B.N. (2004), The Gymnosperms, Narosa Publishing House, New Delhi.
8. Coulter J.M. & Chamberlain C.J.(1978): Morphology of Gymnosperms, Central Book Depot, Allahabad.
9. Kakkar, R.K.and Kakkar, B.R. (1995), The Gymnosperms (Fossils & Living), Central Publishing House, Allahabad.
10. Sharma O.P. (2002) Gymnosperms, Pragati Prakashan, Meerut.
11. Siddiqui, K.A. (2002) Elements of Palaeobotany, Kitab Mahal, Allahabad.
12. Bhatnagar, S.P. and Moitra A. (1996), Gymnosperms, New Age International Pvt. Ltd., New Delhi.
13. Singh, H. (1978), Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X, Gebryder, Bortragear, Berlin.
14. Pant, D.D. (2003): Cycas and allied Cycadophytes, BSIP, Publications.
15. Bierhorst D.W. (1971): Morphology of vascular plants McMillan, New York.
16. Thomas, B.A. & Spicer R.A. (1987): The Evolution and Palaeobiology of land plants. Discordies Press, Fortland, USA.
17. Spicer, R.A. & Thomas, B.A. (1986) Systematic and taxonomic approaches in Palaeobotany. Systematic Association Special Volume.
18. Chamberlain C.J. (1986); Gymnosperms, structure and Evolution, CBS publishers and distributors, New Delhi. On line Journals available on UGC -VSAT

M.Sc. Botany Syllabus
Semester I
Course code/name: Paper- IV Cytology and Genetics

Module I

Mendel's laws of inheritance; chromosome theory of inheritance; deviations from Mendel's findings; Penetrance and expressivity; Modifiers, suppressors and pleiotrpic genes; multiple alleles and isoalleles (example Corn, *Drosophila* and *Nicotiana*); multigene families (globin and immuniglobin genes); sex determination and dosage compensation in plants, *Drosophila, C. elegans*.

Module II

Chromatin organization: Chromosome structure and packaging of DNA; molecular organization of centromere and telomere, rRNA genes, euchromatin and heterochromatin; Karyotype analysis and evolution, banding patterns; specialized types of chromosomes: polytene, lampbrush, B-chromosome, sex chromosome; molecular basis of chromosome pairing, C- value paradox, Cot curve and its significance.

Module III

Structural and numerical changes in chromosomes; origin, breeding behavior of duplications, deficiency, inversion and translocation heterozygotes; effect of aneuploidy on plants; transmission of trisomics and monosomics and their use in chromosome mapping; complex translocation heterozygotes, translocation tester sets; Robertsonian translocation.

Module IV

Mutations: Spontaneous and induced; physical and chemical mutagens; molecular basis; transposable genetic elements; site directed mutagenesis; role of mutations in crop improvement; induction of polyploidy

Epigenetics: Introduction; paramutations in maize; Callipygh sheep; role of histones; DNA methylation; Epigenetics and Lamarckism; Epigenome and epigenomics.

Practicals

1. To study the effect of mutagen treatment on germination, seedling height and cell division.
2. To study the spontaneous and induced chromosomal aberrations in pollen mother cells.
3. To study the effect of mutagen treatment on pollen fertility.
4. To study the karyotype of given organism.
5. To study the chiasma frequency in the given material.
6. To study linear differentiation of chromosomes by chromosome banding.
7. To perfom the site directed mutagenesis in the given system.

Suggested Reading

Gupta P K 2007 Genetics: Classical to Modern. Rastogi Publications, Meerut.

Hexter W and Yost Jr. H T 1977 The Science of Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.

Hartl D L and Jones E W 1998 Genetics: Principles and Analysis (4th ed.). Jones and Barflett Publishers, USA.

Khush G S 1973 Cytogentics of Aneuploids. Academic press, New York.

Snustad D P and Simmons M J 2000 Principles of Genetics (2nd ed.) John Wiley and Son Inc., USA.

M. Sc. Botany Syllabus
Semester II
Paper- V Plant Physiology and Biochemistry

Module-I:-

1) The Scope of plant physiology

2) Photosynthesis: Evolution of photosynthetic apparatus, pigments, Light, light harvesting complex, Mechanism of electron transport, Photo protective mechanism, CO_2 fixation, C_3, C_4 and CAM pathway, Photorespiration, photosynthesis Physiological and ecological consideration (photosynthetic responses to light by the intact leaf, photosynthetic responses to carbon dioxide and temperature) coupled reaction and ATP Synthesis, the chemiosmatic-coupling hypothesis, ATP Synthesis in chloroplast and in mitochondria

Module-II

Respiration:- introduction, the respiratory substrate, fermentation, anaerobic and aerobic respiration, mechanism of respiration ,Glycolysis, Citric acid cycle, oxidative pentose phosphate pathway, Plant mitochondrial electron transport, alternative pathway of electron transport chain, cyanide resistant chain, metabolic pool, respiratory ratio, measurement of R.Q., Regulation of respiration ,respiratory enzymes, the non oxidative enzymes, the oxidative enzymes, factor affecting the rate of respiration

Module-III

1) Carbohydrates Metabolism

General classification and properties of carbohydrates, synthesis of starch and Sucrose, catabolism (degradation) of starch and sucrose

2) **Lipids Metabolism**

General classification and properties of lipids, fatty acid biosynthesis, synthesis of membrane lipids, synthesis of structural lipids, synthesis and catabolism of storage lipids.

3) **Metabolism of amino acids**

General claqssification and properties of amino acids, amino acid biosynthesis in plants, assimilation of inorganic nitrogen in to n-transport amino acids, GS/GOGAT Cycle

4) **Nitrogen metabolism**

Nitrogen cycles, Biological Nitrogen fixation by free-living and symbiotic bacteria, nif genes

5) **Sulfur and Phosphate assimilation by the plants**

Module-IV

Enzymes: - nomenclature and classification of Enzymes, Isoenzymes, Allosteric Enzymes, Multienzymes, Ribozymes, Lysozymes, Ribozymes & Abyzymes and Coenzymes enzyme kinetics, mode and mechanism of Enzyme action (Regulation of Enzyme activity), Activators & Inhibitiors, properties of Enzymes, factors affecting Enzyme activity pH, Buffer, reaction kinetics, colligative properties

Solute transport and photo-assimilate translocation:- Mechanism of water transport through xylem; Pathway of translocation patterns of Translocation through phleom;

Source and sink, Materials Translocated in the Phloem i.e. Sucrose, Amino acids, Hormones and some inorganic ions, Rate of Movement, Phloem loading: from chloroplast to sieve elements, Phloem Unloading: sink-to-source Transition, mechanism of translocation in the phloem

Suggested Laboratory Exercises:

To study the effect of time and enzyme concentration on the rate of reaction of enzyme (e.g. phosphatase, nitrate reductase).

To study the effect of substrate concentration on activity of enzyme and determination of its Km value.

Demonstration of the substrate inducibility of the enzyme nitrate reductase.

Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.

To determine the total carbohydrate content in the given sample

Estimation of Pectic Substances-gravitic mthod

To prove Berr-Lambert's law using a suitable solution.

Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophyll and carotenoids.

To determine the chlorophyll a/ cholorophyll b ratio in C3 and C4 plants.

Isolation of intact chloroplasts and estimation of choloroplast proteins by spot protein assay.

Preparation of standard curve of protein (BSA) and estimation of protein content in extracts of plant material by Lowry's or Bradford's method.

Preparation of Leaf Protein Concentrates from green vegetables.

Determination of reducing sugars by Nelson – Somogyi Method

Suggested Readings (for laboratory exercises):

1 **Bajracharya, D. 1999.** Experiments in Plant Physiology: A Laboratory Manual. Narosa Publishing House, New Delhi.

2 **Cooper, T.G. 1977.** Tools in Biochemistry. John Wiley, New York, USA.

3 **Copeland, R.A. 1996.** Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis. VCH Publishers, New York.

4 **Dennison C. 1999.** A guide to Protein Isolation. Kluwer Academic Publishers, Dordrecht, The Netherland.

5 **Devi, P. 2000.** Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios, Jodhpur, India.

6 **Dryer, R. L. and Lata, G. F. 1989.** Experimental Biochemistry. Oxford University Press, New York.

7 **Hames, B.D.(Ed.).1998.** Gel Electrophoresis of Proteins: A Practical Approach, 8th edition. PAS, Oxford University Press, Oxford, UK.

8 **Harborne, T.C. 1981.** Phytochemical Methods: A Guide to Modern Techniques of Plants Analysis. Chapman& Hall, London.

9 **Moore, T.C. 1974.** Research Experiences in Plant Physiology: A Laboratory Manual. Springer-Verlag, Berlin.

10 **Ninfa, A. J. and Ballou, D. P. 1998.** Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Fitzgerald Science Press, Inc., Maryland, USA.

11 **Plummer, D.F. 1988.** An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

12 **Scott, R.P.W. 1995.** Techniques and Practice of Chromatography. Marcel Dekker, Inc., New York.

13 **Wilson, K. and Goulding, K.H.(Eds), 1986.** A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London,UK.

14 **Wilson, K. and Walker, J. 1994.** Practical Biochemistry: Principles and Techniques, 4th edition. Cambridge University Press, Cambridge, UK.

15 Sadasivam and Manikum: Biochemical Methos , New Age International (p) Limited Publishers 4835/24, Ansari Road, Daryaganj, New Delhi- 110002

SUGGESTED READINGS (FOR THEORY):

1 **Buchanan, B. B., Gruissem, W. and Jones, R.L. 1989.** Biochemistry and Molecular Biology of plants. American Society of Plant Physiologists, Maryland, USA.

2 **Dennis, D.T., Turpin, D. H., Lefebvrc, D.D. and Layzell, D.B. (eds).1997.** Plant Metabolism (2nd Ed.) Longman, Essex, England.

3 **Gaiston, A.W.1989.** Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.

4 **Hooykass P.J.J., Hall, M. A. and Libbenga, K.R.(eds).1999.** Biochemistry and Molecular Biology of plant Horm. Elsevier, Amsterdam, The Netherlands.

5 **Hopkins, W.G. 1995.** Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.

6 **Lodish, H., Berk, A., Zipursky S.L., Matsudaira, P., Baltimore, D and Darnell, J. 2000.** Molecular Cell Biology (4th ed). W. H. Freeman and Company. New York ,USA.

7 **Moore, T.C. 1989.** Biochemistry and Physiology of Plant Hormones (2nd ed). Springer-Verlag, New York, USA.

8 **Nobel, P.S.1999**. Physicochemical and Environmental Plant Physiology (2nd ed). Academic Press, Diego, USA.

9 **Salisbury, F.B. and Ross, C.W.1992:** Plant Physiology (4th ed). Wadsworth Publishing Co., California, USA.

10 **Singhal G.S., Renger, G., Sopory, S.K., Irrgang, K.D. and Govindjee.1999:** Cocepts in Photobiol Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi.

11 **Taiz, L. and Zeiger, E. 1998:** Plant Physiology. Sinaucr Associates, Inc., Publishers, Massachus, USA.

12 **Thomas,B. and Vince-Prue,D.1997:** Photoperiodism in Plants (2nd ed). Academic Press, San Diego, USA.

13 **Westhoff, P.1998:** Molecular Plant Development: From gene to plant. Oxford University Press, Oxford, UK.

14 **Dey, P. M. And Harborne, J. B. 2000:** Plant Biochemistry ,Harcourt Asia PTE Ltd. A Harcourt Publishers International Company, 583 Orchard Road 09-01 Forum Singapore-238884

15 **Ranjan, purohit, Prasad 2003:** Plant Hormones Action and Application, Agrobios(India), agro house, behind Nasrani cinema Chopasani Road, Jodhpur -34

M. Sc. Botany Syllabus
Semester -II
Paper- VI: Plant Development and Reproduction

Module I:
Plant growth
Kinetics and pattern of growth
Shoot Development – Organization of shoot apical meristem (SAM); cytological and molecular analysis of SAM; control of cell division and cell communication; control of tissue differentiation.
Phytohormones: Classification, chemical nature and their role in plant development.

Module II :
Leaf growth and differentiation – Determination; phyllotaxy; control of leaf form; differentiation of epidermis (with special reference to stomata & trichomes) and mesophyll.
Root Development – Organization of root apical meristem (RAM); vascular tissue differentiation; lateral root hairs; root microbe interactions.
Flower Development – Physiology of flowering, florigen concept and photoperiodism, Genetics of floral organ differentiation; homeotic mutants in *Arabidopsis* and *Antirrhinum*. Pollination mechanisms and vectors

Module III :
Male Gametophyte – Structure of anther, microsporogenesis, tapetum; pollen development and gene expression; male sterility; sperm dimorphism; pollen germination; pollen tube growth and guidance.
Female Gametophyte – Ovule types; megasporogenesis; organization of embryo sac; structure of embryo sac cells.
Pollen – pistil interaction and fertilization; Structure of the pistil; pollen – stigma interactions, double fertilization; *in vitro* fertilization.

Module IV :
Seed Development and fruit growth – Endosperm development; embryogenesis; ultrastructure and nuclear cytology; storage proteins of endosperm and embryo; polyembryony; apomixes; embryo.
Germination of seed: Biochemical and hormonal control.
Latent life – **Dormancy** : Importance and types of dormancy; seed dormancy; overcoming seed dormancy; bud dormancy.
Senescence and Programmed Cell Death (PCD) – Basic concepts; types of cell death, PCD in life cycle of plants; metabolic changes associated with senescence and its regulations; influence of hormones and environmental factors on senescence.

Suggested Readings:
1) Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.

2) Fageri, K. and Van der Pol, L. 1979. The Principles of Pollination Ecology. Pergamon Press, Oxford.
3) Fahn, A. 1982. Plant Anatomy, (3rd edition). Pergamon Press, Oxford.
4) Fosket, D.E. 1994. Plant Growth and Development. A molecular Approach. Academic Press, San Diego.
5) Howell, S.H. 1998, Molecular Genetics of Plant Development. Cambridge University Press, Cambridge.
6) Leins, P., Tucker, S.C. and Endress, P.K. 1988. Aspects of Floral Development. J. Cramer, Germany.
7) Lyndon, R.F., 1990. Plant Development. The Cellular Basis. Unnin Hyman, London.
8) Murphy, T.M. and Thompson, W.F. 1988. Molecular PlantDevelopment. Prentice Hall, New Jersey.
9) Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
10) Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
11) Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
12) Raven, P.H., Evert, R.F. and Eichhorn, S.E. 1992. Biology of Plants (5th Edition). worth, New York.
13) Steeves, T.A. and Sussex, I.M. 1989. Patterns in Plant Development (2nd edition). Cambridge University Press, Cambridge.
14) Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London.
15) Waisel, Y., Eshel, A. and Kafkaki, U. (eds) 1996. Plant Roots: The Hidden Hall (2nd edition.) Marcel Dekker, New York.
16) Shivanna, K.R. and Sawhney, V.K. (eds) 1997. Pollen Biotechnology for Crop Production and Improvement, Cambridge University Press, Cambridge.
17) Shivana, K.R. and Rangaswamy, N.S. 1992. Pollen Biology: A Laboratory Manual. Springer-Verlag, Berlin.
18) Shivana, K.R. and Johri, B.M. 1985. The Angiosperm Pollen: Structure and Function. Wiley Eastern Ltd., New York.
19) The Plant Cell. Special issue on Reproductive Biology of Plants, Vol. 5(10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.
20) On line Journals available on UGC -VSAT

Suggested Laboratory / Field Exercises (Any 12):

1. Tissue systems, meristem, vascular and cork cambium

2. Internal structure of root, stem and leaf (dicot and monocot), advanced secondary growth in dicot stem and root.

3. Anomalies in primary and secondary structure of stem

4. Study of living shoot apices by dissections using aquatic plants such as *Ceratophyllum* and *Hydrilla*.

5. Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double-stained permanent slides of a suitable plant such as *Coleus, Kalanchoe, Tobacco.* Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.

6. Study of alternate and distichous, alternate and superposed, opposite and superposed; opposite and decussate leaf arrangement.

7. Examination of rosette plants (*Launaea, Mollugo, Raphanus, Hyoscyamus* etc) and induction of bolting under natural conditions as well as by GA treatment.

8. Microscopic examination of vertical sections of leaves such as *Cleome, Nerium,* Maize and Wheat to understand the internal structure of leaf tissues and trichomes, glands etc. Also study the C3 and C4 leaf anatomy of plant.

9. Study of epidermal peels of leaves such as *Coccinia, Gaillardia, Tradescantia, Thunbergia,* etc. to study the development and finalstructure of stomata and prepare stomatal index. Demonstration of the effect of ABA on stomatal closure.

10. Study of whole roots in monocots and dicots. Examination of L.S. of root. from permanent preparation to understand the organization of root apical meristem and its derivatives. (use maize, aerial roots of banyan, Pistia, Jussieua etc.). Origin of lateral roots. Study of leguminous roots with different types of nodules.

11. Study of microsporogenesis and gametogenesis in sections of anthers.

12. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (Maize, Grasses, *Crotolaria, Tradescantia, Brassica, Petunia, Solanum melongena*, etc.)

13. Tests for pollen viability using stains and *in vitro* germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface culture.

14. Estimating percentage and average pollen tube length *in vitro.*

15. Role of transcription and translation inhibitors on pollen germination and pollen tube growth.

16. Pollen-pistil interaction, self-incompatibility, *in vitro* pollination.

17. Study of ovules in cleared preparations; study of monosporic, bisporic and tetrasporic types of embryo sac development through examination of permanent stained serial sections.

18. Field study of several types of flower with different pollination mechanisms (wind pollination, thrips pollination, bee/butterfly pollination, bird pollination).

19. Emasculation, bagging and hand pollination to study pollen germination, seed set and fruit development using self compatible and obligate outcrossing systems. Study of cleistogamous flowers and their adaptations.

20. Study of nuclear and cellular endosperm through dissections and staining.

21. Isolation of zygotic globular, heart-shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun (*Syzygium cumini*) etc. by dissections.

22. Study of seed dormancy and methods to break dormancy.

M. Sc. Botany Syllabus
Semester II
Course code/name: Paper- VII Cell and Molecular BiologyBiology- I

Module I:
Cell wall: Structure; function; biogenesis and growth; cell differentiation
Plasma membrane: Membrane architecture (fluid mosaic model); sites for ATPases; membrane transport - ion carriers, channels, pumps and aquaporins; receptors.
Plasmodesmata: Structure, role in movement of molecules and macromolecules; comparison with gap junction.

Module II:
Cellular organelles: Ultra-structure and function of golgi complex, lysosomes, peroxisomes, **endoplasmic** reticulum, mitochondria, chloroplast and plant vacuoles.
Cell shape and motility: The cytoskeleton; organization and role of microtubules and microfilaments; motor movements, implications in flagellar & other movements, cell division.

Module III:
Nucleus: Ultrastructure, nuclear pores, nucleolus, DNA structure A, B and Z forms, replication in prokaryotic and eukaryotic cells, DNA replication proteins, damage and repair.

Module IV:
Molecular biology of stress responses: Defination and classification of stress; Plant defence mechanism (passive and active); HR and SAR; modulation of plant metabolism in response to biotic stress: early and late response; production of ROS, induction of enzymes, induction of genes involved in phenylpropenoid metabolism; PR proteins and R- genes

Suggested Readings:

- Atherly, A.G., Griton, J.R. and Mc Donald, J. F. 1999. The Science of Genetics. Saunders College Pub. Fort Worth, USA
- Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 Biochemistry and Molecular Biology of Plants. American Soc. Of Plant Physiologists, Maryland, USA.
- Bush, H. Rothblum, L. 1982. Vol. X. The Cell Nucleus RDNA part A. Academic Press.
- Dc, D. N. 2000 Plant cell vacuoles: An introduction. CSIRO Publication, Collingwood, Australia.
- De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.
- Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.

- Kleinsmith, L.J. and Kish, V.M. 1995 Principles of Cell and Molecular Biology (2nd Edi.) Harper Collins Coll. Publisher, New York, USA.
- Krishnamurthy, K.V. 2000 Methods in Cell wall Cyto-chemistry. CRC Press, Boca Raton, Florida
- Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA
- Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA
- Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Practicals

- Orcein staining of the salivary gland chromosomes of *Chironomus* and *Drosophila*.
- Cell fractionation & isolation of Chloroplast and mitochondria.
- Isolation of plant DNA and its quantification by spectrophotometric method.
- To perform flagellary staining.
- Isolation of DNA and preparation of Cot-curve.
- Demonstration of vital structure and functions of cell
- To study the induction of defence genes by elicitors.

Suggested Readings (for laboratory exercises):

- Fukui, K. and Nakayama, S. 1996. Plant Chromosomes: Laboratory Methods. CRS Press, Boca Raton, Florida.
- Glick, B. R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida USA.
- Goswami, H. K. 1986. Practical cytology – Applied Genetics and Biostatistics Himalaya Pub. House, Bombay.
- Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology: Structure and Function. Jones and Barlett Publishers, Boston, Massachusetts.
- Hall, J.L. and Moore, A.L. 1983.Isolation of Membranes and Organelles from Plant Cells Academic Press, London, U.K.
- Harris,N. and Oparka, K.J. 1994. Plant Cell Biology: A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
- Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering. Har Academic Publishers, Australia.
- Shaw, C.H. (Ed.), 1988. Plant Molecular Biology: A Practical Approach. IRL Press, Oxford.Techniques, 2nd edition. PAS, IRL Press at Oxford University Press, Oxford.

References: Online journals available on UGC V-SAT programme.

Review Journals:

- Annual Review of Plant Physiology and Molecular Biology
- Biochemistry and Cell Biology
- Cell

- Cell Biology International -
- Cell Death and Differentiation -
- Cell Motility and the Cytoskeleton -
- Cellular Physiology and Biochemistry
- Current Advances in Plant Sciences
- Cytokine -
- European Journal of Cell Biology -
- Journal of Cell Science
- Nature Reviews: Molecular and Cell Biology
- Protoplasma- An International Journal of Cell Biology -
- Trends in Cell Biology
- Trends in Plant Sciences

M. Sc. Botany Syllabus
Semester II
Course code/name: Paper- VIII Angiosperms- I

Module I:

Angiosperm Morphology, structural units and floral symmetry, dicot and monocot flower; structure, diversity origin and evolution of stamen, carpels; placentation types and evolution. Floral adaptation to different pollinators

Module II:

Angiosperm Taxonomy: Scope, aims, principles of taxonomy, historical development of plant taxonomy, relative merits and demerits of major systems of classifications. Taxonomic structure: taxonomic hierarchy, concept of taxa, concept of species, concept of genus and family; Taxonomic character: HETEROBATHMY, ANALYTIC Vs. synthetic character, qualitative Vs quantitative characters.

Module III:

Taxonomic evidence: Morphology, anatomy, embryology, palynology, cytology, phytochemistry, genome analysis.
Taxonomic tools: herbarium, floras, monographs, botanical gardens, biochemical and molecular techniques, computers and GIS.

Module IV:

Biosystematics: The population concept phenotypic plasticity, biosystematic categories, methods of biosystematics studies. Numerical taxonomy: principles, aims and objectives, cladistics in taxonomy, polarity of characters, homology, homoplasy, monophyly, polyphily. Plant nomenclature: Salient features of ICBN

Practicals

1. To study the floral symmetry in various taxa.
2. To study and work out the differences in dicot and monocot flower.
3. To study the variation in stamens and carpels.
4. To study placentation types in various taxa.
5. To study the floral adaptations for pollination.
6. To study anatomical features of various taxa.
7. To study embryological features of various taxa.
8. To study palynological features of various taxa.
9. To study cytological features of various taxa.
10. To prepare a cladogram on the basis of various morphological features of the species belonging to a genus.

Suggested Readings

Devis, P.H. and Heywood, V. H. 1973. Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.
Grant, V. 1971. Plant Speciation, Columbia University press, London.

Grant W. F. 1984. Plant Biosystematics. Academic press, London.
Harisson, H.J. 1971. New concept in flowering plant Taxonomy. Hickman educational books Ltd. London.
Hislop-Harisson, J. 1967. Plant Taxonomy. English Language Book Sco. And Edward Arnold Pub. Ltd, UK.
Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.
Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co. New York.
Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw- Hill Book Co., New York.
Nordentam, B., El Gazaly, G. and kassas, M. 2000. Plant systematic for 2ft century. Portlant press. Ltd, London.
Radford, A. E. 1986. Fundamentals of plant systematic. Harper and Raw publication, USA.
Solbrig, O.T. 1970. Principles and methods of plant Sytematics. The Macmillan Co. Publication Co. Inc., USA.
Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.
Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.
Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edvard Arnold Ltd, London.
Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.
Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., New

M. Sc. Botany Syllabus
Semester III
Course code/name: PAPER –IX: Plant ecology

Module I:

Vegetation organization: Concepts of community and continuum, analysis of communities (analytical ad synthetic characters): interspecific associations, concept of ecological niche.

Vegetation development: Temporal changes (cyclic and non-cyclic); mechanism of ecological succession (relay floristics and initial floristic composition; facilitation, tolerance and inhibition models); changes in ecosystem properties during succession, Autecology.

Module II:

Ecosystem organization: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological effeciencies); litter fall and decomposition (mechanism, substrate quality and climatic factors); global biogeochemical cycles of C, N, P, and S; mineral cycles (pathways, processes, budgets) in terrestrial and aquatic ecosystems.

Module III:

Air, Water and Soil pollution: Kinds; sources; quality parameters; effects on plant and ecosystems.

Climate change: Greenhouse gases (CO_2, CH_4, N_2O, CFCs; sources, trends and role); ozone layer and ozone hole; consequences of climate change (Global warming, sea level rise, UV radiation).

Module IV:

Ecosystem stability: Concept (resistance and resilence); Ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion; environmental impact assessment; ecosystem restoration.

Ecological management: Concepts; sustainable development; sustainability indicators.

Plant Ecology- Practicals:

1) A trip to the grass land/ forest/ water body to get acquainted with their plant species.
2) Distribution pattern of different plant species determined by Quadrat/ Transat/ Point centered Quarter methods.
3) Qualitative parameters of distribution of plant species, Frequency, Density, Basal cover, dominance, Abundance and IVI.
4) Analysis of soils of two different areas i.e. Cropland and forest/ grassland for certain nutrients, CO_3, NO_3, Base deffiency.
5) Analysis of water quality for physical properties like colour BOD, COD, O_2, CO_2 contents etc.
6) Study of adaptations in plants of hydrophytic, Xerophytic and halophytic zones.

Suggested Readings:

1. Ambasht R.S. 1968. Freshwater ecosystem- Manual of Ecology 123-137 (See Misra KC et al 1968)
2. Ambasht R.S. 1966 Conservation Ecology, Abs Proc School on Plant Ecol (Full paper in press Oxford and IBH Calcutta).
3. Ambasht R.S. 1995 A text book of plant ecology Student and co. Varanasi-5
4. Anderson JM Ecology for environmental sciences: biosphere ecosystems and man
5. Billings WB 1964 Plants and the ecosystem Macmillan & co, London.
6. Clements FE 1916 Plant succession, An analysis of the development of vegetation. Carnegie Institute of Washington.
7. Cragg JB 1968 The theory and practice of conservation, IUCN Publ, New Series No. 12, 25-35.
8. Dash MC 1993 Fundamentals of Ecology WB Saunders and co. Philadelphia USA.
9. Deangelis DL Energy flow, nutrient cycling and ecosystem resilience. Ecology 56, 238-43.
10. Dwivedi Rama Shankar 1968. The decomposer system manual of ecology See Misra KC et al 1970)
11. Frankel OH, Soule ME, 1981, Conservation and Evolution, Cambridge Univ Press.
12. Grace J 1983, Plant atmosphere relationships. Champman & Hall.
13. Greig Smith P 1983, Quantitative plant ecology, Univ California Press, California.
14. Hutchings MJ (ed) 1988, Plant population biology, Blackwell.
15. Hutchinson GE 1978, An introduction to population ecology. Yale Univ. Press.
16. Kochhar PL 1986 Plant Ecology Ratan prakashan, Mandi, Agra.
17. Krebs GJ 1972 Ecology Harper and Row Publ, New York.
18. Kumar HD 1994 Modern concepts of ecology. Vikas publishing house pvt ltd, New Delhi.
19. May RM (ed) 1981 Theoretical Ecology, Blackwell.
20. Odum EP 1963 Ecology Holt Reinhart and Winston Inc.
21. Odum EP 1983 Basic Ecology, Saunders Publ Philadelphia.
22. Reynolds CS 1984 The ecology of phytoplankton, Cambridge Univ Press
23. Silverton JW 1982 Introduction to plant population ecology, Longman.
24. Southwick CH 1983 (ed) Global Ecology Sinauer.
25. Whittaker RH 1975 Communities and Ecosystems (2^{nd} ed) MacMillan, New York.

M. Sc. Botany Syllabus
Semester III
Course code/name: Paper- X Cell and Molecular Biology- II

Module I:

Ribosomes: Structure and function

Transcription & Translation: Transcription in prokaryotic and eukaryotic cells, plant promoters, transcription factors, types of RNA and their function, splicing, mRNA transport, rRNA biosynthesis; translation in prokaryotic and eukaryotic cells, structural levels of proteins, post-translational modification; structure and role of tRNA.

Module II:

Gene structure and expression: Fine structure of gene, Cis-trans test; fine structure analysis in eukaryotes; introns and their significance, RNA splicing; regulation of gene expression in pro- and eukaryotes.

Protein sorting: Machinery involved, vesicles, coat proteins; protein targeting to plastids, mitochondria, peroxisomes, nucleus, vacuoles; modification during transport.

Module III:

Genome organization in prokaryotes and eukaryotic organelles: Phage genome, genetic recombination in phage and mapping phage genes; mapping of bacterial genes through transformation, conjugation and transduction; genetics of mitochondria and chloroplast.

Genetic recombination and genetic mapping: Recombination, independent assortment and crossing over; molecular mechanism of recombination, role of RecA and RecBCD enzymes; site-specific recombination; chromosome mapping, linkage group, genetic markers, construction of molecular maps, correlation of genetic and physical maps; Somatic cell genetics - an alternative approach to gene mapping.

Module IV:

a. **Cell cycle and apoptosis**: Control mechanisms, role of cyclins and cyclin dependent kinases; retinoblastoma and E2F proteins; cytokinesis and cell plate formation; programmed cell death in plants; regulation in plant growth and development.
b. **Signal transduction**: Overview, receptors and G- proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascades, diversity in protein kinases and phosphatases, specific signaling mechanisms e.g. two-component sensor-regulator system in bacteria and plants, sucrose sensing mechanism
c. **Techniques in cell biology**: Electrophoresis, immunotechniques, FISH, GISH, confocal microscopy

Suggested readings:

- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999. Molecular Biology of Cell, Garland Publishing, Inc., New York.
- Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 Biochemistry and Molecular Biology of Plants. American Soc. Of Plant Physiologists, Maryland, USA.
- De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.
- Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.
- Khush, G.s. 1973 Cytogenetics of Aneuploids, Academic Press, New York, London
- Kleinsmith, L.J. and Kish, V.M. 1995 Principles of Cell and Molecular Biology (2nd Edi.) Harper Collins Coll. Publisher, New York, USA.
- Lewin, B. 2000 Gene VII Oxford Univ. press, New York.
- Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA.
- Malacinski, G. M. and Freifelder, D. 1998 Essentials of Molecular Biology (3rd Edi.) Jones and Bartiet Pub. Inc., London.
- Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA
- Sunstad, D. P. and Simmons, M. J. 2000 Principles of Genetics (2nd Edi.) John Wiley & Sons Inc., USA.
- Tamarin, R. H. 2001 Principles of Genetics 7th Edi. The McGraw−Hill Companies.
- Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.

Practicals:

1. Isolation of nuclei and identification of histones by SDS-PAGE.
2. Isolation of chloroplast and demonstration of two subunits of RUBISCO by SDS PAGE
3. Restriction digestion of plant DNA, its separation by agarose gel electrophoresis, visualization by ethidium bromide staining.
4. To study in vitro transcription.
5. To study in vitro translation.
6. To study conjugation in bacterial cells.
7. To detect the presence of specific antigen by ELISA
8. Isolation of RNA and quantification by spectrophotometric method.

References: Online journals available on UGC V-SAT programme

M. Sc. Botany Syllabus
Semester III
Course code/name: Paper- XI Plant Biotechnology

Module I:

a. **Recombinant DNA technology**: Gene cloning and principles and technique; vectors-types and their properties; construction of DNA libraries; splicing of insert into the vector; screening of DNA libraries and introduction of the recombinant DNA into the host cells.
b. **Genetic engineering of plants**: Aims, strategies for development of transgenics (with suitable examples); Agrobacterium- the natural genetic engineer; T-DNA and transposon mediated gene tagging.

Module II:

a. **Microbial genetic manipulation**: Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.
b. **Genomics and proteomics**: Molecular markers for introgression of useful traits; high throughput sequencing; functional genomics; Protein profiling and its significance**.**
c. DNA synthesis; DNA sequencing; polymerase chain reaction; DNA fingerprinting

Module III:

Plant tissue culture: Basic concepts; Principles and scope; tissue culture media; callus induction and cell suspension; aspects of morphogenesis; haploid and triploid production; production of somatic embryos; applications of plant tissue culture; protoplast isolation and culture; production of cybrids

Transgenic production: Methods to introduce gene in plants; selection of transformed plants/explants; salient achievements in crop bioteachnology.

Module IV:

a. **Bioinformatics**: Introduction, History, Definition and applications of bioinformatics.
b. **Database**: Types and classification of databases – Primary Databases (Nucleic acid sequence, protein sequence, protein structure), Secondary databases (Genomic, cDNA, Organellar, gene expression), special databases (Human, *Escherichia coli*, *Saccharomyces cerevesaie* and *Arabidopsis thaliana*), Literature database (PubMed, OMIM), Information Retrieval system (Entrez). Other databases: GeneBank, KEGG, Taxonomy databases
c. **Data analysis, prediction and submission tools and their uses:** ORF finder**,** Blasts, FASTA, RASMOL, Prediction of pro- and eukaryotic genes and promoters (Genscan); protein structure (SWISS-Prot, pfam, PDB, PIR); **sequin**, webin, AutoDep tools.

Suggested Readings:

- Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics, John-Wiley and Sons Publications, New York.
- Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
- Brown, T. A. 1999. Genomes, John Wiley & Sons(Asia) Pvt. Ltd., Singapore.
- Callow, J. A., Ford-Lloyed, B. V. and Newbury, H. J. 1997. Biotechnology and
- Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.
- Chrispeeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture. Jones & Barlett Publishers, Boston, USA.
- Glazer, A. N. and Nikaido, H. 1995. Microbial Biotechnology. W. H. Freeman & Company, New York, USA.
- Gustafson, R. J. 2000. Genomes. Kluwer Academic Plenum Publishers, New York, USA.
- Henry, R. J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK.
- Jain, S. M., Sopory, S. K. and Veilleux, R.E. 1996. *In vitro* Haploid Production in Higher Plants, Vols. 1-5, Fundamental Aspects and Methods. Kluwer Academic Publishers, Dordrecht, The Netherlands.
- Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
- Kartha, K. K. 1985. Cryopreservation of Plant Cells and Organs. CRC Press, Boca Raton, Florida USA.
- Kingsman, S. M. Genetic Engineering : An Introduction to Gene Analysis and Exploitation in Eukaryotes, Blackwell Scientific Publications, Oxford, 1998
- Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi
- Old, R. W. and Primrose, S. B. 1989. Principles of Genome Analysis. Blackwell Scientific Publications. Oxford, UK.
- Primrose, S. B.1995. Principles of Genome Analysis. Blackwell Scientific Ltd., Oxford, UK.
- Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.
- Watson, J. , Tooze and Kurtz Recombinant DNA: A short course

Practicals:

1. Growth characteristics of *E.coli* using plating and turbidimetric methods.
2. Isolation of plasmid from *E.coli* and its quantification.
3. Restriction digestion of the plasmid and estimation of the size of various DNA fragments.
4. Cloning of a DNA fragment in a plasmid vector, transformation of the given bacterial population and selection of recombinants.

5. Co-cultivation of the plant material (e.g. leaf discs) with *Agrobacterium* and study GUS activity histochemically.
6. Preparation of media for plant tissue culture.
7. To surface sterilize the given seeds/explant for tissue cultural manipulation.
8. To isolate protoplast and determine its viability.
9. To fuse the protoplast for production somatic hybrid.
10. Demonstration of DNA sequencing by Sanger's dideoxy method.
11. To search literature of different organisms and genes from NCBI.
12. Use of various tools to retrieve information available from NCBI
13. To retrieve gene and protein sequences of various organisms from NCBI.
14. To locate gene(s) on chromosomes for a given disease/disorder.

Suggested Readings(for laboratory exrcises)

- Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics, John-Wiley and Sons Publications, New York.
- Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
- Gelvin, S. B. and Schilperoort, R. A (eds) 1994. Plant Molecular Biology Manual, 2nd edition. Kluwer Academic Publishers, Dordrecht, The Netherlands,
- Glover, D. M. and Hames, B. D.(Eds) 1995. DNA Cloning 1: A Practical Approach: Core Techniques, 2nd edition PAS, IRL Press at Oxford University Press, Oxford.
- Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.
- Maniatis et al. Molecular cloning Vol. I, II and III. Cold-Spring Harbor Lab Press.
- Shaw, C. H. (Ed.) 1988, Plant Molecular Biology : A Practical Approach. IRl Press,
- Oxford.

References: Online journals available on UGC V-SAT programme.

M. Sc. Botany Syllabus
Semester III
Course code/name: Paper- XII Angiosperms- II

Module I:
General account, distinguished characters, floral variation and evolution, affinities of :- Magnolidae, Hamamelidae, Dilleniidae, Rosidae, Asteridae, circumscription as per Cronquist,1968

Module II:
Alismatidae, commelinidae, Aracidae, Lilidae; Interesting features and systematic position of Cucurbitaceae, Cactaceae, Asteraceae, Amentiferae, Lemnaceae, Palmae, Orchidaceae.

Module III:
Probable ancestors of angiosperms, primitive living angiosperms, speciation and extinction, IUCN categories of threat, distribution and global pattern of biodiversity.

Module IV:
Biological diversity concept and levels, role of biodiversity in ecosystem functions and stability, Endemism, hotspots and hottest hotspots, invasions and introductions, local plant diversities and its socioeconomic importance.

Practicals:
Angiosperms

1. Description of a specimen from representative, locally available families.
2. Description of a species based on various specimens to study intra specific variation: collective exercise.
3.
4. Description of various species of a genus, location of key characters and preparation keys at generic level.
5. Location of key characters and use of keys at family level.
6. Field trips within and around the campus; compilation of field notes and preparation herbarium sheets of such plants, wild or cultivated as are abundant.
7. Training in using floras herbaria for identification of specimens described in the class.
8. Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
9. Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparation of dendrograms.

Suggested Readings
Devis, P.H. and Heywood, V. H. 1973. Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.
Grant, V. 1971. Plant Speciation, Columbia University press, London.
Grant W. F. 1984**.** Plant Biosystematics. Academic press, London.

Harisson, H.J. 1971. New concept in flowering plant Taxonomy. Hickman educational books Ltd. London.
Hislop-Harisson, J. 1967. Plant Taxonomy. English Language Book Sco. And Edward Arnold Pub. Ltd, UK.
Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.
Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co. New York.
Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw- Hill Book Co., New York.
Nordentam, B., El Gazaly, G. and kassas, M. 2000. Plant systematic for 2ft century. Portlant press. Ltd, London.
Radford, A. E. 1986. Fundamentals of plant systematic. Harper and Raw publication, USA.
Solbrig, O.T. 1970. Principles and methods of plant Sytematics. The Macmillan Co. Publication Co. Inc., USA.
Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.
Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.
Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edvard Arnold Ltd, London.
Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.
Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., New Delhi.

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper- XIII Plant conservation, IPR and Ethnobotany

Module I

Plant biodiversity – Concept of Biodiversity; Types (Species, Genetic, Ecosystem diversity. Present status in India

Origin of Biodiversity; values of Biodiversity; loss of Biodiversity.

Megabiodiversity Centers with special emphasis on Western Ghats and Indo-Burma region

Biodiversity and agriculture; Bioprospecting; commercial values of Biodiversity.

CBD – General account

Module II

IUCN – General account, categories, Commissions, role in conservation; Red Data Book

CITES – General account, CITES & International trade

Strategies for conservation

Protected areas concept: Sanctuaries, National parks, Man and Biospere programme, Biosphere reserves

Tiger reserves with reference to Melghat Tiger Project, Tadoba Andhari Tiger Reserve and Pench)

Wetlands – Types, Importance, Measures taken for conservation at National and International levels, Ramsar Convention

Mangroves – Types, Zonations, Importance, Measures taken for conservation at National and International levels

Module III

Coral Reefs – Types, importance, artificial reefs, conservation measures

Legislative framework for protection

Principles and practices for *Ex- situ* conservation, Botanical gardens, Field Gene Banks, Seed Banks.

In-vitro repositories, Cryobanks,

General accounts and activities of national institutes like Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Department of Biotechnology (DBT) and their role in plant conservation

Module IV

Intellectual property right; patenting: basic requirement, novelty, public domain; plant variety ptotection act; farmers right protection act; WTO with reference to biotechnological affairs

Ethnobotany: Definition, scope and significance. Status in India Major tribes of Maharashtra – Madia, Korku, Gond, Bhil, Varli (information on customs, traditions, plants used as medicines, scarcity food); Important medicinal plants used by tribals in Vidarbha; Sacred groves and their role in conservation.

M. Sc. Botany Syllabus

Semester IV

Course code/name: Paper- XIV Plant resource utilization, Bioethcs, Biosafety, Plant breeding and Biostatistics

Module 1:

Centres of diversity of domesticated plants; Green revolution.

Important fire wood and timber yielding plants; qualities of timber plant, Non-wood forest products (NWFPs) such as Bamboos and rattans

Origin, evolution, botany and uses of food crop (rice and pigeonpea), Fibre crop (Cotton, jute), Vegetable oil yielding crop (Safflower, Sunflower) Sugar and biomass crop (Sugarcane, Beet)

Source, types and uses of – gums, resins, tannins and dyes

A brief account of major spices, condiments, narcotics, mastigatories and fumitories and beverages

Fodder and forage plants

Medicinal and aromatic plants

General account of petrocrops

Module 2:

Sampling-Sampling procedure, homogenization of samples, samples size, Selection of random sample, Limitation of analytical methods

Types of data, Frequency distribution, Measure of central values - Mean, median and mode, **Measures of dispersion** - range , mean deviation , standard deviation, coefficient of variation, moment, Statistical Inference of Qualitative & Quantitative Variables, level of significance, Chi square test & its applications, One-Way ANOVA, Two way ANOVA, t-test

Module 3:

Population genetics: Hardy-Weinberg equilibrium and deviations from it; quantitative trait loci (Kernel colour in wheat, corolla length in *Nicotiana longifera*).

Plant breeding: Methods of breeding sexulally (self and cross pollinated) and vegetatively propagated crops; heterosis and inbreeding depression and their genetic basis; use of male sterility in hybrid production.

Bioethics: Professional ethics, ethical decision making and ethical dilemmas

Module 4:

Biosafety in the laboratory institution: Laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, prudent biosafety practices in the laboratory/ institution

Biosafety regulations in the handling of recombinant DNA processes and products in institutions and industries, biosafety assessment procedures in India and abroad

Biotechnology and food safety: The GM-food debate and biosafety assessment procedures for biotech foods & related products, including transgenic food crops, case studies of relevance.

Ecological safety assessment of recombinant organisms and transgenic crops, case studies of relevance (Eg. Bt cotton).
Biosafety assessment of biotech pharmaceutical products such as drugs/vaccines etc.
International dimensions in biosafety: Catagena protocol on biosafety, bioterrorism and convention on biological weapons

Recommended Books :

- Arora, P. N. & Malhon, P. K., 1996 Biostatistics. Himalaya Publishing House, Mumbai.
- Bliss, C. I. K.1967 Statistics in Biology. Vol. 1 Mc Graw Hill, New York.
- Campbell, R. C. 1974 Statistics for Biologists. Cambridge University Press, Cambridge.
- Cochran, W. G. Sampling Techniques, Wiley estern Ltd, New Delhi.
- Daniel, W.W. 2004, Biostatistics. 8th Edn. Wiley
- Donald T. Haynie, Biological thermodynamics. Cambridge University Press, 1st edition.
- Felller, W. Introduction to probability theory and its applications, Asia Publ. House, Mumbai.
- Glover, T. and Mitchell, K. 2002, An introduction to Biostatistics. McGraw-Hill , N.Y.
- Intellectual Property Rights - Brigitte Anderson, Edward Elgar Publishing
- Intellectual Property Rights and the Life Sciences Industries - Graham Dutfield, Ashgate Pub.
- WIPO Intellectual Property Handbook
- Intellectual Property Rights - William Rodelph Cornish, David Clewelyn
- Biotechnology-The science and the business Mosses V, Cape RE,2nd edn., CRC press 2000.
- Patterns of Entrepreneurship - Jack M. Kaplan
- Indian Patents Law, Mittal, D.P. (1999) Taxmann, Allied Services (p) Ltd.
- Handbook of Indian Patent Law and Practice - Subbaram , N. R. , S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.

Websites:1) Intellectual Property Today : Volume 8, No. 5, May 2001, www.iptoday.com
2) Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000. www.ipmatters.net/features/000707_gibbs.html

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper-XV (Molecular Biology and Plant Biotechnology –special I)

Module I:

a. **DNA replication:** DNA **r**eplication in prokaryotic organism **–** Initiation, elongation, and termination, DNA replication in eukaryotes – origin, replication form, replication proteins, Comparative account of DNA replication in prokaryotes and eukaryotes, DNA replication proteins
b. **DNA damage and repair:** Types of DNA damage, factors for DNA damage,
Repair system: Single base change, direct repair, mismatch repair, SOS response.

Module II:

a. **Isolation of gene and nucleotide sequence**: DNA manipulation enzymes; General methods of gene isolation.
b. **Molecular probing:** Recombinant DNA libraries (gDNA and cDNA, oligonucleotide probes); nucleic acid hybridization (southern, northern, dot-blot and slot-blot); antibodies as probe for proteins (immunoblotting or western blotting, immunoprecipitation, southwestern screening).

Module III:

a. **Splicing of foreign DNA into cloning vector**: Vectors for prokaryotes; ligation.
b. **Introduction of foreign DNA into host cell**: Transformation; transfection; transgenesis
c. **Isolation of genes or protein products from clones**: Expression vectors-Characteristics; vectors producing fusion proteins
d. **Polymerase chain reaction:** Types of PCR's and their applications in molecular biology

Module IV:

a. **Sequence alignment and phylogenetic trees:** Dot plots, sequence similarity, pairwise and multiple alignment, significance of alignment, phylogeny and phylogenetic trees and evolution.
b. **Genomics:** Definition; genome analysis (genetic polymorphisms, genetic mutations); microarray technology and applications (gene expression and diseases).
c. **Proteomics**: Protein stability and folding; application of hydrophobicity; DALI (Distance-matrix alignment); Protein structure- evolution, classification, prediction and modeling, prediction of function. DNA microarrays, mass spectrometry, network and graphs, protein complexes and aggregates, protein interaction networks, regulatory networks.

Suggested Readings:

- Alberts, Bruce; Johnson Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter,
- Peter, C. 2002 Molecular Biology of the Cell, Garland Science, New York and London.
- Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
- Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics
- Bergman, N.H 2007 Comparative Genomics_Humana Press Inc., Part of Springer Science+ Business Media
- Brown, T. A. 1999. Genomes, John Wiley & Sons(Asia) Pvt. Ltd., Singapore
- De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.
- Glover, D.M. and. Hames, D.B 1995 DNA Cloning : A practical approach, R.L. Press, Oxford.
- Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.
- Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
- Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.
- Lehninger' Principles of biochemistry-Nelson, Cox, 4th Edn., W.H.Freeman and Co.,2005.
- Lewin, B. 2000 Gene VII Oxford Univ. press, New York.
- Lewin, B. 2010 Gene X Oxford Univ. press, New York.
- Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA
- Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi
- Old and Primrose , 1994, Principles of gene manipulation. Blackwell Scientific Publ.
- Raymond Schuler and Zielinski, E. 2005, Methods in plants Molecular biology - Acad. Press.
- Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA
- Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.
- Shaw, C.H. 2006, Plant Molecular Biology: A practical approach. Panima Pub. Corp.
- Stryer, Berg, Biochemistry- 6th Edition, W. H. Freeman and Co.,2007.
- Voet, D.; Voet, J.; Biochemistry – 3rd Edn. John Wiley and sonsInc., 2004.
- Wilson Keith and Walker John 2005 Principles and techniques of biochemistry and molecular biology, 6th Ed. Cambridge University Press, New York.

- Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Practicals:

1. Detection of DNA damage by mutagens
2. Bacterial transformation and selection of transformed cells.
3. To detect molecular polymorphism of different species
4. To demonstrate the presence of particular polypeptide by Western blotting.
5. To design PCR primers for isolation of given gene and to clone it in the given vector.
6. Amplification and sequencing of nr DNA by PCR
7. To find the sequences of a given protein in SWISS-Prot, Uni-Prot
8. To work out the sequence from given autoradiogram and to identify it from GeneBank by BLAST method.
9. To generate Pairwise and multiple sequence alignment of a given organisms
10. To generate phylogenetic tree using given sequences.
11. To predict a protein from given sequence by using online tools from NCBI.

Suggested Readings(for laboratory exrcises)

- Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
- Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics.
- McEntyre, J.; Ostell, J., editors Bethesda (MD) The NCBI Handbook: National Library of
- Medicine (US), NCBI; 2002-2005
- Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.
- Tools & updated literature available at www.ncbi.com

References: Online journals available on UGC V-SAT programme.

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper XV- Reproductive Biology of Angiosperms (Special) I

Module I:
General: Need for reproductive system as experimental material, Interdisciplinary approaches: genetic and molecular perspective,
Anther: Structure, anther wall;: endothecium, middle layer, tapetum-Structure, types-structure-function relationship, role of tapetum, microsporogenesis- sporogenous cells cytoplasmic reorganization during sporogenesis (Ultrastructural changes), molecular biology of meiosis, DNA and RNA synthesis, Protein synthesis, meiosis specific genes. Pollen tetrad development, pollen wall proteins, adaptive significance of pollen wall,

Module II:
Male gametophyte development: formation of vegetative and generative cells, differential behavior of sperms, gene expression during pollen development.
Pollen: Physiological and biochemical aspects, pollen storage, viability causes for loss of viability. pollen abortion and male sterility, structural, developmental and functional aspects of male sterility environmental factors, role of mitochondrial genome in male sterility, gametocides.

Module III:
Pistill: Carpel determination, ovule and its structural details.
Megasporogenesis: Meiosis, functional megaspores, organization of female gametophyte structure of the embryo sac, egg, synergid-ultrastructure, role central cell, antipodal cell, haustoria, cytoskeleton of the embryo sac, enzymatic isolation of embryo sac, types of embryo sac, nutrition of embryo sac.

Module IV:
Pollination-pollination mechanism, biotic and abiotic pollination, floral attractants and rewards,
Pollen-pistil interaction; The stigma-Types and structure, stigmatic exudates, style-transmitting tissue, canal cell, post pollination events (stigma receptivity, pollen adhesion, pollen hydration, pollen germination and pollen tube growth, biochemistry of pollen germination, RNA and protein metabolism during pollen tube, calcium gradient in the pollen tube (Chemotropism) pollen allelopathy.
Incompatibility: General concept, self incompatibility (Intraspecific type) heteromorphic, homomorphic types, mechanism of self compatibility, importance of self compatibility, methods of overcoming self incompatibility, Parasexual hybridization,

Suggested Readings:

1. Asker S. 1979, Progress in apomixis research. Hereditas 91, 231-240.
2. Barnier, G. 1986, The flowering process as an example of plastic development. Soc. Expt.. Biol. 40: 257-286.

3. Barth, F.G. 1991, insects and flowers, Princeton Univ. Press. Princeton.
4. Battaglia, E. 1963. Apomixis In recent advances in the embryology of angiosperms (ed P. Maheshwari), pp- 264, Intt. Soc. Plant Morphologists, Univ. Delhi.
5. Bhandari N. N. 1984, The microsporangium in embryology of angiosperms (ed B.M. Johri) Springer- Verlag, Berlin, pp. 53-121.
6. Bhandari N.N., M. Bhargava and P. Chitralekha 1986, Cellularization of free nuclear endosperm of *Pappaver somniferum* L. Phytomorphology, 36, 357-366.
7. Bhojwani S.S. and M.K. Rajdan 1983, Plant tissue culture, Theory and Practice Elsevier, Amsterdam.
8. Boesewinkel F.D. and Boman F. 1984, The seed structure in embryology of angiosperms (ed B.M.Johri), Springer- Verlag, Berlin, pp. 567-610.
9. Bouman F. 1984 The ovule in embryology of angiosperms (ed B.M.Johri), Springer-Verlag, Berlin, pp. 123-157.
10. Cartson P.S., Smith N.H., Dearing R.D. (1972) Parasexual interspecific plant hybridization. Proc. Nat. Acad. Sci. USA, 69, 2292-2294.
11. Cartson P.S. (1973) The use of protoplasts of genetic research. Proc. Nat. Acad. Sci. USA, 70, 598-602.
12. Chitralekha P. and N.N. Bhandari 1991, Post fertilization development of antipodal cells in *Ranunculus scferatus*. Phytomorphology 41, 200-212.
13. Ciampolini F.M., Nepi and E. Pacini 1993, tapetum development in *Cucurbita pepo* (Cucurbitaceae) Pt. Syst. Evol. (Suppl) 7-13-22.
14. Cocking E.C. 1960, A method for the isolation of plant protoplasts and vacuoles. Nature (London) 187-927-929.
15. Cocking E.C. 1970, Virus uptake, cell wall regeneration and virus multiplication in isolated plant protoplasts. Int. Rev. Cytol 28-89-124.

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper XV- ADVANCED PHYCOLOGY PAPER- I (Special)

MODULE 1:

1 Prokaryotic characters , ultra structure of cell, reproduction and affinities.
2 Sources of Nitrogen and its assimilation, importance and activity of biofertilizers , biotechnological implication and Biological Nitrogen fixation.
3 Biotechnology and international market, Nif gene transformation and present status of genetic engineering
4 Toxic algae: Phycotoxins, characteristics and their effects on human beings.
5 Algae cytology and genetics
6 Calcification, extracellular products of algae and fossil algae.( )

MODULE 2:

Bacteria: Strain selection, sterilization, growth, fermentation production, application technology for major biofertilizers, viz. *Rhizobium , Azotobacter, Azospirillum, Bacillus megaterium* (PSB), *Pseudomonas fluorescens.*
Cyanobacteria: *Phormidium, Aulosira, Cylindrospermum, Rivularia,* Symbiotic algae and their role in other plan.

MODULE 3:

1 Algae as a food feed and medicine.
2 Eukaryotic characters (morphology) reproduction, life cycle patterns, taxonomy, Phylogeny , and interrelationship of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Pheophyta and Rhodophyta;
3 Prochlorophyta : *Prochloron.*
4 Chlorophyta: *Microspora, Draparnaldia,Trentopholia, Fritschiella, Cosmarium, Codium, Bryopsis.* .

MODULE 4:

Industrial product from algae of marine and freshwater
Phaeophyta : Thallus range, cell structure, alternation of generation, *Cutleria, Padina, Laminaria, Turbinaria.*
Rhodophyta :, *Nemalion, Gelidium, Gracilaria, Corallina, Polysiphonia.*
Euglenophyta :, *Euglena, Phacus.*
Bacillariophyta : *Cyclotella, Synedra, Cymbella, Navicula,Gomphonem*
Chrysophyta:- *Synura* and *Dinobryon.*

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper- XV (Mycology and Plant pathology- special I)

MODULE I: General Microbiology –
Bacteria – Morphology, size, shape, structure, Characters of Eubacteria, Actinomycetes, Archaebacteria, Bacterial nutrition, reproduction.
Viruses – General Characteristics, structure, classification (LHI System), replication (lytic cycle & lysogeny)
Rikettsia – General characters

MODULE II: Mycorrhiza :

1. Kinds of mycorrhizae. Ectotrophic and endotrophic mycocrhizae, their morphology and anatomy. V A - mycorrhiza. Importance of mycorrhiza in Agriculture.
2. Rhizoshere and phyllosphere - General concept and importance.
3. Medical Mycology - Dermatophytic fungi - Knowledge of common dermatophytes and human diseases caused by them viz. *Tinea pedis. Tinea capitis, Tinea barbae. Tinea, corporis* and *Tinea manuum*, Non-dermatophytes.

MODULE III: Production of Metabolites By Fungi:

A) Industrial Fungal Metabolites:

i) Antibiotics - Penicillin, Cephalosporin, Griseofulvin, Industrial production. of Penicillin
ii) Enzymes -. Amylase, proteases, Lipases, Pectinases, Cellular and xylanases.
iii) Organic acids - Critic acid, Gluconic acid, lactic acid, kojic acid. Itaconic acid.

B) Non Industrial Fungal Metaboilites :

i) Phytoalexins , ii) Mycotoxins ,"

MODULE IV :Fungi as welfare to human beings:

i) Fungi in food processing
ii) Fungi in Medicine
iv) Fungi as food - edible mushrooms, methods of their cultivation
v) and economic importance.
vi) Concept of biodeterioration and Biodegradation

a) Biodeterioration of noncellulosic materials.
b) Biodeterioration of cellulosic materials.
c) Role of microorganisms in Biodegradation of organic wastes. Factors affecting the process of Biodegradation.

Suggested Readings .

1. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
2. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.

3. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.
4. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.
5. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York
6. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
7. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.
8. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.
9. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.
10. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S.Chand & Co. Ltd.
11. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology - S.Chand & Co. Ltd.
12. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.
13. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.
14. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.
15. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermidiate Press.
16. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.
17. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.
18. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.
19. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.
20. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.
21. Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.
22. Sunder Rajan, S. (2001) Tools and Techniques of Microbiology, Anmol Publ.New Delhi.
23. Thind, T.S. (1998) Diseases of field crops and their management, National Agricultural Technology, Information Centre, Ludhiana.
24. Vaidya, J.G. (1995) Biology of the fungi, Satyajeet Prakashan, Pune.
25. Walker, J.G. (1952) Diseases of Vegetables Crops. McGraw Hill, New York.
26. Walker, J.C. (1968) Plant Pathology, McGraw Hill, New York.
27. Eggins, H.O.W. and Allsop (1975) The Filamentous Fungi Vol. I Industrial Mycology (Biodetoriation and Biodegradation by Fungi) Eds. J.E. Smith and D.R. Berry Edward Arnold, London.

28. Emmons, C. W., C. H. Bin ford, J.P. Utz and Know Chung (1977) Medical Mycology, Lea and Febigo, Philadelphia.
29. Holliday, P. Fungus disease of tropical plants (1980), Cambridge University Press, Cambridge.

On line Journals available on UGC -VSAT

M. Sc. Botany Syllabus
Semester IV
Course code/name:Paper- XV (Palaeobotany - special I)

MODULE – I:
Introduction to the science of Petrology- The earth zones, chemical composition of earth crust. The classification of rocks i.e.Endogenetic and Exogenetic (igneous, metamorphic and sedimentary) and their brief account.Glaciations, volcanic eruption and earthquake.

MODULE –II
Geological column and time scale.Physiography of India.Fossilisation, modes of preservation, preparation and age determination and techniques.Systematics, reconstruction and nomenclature. Life in Precambrian, greening of earth –speculation.

MODULE –III:
Study of Rhyniopsida (primitive vascular plants)Cooksonia,Steganotheca,Uskiella,Renalia,Horniophyton,Aglophyton,Zosterophylopsida(ancestors of microphyllous plants) Zosterophyllum,Sawadonia,Asteroxylon.Prelycopods and Lycopsida-Hebaceous Lycopods of Devonian –Baragwanthia,Protolepidodendron,and Miadesmia, Arborescent Lycopods of Carboniferous-study of Lepidodendrales members.

MODULE –IV:
Shpenopsida-Its origin and evolutionary consideration .Study of Hyeniales and Sphenophyllales .Horsetails and their relatives-Calamitales members.Filicopsida-Study of primitive ferns and their relatives-Cladoxylales,Stauropteridales,Zygopteridales.Filicales-classification and study of itsmembers,Coenopteridales-Ankyropteris.Marratiales - -Psaronius.

Suggested Laboratory and Field Exercises for Paper I

- Stratigraphy Maps of the India and World
- Geological Maps of India
- Geological column and time scale.
- Study of different rocks.
- Different techniques to study fossils. (Ground sectioning, peel technique) Study different types of fossils
- Study of plant fossils as per syllabus based on specimens and slides.
- Study of Rhyniopsida (primitive vascular plants)
- Arborescent Lycopods of Carboniferous-study of Lepidodendrales members
- Sphenophyllales, Calamitales members.
- Studyofprimitive ferns and their relativesCladoxylales,Stauropteridales,Zygopteridales.Filicales-Coenopteridales-Ankyropteris.Marratiales - -Psaronius
- Preparation of practical record.

M. Sc. Botany Syllabus
Semester IV
Course code/name:Paper- XV (PALYNOLOGY - special I)

MODULE -I: -

General aspects of Palynology: -Historical background, Definition , basic concepts, scope, inter-relationship with other branches of Botany, Applications, Indian work on Palynology, Palynological centres in India.

Microsporogenesis : Stamen initiation, anther differentiation- anther initiation, anther wall, Tapetum, structure and functions, its role in pollen development, Functions of callose wall, pollen/microspore and wall development, production and deposition of sporopollenin.

Pistil : Structure and function of stigma and style, stigma receptivity and its importance.

MODULE II: -

Pollination Biology -Origin of pollination biology/anthecology, Spore and pollen dispersal in lower plants and gymnosperms,

Pollination in angiosperms- types of pollination, floral adaptation to different pollinators (mode, style) flowers pollinated biotically (Hymenoptera, Diptera, Coleoptera, Lepidoptera, birds, bats) and abiotically (wind, water), pollination-plant interactions and evolution of breeding systems, special devices associated with pollinator attraction - pollen, nectar, Elaiophores, resin glands, osmophores, floral scent and perfume flowers.

Palaeopalynology: - Palynomorphs, their preservation in diverse lithic types, techniques involved in the recovery and concentration of spores and pollen from clays, shales, coals and lignites. Maceration techniques, Application of Palynology in relation to oil and coal exploration. Role of spores and pollen in stratigraphy, index spores.

MODULE III: -

Phylogeny of Pollen and spores, **Systematic palynology**-monocotyledoneae and dicotyledoneae, evolutionary trends among pollen grains based on palynotaxonomical works,

Palynology of spores / pollen- Algae, Fungi, Bryophytes, Pteridophytes and pollen types of Gymnosperms.

Pollen morphology of Angiosperms.: -

Introduction- Pollen units, polarity, symmetry, Shape, size, Apertures size, shape of the pollen grain, saccate pollen grain, sporoderm stratification, Apertures-NPC System of classification, Apertural types, Exine ornamentation, LO analysis

Pollen wall morphogenesis, evolutionary trends in exine structure, trends of evolution in apertural pattern,

Techniques for the preparation of pollen slides, Light and scanning election microscopic studies of pollen, significance of SEM and TEM studies.

MODULE -IV:

Melittopalynology- pollen analysis of honey-methods, qualitative and quantitative, social behaviour of honey bees, floral fidelity, foraging behavior, geographical and floral origin of honey, its' chemical analysis, adulteration of honeys, physical characteristics of honey, honey

quality standard, deterioration of honey, heavy metal contamination in honey, honey as environmental monitors, honey and allergy, unifloral and multifloral honey, pollen toxicity, Applied Palynology with special reference to Agriculture and Horticulture - Bees as pollinators, role of apiaries in crop production. Bee keeping and enhanced honey production, recognition of areas suitable for honey production, use of honey in medicine, cosmetics, confectionary and other applications, pollen loads, analysis, Bee pollen, chemical composition, utility, and its role in curing various human ailments.

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper- XVI (Molecular Biology and Plant Biotechnology- Special II)

Module I:

a. **Transgenics** : Cloning vectors for higher plants; Methods for gene transfer, *Agrobacterium tumefaciens* mediated- Basis of tumor formation, features of Ti and Ri plasmids, mechanisms of DNA transfer, role of virulence genes, use of Ti and Ri genetic markers, use of reporter genes and introns; Direct DNA transfer; particle bombardment; electroporation; microinjection; macroinjection; liposomes; electrophoretic; pollen tube method; pollen transformation; PEG method; transformation of monocots; transgene stability and gene silencing; chloroplast transformation.

Module II:

a. **Applications of transformation**: Herbicide resistance; insect resistance; Bt genes, disease resistance; Nutritional quality; biopesticides and biofertilizers; hazards and safety regulations for transgenic plants.

b. **Metabolic engineering through transgenic plants**: Production of secondary metabolites; industrial enzymes; biodegradable plastics (PHB and any other); edible vaccines; antibody production and other important drugs.

Module III:
Plant tissue culture: History, Culture types: Callus culture, organ culture, suspension culture for production of secondary metabolites, protoplast culture, fusion and somatic hybrids, Somatic embryogenesis, anther and pollen culture, haploid plants, somaclonal variations, organogenesis (direct and indirect).
Gene expression: Gene expression in Mitochondria, chloroplast, yeast
Regulation of gene expression: Regulation of gene expression in translation and post-translation level

Module III:

a. **Nitrogen fixing genes**: Organization, function and regulation of nitrogen fixing genes in *Klebsiella, hup* genes.
b. **DNA fingerprinting and marker assisted breeding**: RFLP maps; linkage analysis; RAPD markers; STS; SSR (microsatellites); ISSR; SCAR (sequence characterized amplified regions); SSCP (single strand conformational polymorphism); AFLP; QTL: map based cloning; molecular marker assisted selection
a. **Cleaner Biotechnology**: Pollution control through genetically modified organisms.

Suggested Readings:

- Alberts, Bruce; Johnson, Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter,
- Bhojwani SS and Rajdhan MK 1996 Plant tissue culture: Theory and Practice. Elsevier Sci. Publ., New York
- Peter c2002 Molecular Biology of the Cell, New York and London: Garland Science.
- Callow, J. A., Ford-Lloyed, B. V. and Newbury, H. J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.
- Charlwood, B. Y. and Rhodes, M.V. 1999 Secondary products from plant tissue culture, Clarendon Press. Oxford.
- Chrispeeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture. Jones & Barlett Publishers, Boston, USA.
- Collins HA and Edwards S 1998 Plant cell culture. BIOS Sci. Publ., Oxford UK
- Dicosmo F and Misawa, M. 1996 Plant Cell culture: Secondary metabolism towards industrial application, CRC press, Boca Raton, NewYork.
- Glazer, A. N. and Nikaido, H. 1995. Microbial Biotechnology. W. H. Freeman & Company, New York, USA.
- Gustafson, R. J. 2000. Genomes. Kluwer Academic Plenum Publishers, New York, USA.
- Henry, R. J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK.
- Jain SM, Sopory SK and Veilleux RE 1996 In vitro haploid production in higher plants. Vols. 1-5. Kluwer Acad. Publ., The Netherlands
- Kurz, W.G.W 1989 Primary and Secondary metabolism of plant and Cell cultures, Springer Verlag, Berlin.
- Old, R. W. and Primrose, S. B. 1989. Principles of Genome Analysis. Blackwell Scientific Publications. Oxford, UK.
- Primrose, S. B. 1995. Principles of Genome Analysis. Blackwell Scientific Ltd., Oxford ,UK.
- Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.
- Shantharam, S. and Montgomery, J. F. 1999. Biotechnology, Biosafety, and Biodiversity. Oxford & IBH Publication Co., Pvt., Ltd., New Delhi.

Practicals:

1. Agrobacterium *tumefaciens* mediating gene transfer in a suitable plant
2. Elisa testing of Bt gene in cotton
3. Induction of secondary metabolite synthesis in suspension culture.
4. Isolation of secondary metabolites by gel filteration.
5. Purification of plant metabolite/ protein by column chromatography.
6. Use of RAPD/RFLP/SSCP etc. markers to detect molecular polymorphism of different species.

7. Isolation and protein profiling in different plant species by SDS-PAGE.
8. Raising of suspension culture and plotting of growth curve.
9. Bacterial transformation and selection of transformed cells.
10. DNA ligation and analysis of ligated DNA on agarose gel (cloning and analysis using GUS gene.
11. Study of expression of inducible genes at biochemical level.
12. Organogenesis and somatic embryogenesis using appropriate explants and preparation of artificial seeds.
13. Demonstration of anther culture.

Suggested Readings(for laboratory exrcises)

- Gelvin, S. B. and Schilperoort, R. A (eds) 1994. Plant Molecular Biology Manual, 2nd edition. Kluwer Academic Publishers, Dordrecht, The Netherlands.
- Glick, B. R. and Thompson, J. E. 1993, Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.
- Glover, D. M. and Hames, B. D.(Eds) 1995. DNA Cloning 1: A Practical Approach: Core Techniques, 2nd edition PAS, IRL Press at Oxford University Press, Oxford.
- Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.
- Hall, R. D. (Ed.), 1999. Plant Cell Culture Protocols. Humana Press. Inc. New Jersey, USA.
- Maniatis et al. Molecular cloning Vol. I, II and III. Cold-Spring Harbor Lab Press.
- Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.
- Shaw, C. H. (Ed.) 1988, Plant Molecular Biology : A Practical Approach. IRl Press, Oxford.
- Smith, R. H. 2000. Plant Tissue Culture : Tecniques and Experiments. Academic Press, New York.

References: Online journals available on UGC V-SAT programme.

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper Xvi- Reproductive Biology of Angiosperms (Special) II

Module I:

Fertilization: Cellular nature of sperm, the sperm cytoskeleton, the male germ unit, isolation and characterization of sperm, growth of the pollen tube through the style, passage of sperm into the embryo sac, fussion of nuclei, double fertilization, triple fussion, unusual features. In-vitro approaches to the study of fertilization-Intra-ovarian pollination, test tube fertilization, in-vitro fertilization, placental pollination, Gynogenesis.

Endosperm: types of endosperms, ruminate endosperm, cytological status. endosperm haustoria, chemical composition of endosperm, food reserve in endosperm, role of endosperm in embryo development, endosperm mutants.

Module II:

Embryogenesis: Zygote and its ultra-structure, milieu of the developing embryo, symmetry and polarity, rest period in zygote embryonic formulae, embryonomic law. **Suspensor-**Ultra structure of suspensor cells, cytology of suspensor cell, physiology and biochemistry of suspensor; Nutrition of embryo- nutrient supply of the zygote, embryo-endosperm relation.

Polyembryony: Defination, causes, classification, induction of polyembryony, practical importance of polyembryony.

Module III:

Apomixis: Defination, causes, classification, - Diplospory, Apospory, pseudogamy, autogamous development of endosperm, causes of apomixes, significance.

Parthenocarpy: Defination, causes, practical importance

Mellitopalynology : Pollen analysis of honey, Role of apiary in crop production.

Biotechnology: Concept and scope of biotechnology; Cell structure, cellular totipotency

a) Anther and pollen culture,
b) ovule and nucellus culture
c) Endosperm culture and its practical applications
d) **Embryo culture:** Techniques, nutritional aspects of embryo culture morphological and physiological considerations, culture of mature embryo and proembryo.
e) **Somatic embryogenesis**: historical background, embryogenesis from callus, direct embryogenesis- recurrent embryogenesis; cytology of somatic embryogenesis, nutritional factors, hormonal factors.

Module IV:

f) **Protoplast culture and somatic hybridization-** isolation of protoplast, culture methods, fussion of protoplast, selection of fussion products, consequences of fussion, production of Cybrids and hybrids.
g) Biotransformation and production of useful compounds through cell culture, factor affecting yield, biotransformation, bioreactors, perspective.

Practicals

1) Study from the permanent preparations.
   a) Development and structures of anther pollen.
   b) Structure of ovule, types, megasporogenesis, embryo sac types.
   c) Development of endosperm, types.
   d) Structure and development of embryo- types
   e) Pericarp and seed coat structure from sections and macerations.
   f) Sketching of ovular structure, embryo sac, anther wall, embryo with the help of camera lucida.
2) Techniques, Familiarity with phase contrast, polarizing, fluroscence and electron microscopy, wholemounts, fissection and macerations, permanent double stained microtome sections, photo microscopy.
3) Preparation of dissected wholemounts of endothecium, tapetum, endosperm and embryo, squash preparations of tapetum, microspore mother cells, dyads, tetrads pollinia and massulae. Study of mitosis and meiosis and identification of various stages.
4) Study of different pollen using acetolysed and non acetolysed pollen, preparation of permanent slides for morphological study. (polarity, symmetry, shape, size, aperture, sporoderm stratification: minimum 15 slides to prepare).
5) Interpretation of electron micrographs (SEM, TEM) of pollen.
6) Short term exercises on pollen production, viability and their percentage of germination. Rate of growth of germ tube to be studied in a given period.
7) Viability of seed through germination, biochemical and excised embryo methods.
8) Cytology of pollen inhibition in self and interspecific incompatibility, application of some technique to overcome incompatibility.
9) Experiments on intra- ovarian pollination.
10) Experiments on plant tissue culture. Technique- washing. Sterilization, preparation of media, storage of media, inoculation, callus initiation, proliferation.
11) Responses of calli to stress condition viz. temp, (low, high), moisture, salinity.
12) Induction of androgenesis through anther culture.
13) Physiology of embryo development, using electropheratic and histochemical methods embryo culture.
14) Somatic embryogenesis
15) Protoplast culture.

Suggested Readings:

1. Asker S. 1979, Progress in apomixis research. Hereditas 91, 231-240.
2. Barnier, G. 1986, The flowering process as an example of plastic development. Soc. Expt.. Biol. 40: 257-286.
3. Barth, F.G. 1991, insects and flowers, Princeton Univ. Press. Princeton.
4. Battaglia, E. 1963. Apomixis In recent advances in the embryology of angiosperms (ed P. Maheshwari), pp- 264, Intt. Soc. Plant Morphologists, Univ. Delhi.
5. Bhandari N. N. 1984, The microsporangium in embryology of angiosperms (ed B.M. Johri) Springer- Verlag, Berlin, pp. 53-121.

6. Bhandari N.N., M. Bhargava and P. Chitralekha 1986, Cellularization of free nuclear endosperm of *Pappaver somniferum* L. Phytomorphology, 36, 357-366.
7. Bhojwani S.S. and M.K. Rajdan 1983, Plant tissue culture, Theory and Practice Elsevier, Amsterdam.
8. Boesewinkel F.D. and Boman F. 1984, The seed structure in embryology of angiosperms (ed B.M.Johri), Springer- Verlag, Berlin, pp. 567-610.
9. Bouman F. 1984 The ovule in embryology of angiosperms (ed B.M.Johri), Springer-Verlag, Berlin, pp. 123-157.
10. Cartson P.S., Smith N.H., Dearing R.D. (1972) Parasexual interspecific plant hybridization. Proc. Nat. Acad. Sci. USA, 69, 2292-2294.
11. Cartson P.S. (1973) The use of protoplasts of genetic research. Proc. Nat. Acad. Sci. USA, 70, 598-602.
12. Chitralekha P. and N.N. Bhandari 1991, Post fertilization development of antipodal cells in *Ranunculus scferatus*. Phytomorphology 41, 200-212.
13. Ciampolini F.M., Nepi and E. Pacini 1993, tapetum development in *Cucurbita pepo* (Cucurbitaceae) Pt. Syst. Evol. (Suppl) 7-13-22.
14. Cocking E.C. 1960, A method for the isolation of plant protoplasts and vacuoles. Nature (London) 187-927-929.
15. Cocking E.C. 1970, Virus uptake, cell wall regeneration and virus multiplication in isolated plant protoplasts. Int. Rev. Cytol 28-89-124.

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper XVI- ADVANCED PHYCOLOGY PAPER- II (Special)

MODULE 1:
Algae Physiology,and Cultivation;-
1 Cyanide resistance, respiration in algae, heavy metal pollution and their role in Biotechnology.
2 Intracellular substance of *Spirulina, Scenedesmus, Chlorella* and marine algae.
3 Algae cultures & continuous and mass cultivation in laboratory and their field applications.

MODULE 2: Hydrobiology / Limnology
1. Lentic environment: General consideration, physico-chemical factors, and their influence, Phytoplankton nature and adaptation of plankters, periodicity and succession, vertical distribution, productivity and factors influencing it.
2. Lotic environment: General consideration, physico-chemical factors, and their influence.
3. Marine benthic: General Principal, shore types, zonation patterns and factors governing them, Life forms, Geographical distribution, Marine Algae in India.

Eutrophication and algal blooms: Definition factor: responsible for water quality, use of algal blooms and their control measures.

MODULE 3 : Study of phytoplanktons
Terminology, population, adaptations
Distribution, productivity and succession
Primary productivity and measurement of growth rate and natural mortality.
Chemical features and chemical cycles in epilimnion and hypolimnion.

MODULE 4 : Ecology and environmental Biotechnology:
1. Distribution, community structure in fresh and marine water. Role of algae as indicators of pollution and its concept.
2. Algae in waste water treatment, use of algal bacterial system in sewage and other waste effluents, Biomonitoring of water quality. Algae stabilization pond.
3. Ecobiotechonology for the remediation of eutrophic lentic and lotic water bodies.

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper- XVI (Mycology and Plant Pathology - special II)

Module 1:

History : Milestones in phytopathology with particular reference to India. Major epidemics and their social impacts. Historical developments of chemicals, legislative, cultural and biological protection measures including classification of plant diseases.

Physiological and Molecular Plant Pathology

Altered metabolism of plants under biotic and abiotic stresses. Molecular mechanisms of pathogenesis: recognition phenomenon, penetration, invasion, primary disease determinant.

Module II: Principles of Plant pathology

i. Principles of plant pathology- Importance, nature, classification and general symptoms of plant diseases.
ii. Koch's Postulates: Pathogenecity of microorganisms and pathogenesis.
iii. Host parasite relationship and Interaction, mechanism of infection, path of infection. .
iv. Defence mechanism in host plants against pathogens - morphological or structural defence mechanism, Biochemical defence mechanisms, defence, role of phenolic compounds, enzymes and toxins,
v. Epidemiology and forcasting of plant diseases- the form of epidemic conditions for decline of epidemic, methods used in forecasting. .
vi. Principles and methods of plant disease control - cultural methods, chemical methods, Biological control , integrated pest management (IPM), Biopesticides.

Module III :

A Detailed study of the Diseases of the following crops caused by fungal pathogens with effective control measures.

Diseases of Cereals :

Seedling blight of cereals, Smut of wheat, Foot rot of wheat, Loose smut, Covered smut of Barley, False smut of rice, Leaf spot of rice, Downey mildew of jowar, Green ear disease of Bajra, Ergot of Bajra, Downey mildew of maize.

Diseases of Vegetable crops with special reference to the important diseases of the following:

Chilli, Brinjal, Tomato, Potato, Coriander, Ginger, Onion, Bhindi.

General knowledge of post harvest diseases of fruits and vegetables and their control.

Diseases of Oil Seed Crops:Viz. - Linum, Seasamum, Groundnut, Mustard and Sunflower

Diseases of Fruit Trees-

With special reference to important diseases of the following Citrus, Apple, Mango, Papaya., Banana and Grapes.

Module- IV :Bacterial Diseases of Plants:

Important Pathological aspects of the following bacterial diseases.

Bacterial blight of rice, Tundu disease of wheat, Angular leaf spot of cotton, stalk rot of maize, Fire blight of Apple, Bacterial soft rot of fruits and Vegetables. .

Viral Diseases of Plant :

Bunchy top of Banana, Leaf curl of Papaya, Yellow vein mosaic of Bhindi. Mosaic of .Cucurbits, Viral diseases of Tobacco, Potato and Tomato.

Mycoplasma Diseases of Plants :

Citrus greening, Rice yellow dwarf: Little leaf of Brinjal, Sandal Spike.

Nematode Diseases of Plants :

General knowledge of plant parasitic nematodes and Important nematode diseases viz. Root knot of Vegetables, Ear cockle of wheat. .

Suggested Readings .

1. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
2. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.
3. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.
4. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.
5. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York
6. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
7. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.
8. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.
9. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.
10. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S.Chand & Co. Ltd.
11. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology - S.Chand & Co. Ltd.
12. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.
13. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.
14. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.
15. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermidiate Press.
16. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.
17. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.
18. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.
19. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.

20. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.
21. Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.
22. Sunder Rajan, S. (2001) Tools and Techniques of Microbiology, Anmol Publ.New Delhi.
23. Thind, T.S. (1998) Diseases of field crops and their management, National Agricultural Technology, Information Centre, Ludhiana.
24. Vaidya, J.G. (1995) Biology of the fungi, Satyajeet Prakashan, Pune.
25. Walker, J.G. (1952) Diseases of Vegetables Crops. McGraw Hill, New York.
26. Walker, J.C. (1968) Plant Pathology, McGraw Hill, New York.
27. Eggins, H.O.W. and Allsop (1975) The Filamentous Fungi Vol. I Industrial Mycology (Biodetoriation and Biodegradation by Fungi) Eds. J.E. Smith and D.R. Berry Edward Arnold, London.
28. Emmons, C. W., C. H. Bin ford, J.P. Utz and Know Chung (1977) Medical Mycology, Lea and Febigo, Philadelphia.
29. Holliday, P. Fungus disease of tropical plants (1980), Cambridge University Press, Cambridge.
30. On line Journals available on UGC -VSAT

Laboratory Exercises:

1. Principles & working of tools, equipments and other requirements in the Mycology & Plant Pathology laboratory.
2. Micrometry and measurement of organisms.
3. Sterilization Processes viz. moist heat, dry heat, chemical and radiation.
4. Drawing of Camera Lucida diagrams and knowledge of computer based photomicrography and image processing
5. Preparation of different cultural media for cultivation of Fungi and Bacteria.
6. Monitoring and analysis of Aeromycoflora.
7. Isolation & identification of Phyllosphere mycoflora.
8. Demonstrate antifungal activities of different antibiotics and leaf, flower and root extract.
9. Study of toxicity of fungi in relation to seed germination, and seedling abnormality.
10. Cultivation of Mushrooms.
11. Demonstration on biodegradation of organic waste.
12. Isolation of Soil fungi by soil plate (War cup) and serial dilution (Walksman) method.
13. Isolation and identification of Rizosphere mycoflora.
14. Isolation of external and internal seed borne mycoflora by blotter and Agar Plate method. Cereals, pulses, oil seeds, fruit seeds.
15. Demonstration of Koch's Postulate.
16. Monographic study of locally available plant diseases caused by fungi (atleast 10).
17. Study of locally available crop plant diseases caused by Bacteria (Five)
18. Study of locally available plant diseases caused by viruses & Phytoplasma (Five)
19. Demonstration of morphological & physiological changes in disease plants.

20. Preparation and presentation of herbarium of pathological specimens available in the region (Atleast 20)
21. Field visit to different localities

Visit to Agriculture University, Plant Pathological research centers

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper- XVI (Palaeobotany - special II)

MODULE –I:
Gymnospermopsida-- Study of Aneurophytales and Archaeopteridales.Gymnosperm and early evolution (Archeosperma, Elkinsia, and Morentia) of seed habit stages in evolution. Study of Pteridosprmales-Lyginopteridaceae, Medullosaceae, Cycadeoidales-Cycadeoidaceae, Williamsoniaceae, Wielandiellaceae.and Fossil Cycads (Nilssonia, Baenia, Androstrobus).

MODULE -II:
Gymnosper- Caytoniales, Glossopteridales, Penntoxylales.fossil Cordaitales, Voltziales and phylogenenetic consideration of all the orders.

MODULE –III:
Study of Deccan Intertrappean flora of India. Formation of Deccan traps and Intertraps, age and its floristic composition in relation to Pteridophytes, Gymnosperms and Angiosperms.Palecimate and Paleogeography of Deccan Intertraps.

MODULE – IV
Paleopalynology-Important features of spores and pollen morphology, their role in stratigraphy and in exploration of coal and oil.Palaeopalynological studies, microfossils and its application.Paleoecology and paleogeography.
Indian Gonwana-Its stratigraphy and classification (Two fold and three fold). Index fossil.

Suggested Laboratory and Field Exercises for Paper II

- Study different types of fossils
- Study of plant fossils as per syllabus based on specimens and slides.
- Gymnosperm- Caytoniales, Glossopteridales, Penntoxylales.fossil Cordaitales.
- Lyginopteridaceae, Medullosaceae, Cycadeoidales-Cycadeoidaceae, Williamsoniaceae, Wielandiellaceae.and Fossil Cycads (Nilssonia, Baenia, Androstrobus).
- Study of Deccan Intertrappean flora of India. Pteridophytes, Gymnosperms and Angiosperms-flowers and fruits.
- Important features of spores and pollen morphology and technique to study them (Maceration)
- Study of wood anatomy of fossils.
- Exploration and excursion to different fossiliferous localities.
- Preparation of practical record/submission of collection and tour report of excursion.

SPECIAL PRACTICAL-II

Time: 5 hours)	**(Full marks: 70**
Preparation of slide by maceration technique of a given material	10
Write the monograph on given specimens	20
Comment on the spots (five spots)	15
Practical record, Viva-voce and Field report (10+05+05)	20
Project	05

M. Sc. Botany Syllabus
Semester IV
Course code/name: Paper- XVI (Palynology - Special II)

UNIT-I. Pollen physiology and biochemistry-
Pollen production,
Pollen viability, tests for pollen viability,
Pollen germination of pollen in *vivo* and in *vitro*, germination requirements, germination of 3-nucleated pollen grain, effect of pH and light, effects of hormones and other substances radiation effect, release of metabolites in germination and tube growth, Role of boron and calcium in pollen germination,
Chemical composition of pollen wall and pollen contents (amino acids, proteins, carbohydrates, lipids, vitamins, pectin, DNA, RNA, ascorbic acid, flavones, pigments etc.) in pollen and pollen tube at different steps in germination & their significance, pattern of pollen tube elongation,
Fine structure inside the tube, pollen culture movements of nuclei-and formation of callose plug, promotion and inhibition of pollen tube, elongation, pollen enzymes and isozymes,

UNIT II- Pollen biotechnology and genetics
Pollen storage-Factors affecting viability in storage, freeze-drying of pollen, storage of pollen in organic solvents, causes of decreased viability in storage and pollen germination.
Pollen - pistil interaction - significance, self incompatibility (regulation of fertilization).Pollen allelopathy, chemotropism, Pollen herbarium,
Pollen biotechnology & crop production- Anther / pollen culture, production of haploids
Genetics of pollen: Genetic segregation of pollen, pollen sterility- genic and cytoplasmic male sterility, factors involved in male sterility. Male sterility through recombinant DNA technology.
Forensic palynology- Introduction, methodology, role in criminology, problems

UNIT III :-
Aerobiology-Introduction, Historical background, applications of Aeropalynology Aeromycology Aerophycology. Importance in medical field, importance of aero mycological studies in various types of crop infection by spores, disease forecasting , aerobiological work in India and abroad.
Intramural and extramural studies, different devices to collect spores, pollen grains such as kite, balloons, trap air strips and slides, volumetric samplers, culturing techniques, analysis of data and their processing, seasonal changes of air-spora
Indoor environments, Sick buildings & hazards, occupational environment and immunology
Outdoor airspora, characteristics, identification,

UNIT IV :-
Airborne allergens- Introduction, allergens and their types, Impact of airborne materials on human system, Lung as particulate sampler,

Source, causes, symptoms of Pollen allergy, fungal spore allergy, dust mite allergy, algal allergy other allergies, Prevention and cure, isolation & culturing of spores, mites, algae. antibodies to human immunoglobulin, types, and significance in diagnosis of allergy,diagnosing allergic diseases based on total and specific IgE determinations, radio immunoassay,(RAST, PRIST, ECP-immuoassay technique), ELISA (competitive, Double-antibody sandwich, indirect ELISA),Western blotting, allergen standardization, Testing and treatment, pollinosis, nasobroncheal allergy, Immunotherapy and prevention of allergy, pollen calendar and daily census of airborne pollen, circadian periodicities of pollen, Correlation between aerobiological, clinical and meteorological data.

LIST OF PRACTICALS: -

Section A. Basic aspects / Pollen Morphology

1. To study structure of stamen
2. Study of permanent slides of microsporogenesis
3. Field study on different pollination mechanism
4. To study structure of pistil
5. Preparation of glycerin jelly
6. Preparation of pollen- Acetolysis technique
7. Preparation of pollen – Wodehouse technique.
8. Study of pollen types using acetolysed and non-acetolysed pollen. Pollen morphology polarity, symmetry, shape, size, sporoderm stratification aperture NPC (To study the pollen types from at least 30 different species, Angiosperms preparation of permanent slides.)
9. Preparation and palynological description in technical language (at least 10 species of Angiosperms).
10. Interpretation of selected electron micrographs (SEM, TEM) of pollen.
11. Preparation, description and identification of spores of Algae, Fungi, Bryophytes, Pteridophytes and pollen types of Gymnosperms.

Section B. Aeropalynology/Melittopalynology/Palaeopalynology

12. Use of pollen traps to study local air-spora.
13. Analysis of aerospora slides.
14. Preparation of reference slides by different techniques, culture method (culture of fungi/Algae)
15. Preparation of slides honey samples
16. Analysis of honey samples for qualitative and quantitative study of pollen contents.
17. Estimation of pollen load from bee hive or bees/ pollinator
18. Analysis of coal samples for microfossils with special reference to pollen and spores.
19. Preparation of allergenic extract of pollen.

Section C Pollen Physiology/ecology/biochemistry/ecology. (Expt. No.29 is compulsory)

20. To study pollen production and pollen viability of the given flowers.
21. To study percentage of pollen germination & rate of pollen tube growth.
22. To study different techniques of pollen storage

23. Effect of temperature and relative humidity on viability of stored pollen
24. Effect on Boron and Calcium on pollen germination and tube growth.
25. Semi-vivo technique to study pollen germination and pollen tube growth.
26. Multiple staining for localizing pollen tubes in the pistil
27. To study pollen germination and pollen tube growth in the pistil by employing aniline-blue fluorescence method
28. Cytochemical localization of esterase on stigma surfaces
29. Cytochemical analysis of pollen and pollen tube for various metabolites like proteins, amino acids, carbohydrates, starch, ascorbic acid, DNA, RNA, lipids, lignin, pectin, cellulose, etc (at least five metabolites)
30. Study of pollen contents by paper chromatography/TLC.
31. Colorimetric estimation of proteins/carbohydrates of pollen grains
32. To separate pollen proteins by SDS-PAGE electrophoresis
33. Enzyme bioassay in pollen grains.

M.Sc. PART –II PRACTICAL EXAMINATION

BOTANY (Practical –III)

M.Sc. PART-II BOTANY

PRACTICAL-III –PALYNOLOGY (Elective)

Time: - hrs] [Max. Marks-

1. Any ONE experiment from Section A.
2. Any ONE experiment from Section B.
3. Any ONE experiment from Section C.
4. Any ONE experiment from Section C.
   (Other than asked in Question 3)
5. Spots (1-5)
6. Practical Record, Permanent slides & field record and Viva-voce

---

RECOMMENDED READING

1. Afzelius, B.M. 1956 Electron-microscope investigation into exine stratification *Grana Palynologica* (N.S.) 1:2,
2. Agashe S. N. – Paleobotany (1997) – Plants of the past their evolution paleoenvironment and applications inexploration of Fossil.
3. Agashe S. N. – Palynology and its Applications – Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Alexander M.P. (1969). Differential staining of aborted and non-aborted pollen *Stain Technol* 44:117-122.
5. Alexander, M.P. (1987). A method for staining pollen tubes in pistil. Stain Technol 62, 107-112.
6. Alexander, M.P., Ganeshan S. (1990). An improved cellophane method for *in vitro* germination of recalcitrant pollen. *Stain Technol* 64:225-227. Archaeology, *Rev. Palaeobot. Palynol* 21:171-185,
7. Baker, H.G. 1954. Aperture membranes in Studies of Pollen Morphology and Taxonomy. *Newphytologist, 54(3),*
8. Banerjee, U.C. 1965,*et al*. Exine plasticity during pollen grain maturation. *J.palynol.:* 70-89,
9. Banerjee, U.C. 1967.U!trastructure of the tapetal membranes in grasses. *Grana paIynologia: 7,2-3,*
10. Bhattacharya K., Majumdar M. and Gupta Bhattacharya S. (2006). A text book of Palynology.New Central Book Agency(P) Ltd.,Kolkata
11. Bhojwani, S .S. and S.P. Bhatnagar. 1978. The Embryology of Angiosperms. Vikas Publishing House, New Delhi,
12. Bir Bahadur 1998. Nectary biology. Datt sons publications, Nagpur Bombay,
13. Brooks. J. and G. Sha'w. 1978. Sporopollenin: A review of its chemistry, palaeochemistry and Geochemistry. *Grana. 17(2)* : 91-98.

14. Caulton Eric, Agashe S. N. - Pollen and Spores applications with special emphasis on Aerobiology and Allergy-
15. Chowdhary, J.B. and T.M. Varghese. 1968. Pollen sterility in crop plants- A review *Palyn. Bull.*IV (2).
16. Colombo P.M., Lueehin F., Colombo B. (1977). On the control of the population effect on in vitro assays of pollen germination. *J Exp. Bot*. 28:425-438.
17. Cresti, M., Gori P., Pacini E. (eds.) (1988) Sexual reproduction in higher plants. Springer, Berlin Heidelberg New York Tokyo.
18. Cronquist, A. 1968. The evolution and classification of flowering plants, Nelson, London
19. Dafni Amots, Hesser Michel, Paeini Ettore – Pollen and Pollination- Springer Wien New York
20. Davis. P.H. and V.H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London,
21. Dumas C, Knox R.B. (1983). Callose and determination of pistil viability and incompatibility. *Theor Appl. Genet* 67: 1 -10.
22. Echlin, P. Pollen. 1968. *Scientific American 218(4),*
23. EI-Gazzar and M.K. Hamza. 1973. Morphology of the twin Pollinia of Asclepiadaceae. *Pollen et spores* XV (3-4)
24. Erdtman, G, (1956) "Lo-analysis" and "Welcker's rule". *Sven Bot. Tidskr*. 50:1-7.
25. Erdtman, G. 1945. Pollen Morphology and Plant Taxonomy IV Labiatae, Verbenaceae, Avicenniaceae. *Svensk Botanisk Tidskrift. 39(3),*
26. Erdtman, G. (1966). Pollen morphology and plant taxonomy angiosperms hafner. New York.
27. Erdtman, G. (1969). Handbook of Palynology. Hafner, New York
28. Erdtman, G. 1943. An Introduction to Pollen Analysis. Chronica Botanica Co., Waltham, Mass. pp. 239,
29. Erdtman, G. 1952. Pollen Morphology and Plant Taxonomy (An Introduction to Palynology-1, Angiosperms). Aimqvist, and Wicksell, Stockholm,
30. Erdtman, G. 1956. Current Trends in Palynological Research Work *Grana Palynologica* (N.S.) 1:2,
31. Erdtman, G. 1960. The Acetolysis method revised description *Su. Bot. Tidskr.* 54(4).
32. Erdtman, G. 1964. Palynology. In: W.B. Turrill (Editor) Vistas in Botany. Macmillan Go., New York, Vol. 4:23-54,
33. Erdtman. G.1945. Pollen Morphology and Plant Taxonomy V on the occurrence of tetrads and dyads. *Su. Bot. Tidsker.* 39(3),
34. Faegri, K. 1956. Recent trends in Palynology. *Totan. Rev.* 22:639-644
35. Faegri, K. 1975..(3rd Revised Ed.) Text Book of Pollen Analysis. Blackwell Scientific Publ. Oxford,
36. Faegri, K. and J.Iversen. 1964. (2nd ed.) Text Book of Pollen Analysis. Blackwell Scientific Publ. Oxford.
37. Faegri. K. 1978. What is Polar axis? *Grana17*: 15-16

38. Ferguson, I.K. and J. Muller (Editors). 1976. The evolutionary significance of the exine. *Linn. Soc. Symp. Ser*. No. I Academic press, London,
39. Heslop-Harrison, J. (1987). Pollen germination and pollen tube growth. *Int. Rev. Cytol*. 107:1-78.
40. Heslop-Harrison, J. 1962.Origin of Exine. *Nature,* 195 (4846): 1069-1071
41. Heslop-Harrison, J. 1971. (Editor). Pollen: Development & Physiology. Butterworths, London,
42. Heslop-Harrison, J. 1976. The adaptive significance of the exine. Academic Press. London, *Linn. Soc. Symp. Ser* 1:27-37,
43. Heslop-Harrison, Y. (1981). Stigma characteristics and Angiosperm taxonomy. *Nord J. Sot.* 1:401-420.
44. Heslop-Harrison. J. Heslop-Harrison, Y., Shivanna K.R. (1984). The evaluation of pollen quality and a further appraisal of the fluorochromatic (FCR) test procedure. *Theor. Appl. Genet* 67:367-375.
45. Heywood, V.H. 1967. Plant Taxonomy, Studies in Biology No. 5 Edward Arnold (Publ.) London,
46. Hyde, H.A. anrl D, A. Williams. 1945. 'Palynology', *Nature.* . 155-265, London
47. Iwanami, Y,, Sasakuma, T., Yamada, Y. (1988). Pollen: illustrations and scanning electron micrographs. Kodansha (Tokyo) and Springer, Berlin Heidelberg New York Tokyo
48. Jain A., Shivanna, K.R. (1988a). Storage of pollen grains in organic solvents: effect of organic solvents on ieaching of phospholipids and its relationship to pollen viability. *Ann. Bot.* 61:325-330
49. Jain A., Shivanna, K.R. (1988b). Storage of pollen grains in organic solvents. Effects of solvents on pollen viability and membrane integrity. *J. Plant Physiol*. 132:499-502.
50. Jain A., Shivanna, K.R. (1989). Loss of viability during storage is associated with changes in membrane phospholipid. *Phytochemistry* 28: 999-1002.
51. Knox,R.B., Singh, M.B. (1987). New perspectives in pollen biology and fertilization. Ann. Bot. Suppl. 4:15-37.
52. Knox. R.B., Williams, E.G., Dumas, C. (1986). Pollen, pistil and reproductive function in crop plants. *Plant Breed. Rev*. 4:9-79.
53. Koch, K.F. (1972). Fluorescence microscopy. Instruments and applications. Ernst, leitz. Wetzlar, Germany.
54. Maheshwari, P, 1978. An Introduction to the Embryology of Angiosperms, Tata McGraw-Hill Publ. Co. New Delhi
55. Mascarenhas, J.P. 1975. The biochemistry of angiosperm pollen development, *Bot. Rev* 41(3)
56. Mascarenhas. J.P. (1989). The male gametophyte in flowering plants. *Plant Cell* 1:657-664.
57. Moore, P.D., Webb. J.A. (1978). An illustrated guide to pollen analysis. Hodder and Stoughton, London.
58. Mulcahy, D.L., Ottaviano, E., (eds.). (1983). Pollen: biology and implications for plant breeding, Elsevier Biomedical, New York.

59. Muller, J. 1979. Form and Function in Angiosperm Pollen. *Ann. Missouri. Bot. Gard.*-66(4)
60. Nair, P K.K. 1965. Trends in the morphological evolution of pollen and spores. *Journs. Indian. Bot. Soc.* XLIV (4):
61. Nair, P.K.K. 1965.Pollen morphology 'of some families of monochlamydeae, *Bot. Notiser:* 118(3) Lund,
62. Nair, P.K.K. 1966.Essentials of Palynology. Asia Publ. House, Bombay,
63. Nair, P.K.K-. 1970.Pollen morphology of Angiosperms. Scholar Publ. House, Lucknow,
64. Nair. P.K.K. 1965.Pollen Grains of Western Himalayan Plants. Asia Publ. House.

of pollen vedamse Book (P) Ltd. New Delhi.

65. P. K. K (1970). Pollen morphology of angiosperms. Scholar, Lucknow,
66. Pant, D. D. 1954. Suggestions for the classification and nomenclature of fossil spores and pollen grains. *Bot. Rev.* 20(1). 30-60,
67. Plummer, D.T (1987), An introduction to practical biochemistry (3rd edn). MeGraw-Hill. London (Tata Mc-Graw-Hill Edition, 1988).
68. Praglowski, J. 1971. Reticulate and allied exines. *Grana, 11(2):*
69. Ramanna, M.S.(1973). Euparol as a mounting medium for preserving fluorescence of aniline blue in plant material. *Stain Technol* 48.103-105.
70. Rangaswamy, N.S. (1977). Applications of *in vitro* pollination and in vitro fertilization. In.. Reinert J., Bajaj. YPS (eds.). Applied and fundamental aspects of plant cell tissue and organ culture. Springer, Berling**,** Heidelberg. New York, pp**.** 412-425.
71. Rowley, J.R. 1967. Fibrils, microtubules and lamellae in Pollen grains. Rev. *Palaeobotan. Palynol* 3:213-226,
72. Rowley,'J.R. 1975. Germinal, Apertural Formation in Pollen. *Taxon.* 24(l): 17-25,
73. Saad, S.I. 1963.sporoderm Stratification: The 'Medine' a distinct third layer in the pollen wall. *Pollen et spores.* 5: 17 -38
74. Shivanna, K, R. (1982,). Pollen-pistil-interaction and control of fertilization. In: Johri B.M. (ed.). Experimental embryology of vascular plants. Springer, Berlin Heidelberg New York, pp, 131-174.
75. Shivanna, K.R. (1985). Some applied aspects of pollination biology. Biol. Mem. II: 113-119.
76. Shivanna, K.R. and Johri, B M 1989. The Angiosperm Pollen:Structure and Function. Wiley Eastern Ltd., New Delhi
77. Shivanna, K.R. and Rangaswami, N.S. 1992. Pollen Biology: A laboratory manual. Narosa Publishing House, New Delhi.
78. Shivanna, K.R. Cresti, M. (1989). Effects of high humidity and temperature stress on pollen membrane and pollen vigour. *Sex Plant Reprod*. 2:137-141.
79. Shivanna, K.R., Heslop-Harrison, J. (1981). Membrane state and pollen viability. *Ann. Bot.* 47:759-779.
80. Shivanna. K.R., Linskens, H.F., Cresti, M. (l991a). Responses of tobacco pollen to high humidity and heat stress: germination in vitro and in *vivo*. *Sex Plant Reprod* 4: 104-109

81. Shukla, A.K., M.R.Vijayraghwan and B.Chaudhari (1998). Biology
82. Sowunmi, M.A. 1976. The potential value of Honey in palaeopalynology and
83. Sporne, K.R. 1972. Some observations on the evolution of pollen types in dicotyledons. *Newphytol.* 71:181-185,
84. Stanley, R.G. and H.F. Linskens. 1974. Pollen. Biology, Biochemistry management, Springer-Verlag, Berlin,
85. Stanley, R.G., Linskens, H.F. (1974). Pollen: biology. Biochemistry and management. Springer, Berlin Heidelberg New York.
86. Stanley, R.G., Search, R.W. (1971). Pollen protein diffusates. In Heslop-Harrison-J. (Ed.) Pollen: development and physiology. Butterworths, London, pp 174-176.
87. Steer, M.W, Steer, J.M. (1989). Pollen tube tip growth. *New Phytol*. 111:323-358
88. Swamy, B.G.L. and K.V. Krishnamurthy. 1980 From Flower to Fruit. Tata McGraw-Hill Publisher,
89. Takhtajan A.L. 1980. Outline of the classification of flowering plants (Magnoliophyta). *Bot.rev.* 46(3):
90. Talde U.K. 1994.Advances in Mycology and Aerobiology- Dr S T Tilak commemoration volume.
91. Thanikaimoni, G. (1978). Pollen morphological terms proposed definition-I ln Proc. IV Int. Palynol. Conf, Lucknow, Vol. 1, pp. 228-239.
92. Tilak S.T. 1982. Aerobiology, Vaijyanti Prakashan, Aurangabad
93. Tilak S.T.1989. Recent researches in Ecology, Environment and Pollution. Today & Tomorrow Pub., New Delhi
94. Tilak S.T. 1987 "Air monitoring practical Manual", Vaijanti Prakashan, Aurangabad.
95. Tilak S.T. 2009. Aeromycology. Bharati Printing Press, Pune.
96. Tilak S. T. 1989. Atlas of airborne pollen grains and fungal spores. Vaijayanti Prakashan, Aurangabad.
97. Tilak S. T. 1989. Env. Ecology and Aerobiology. Today & Tomorrow's Printers, New Delhi.
98. Tilak S T and Pande B N 1997. Aerobiology. Satyajeet Prakashan, Pune.Van Campo, M. 1967. Pollen at classification, *Rev. Palaeobotan. Palynol* 3:65-71.
99. Van, Campo, M. 1966-67. *et al*. Suppl. Electron microscopy's contribution to the Knowledge of the structure of acetolysed pollen grains, I. *Palyn Bull. II* and III
100. Vishnu-Mittre. 1964.Contemporary thought in Palynology. *Phytomolphology. 14(l):*
101. Walker, J.W. 1947.Evolution of exine structure in the pollen of primitive angiosperms. *Amer. J. Bot* 61(8):
102. Walker, J.W. and J.A. Dolyle. 1975. The basis of angiosperm phylogeny: Palynology. *Ann. Missouri. Bot. Gard,* 62. 664-723,
103. Walker, J.W. Aperture evolution in the pollen of primitive angiosperms. *Amer. J. Bot.* 61(10): 197b.
104. Walton, John. 1940. An Introduction to the Study of Fossil Plants. Adam and Charles Black, London
105. Wodehouse, R.P. 1935.Pollen Grains. McGraw Hill and Co. New York
106. Wodehouse, R.P. 1936. Evolution of Pollen Grains. *Bot. Rev.* 2- 67-89.

107. Zenkteler, M. (1980). Intra-ovarian and in *vitro* pollination. In. Vasil I, K. (ed.) Perspectives in plant cell and tissue culture. *Int. Rev. Cytol. Suppl*. 11 B: 137-156.

Scheme of Examination for M.Sc. (Chemistry)

Semester IV	Internal Assessment	Total Marks	Credits
CH-401: Paper XIII (Spectroscopy)	20 Marks	80 Marks	4 Credits
CH-402: Paper XIV (Special I-Inorganic /Organic/ Physical/Analytical)	20 Marks	80 Marks	4 Credits
CH-403: Paper XV (Special II-Inorganic /Organic/ Physical/Analytical)	20 Marks	80 Marks	4 Credits
CH-404: Paper XVI (Elective- Applied Analytical/ Nuclear/ Environmental /Polymer/Medicinal)	20 Marks	80 Marks	4 Credits
CH-405: Practical VII- Special (Inorganic /Organic/ Physical/Analytical)	20 Marks	80 Marks	4 Credits
CH-406: Practical VIII- Project	20 Marks	80 Marks	4 Credits
CH-407: Seminar-IV	--------	25 Marks	1 Credit
Total:	***120 Marks***	***505 Marks***	***25 Credits***

General scheme for distribution of marks in practical examination

Time : 6-8 h (One day Examination) Total Marks : 80)

Exercise-1 - 30 Marks

Exercise-2 - 20 Marks

Viva-Voce -15Marks

Record -15 Marks

www.Oxpdf.com

Syllabus prescribed for M.Sc. Chemistry Semester IV

CH-401: Paper XIII (Spectroscopy)

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: **15 h**

A] Ultraviolet and visible spectroscopy: Natural line width, line broadening, transition probability, Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels. General nature of band spectra. Beer- Lambert Law, limitations, Frank-Condon principle, various electronic transitions, effect of solvent and conjugation on electronic transitions, Fiesher Wooodward rules for dienes, aldehydes and ketones. Structure differentiation of organic molecules by UV Spectroscopy

B] Photoelectron spectroscopy: Basic principles, photoelectric effect, ionization process, Koopman theorem, PES and XPES, PES of simple molecules, ESCA, chemical information from ESCA, Auger electron spectroscopy.

Unit II: Nuclear magnetic Resonance Spectroscopy **15 h**

Magnetic properties of nuclei, resonance condition, NMR instrumentation, chemical shift, spin spin interaction, shielding mechanism, factors affecting chemical shift, PMR spectra for different types of organic molecules, effect of deuteration, complex spin spin interaction (1^{st} order spectra), stereochemistry, variations of coupling constant with dihedral angle, electronegativity, Karplus equation etc., classification of molecules as AX, AX_2, AMX, A_2B_2, Shift reagents. NMR studies of ^{13}C, chemical shift in aliphatic, olefinic, alkyne, aromatic, heteroatomic and carbonyl compounds, ^{19}F, ^{31}P. Structure determination of organic molecules by NMR spectroscopy,

Unit III: **15 h**

A] Application of NMR spectroscopy: FT-NMR, advantages of FT-NMR, use of NMR in medical diagnosis, 2 dimensional NMR spectroscopy-COSY, NOSEY, DEPT, INEPT, APT, INADEQUATE techniques, Nuclear overhauser effect, nuclear quadrupole resonance spectroscopy: quadrupole nuclei, quadrupole moment, electric field gradient, coupling constant, splitting, applications.

B] Problems based on structure determination of organic molecules by using combined spectral techniques.

Unit IV: Diffraction techniques **15 h**

X ray diffraction: Braggs condition, Miller indices, Laue method, Bragg method, Debye Scherrer method, identification of unit cells from systematic absences in diffraction pattern,, structure of simple lattices and x-ray intensity, structure factor and its relation to intensity and electron density, absolute configuration of molecules, Ramchandran diagram.

www.oxadi.com

Electron diffraction: scattering intensity vs scattering angle, Wierl equation, measurement techniques, elucidation of structure of simple gas phase molecules, low energy electron diffraction and structure of surfaces.

Neutron diffraction: Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques, elucidation of structure of magnetically ordered unit cell.

List of books

1] Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morril, John Wally

2] Introduction to NMR spectroscopy-R. J. Abraham, J. Fisher and P Loftus Wiely

3] Application of Spectroscopy to Organic Compound-J. R. Dyer, Printice Hall

4] Organic Spectroscopy-William Kemp, ELBS with McMillan

5] Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi

6] Organic Spectroscopy-RT Morrison and RN Boyd

7] Practical NMR Spectroscopy-ML Martin, JJ Delpench, and DJ Martyin

8] Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming

9] Fundamentals of Molecular Spectroscopy-CN Banwell

10] Spectroscopy in Organic Chemistry-CNR Rao and JR Ferraro

11] Photoelectron Spectroscopy-Baber and Betteridge

12] Electron Spin Resonance Spectroscopy-J Wertz and JR Bolten

13] NMR –Basic Principle and Application-H Guntur

14] Interpretation of NMR spectra-Roy H Bible

15] Interpretation of IR spectra-NB Coulthop

16] Electron Spin Resonance Theory and Applications-W gordy

17] Mass Spectrometry Organic Chemical Applications, JH Banyon

18] Spectroscopy- H. Kaur

www.oxadi.com

INORGANIC CHEMISTRY SPECIALIZATION

CH-402: Paper XIV (Special I-Inorganic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit-I **15h**

A) Nanoparticals & Nanostructural materials :Introduction, methods of preparation, physical properties, and chemical properties. Molecular Precursor routes to inorganic solids:- Introduction, sol-gel chemistry of metal alkoxide, hybrid organic-inorganic compounds. Nanoporous Materials: Introduction, Zeolites & molecular sieves, determination of surface acidity, porous lamellar solids, composition-structure, preparation & applications.

B) Solid State Reaction: General principles, reaction rates, reaction mechanism, reaction of solids, factors influencing reactivity, photographic process.

Unit-II **15h**

A) **Coordination Polymers**:

Coordination polymers and their classification. Synthesis and applications of coordination polymers. Use of polymeric ligands in synthesis of coordination polymers. Organosilicon polymers. Synthesis and their uses.

B) **Characterization of coordination polymers on the basis of**:

i) Spectra (UV, Visible, IR and NMR)

ii) Magnetic and thermal (TGA,DTA and DSC) studies

Unit-III **15h**

Catalysis: Basic principals, thermodynamic and kinetic aspects, industrial requirements, classification, theories of catalysis, homogeneous and heterogeneous catalysis.Introduction, types & characteristics of substrate-catalyst interactions, kinetics and energetic aspects of catalysis, selectivity, stereochemistry, orbital symmetry and reactivity. Catalytic reactions of coordination and Organometallic compounds including polymerization activation of small molecules, addition to multiple bonds, hydrogenation Zeigler-Natta polymerization of olefins, hydroformylations, oxidations, carbonylations and epoxidation.

Unit-IV **15h**

A) **Supramolecular chemistry:**Molecular recognition: Molecular receptors for different types of molecules including arlsonic substrate, design nad synthesis of co receptor molecules and multiple recognition. Supramolecular reactivity and catalysis.Transport processes and carrier design. Some examples of self-assembly in supramolecular chemistry.

www.oxpdf.com

B) **Thin films and languir-Biodgett films**: Preparation technique, evaporation/spultering, chemical processes, MOCVD, solgel etc. Languir-Biodgett(LB) film, growth techniques, photolithography properties and applications of thin and LB films.

List of books:

1. Barsoum ,M.W.,Fundamentals of Ceramics,McGraw Hill ,New Delhi
2. Ashcroft ,N.W. and Mermin,N.D.,Solid Stae Physics,Saunders College
3. Callister W.D.,Material Science and Engineering, An Introduction,Wiley
4. Keer,H.H,Principals of Solid State,Wiley Eastern
5. Anderson J.C.,Lever K.D.,Alexander J.M and Rawlings,R.D.,ELBS
6. Gray G.W.Ed.Thermotropic Liquid Crystals,John Wiley
7. Kelkar and Hatz Handbook of Liquid Crystals,Chemie Verlag.
8. Kalbunde K.I.,Nanoscale Materials in Chemistry,John Wiley,NY.
9. Shull R.D.,McMichael R.D. and Swartzendrub L.J.,Studies of Magnetic Properties of Fine particles and their relevance to Mataerials Science, Elsevier Pub. Amsterdam

www.Oxpdf.com

CH-403: Paper XV (Special II-Inorganic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit-I **15 h**

A) Basics of Photochemistry: Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped flow techniques, Energy dissipation by radiative and no-radiative processes, absorption spectra Frank-Condon principles; photochemical stages-primary & secondary processes.

B) Properties of excited states: Photochemical kinetics,Calculation of rates of radiative processes.

C) Excited States of Metal Complexes: Electronically excited states of metal complexes, charge transfer spectra, charge transfer excitations, metods for obtaining charge transfer spectra.

Unit-II **15h**

A) Ligand field Photochemistry: photosubstitution, photo oxidation & photoreduction. Liability and selectivity, zero vibrational levels of ground state and excited state, energy content of excited state, zero-zero spectroscopic energy, development of the equations for redox potentials of the excited states.

B) Redox reactions by Excited Metal Complexes: Energy transfer under conditions of weak interaction & strong interaction – exciplex formation, conditions of excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2-bipyridine & 1,10-Phenanthroline complexes.), illustration of reducing and oxidizing character of ruthenium (II); role of spin-orbit coupling, lie time of these processes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants in to highenergy products, chemical energy in to light.

C) Metal Complex Sensitizers: Metal Complex Sensitizers, electron relay, metal colloid systems, and semiconductor supported metal or oxide systems, water photolysis, nitrogen fixation & carbon dioxide reduction.

Unit-III **15h**

Organotransition Metal Chemistry: Alkyls and Aryls of Transition Metals: Types, routes of synthesis, stability & decomposition pathways of alkyls & aryls of transition metals. Organocopper in Organic synthesis. Compounds of Transition Metal –Carbon Multiple bonds: Alkylidenes, alkylidynes, low valent carbenes & carbynes–synthesis, nature of bond, structural characteristics, nucleophilic & electrophilic reactions on ligands, role inorganic synthesis.

Unit-IV **15h**

Transition Metal Pi Complexes-Carbon multiple bonds. Nature of bonding, structural characteristics & synthesis, properties of transition metal pi- Complexes with unsaturated organic molecules, alkenes alkynes,

www.oxpdf.com

allyl, diene, dienyl, arene & trienyl complexes. Application of transition metal, organometallic intermediates in oraganic synthesis relating to nucleophilic & electrophilic attack on ligands, role in organic synthesis.

List of books:

1. Elschenbroich Ch.and Salzer A.: Organometallics, VCH,Weinheim, NY.
2. Balzani Vand Cavassiti V.:Photochemistry of Coordination compounds,AP,London
3. Purcell K.F.and KotzJ.C., An Introduction to Inorganic Chemistry,Holt Sounder,Japan.
4. Rohtagi K.K.and Mukharjee,Fundamentals of Photochemistry,Wiley eastern
5. Calverts J.G.and Pits.J.N.,Photochemicals of Photochemistry,John Wiley
6. Wells,Introduction of Photochemistry
7. Paulson,Organometallic Chemistry,Arnold
8. Rochow,Organometallic Chemistry,Reinhold
9. Zeiss,Organometallic Chemistry,Reinhold
10. Gilbert A.and Baggott,J,Essential of Molecular Photochemistry,Blackwell Sci.Pub.
11. Turro N.J.and Benjamin W.A.,Molecular Photochemistry
12. CoxAand Camp,T.P.Introductory Photochemistry,McGraw-Hill
13. KundallR.P.and GilbertA,Photochemistry, Thomson Nelson Coxon J and Halton B.,Organic Photochemistry, Cambridge University Press.

www.oxpdf.com

CH-405: Practical-VII (Inorganic Chemistry Special)

9 h /week Marks: 80

A) Preparation and characterization of following the following complexes/organometallic compound including their structural elucidation by the available physical methods. (Element analysis, molecular weight determination, conductance and magnetic measurement and special studies) Selection can be made from the following:

i) Cis and trans isomers of bis(glycinato) copper(II) monohydratye.

ii) N,N-bis (salicylaldehyde) ethylene diaminato nickel(II)

iii) Trinitrotriamine cobalt(III)

iv) Cis and trans disubstituted octahedral Cr (III) complexes $[CrF_2(en)_2]$.

v) Preparation of Grignard reagent

vi) Ferrocene and its acelytion

vii) Sodium amide

viii) Synthesis of trichlorodiphenylantimony(V) hydrate.

ix) Synthesis of metal acetylacetonate: magnetic moment, IR, NMR.

x) Magnetic moment of $Cu(acac)_2H_2O$

xi) Determination of Cr (III) complexes: $[Cr(H_2O)_6]NO_3.3H_2O$, $[Cr(H_2O)_4Cl_2].Cl.2H_2O$, $[Cr(en)_3]Cl_3$

xii) Preparation of N,N bis (salicylaldehyde) ethylenediamine,(salen), Cobalt and copper complexes.

B) Solid State:

1) Preparation of oxides and mixed oxides (Mn_2O_3, NiO, Cu_2O, Fe_3O_4, $ZnFe_2O_4$, $ZnMn_2O_4$, $CuMn_2O_4$ and $NiFe_2O_4$)

2) Preparation of Silica and Alumina by sol-Gel technique.

3) To study the electrical conductivity of ferrites, Magnetites, doped oxides and pure samples and determine band gap.

A) Bioinorganic Chemistry

1) Extraction and absorption spectral study of chlorophylls from green leaves of students choice

2) Separation of Chlorophyll and their electronic spectral studies.

3) Complexation study of Cu(II) with biologically important amino acids

B) Inorganic reaction mechanism:

Kinetics and mechanism of following reactions:

1) Substitution reactions in octahedral complexes (Acid/Basehydrolysis)

2) Redox reactions in octahedral complexes.

www.oxodf.com

3) Isomerization reaction of octahedral complexes.

D) Inorganic Photochemistry:

i) Synthesis of potassium ferrioxalate and determination of intensity of radiation

ii) photoxidation of oxalic acid by UO_2^{2+} sensitazation

iii) Photo decomposition of HI and determination of its quantum yield.

List of books:

1. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall.

2. Inorganic Experiments, J. Derck Woollins, VCH.

3. Practical Inorganic Chemistry, G. Marrand, B. W. Rockett, Van Nostrand.

4. A Text Book of Quantitative Inorganic Analysis, A. I.Vogel,Longoman.

5. EDTA Titrations. F. Laschka

6. Instrumental Methods of Analysis, Willard, Merit and Dean (CBS, Delhi).

7. Inorganic Synthesis, Jolly

8. Instrumental Methods of Chemical Analysis, Yelri Lalikov

9. Fundamental of Analytical Chemistry, Skoog D.A. andWest D.M Holt Rinehart andWinston Inc.

10. Experimental Inorganic Chemistry, W.G.Palmer, Cambridge.

11. Solid state Chemistry, N.B.Hanney

12. Introduction to Thermal Analysis, TechniquesandApplications,M.E.Brown, Springer

13. Preparation and Properties of solid state Materials, Wilcox, Vol.IandII, Dekker

14. The Structure and Properties of Materials Vol.IV, JohnWulff, Wiley Eastern.

www.oxpdf.com

ORGANIC CHEMISTRY SPECIALIZATION

CH-402: Paper XIV (Special II-Organic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit I:

A] Carbanions in organic Chemistry **15 h**

Ionization of carbon hydrogen bond and prototopy, Base and acid catalysed halogenation of ketones, keto-enol equilibria, structure and rate in enolisation, concerted and carbanion mechanism for tautomerism, carbanion character in phenoxide and pyrrolyl anions, geometry of carbanions, kinetic and thermodynamic control in the generation of enolates, LDA, hydrolysis of haloforms, use of malonic and acetoacetic esters, Aldol, Mannich, Cannizzaro, Darzens, Dieckmann, Claisen Baylis-Hillman reactions, Knoevenagel, benzoin condensation, Favorski reaction, alkylation of enolates and stereochemistry thereof, Conjugate additions.

B] Organometallic reagents -I

Synthesis and applications of organo Li and Mg reagents, nucleophilic addition to aldehyde, ketones, ester, epoxide, CO_2, CS_2, isocyanates, ketenes, imines, amides, lactones, Stereochemistry of Grignard addition to carbonyl compounds, *o*-metallation of arenes using organolithium compounds.

Unit II: **15 h**

A] Organometallic reagents-II

Organozinc reagents: Preparation and applications, Reformatsky reaction, Simon-Smith reaction.

Organocopper reagents: Preparation and applications in C-C bond forming reaction, mixed oragnocuprates, Gilman's reagent. Organo Hg and Cd reagents in organic synthesis.

B] Transition metals in organic synthesis

Transition metal complexes in organic synthesis-Introduction-oxidation states of transition metals, 16-18 rule, dissociation, association, insertion, oxidative addition, reductive elimination of transition metal

Organopalladium in organic synthesis-Heck reaction, allylic activation, carbonylation, wacker oxidation, isomarization formation N-aryl and N-alkyl bond transmetalation, allyl deprotection in peptides, coupling reactions: Kumada Reaction, Stille coupling, Sonogashira and Suzuki coupling reactions and their importance

Applications of $Co_2(CO)_8$, $Ni(CO)_4$, $Fe(CO)_5$ in organic synthesis. Wilkinson, Noyori, Knowls catalyst of Ruthenium and Rhodium – synthesis and uses its use in hydrogenation reactions-deallylation, C-C, C-O, C-N bond cleavages.

Olefin metathesis by Ist and IInd generation catalyst, reaction mechanism and application in the synthesis of homo and heterocyclic compounds

www.oxpdf.com

Unit III: **15 h**

A] Advanced Stereochemistry:

Conformation of sugars, monosaccharides, disaccharides, mutorotation, Recapitulation of Stereochemical concepts- enantiomers, diastereomers, homotopic and heterotopic ligands, Chemo-, regio-, diastereo- and enantio-controlled approaches; Chirality transfer, Stereoselective addition of nucleophiles to carbonyl group: Re-Si face concepts, Cram's rule, Felkin Anh rule, Houk model, Cram's chelate model. Asymmetric synthesis use of chiral auxiliaries, asymmetric hydrogenation, asymmetric epoxidation and asymmetric dihydroxylation,

B] Protection and Deprotection of functional groups: Protection and deprotection of functional groups like, hydroxyl, amino, carbonyl and carboxylic acids groups, Solid phase peptide synthesis.

Unit IV: Designing the synthesis based on retrosynthetic analysis **15 h**

(A) Disconnection Approach: An introduction to synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reactions, amine synthesis

(B) One Group C-C Disconnections: Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis

(C)Two Group C-C Disconnections: Diels-Alder reaction, 1,3-difunctionalised compounds, α,β-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds, Michael addition and Robinson annelation, Methods of ring synthesis

List of books

1] Principle of Organic Synthesis R. O. C. Norman and J. M. Coxon

2] Modern Synthetic Reaction. H. O. House and W. A. Benjamin

3] Organic Synthesis: The Disconnection Approach-S. Warren

4] Designing Organic Synthesis-S. Warren

5] Some Modern Methods of Organic Synthesis-W. Carruthers

6] Advance Organic Reaction. Mechanism and Structure-Jerry March

7] Advance Organic Chemistry Part-B-F. A. Caray and R. J. Sundberg Plenum Press

8] Organic Reaction and their Mechanism-P. S. Kalsi

9] Protective Groups in Organic Synthesis-T. W. Greene

10] The Chemistry of Organo Phosphorous-A. J. Kirbi and S. G. Warren

11] Organo Silicon Compound-C. Eabon

12] Organic Synthesis via Boranes-H. C. Brown

13] Organo Borane Chemistry-T. P. Onak

14] Organic Chemistry of Boron-W. Gerrard

www.oxdf.com

CH-403: Paper XV (Special II-Organic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit I: Enzyme chemistry **15h**

A] Enzymes: Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Baker's yeast catalyzed reactions, Applications of enzymes in food and drug chemistry

B] Mechanism of Enzyme Action: Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Example of some typical enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A.

C] Co-Enzyme Chemistry: Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD^+, $NADP^+$, FMN, FAD, lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors.

Unit II: Heterocycles **15h**

A] Azoles: Structural and chemical properties; Synthesis of pyrazole, isothiazole and isoxazole; Synthesis of imidazoles, thiazoles and oxazoles; Nucleophilic and electrophilic substitutions; Ring cleavages

B] Benzofused heterocycles: Synthesis of indole, benzofuran and benzo-thiophene, quinoline and isoquinoline Nucleophilic, electrophilic and radical substitutions; Addition reactions; Indole rings in biology.

C] Diazines: Structural and chemical properties; Synthesis of pyridazines, pyrimidines, pyrazines; Nucleophilic and electrophilic substitutions.

Unit III: **15h**

A] Nucleic Acids: Primary, secondary and tertiary structure of DNA; DNA replication and heredity; Structure and function of mRNA, tRNA and rRNA. Purines and pyrimidine bases of nucleic acids and their preparation.

B] Lipids: Fatty acids, essential fatty acids, structures and functions of triglycerols, glycerophospho lipids, spingolipids, lipoproteins, composition and function, role in atherosclerosis

Properties of lipid aggregates, micells, bilayers, liposomes and their biological functions, biological membranes, fluid mosaic model of membrane structure, Lipid metabolism, β-Oxidation of fatty acids

C] Vitamins: Structure determination, synthesis and biosynthesis of vitamin A, E and H.

www.oxdf.com

Unit IV: **15h**

A] Dyes:

General Introduction, classification on the basis of structure and methos of application dying mechanism, methods of dying, such as direct dying, vat dying, dispersive dying, formation of dye in fibre, dying with reactive dyes, study of quinoline yellow, cyamine dye, ethyl red, methylene blue, Alizarin, cyamine-green, fluorescein, cosin, erythrosine, Rhodomines and Indigo.

B]Pharmaceutical chemistry:

History, medical terms in pharmaceutical chemistry, classification of drugs, antibacterial and antifungal drugs, specific clinical applications, Serendipity and drug development, Synthesis and applications of: Benzocaine, Methyl dopa, dilantin, ciprofloxacin, acyclovir, terfenadine, salbutamol

C] Polymer chemistry: Importance of polymers, Basic concepts: monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition, radical chain-ionic and co-ordination and co-polymerization and their mechanisms, Polymerization in homogeneous and heterogeneous systems. Ziegler-Natta polymerization with mechanism, Stereo regulated polymers, syndiotactic, isotactic and atactic polymers

List of books

1] Textbook of Polymer Science, F. W. Billmeyer Jr, Wiley

2] Polymer Science, V. R. Gowarikar, N. V. Viswanathan and J. Sreedhar, Wiley-Eastern

3] Functional Monomers and Polymers, K. Takemoto, Y. Inaki and R. M. Ottanbrite

4] Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-Verlag

5] Understanding Enzymes, Trevor Palmer, Prentice Hall

6] Enzyme Chemistry: Impact and Applications, Ed. Collin J. Suckling, Chapman and Hall

7] Enzyme Structure and Mechanism, A. Fersht, W. H. Freeman

8] Introduction to Medicinal Chemistry, A. Gringuage, Wiley-VCH

9] Wilson and Gisvold's Text Book of Organic Medical and Pharmaceutical Chemistry, Ed Robert F. Dorge

10] Burger's Medicinal Chemistry and Drug Discovery, Vol-1, Ed. M. E. Wolff, John Wiley

11] Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley

12] The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press

www.oxpdf.com

CH-405: Practical-VII (Organic Chemistry Special)

9 h /week Marks: 80

[A] Quantitative Analysis based on classical and instrumental technique (any 9-10)

1] Estimation of nitrogen.

2] Estimation of halogen.

3] Estimation of sulphur.

Spectrophotometric/calorimetric and other instrumental methods of estimation

4] Estimation of streptomycin sulphate.

5] Estimation of vitamin B-12.

6] Estimation of amino acids.

7] Estimation of proteins.

8] Estimation of carbohydrates.

9] Estimation of Ascorbic acid.

10] Estimation of Aspirin.

11] Solvent extraction of oil from oil seeds and determination of saponification value, iodine value of the same oil.

[B] Organic multi-step preparations (Two/Three steps): Minimum 10-12 preparations

[1] Aniline → Diaminoazobenzene → p-aminoazobenzene

[2] Benzoin → Benzyl → Dibenzyl

[3] Aniline → acetanilide → *p*-bromoacetanilide → *p*-bromoaniline

[4] Aniline → Acetanilide → *p*-nitroacetanilide → *p*-nitroaniline

[5] Benzaldehyde (thiamine hydrochloride) → benzoin → benzil → benzilic acid

[6] *p*-Nitrotoluene → *p*-nitrobenzoic acid → PABA → *p*-iodobenzoic acid

[7] *p*-Cresol → *p*-cresylacetate → 2-hydroxy-5-methyl acetophenone → 2-hydroxy chalcone

[8] Benzaldehyde → benzilidene acetophenone → 4,5-dihydro-1,3,5-triphenyl-1*H*-pyrazole

[9] Aniline → phenylthiocarbamide → 2-aminobenzthiazole (Microwave in step I)

[10] Chlorobenzene → 2,4- Dinitrochlorobenzene → 2,4- Dinitrophenylhydrazine.

[11] Acetophenone → acetophenone phenyl hydrazone → 2-phenylindole

[12] Benzion → benzoin benzoate → 2,4,5-triphenyl oxazole

[13] Benzophenone → benzpinacol → benzopinacolone (Photochemical preparation)

[14] Benzophenone → Benzophenone oxime → Benzanilide → Benzoic acid + aniline

www.Oxpdf.com

[15] Aniline → aniline hydrogen sulphate → sulphanilic acid → Orange II

[16] Aniline → N-arylglycine → indoxyl → indigo

[17] Phthalimide → Anthranilic acid → Phenyl glycine-o-carboxylic acid → Indigo

[18] Phalic anhydride → Phthalimide → Anthranilic acid → o-chlorobenzoic acid

[19] Phalic anhydride → Phthalimide → Anthranilic acid →Diphenic acid

[20] Ethyl acetoacetate → 3-methyl-pyrazol-5-one → 4,4-dibromo-3-methyl-pyrazol-5-one → Butanoic acid

[21] Biosynthesis of ethanol from sucrose

[22] Enzyme catalyzed reactions

[C] SPECTRAL INTERPRETATION

Structure Elucidation of organic compounds on the basis of spectral data (UV, IR, ^{1}H and $^{13}CNMR$ and Mass) (Minimum 12 compounds are to be analysed during regular practicals).

www.oxpdf.com

PHYSICAL CHEMISTRY SPECIALIZATION

CH-402: Paper XIV (Special I-Physical Chemistry)

60h (4h/week) 15h/unit 80 Marks

UNIT-I SURFACE CHEMISTRY **15h**

A] Macromolecules: Number and average molecular mass, molecular mass determination:Osmometry, Viscometry, sedimentation, diffusion and light scattering method.

B] Chemical adsorption, application of adsorption, factors affecting adsorption, Langmuir theory, BET theory, heat and entropy of adsorption. Surface film on liquids; Electro-kinetic phenomena. types of adsorption isotherm. micelle formation, mass action model and phase separation model, shape and structure of micelles, CMC, factors affecting CMC effect of added electrolyte on the surface excess of ionic surfactants.

C] Modern techniques for investigating surfaces-Low energy electron diffraction(LEED), PES, Scanning tunneling and atomic force microscopy (STM and AFM)

UNIT II CORROSION AND CORROSION ANALYSIS **15h**

A] Scope and economics of corrosion, causes (Change in Gibbs free energy) and types of corrosion, lectrochemical theories of corrosion, dry and wet corriosion, Different types of corrosion-Pit, Soil, chemical and electrochemical, intergrannular, waterline, microbial corrosion, measurement of corrosion by different methods, factors affecting corrosion, passivity, galvanic series, protection against corrosion, design and material selection.

B] Thermodynamics of corrosion, corrosion measurements (Weight loss, OCP measurements, polarization methods), passivity and its breakdown, corrosion prevention (electrochemical inhibitor and coating methods).

UNIT III: RADIATION CHEMISTRY **15h**

Measurement of dose. Dosimetric terms and units (Roentgen, REM, Rad, Gray, Sievert), inter conversions, calculation of absorbed dose-various types of dosimeters, chemical dosimeters (Fricke and Ceric sulphate), experimental methods, TLD badges, Radiolysis-definition, process, Radiolysis of water and aqueous solutions, hydrated electron, Effect of radiation on biological substances, genetic effects, radiation effects on organic compounds (Halides-carboxylic acids), polymers, nitrates and solid thermoluminescence.

UNIT IV: LIQUID STATE **15h**

A] Theory of liquids:- Theory of liquids, partition function method or model approach, single cell models, communal energy and entropy, LTD model, significant structure model.

www.0xpdf.com

B] Supercooled and ionic liquids: Supercooled and ionic liquids, theories of transport properties, non Arrhenius behavior of transport properties, Cohen- Turnbull free volume model, configurational entropy model, Macedo- litovitz model, glass transition in supercooled liquids.

Books Sugggested:

1. Y. Moroi, *Micelles : Theoretical and Applied Aspects*, Plenum Press, New York (1992).
2. E.M. Mc Cash, *Surface Chemistry*, Oxford University Press, Oxford (2001).
3. P.A. Eglestaff," An Introduction to Liquid State" Academic Press.
4. J.A.Pryde,"The Liquid State"
5. A.F.M.Barton, "The Dynamics of Liquid State", Longman.
6. Introduction to Radiation Chemistry: J. W. T. Spinks and R. J. Woods
7. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
8. G. Hughes- Radiation Chemistry- Oxford University Press, London

www.Oxpdf.com

CH-403: Paper XV (Special II-Physical Chemistry)

60h (4h/week) 15h/unit 80 Marks

UNIT I: ELECTRICAL AND MAGNETIC PROPERTIES OF SOLIDS **15h**

A] Metals, insulators and semiconductors, electronic structure of solids-band theory, fermi gas model, electrical conductivity, thermal conductivity, Lorenz number, periodic potential, band structure of metals, insulators and semiconductors, intrinsic and extrinsic semiconductors, doping semiconductors, semiconductor p-n junctions, colors in solids.semiconductors, meissner effect, LTSC, HTSC.

B] Behaviour of substances in magnetic field, effect of temperature: Curie and Curie-weiss law, calculation of magnetic moments, magnetic materials, their structure and properties, Applications: structure/ property relations, numericals.

UNIT II: ELECTRICAL PROPERTIES OF MOLECULES **15h**

Dipole moments of molecules, basic ideas of electrostatic interactions, polarizability, orientation polarization, Debye equations, limitation of the Debye theory, Clausius-Mossotti equation. electrostatic of dielectric medium, molecular basis of dielectric behavior, structural information from dipole moment measurements, use of individual bond dipole moments, application to disubstituted benzene derivatives, dipole moment and ionic character of a molecule, determination of dipole moment from dielectric measurements in pure liquids and in solutions. The energies due to dipole-dipole, dipole induced dipole and induced dipole-induced dipole interaction. Dispersion, dielectric loss and refractive index. Lennard-Jones potential.

Unit III: LIQUID CRYSTALS **15h**

A] LIQUID CRYSTALS :Mesomorpic behavior, thermotropic liquid crystals, positional order, bond orientational order, nematic and sematic meso phases, sematic and nematic transitions and clearing temperature, homeotrpic, planer and schlieren textures twisted nematics, chiral nematics, molecular arrngement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals.

B] THIN FILMS: Langmuir- Blodgett (LB) Film, growth techniques, photolithography, properties and applications of thin and LB films.

Unit IV: **15h**

A] Liquid gas and liquid interfaces: Surface tension, methods of determination of surface tension, surface tension across curved surfaces, vapor pressure of droplet (Kelvin equation) , surface spreading , spreading coefficient, cohesion and adhesion energy, contact angle, constant angle hystereis, wetting and detergency.

B] Solid - Solid interfaces : Surface energy of solids, adhesion and adsorption, sintering and sintering mechanism, Tammann temperature and its importance, surface structure and surface composition.

www.oxodi.com

List of books

1. Physical Chemistry - P.W. Atkin, ELBS fourth edition.

2. Physical Chemistry – R.A. Alberty, R.I. Bilby, Johy Wiley – 1995

3. Physical Chemistry – G.M. Barrow, Tata Mc – Graw Hill – 1988

www.oxpdf.com

CH-405: Practical-VII (Physical Chemistry Special)

9 h /week Marks: 80

Adsorption:

1. To verify Freundlich adsorption isotherm.

2. To verify Langmuir adsorption isotherm.

3. To verify Gibbs adsorption isotherm and to find surface excess concentration of solute.

4. To determine CMC of the given surfactant by surface tension method.

5. Study of variation of surface tension of solution of n-propyl alcohol with concentration and hence determine the limiting cross section area of alcohol molecule.

Kinetics:

6. Clock reaction- activation energy of bromide-bromate reaction.

7. Temp dependence of persulfate-iodide reaction by iodine clock method and calculation of thermodynamic and Arrhenius activation parameters. Study of ionic strength effect on persulfate-iodide reaction.

8. Kinetics of B-Z reaction; Kinetics of modified B-Z reaction

9. Investigate the Autocatalytic reaction between potassium permanganate and oxalic acid.

10. Determination of PKa value of a weak acid by chemical kinetic method(formate-iodine reaction)

Potentiometry and Conductometry:

11. Transport number by potentiometry.

12. Hydrolysis constant by aniline-hydrochloride by potentiometry and conductometry

13. pKa of weak acids by potentiometry and conductometry.

14. Complexation between Hg^{2+} and I^- conductometrically.

www.oxpdf.com

ANALYTICAL CHEMISTRY SPECIALIZATION

CH-402: Paper XIV (Special I-Analytical Chemistry)

60h (4h/week) 15h/unit 80 Marks

Unit-I: Radioanalytical Chemistry-II **15h**

Preparation of some commonly used radioisotopes, Use of radioactive isotopes in analytical and physico-chemical problems, Industrial applications, Neutron sources, Neutron Activation Analysis, Isotope Dilution Analysis, Radiometric titrations (Principle, Instrumentation, applications, merits and demerits), Radiochromatography, Carbon dating, Numericals based on above.

Unit-II: Optical methods of analysis-IV **15h**

Inductively coupled plasma-atomic emission spectroscopy: Principle, atomization and excitation. Plasma source and sample introduction. Instrumentation. Comparison of ICP-AES with AAS. Applications.

X-ray fluorescence spectroscopy*:* Principle. Instrumentation: wavelength and energy dispersive devices. Sources and detectors. Comparison between wavelength and energy dispersive techniques. Sample preparation for XRF. Matrix effects in XRF. Applications in qualitative and quantitative analysis.

Particle induced X-ray emission (PIXE): Basic principle, Instrumentation and applications.

Electron microscopy: Principle, instrumentation and applications of scanning electron microscopy (SEM) and transmission electron microscopy (TEM)

Unit-III: Electrochemical methods of analysis-III **15h**

Ion selective electrodes: Theory of membrane potential. Types of ion-selective electrodes. Construction of solid state electrodes, liquid membrane electrodes, glass membrane electrodes and enzyme electrodes, Selectivity coefficients, Glass electrodes with special reference to H^+, Na^+ and K^+ ions. Applications of ISE in analysis of environmentally important anions like F^-, Cl^-, Br^-, I^-, NO_3^- and CN^-. Advantages of ISE.

Coulometry: Principle. Coulometry at constant potential and constant current. Instrumentation. Applications and advantages of coulometric titrations.

Electrochemical microscopy: Introduction to scanning probe microscopy (SPM), scanning tunneling microscopy (STM), atomic force microscopy (AFM) and scanning electrochemical microscopy (SECM).

Unit-IV:Thermal methods of analysis **15h**

Introduction to different thermal methods, Thermogravimetry (TG and DTG), Static thermogravimetry, quasistatic thermogravimetry and dynamic thermogravimetry, Instrumentation-Balances, X-Y recorder, Stanton-Redcroft TG-750, Thermogram, Factors affecting thermogram, Applications of thermogravimetry, Differential Thermal Analysis (DTA)-Theories, DTA curves, Factors affecting DTA curve, Applications of DTA, simultaneous determination in thermal analysis, Differential Scanning Calorimetry (DSC)- Introduction, Instrumentation, DSC curves, factors affecting DSC curves, applications, Thermogravimetric titration-Theory, Instrumentation and applications.

www.oxpal.com

CH-403: Paper XV (Special II-Analytical Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit-I: Pharmaceutical and clinical analysis **15h**

Requirements of a quality control laboratory for pharmaceutical units, a general idea about following classes of drugs and their analysis-

a. Antibiotics-Chloroamphenol, ampicilline, terramycine

b. Vitamins-Thymine hydrochloride (Vitamin-B1) Riboflavin (Vitamin-B2), Ascorbic acid (Vitamin-C)

c. Sulpha drugs- sulphaguanidine, sulphapyrazine, sulphanilamide

d. Narcotics and dangerous drugs- screening by GC and TLC and spectrophotometric measurements.

Composition of blood, sample collection for blood and urine, clinical analysis, Immuno Assay-RIA, Setting up of RIA and applications, Fluorescence Immunoassay, Enzyme immunoassay, Blood gas analyzer, Trace elements in the body.

Unit-II: Soil analysis and coal analysis **15h**

Soil analysis- Classification and composition, pH and conductivity, analysis of constitutents such as nitrogen, phosphorous, potassium and microconstitutents.

Coal analysis- Proximate analysis (moisture content, ash content, volatile matter, fixed carbon). Ultimate analysis (carbon, hydrogen, sulphur, nitrogen, oxygen content). Combustion of carbonaceous fuel- Flue gas. Calorific value and its units.

Unit-III: Corrosion and corrosion analysis **15h**

Definition, draw backs and theories of corrosion-dry and wet corrosion, Different types of corrosion-Pit, Soil, chemical and electrochemical, intergrannular, waterline, microbial corrosion, measurement of corrosion by different methods, factors affecting corrosion, passivity, galvanic series, protection against corrosion, design and material selection.

Unit-IV: Automation in analytical chemistry **15h**

Automation in the laboratory, Principle of automation, automated instruments, classification, continuous analyzer, automatic instruments, semiautomatic instruments GeMSAEC Analyzer, Flow Injection Analysis (FIA), Dispersion coefficient, Factors affecting Peak Height, microprocessor based instruments, Numericals based on above.

***Hyphenated techniques*:** Introduction to GC-MS, LC-MS, ICP-MS and MS-MS (Tandem) spectrometry.

www.oxpdf.com

CH-405: Practical-VII (Analytical Chemistry Special)

9 h /week Marks: 80

A. Organoanalytical chemistry

1. Estimation of sulphur, nitrogen, phosphorous, chlorine in organic compound.
2. Estimation of phenol.
3. Estimation of aniline.

B. Separation techniques

Ion exchange

1. Separation and estimation of zinc and magnesium/cadmium in a mixture on anion exchanger.
2. Separation and estimation of chloride and iodide in a mixture on anion exchanger.
3. Determination of total cation concentration in water.

Solvent extraction

1. Estimation of Copper using Na-DDC.
2. Estimation of Iron using 8-hydroxyquinoline.
3. Estimation of Nickel using DMG.
4. Estimation of Cobalt using 8-hydroxyquinoline.
5. Estimation of Nickel by synergistic extraction with 1,10-phenanthroline and dithizone.

Paper chromatography

1. Separation and estimation of copper and nickel in a mixture.
2. Separation and estimation of cobalt and nickel in a mixture.

Thin layer chromatography

Separation and estimation of bromophenol blue, congo red and phenol red in a mixture.

C. Water analysis

Mineral analysis: Ttemperature, pH, conductivity, turbidity, solids, alkalinity, chloride, fluoride, sulphate, hardness

Demand analysis: DO, COD

Heavy metals: Fe, Cd and Pb

D. Demonstrations

1. Gas chromatography
2. HPLC

List of books:

1. Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)

www.oxbdf.com

2. Substoichiometry in Radioanalytical Chemistry: J. Ruzicka and J Stary (Pergamon Press)
3. Thermal analysis: Blazek (translated by J. F. Tyson, Van Nostrand)
4. Instrumental Methods of Analysis: Willard, Meriit and Dean(Van Nostrand)
5. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
6. Vogel's Text Book of Quantitative inorganic Analysis: Bassett, Denney, Jeffery and Mendham (ELBS)
7. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
8. Atomic Absorption Spectroscopy: Robinson (Marcel Dekker)
9. Instrumental Methods of chemical Analysis: Braun (Tata McGraw-Hill)
10. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
11. Analysis of Water: Rodier
12. Ion selective electrods: Koryta (Cambridge University Press)
13. Instrumentation in analytical chemistry: Borman (American Chemical Society)
14. Industrial Chemistry: Arora and Singh (Anmol Publications)
15. Diffraction Methods: John Wormald (Clarendon Press)
16. Electroanalytical Chemistry: Bard (Dekker)
17. Analytical Chemistry by Open Learning (Wiley)
18. An Introduction to Electron Diffraction: Beeston (North Holand Publishing Co.)
19. Material Science and Engineering: V. Raghavan (Printice-Hall of India)
20. Practical Physical Chemistry: J. B. Yadav (Goel Publishing House)

www.oxpdf.com

CH-404: Paper XVI (Elective- Applied Analytical Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Water treatment **15h**

Hardness of water and types of hardness. Problems due to hardness. Removal of hardness by lime-soda process, Zeolite process and synthetic ion-exchange resins. Principle, instrumentation and comparison of these three processes. Numericals based on hardness removal. Desalination of sea-water.

Unit-II: Polymer chemistry and Glass analysis **15h**

***Polymer chemistry**:* Definition, classification, co-polymers, conducting polymers, determination of molecular weight, acid value, saponification value, iodine value and hydroxyl groups of polymers., TGA and DTA studies of polymers, LDC polymers. Rubbers, elastomers, silicones.

Glasses: Introduction. Physical and chemical properties. Composition of ordinary glass and special glasses. Determination of silicon, calcium, magnesium, aluminium, chloride, sulphur, barium, arsenic, antimony, chromium, cobalt, copper, iron, manganese, nickel, titanium in glasses.

Unit-III: Cosmetic technology and leather analysis **15h**

Importance of quality control in cosmetic preparations, stability testing of various cosmetic products, Study of rheological properties of semi-solid preparations, evaluation of active ingredients in finished products like shampoos, hair dyes, toothpaste, talcum powder, lip sticks, sun screen preparations.

Analysis of leather: Determination of moisture, acid, free sulphur, total ash, chromic oxide in leather, tensile strength and stretch of leather.

Unit-IV: Explosives and propellants **15h**

Classification of explosives, characteristics of TNB, TNT, RDX, dynamite, lead azide, ammonium nitrate, ammonium picrate. Pyrotechniques.

Analysis of explosives and propellants: Heat of explosion, moisture determination by Karl-Fisher reagent, vacuum oven drying and non-aqueous titration. Stability by different methods. Total volatiles. Qualitative tests for explosives. Colorimetric methods for nitro-compounds. Mechanical tests for explosives.

www.oxpdf.com

CH-404: Paper XVI (Elective- Nuclear Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Radiation Chemistry, Radiolysis **15h**

Measurement of dose. Dosimetric terms and units (Roentgen, REM, Rad, Gray, Sievert), inter conversions, calculation of absorbed dose-various types of dosimeters, chemical dosimeters (Fricke and Ceric sulphate), experimental methods, TLD badges, Radiolysis-definition, process, Radiolysis of water and aqueous solutions, hydrated electron,

Effect of radiation on biological substances, genetic effects, radiation effects on organic compounds (Halides-carboxylic acids), polymers, nitrates and solid thermoluminescence.

Unit-II: Hot Atom Chemistry and Radiochemistry **15h**

Recoil energy and calculations, Szilard Chalmers effects, Kinetics, primary and secondary retention-effect of various factors on retention and its uses, Mossbauer effect- principle, instrumentation and chemical applications,

Unit-III: Radioanalytical techniques **15h**

Neutron sources, Neutron activation analysis, principle, methodology and application for trace analysis, Isotope dilution analysis-principle and application, Isotopic exchange reaction, mechanism and application in use of radioisotopes and tracers, radioactive dating based on carbon-14 and lead isotopes.

Unit-IV: Radiopharmaceuticals **15h**

Radioimmunoassay (RIA), discovery, principle, set up of RIA, Principle of Immunoradiometric assay (IRMA), principle and set up, Radiopharmaceuticlas, classification of products, preparations, quality control aspects, ^{99}Mo-^{99m}Tc generator, Cylotron based products, PRT studies, Therapeutic applicatyions , Radiotherapy

www.oxodf.com

CH-404: Paper XVI (Elective- Environmental Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Water Pollution **15h**

Pollutants- Types of pollutants, sources of water pollution, sampling, preservation and storage of water sample, physico –chemical, organoleptic and chemical analysis of water, electro-analytical, optical (UC-visible spectrophotometry, AAS, flame photometry, XRF, ICPAES), chromatographic (GC and HPLC) and neutron activation methods of analysis of Co, Ni, Cu, Fe, Mn, Zn, Cd, Pb, Hg, As, Cl^- ,F^-, $SO4^{--}$,PO_4^-, NO_3^-. Historical development of detergents, chemistry of soaps and detergents.

Unit-II: Air Pollution **15h**

Natural versus polluted air, air quality standards, air sampling, analysis and control of Particulates, Chemistry and analysis of SOx, NOx, CO, ozone, hydrocarbons, CFCs. Chemistry of gaseous, liquid and solid fuels-gasoline and additives, antiknock agents. Air pollution control—control of automobile emission and control measures in thermal power stations.

Unit-III: Soil Pollution **15h**

Types and sources of soil pollution, classification of soil pollutants, impact of soil pollution on air quality, Specifications for disposal of sewage and effluent on land for irrigation and ground water recharge. Methodology of waste water disposal on land in India. Impact of usage of land for solid waste disposal both municipal solid waste and industrial solid wastes (fly ash from thermal power station, lime sludge from paper and pulp industry), cause of soil erosion, effects of soil erosion, conservation of soil, control of soil pollution.

Unit-IV: Solid waste pollution **15h**

Sources, types and consequences, classification of wastes- domestic, industrial, municipal, hospital, nuclear and agricultural and their methods of disposal. Transfer and transport, Recycle, reuse, recovery, conversion of solid wastes -energy / manure. Analysis and monitoring of pesticides.

Impact of toxic chemicals on enzymes, Biochemical effects of As, Cd, Pb and Hg, their metabolism, toxicity and treatment.

www.oxpdf.com

CH-404: Paper XVI (Elective- Polymer Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: Polymerization **15h**

Types of polymerization, addition-chain, free radical, ionic polymerization, step polymerization, electropolymerization, ring-opening polymerization.

Unit II: Techniques of polymerization **15h**

Techniques of polymerization-suspension, emulsion and bulk polymerization, coordination, polymerization mechanism of Ziegler Natta polymerization, stereospecific polymerization, interfacial polycondensation, mechanism of polymerization.

Unit III: Characterization of polymers **15h**

Electronic, IR and NMR spectral methods for characterization of polymers (Block and Graft)

Thermal methods-TGA, DTA, DSC, thermomechanical and X-ray diffraction study, Block and Graft copolymers, random, block, graft co-polymers, methods of copolymerization.

Unit IV: Specific polymers **15h**

A) Biomedical polymers: Contact lens, dental polymers, artificial heart, kidney and skin.

B) Inorganic polymers: Synthesis and application of silicon, phosphorous and sulphur containing polymers.

C) Coordination polymers: Synthesis and applications of coordination polymers.

www.oxpdf.com

CH-404: Paper XVI (Elective- Medicinal Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

UNIT-I: **15 h**

A] Drug rules and drug acts, Overview of Intellectual property right, Indian and International framework for patent protection**.**

B] Chromatographic separation techniques for drugs: TLC, Paper chromatography, GC, HPLC, LCMS. Dignostic agents: Radio Pharmaceuticals, Radiology and CT.

UNIT-II: **15 h**

A]Statastical method: For sampling and interpretation of results, Statastic in quality control, T-Test, F-Test, Validation of analytical methods as defind proceding USP Radioimmunoanalysis, Investigational drugs.

B]Anti-Viral agents: Inroduction, viral diseases, viral replication, and transformation of cells, investigation of antiviral agents,. Chemotherapy for HIV. Synhesis of: Idoexuidine,acyclovir ,amantadine and cytarabin.

C]Anti-malarial agents: Introduction, malarial parasite, and its life cycle, development of antimalarials, chemotherapy of malaria. Synthesis of: Chloroquin, primaquin, proguanil, and Quinacrine

UNIT-III: **15 h**

A) Histamines and Antihistamic agents: Introduction, histamine H1-receptor antagonists. Inhibitors of histamine release. Synthesis of: alkyl amines, phenothiazines, piperzines derivatives.

B) Antibiotics: Introduction, β-lactam antibiotics, classification, SAR and chemical degradation of penicillin, cephalosporins-classification , tetracycline antibiotics-SAR,miscellaneous antibiotics. Synthesis of ampicillin, cephradine, methacycline,chloramphenicol

UNIT-IV: **15 h**

A) Anthelminitics and antiamoebic drugs: Introduction to Helminthiasis, Anthelminitics, drugs used in cestode infection, drugs used in trematode infection, origin of antiamoebic drug, drugs used in nematode infection. Synthesis of: Clioquinol, Iodoquinol, Haloquinol, Dichlorphen, Niclosamide.

B) Anti-inflammatory drugs: Introduction, etiology of inflammatory diseases. The inflammatory response, biochemical response. Synthesis of: Phenyl butazone and its derivatives, pyrazolone derivatives, pyrole and indole acetic acid derivatives.

www.oxdf.com

CH-406: Practical VIII- Project

9 h/week 80 Marks

Project is a part of practical examination. Project should be carried out by the student under the supervision of Guide/Teacher. The examination shall be conducted by External and Internal Examiners. Students are supposed to present their work either on LCD Projector / OHP or blackboard.

The division of marks will be as follows:

External examiner: 40 marks

Internal examiner (Guide/ Teacher): 40 marks

(With Internal Assessment of 20 Marks)

Note: One external examiner shall be appointed for evaluation of group of 6 students.

www.Oxpdf.com

CH-407: Seminar-IV

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

www.Oxpdf.com

Kvisoft PDF Merger DEMO : Purchase from www.kvisoft.com to remove the watermark

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
M.Sc. Part I
Subject- Zoology
Semester I – Paper I
Animal Structure and function : Invertebrates

Unit-I

1.1 Modern scheme of animal classification into sub-kingdom, division, section, phyla and minor phyla.

1.2 Protozoa : Ultrastructure of locomotory organs, pseudopodia, flagella, cilia and pellicular myonemes. Mechanism of various modes of locomotion.

1.3 Porifera : Cellular grade of organization in sponges.

1.4 Coelom : formation, evolution and significance.

Unit-II

2.1 Origin of metazoan : colonial, syncytial and molecular theories.

2.2 Coelenterata : Polymorphism, metagenesis and metamorphosis.

2.3 Helminthes : Reproductive system, structure and mechanism of reproduction in, *Fasciola*, *Taenia* and *Ascaris*.

2.4 Annelida : Evolution of nephridia and mechanism of excretion in Polychaeta, Oligochaeta and Hirudinea

Unit-III

3.1 Onychophora : *Peripatus* structure, affinities and taxonomic position.

3.2 Arthropoda : Respiratory organs, mechanism of gaseous exchange - tracheal respiration in Insecta and gill respiration in Crustacea.

3.3 Monoplacophora : *Neopilina* - structure, affinities and taxonomic position.

3.4 Mollusca : Neuroanatomy in Gastropoda (*Pila*), Bivalvia (*Unio*) and Cephalopoda (*Loligo*).

Unit-IV

4.1 Echinodermata : Water vascular system - structure and functions.

4.2 Echinodermata : Larval forms, Metamorphosis and evolutionary significance.

4.3 Ctenophora : General account and affinities.

4.4 Entoprocta and Ectoprocta : General account and affinities.

Semester-I, (M.Sc. Part-I, Zoology)
Paper-II : General Physiology

Unit-I

1.1 Enzyme : Classification, mechanism of enzyme action. Factors affecting enzyme action, regulation of enzyme activity, activators and inhibitors.

1.2 Respiratory pigments : types, distribution and properties, structure of haemoglobin and mechanism of O_2 transport.

1.3 Neurotransmitters: chemical nature, biosynthesis and mechanism of synaptic transmission.

1.4 Colour change mechanism: Chromatophores and melanophores- structure, physiology and significance.

Unit-II

2.1 Bioluminescence: light producing organs in animals, physiology and significance.

2.2 Thermoregulation : poikilotherms and homeotherms, adaptations and regulatory mechanisms.

2.3 Osmoregulation : Mechanism in Pisces and Amphibia,

2.4 Molecular mechanism of peptide and steroid hormonal action.

Unit-III

3.1 Digestion and absorption of carbohydrate, proteins and lipids in the gastrointestinal tract.

3.2 Carbohydrates- classification and metabolism- glycogenesis, glycogenolysis, glycolysis, TCA cycle, electron transport system and oxidative phosphorylation.

3.3 Lipids- classification and metabolism- oxidation of fatty acids, cholesterol metabolism.

3.4 Proteins- classification and metabolism- oxidative deamination, decarboxylation and transamination of amino acids, arginine-ornithin cycle.

Unit-IV

4.1 Heart : Myogenic and neurogenic, Structure and working - Cardiac cycle, ECG, pace maker.

4.2 Cerebrospinal fluid: Chemistry and functions.

4.3 Mechanism of reflex action.

4.4 Environmental stress and strain : Physiology, tolerance, avoidance, resistance and adaptations.

Semester-I, (M.Sc. Part-I, Zoology)

Paper-III : Cell Biology and Genetics

Unit-I

1.1 Cell membrane : structure and function, models, passive and active transport, uniport, symport, antiport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties.

1.2 Cell organelles : Structure and functions of - nucleus, mitochondria, endoplasmic reticulum, Golgi complex, lysosomes.

1.3 Microfilaments, microtubules : Structure and Functions.

1.4 Cell cycle - Phases and regulation of cell cycle, mitosis, meiosis.

Unit-II

2.1 Cell signaling - hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, Receptor protein- tyrosin kinase and ion channel receptors.

2.2 Signal transduction : Pathways, primary and secondary messenger systems, regulation of signaling pathways.

2.3 Cellular communication - general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix and integrins.

2.4 Cancer - genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, metastasis.

Unit-III

3.1 Mendelian, non-Mendelian inheritance - mono / dihybrid inheritance, types of dominance, multiple allelism, probability, exercises for solving genetics problems.

3.2 Extensions of Mendelian principles - codominance, incomplete dominance, gene interactions, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

3.3 Population genetics – Mendelian population, Hardi-Weinberg law, applications and factors influencing deviation from Hardi-Weinberg equilibrium.

3.4 Mutation - types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants.

Unit-IV

4.1 Structural and numerical alterations of chromosomes - deletion, duplication, inversion, transversion, translocation, ploidy and their genetic implications.

4.2 Extra chromosomal inheritance - cytoplasmic inheritance, inheritance of mitochondrial genes, maternal inheritance.

4.3 Microbial genetics - recombination in bacteria and gene mapping, transformation, conjugation, transduction.

4.4 Human genetics- pedigree analysis, Human chromosomes (karyotypes) , Human traits, genetic disorders (Haemophilia, Alziemer's disease, thalassemia).

Semester-I (M.Sc. Part-I, Zoology)

Paper-IV : Reproductive Biology

Unit-I

1.1 Various methods of asexual and sexual reproduction in Protozoa.

1.2 Regeneration in *Hydra*, and Annelid worms; Morphogenesis and hormonal control.

1.3 Metamorphosis in insects: Partial and complete metamorphosis, metamorphic forms- nymph, larvae and pupae.

1.4 Mechanism of vitellogenesis in insects.

Unit-II

2.1 Spermatogenesis: Process, hormonal regulation and ultra-structure of human spermatozoa.

2.2 Mechanism of oogenesis: Process, biochemical events, hormonal regulation.

2.3 Cytological and molecular events of fertilization.

2.4 Types of cleavage, blastulation, gastrulation and embryonic induction.

Unit-III

3.1 Male accessory sex glands in mammals: structure, secretion and functions.

3.2 Semen- biochemical composition and sperm abnormality.

3.3 Sperm capacitation and decapacitation- molecular mechanism and significance.

3.4 Pheromones and sexual behavior in mammals.

Unit-IV

4.1 Neurohormonal control of fish reproduction.

4.2 Molecular induction (Morphogenetic gradients) and organizer concept.

4.3 Cryopreservation of gametes, embryo and test-tube baby.

4.4 In vitro fertilization (IVF) and its significance.

Semester I, Practical-I, Structure and Function of Invertebrate and General Physiology
Section-A

1. **Study of museum specimens**.
Classification up to order and comments on the specimens representing all phyla.

2. **Anatomical Observations**
Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc.
a. Digestive system – Earthworm, Leech, Cockroach, Honey bee
b. Nervous system – Prawn, Cockroach. Honey bee
c. Reproductive system- Earthworm, Leech, Cockroach, Honey bee.

3. Mounting - Study of permanent Preparation of the following with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc.

a. Earthworm – Nerve ring, ovary, spermatheca, nephridia.
b. Leech – jaws, ciliated organ.
c. Cockroach – Mouth parts, Salivary glands, trachea.
d. Prawn –Appendages, Statocyst.
e. Protozoans- rhizopods , flagellates , ciliates (fresh water forms).
f. Porifera – Spicules and gemmules of fresh water sponges.
g. Crustaceans and rotifers - Planktonic copepodes, cladoceran, ostracoderm and rotifers.
h. Larval forms of the free living invertebrates.
i. Larval forms of parasitic invertebrates.

Note: Student should prepare and submit at least 10 permanent stained micropreparation.

4. Study of permanent Invertebrate slides with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc
a. Porifera – T.S. and L.S. of *Sycon*, gemmules, spicules
b. Coelenterata – T.S. of *Hydra* , T.S. of Sea anaemon, Ephyra larva
c. Helminths – T.S. of *Planaria,* T.S. of *Taenia* , scolex W.M., Mature , gravid proglotids , T.S. of male and female *Ascaris*, W.M of *Ankylostoma* , *Enterbios*, *Dracunculus*, *Wuchereria*
d. Annelida -T.S. of *Nereis*, T.S. of Earthworm passing through various organs, T. S. of Leech.
e. Arthropod larvae – Nauplius, Zoea, Megalopa, Mysis.
f. Mollusca – Veliger and Glochidium larva.
g. Echinodermata- pedicellarae, T.S. of arm of star fish, Bipinnaria, Auricularia larva .
h. Hemichordata – T.S. through collar, proboscis, trunk and branchio-genital regions. Tornaria larva.

Note: Students should prepare at least 10 permanent stained micropreparations.

Section-B
1. **Physiology experiments** –

a) Total leucocyte count and differential leucocyte count
b) Total R.B.C. count.
c) Demonstration of action of salivary amylase, trypsin, pepsin.
d) Demonstration of rate of O_2 consumption in aquatic animals, under various environmental stresses.
e) Demonstration of haemoglobin concentration in normal and pathological condition.
f) Estimation of sodium, potassium and chloride in blood and excretory organs by Colorimeter or flame photometer.
g) Estimation of glucose in blood by spectrophotometer or Colorimeter.
h) Estimation of total blood proteins by spectrophotometer or Colorimeter.
j) Estimation of cholesterol in blood by spectrophotometer or Calorimeter.

Distribution of Marks: Total Marks: 80

Anatomical observations	:	15
Stained permanent preparation	:	05
Identification and comment on the spots (1-10)	:	20
Submission of stained permanent slides	:	05
Physiology experiment (Major)	:	15
Physiology experiment (Minor)	:	10
Class Record	:	05
Viva-voce	:	05
	Total Marks :	**80**

Semester-I, Practical-II, Cell Biology, Genetics and Advance Reproductive Biology

Section-A

1. Study of mitotic metaphasic chromosomes in plant material/ cultured animal cells/cleaving eggs of invertebrate/vertebrate.
2. Preparation of human karyotypes by using photographs/pictures.
3. Demonstration of Barr body in human female leucocytes.
4. Demonstration of polytene chromosome in dipteran larvae.
5. Problems on genetics based on monohybrid/dihybrid ratios, sex linked inheritance and blood groups
6. Study of various human genetic traits

Section-B

1. Study of meiotic chromosomes and spermatogenesis in grasshopper with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
2. Demonstration of oogenesis in earthworm/ fish/ rat ovary with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.
3. Semen analysis: physical viscosity, pH, liquefaction time, agglutination test, motility and sperm count. (Source of semen: Government artificial insemination centre).
4. Sperm vitality study using suitable stains. . (Source of semen: Government artificial insemination centre).
5. Histology of male and female reproductive organs and accessory reproductive glands with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

Distribution of Marks Total Marks: 80

1. Cytological preparation	:	15
2. Problems on genetics (any two)	:	20
3. Spermatogenesis/oogenesis/spermvitality	:	10
4. Semen analysis	:	10
5. Identification and comment on spots (1-5)	:	15
6. Class record	:	05
7. Viva-voce	:	05

Suggested Readings

Invertebrate structure and function

1. Hyman L.H. The Invertebrate Vol. I, Protozoa through Ctenophora. McGraw-Hill Co., New York.
2. Barrington E.J.W. Invertebrate structure and function. Thomas Nelson and sons Ltd., London
3. Jagerstein G. Evolution of Metazoan life cycle . Academic press, New York and London.
4. Hyman L.H. The invertebrate vol. 2 McGraw-Hill Co., New York.
5. Hyman L.H. The invertebrate vol. 8 McGraw-Hill Co., New York.
6. Barnes R.D. Invertebrate Zoology W.B. Saunders and Co., Philadelphia
7. Russet Hunter W.D.D. biology of higher invertebrate The Macmillan Co. Ltd., London.
8. Hyman L.H. The Invertebrates, smaller coelomate groups. Vol. 5 McGraw-Hill Co. New York.
9. Read C.P. Animal Parasitism. Prentice Hall. New-Jersey.
10. Kudo R.R. (1966) Protozoology, Charler, C. Thomas Springfield, Illinois.
11. Barradailes L.A. and potts F.A. Invertebrates (1961) The Eastham L.E. S. Saunders, Cambridge University Press, Cambridge.
12. Russel W.D. Hunter, Biology of lower invertebrates McMillan, New York.
13. Marshall A.J. and Williams W.D. (1972) J. B. Zoology of Invertebrates , ElBs and McMillan, London.
14. Gtryyrt V. and Graham A. A Functional anatomy of Invertebrates. Academic press, New York.
15. Backlemiccher W.N. Principles of comparative anatomy of Invertebrates Oliver and Boyed Edinberg.
16. Hadisi J. The Evolution of Metazoa. Pergamon Press, Oxford.
17. Dales R.P. Annelids, Hutchinson, London.
18. Green J. Biology of Crustacea, Wither by, London
19. Morton J. E. Mollusca, Hutchinson, London
20. Nichols D. Echinodermata, Hutchincon, London

General Physiology

1. Text Book of Physiology & Biochemistry : Bell, G.E. & Davidson, J.N. & Emslie D. Smith, 1922.
2. Medical Physiology : A Wiley Medical Publication, John Wiley & Sons, New York.
3. Mineral Metabolism : Comar, C.L. & Felix Bronner (1961) Acad Press, New York & London.
4. A Text Book of General Physiology : Dayson (1964) : Little Brown & Co. Boston.
5. Animal Physiology : R. Eckert & D. Randall (1983) 2nd Edn., W.H. Rexeman & Co.
6. Biochemistry & Physiology of the Cell : (2nd Edn.), M.A. Edwards & K.A. Hassall (1980) Mc. Graw Hill Co.
7. The Physiology of Cells : Cuthe F. (1968) : The Macmillan Co.
8. Textbook of Medical Physiology: Guyton, A.G. (1968). 7th Edn. Saunders Pub.
9. Samson Wrights Applied Physiology : Oxford University Press.
10. Comparative Animal Physiology C.L. Prosser, W.B. Saunders & Company.

11. Animal Physiology : Mechanism & Application, R. Eckert, W.H. Freeman & Company.
12. General & Comparative Animal Physiology : W.S. Hoar.
13. Medical Physiology : W.F. Ganong (1981) : 10th Edn. Lange Medical Publications.
14. Principles of Anatomy and Physiology: Tortora Grabowski, 9th Edn., John Willey & Sons.
15. Reproductive Physiology of Vertebrates: Van Tienhoven, A. (1983): 2nd Edn. Cornell Univ. Press, New York.

Cell Biology and Genetics

1. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication.
2. Molecular Biology by Turner P. C. and Mc Lennan , Viva Books Pvt. Ltd.
3. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd.
4. Molecular Biology by Freifelder D., narosa publication House.
5. Gene VI by Benjamin Lewis, Oxford press.
6. Gene VIII by Benjamin Lewis, Oxford press.
7. Molecular biology of Gene by Watson J. D. et. al., Benjamin publication.
8. Molecular cell Biology by Darnell J. Scientific American Books USA.
9. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc.
10. Genetics Vol. I and II by Pawar C. B., Himalaya publication.
12. Essentials of Molecular Biology by Freifelder D., narosa publication House.
13. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell J., W. H. Freeman and Co.
14. The Cell: Molecular Approch by Cooper G. M.
15. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication.

Advance reproductive Biology

1. Developmental Biology. 2nd Edition. Leon W. Browwer Saunders College publishing.
2. Current Topics in Developmental Biology eds. R. A. Pedersen and G. P. Schatten.
3. Principles

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
M.Sc. Part I
Subject- Zoology Semester-II,
Paper- V, Animal structure and Function ,Vertebrates

Unit-I

1.1 Origin and ancestry of Chordata.

1.2 General organization and affinities of Cephalochordata.

1.3 General characters and affinities of Dipnoi.

1.4 Organs and mechanism of respiration in Pisces and Amphibia.

Unit-II

2.1 Vertebrate integument and its derivatives.

2.2 Appendicular skeleton (Limbs and girdles) in Amphibia, Reptilia, Aves and Mammals.

2.3 General body organization and classification in Chelonia.

2.4 Evolution of urinogenital organs in vertebrates.

Unit-III

3.1 Origin of Birds.

3.2 Cetacia: general characters and adaptations.

3.3 Comparative anatomy of the brain in vertebrates (teleost, frog, lizard, fowl and rat).

3.4 Autonomous nervous system in vertebrates: structure and functions.

Unit- IV

4.1 Structure, development and metamorphosis of Ammoecoetus.

4.2 Evolution of heart in vertebrates.

4.3 Sense organs in vertebrates: lateral line system and electroreception in fishes.

4.4 Evolution of Man.

Semester-II, (M.Sc. Part-I, Zoology)

Paper-VI, General and comparative Endocrinology

Unit-I

1.1 Hormones and functions in Coelentereta and Helminths.

1.2 Neurosecretory system in Annelida: structure, hormones and functions.

1.3 Neuroendocrine system in Mollusca: structure, hormones and functions.

1.4 Hormones and functions in Echinodermata.

Unit-II

2.1 Neuroendocrine system in crustacean; structure and hormones.

2.2 Endocrine control of metamorphosis, reproduction and colour change mechanisms in crustacea.

2.3 Cephalic neuroendocrine system in insects: structure and hormones.

2.4 Endocrine control of metamorphosis and reproduction in insects.

Unit-III

3.1 Pineal organ: structure, hormones and functions.

3.2 Hypothalamus: Nuclei, hormones and functions.

3.3 Pituitary: cell types, hormones and functions.

3.4 Hypothalamo-hypophysial system: neuroendocrine integration and feedback mechanisms in mammals.

Unit-IV

4.1 Thoracic endocrine glands: thyroid, parathyroid and ultimobranchial glands: structure, hormones and regulatory mechanisms.

4.2 Gastro-entero-pancreatic endocrine system: endocrine pancreas and gastro intestinal tract: endocrine cells, hormones and functions.

4.3 Adrenal gland: structure, hormones and functions in vertebrates.

4.4 Gonadal hormones in vertebrates and their hormonal actions, feedback mechanisms.

Semester-II, (M.Sc. Part-I, Zoology)
Paper-VII, Molecular Biology and Biotechnology

Unit-I

1.1 Genome organization – C value paradox, genome size, , repetitive and non repetitive DNA sequences , pseudo- genes, gene families, gene clusters, organelle genome, chromosomal structure , chromatin organization and remodeling, DNA structure, forms of DNA.

1.2 DNA replication – molecular mechanisms of prokaryotic and eukaryotic DNA replication, regulation of replication.

1.3 DNA damage and repair – types of DNA damages, excision repair system(BER), mismatch repair(MMR), recombination repair, double strand break repair, and transcription coupled repair.

1.4 Recombination- homologous and non homologous recombination.

Unit-II

2.1 Transcription- prokaryotic and eukaryotic transcription, RNA polymerases, transcriptional unit, initiation, elongation, termination, transcriptional factors.

2.2 Regulation of transcription : lac operon- positive and negative control, attenuation-phage strategies , anti-termination,.

2.3 Translation - prokaryotic and eukaryotic translation, genetic code, , termination factors, post translational modifications.

2.4 Mobile DNA elements – transposable elements, IS elements, P elements, retroviruses, retroposons.

Unit-III

3.1 Post–transcriptional RNA processings : splicing, polyadenylation, molecular mechanisms of antisense molecules, gene silencing.

3.2 Isolation and sequencing of DNA : gene amplification, PCR, RAPD, RFLP, Maxam-Gilbert, Sanger's dideoxy methods.

3.3 Recombinant DNA technology : Cloning vectors,plasmids, cosmids, phagemids, YACS, gene replacement, restriction enzymes.

3.4 Hybridization techniques – Southern- Northern hybridization, microarray.

Unit-IV

4.1 Medical biotechnology-Application of restriction fragment length polymorphism (RFLP) in forensic science, disease prognosis and genetic counseling.

4.2 Agricultural biotechnology–- biofertilizers, bioinsecticides, biogas

4.3 Immunobiotechnology- Hybridoma technology -monoclonal antibodies.

4.4 Industrial and Environmental biotechnology-microbial production of fermentation products, enzymes, antibiotics, single Cell proteins and biosensors.

Semester-II, (M.Sc. Part-I, Zoology)
Paper-VIII, Advance Developmental Biology

Unit-I

1.1 Implantation in Mammals.

1.2 Foetal membranes- types, structure and functions.

1.3 Placenta-types, structure, functions. Hormones and their functions.

1.4 Metamorphosis in Amphibia: morphogenetic and biochemical mechanism, hormonal control.

Unit-II

2.1 Regeneration in vertebrates: tail, limb, lens and retina.

2.2 Apoptosis- mechanism and significance.

2.3 Ageing- mechanism, concepts

2.4 Polymorphism in insect -Termites, Honey bees and Ants.

Unit-III

3.1 Multiple ovulation and embryo transfer technology (MOET).

3.2 Embryonic sexing, cloning, screening for genetic disorder diagnosis (ICSI, GIFT etc.)

3.3 Cloning of animals by nuclear transfer.

3.4 Application of embryonic stem cells, clinical and economic significance.

Unit-IV

4.1 Immunocontraception- fertilization, inhibition and pregnancy termination.

4.2 Classical contraceptive techniques: Physical, chemical, surgical and IUCD devices.

4.3 Anti-androgen and anti-spermiogenic compounds (LDH-CY and SP-10)

4.4 Role of mutants and transgenics in human welfare.

Semester-II, Practical-III,
Structure and Function of Vertebrates and Endocrinology

Section-A

1. **Study of museum specimens**.

Classification of vertebrates up to order and comments on the specimens representing all phyla.

2. **Anatomical Observations**

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc. **(Any animal)**

a) Brain and cranial nerves- Fish/Rat.

b) Arterial and venous systems- Fish/Rat

c) Urinogenital system- Fish/Rat.

d) Reproductive systems -Fish/Rat.

e) Internal ear ,Weberian ossicles, accessory respiratory organs in fish.

3. **Mounting –** Study of stained permanent micropreperations of scales, ampullae of Lorenzini, otolith, striated muscles, cartilage from animal waste from locally available fish market or Study of permanent Preparation of the following with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc.

4. **Microtomy, Histology and Skeleton**

a) Fixation, embedding, sectioning and staining of the internal organs of vertebrates.
(Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)

b) Study of slides of internal organs of vertebrates with the help of already already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

c) Axial and appendicular skeleton of fowl and rabbit using already available skeleton/ ICT tools/ models/ charts/ photographs etc.

Note: Students should prepare at least 10 permanent stained micropreparations.

Section-B

1. Microtomy - Fixation, embedding, sectioning and staining of the endocrine gland (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)

2. **Histological study** –

a) Histological slide of endocrine glands and gonadal endocrine components, EM structure of endocrine gland. b) Identification of pituitary cell type. c) Identification of α, β, γ, cells of Islets

of Langerhans with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

4. **Anatomical Observations-** Anatomical observations, demonstration and detailed explanation of the a. endocrine glands in Cockroach and b) Endocrine glands- pituitary, thyroid parathyroid, adrenal in fish/rat with the help of ICT tools/ models/ charts/ photographs etc.

Distribution of Marks Total Marks: 80

Anatomical observations fish/rat	:	15
Stained permanent preparation	:	05
Identification and comment on the spots (1-10)	:	20
Submission of stained permanent slides	:	05
Anatomical observations Endocrine glands	:	15
Histological staining of endocrine gland	:	10
Class Record	:	05
Viva-voce	:	05

Practical –IV,
Molecular Biology, Biotechnology and Developmental Biology

Section-A

1. Demonstration of glycogen/ carbohydrate- PAS reaction (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
2. Demonstration of DNA: Feulgen's reaction. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
3. Demonstration of DNA: RNA: Methyl Green- Pyronin reaction. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
4. Demonstration of Lipid: Sudan Black B staining. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
5. Demonstration of Protein: HgBP staining. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
5. Histochemical analysis of alkaline phosphatase (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
6. Histochemical analysis of acid phosphatase (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
7. Biochemical estimation of sugar: O-toluidine method. (Source of blood: local recognized pathology laboratory.)
8. Biochemical estimation of protein: Lowrey's method. (Source of blood: local recognized pathology laboratory.)
9. Biochemical estimation of DNA: Diphenylamine method. (Source of blood: local recognized pathology laboratory.)
10. Biochemical estimation of RNA: Orcinol method. (Source of blood: local recognized pathology laboratory.)
11. To perform tests for qualitative analysis of saliva
12. To perform tests for qualitative analysis of bile
13. Separation of amino acids by paper chromatography and TLC.

Section-B

1. Study of the reproductive system in mammals with the help of ICT tools/ models/ charts/ photographs etc.
2. Study of different types of eggs on the basis of their yolk content.
3. Study of developmental stages of live eggs of Lymnea or any gastropod with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
4. Study of developmental stages of insects/ fishes with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
5. Study of developmental stages of frog and whole mounts with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
6. Chick embryo mounting by window method.
7. Study of developmental stages of chick through slides and whole mounts.

8. Morphological study of different types of placenta with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

8 Histological study of placenta with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

9 Sperm count from any domestic animal (Source of semen: Government artificial insemination centre).

Distribution of Marks Total Marks: 80

1. Histochemical demonstration of DNA/RNA protein / carbohydrate/lipids/enzymes	15
2. Estimation of sugar/protein/DNA/RNA/ qualitative analysis of saliva/bile	20
3. Whole mount preparation of chick embryo/spermcount/ Viginal snear/hypoosmotic test for fertility.	10
4. Preparation of development stages of live eggs of Lymnea	10
5. Identification and comment on spots (1-5)	15
6. Class record	05
7. Viva voce	05

Suggested Readings

Structure and function of Vertebrate

1. Alexander R.N., The Chordata, Cambridge University Press London.
2. Barrington EJW, The Biology of Hemichordates and Protochordates, Oliver and Boid Edinberg.
3. Bourne G.H., The structure and function of nervous tissue Academic press New York.
4. Kingslay J.S, Out lines of Comparative anatomy of vertebrates, Central Book Depot, Allahabad.
5. Honyelli A.R. The Chordates Cambridge University Press, London
6. Smith H.S. Evolution of Chordate structure, Hold Rinehart and Wintoin Inc. New York
7. Walter H.A. and Sayles L.D. Biology of Vertebrates Macmillan and co. New York
8. Romer A.S. Vertebrate body W.P. Sanders co., Philadelphia.
9. Young J.Z. Life of Vertebrates Oxford University Press, London.
10. Young J.Z. Life of Mammals Oxford University Press, London.
11. Colbert E.H. Evolution of Vertebrates John Wiley and sons Inc. New York.
12. Kent C.J. Comparative anatomy of Vertebrates.
13. Waterman A.J. Chordate Structure and Functions Macmillan Co. New York.
14. Montagna W. Comparative anatomy clarenden press, Oxford

15. Weichert C.K. Preach W. Elements of Chordates anatomy McGraw-Hill book co., New York.
16. Lovetrup S. The phytogeny of Vertebrates John Wiley and sons Inc., London.
17. Joysey K.A. and Kemp T.S. Vertebrate Evolution Oliver and Boyd, Edinberg.
18. Romer A.S. Vertebrate Paleontology University of Chicago Press, Chicago.
19. Newman Phylum Chordata.
20. Goodrich E.S. Structure and development of vertebrates. Dover publications Inc., New York
21. Hard disty M.W. and Potter I.C. Biology of Lampreys Academic Press Newyork
22. T.B.of Zoology Parker and Haswell W.A. Mac millon co. Ltd. London
23. The Biology of Amphibia Noble G.K. Dover Publication Inc Newyork

Endocrinology

1. General & Comparative Endocrinology : E.J.W., Barrington, Oxford, Clarendon Press.
2. Text Book of Endocrinology : R.H. Williams, W.B. Saunders.
3. Endocrine Physiology : C.R. Martin, Oxford University Press.
4. Comparative Endocrinology : A Gorbman et al, John Wiley & Sons.
5. Medical Physiology : W.F. Ganong (1981) : 10th Edn. Lange Medical Publications.
6. Principles of Anatomy and Physiology: Tortora Grabowski, 9th Edn., John Willey & Sons.
7. Reproductive Physiology of Vertebrates: Van Tienhoven, A. (1983): 2nd Edn. Cornell Univ. Press, New York.
8. The Pituitary Gland : Imura, H. (1994), 2nd Edn., Comprehensive Endocrinology Revised Series Raven, New York.
9. Comparative Vertebrate Endocrinology : Bentley, P.J. (1976) Cambridge University Press, Cambridge.
10. General & Comparative Endocrinology : E.J.W., Barrington, Oxford, Clarendon Press.
11. Text Book of Endocrinology : R.H. Williams, W.B. Saunders.
12. Comparative Vertebrate Endocrinomental : Bentely, P.J. (1976) Cambridge University Press, Cambridge.

Molecular Biology and Biotechnology

1. Harper's Review of Biochemistry, Prentice Hall.
2. Principles of Biochemistry by Lehninger and Nelson, CBS publications and Distributors.
3. The Biochemistry "Students companion" by Allen J. Scism, Prentice Hall.
4. Fundamentals of Biochemistry by Jain J. L., S. Chand Publication.
5. Principles of Biochemistry by Zubay J. L., WM. C. Brown Publishers.
6. Principles of Biochemistry by Horton, Prentice Hall.
7. Concept of Biochemistry by Boyer R., Coel publication co.
8. Harper's Biochemistry eds.Murray, R. K. P. and Granner, D. K. Prentice Hall.
9. Biochemistry by Mathews C. K. and Van Holde K. E., Benjamin C. publishing Co.
10. Biochemistry by Garrett R. H. and Grisham C. M., Saunders College publication.
11. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication.
12. Molecular Biology by Turner P. C. and Mc Lennan , Viva Books Pvt. Ltd.
13. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd.
14. Molecular Biology by Freifelder D., narosa publication House.
15. Gene VI by Benjamin Lewis, Oxford press.
16. Gene VIII by Benjamin Lewis, Oxford press.
17. Molecular biology of Gene by Watson J. D. et. al., Benjamin publication.
18. Molecular cell Biology by Darnell J. Scientific American Books USA.
19. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc.

20. Genetics Vol. I and II by Pawar C. B., Himalaya publication.
21 Essentials of Molecular Biology by Freifelder D., narosa publication House.
22. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell J., W. H. Freeman and Co.
23. The Cell: Molecular Approch by Cooper G. M.
24. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication.

Gamete and Developmental Biology

1. Developmental Biology. 2nd Edition. Leon W. Browwer Saunders College publishing.
2. Current Topics in Developmental Biology eds. R. A. Pedersen and G. P. Schatten.
3. Principles of animal developmental biology: S. C. Goel, Himalaya Publishing House.
4. Developmental Biology, S.F. Gilbert. 4th Edn. Sinauer Associates Inc. Publishers.
5. An Introduction to Developmental Biology: D. A. Ede.
6. Principles of developmental: Paul Weiss edited by Hafner publishing company New York.
7. Cells into organs. 2nd Edition. The forces that shape the Embryo. John Philip Trinkaus ed. Tom Aloisi.
8. Principles of development: Lewis Wolpert et al. 1998. Oxford University Press.
9. Foundations of Embryology. B. M. Patten & B. M. Carlson. Tata McGraw Hill Publishing Company Ltd., New Delhi.
10. An Introduction to Embryology: Balinsky (1981) 5th Ed. (CBS College Publishing).
11. Embryonic and foetal development. Cambridge University Press by Austin and Short, 1982, 1994 2nd Ed.
12. Marshall's Physiology of Reproduction Longmont, Green and Co. London Vol. 1 &2. Lamming 1984, 2000.

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
M.Sc. Part II
Subject- Zoology, Semester-IV,
Paper XIII- Biotechniques, Biostatistics and Ethology

Unit-I

1.1 Sterilization techniques, media for microbial culture, inoculation methods.

1.2 Animal cell & tissue culture- primary culture, cell lines, cell quantification, growth kinetics of cells in culture, cryopreservation of cells.

1.3 *In vitro* fertilization technology, cloning, socio-ethical issues of cloning.

1.4 Cell separation by Flowcytometry.

Unit-II

2.1 Basic principle of sedimentation, Preparative centrifugation, analytical centrifugation and applications of ultracentrifugation in cell fractionation.

2.2 Radioactive isotopes, half lives of radioisotopes, isotope techniques in biology and autoradiography.

2.3 Chromatographic separation: Thin layer and gas chromatography, High performance liquid chromatography (HPLC).

2.4 Electrophoretic separation techniques.

Unit-III

3.1 Introduction to statistics and Biostatistics- history, subdivision of statistics, data type, steps in statistical methods, Graphical representations of data in tabular form, characteristic and classification of table, line chart, histogram, bar diagram, pie diagram, cumulative frequency tables and diagrams.

3.2 Central tendency and dispersion-Descriptive statistics, central tendency, mean, median and mode with examples, dispersion, and variance.

3.3 Probability and probability distribution -Basic theory and type of probability and probability distribution with example (binomial, poison and normal distribution).

3.4 Sampling – types, standard error (SE), standard deviation (SD), significance tests – t test, z-test, Chi square test- assumption, importance and example.

Unit-IV

4.1 Population ecology- population structure, distribution, growth, density, fluctuation and dispersal.

4.2 Orientation, navigation and homing.

4.3 Neuronal control, genetic and environmental components in development of animal behaviour.

4.4 Animal ethics- Introduction, concept, organizations and their functions.

M.Sc.II Semester-IV

Paper-XIV, Toxicology and Bioinformatics

Unit-I

1.1 Introduction and Scope of Toxicology

1.2 Principles of Testing for Toxic Effects

1.3 Absorption, Distribution, Metabolism and Excretion of Toxicants

1.4 Mechanisms of Toxicity-receptor concept, nature of receptors, theory of toxicant receptor inter action and mechanism of action.

Unit-II

2.1 Environmental toxicants-Pesticides, Fertilizers, Heavy and trace metals, radioactive substances, food additives, Automobile emission, their accumulation, residual effects distribution in body and excretion

2.2 Toxicants at organ and system level- Tetratogens- causes, mode of action and evaluation.

2.3 Nutritional toxicology- Potential toxicants in foodstuff, natural toxic compound, Industrial contaminants, food additives, liver function test in toxicology and Antidotal procedure (type of intoxication, administration of antidotes and chelation theory)

2.4 Physiological and Biochemical Impact of toxicants on aquatic organisms.

Unit-III

3.1 Scope of bioinformatics - history, scope of bioinformatics in research, business and employment opportunities.

3.2 Bioinformatics and internet.

3.3 Human genome project and online Mendelian inheritance in man (OMIM).

3.4 Bioinformatics in India- current status and future implication.

3.5 Databases - content, structure and annotation and type of databases.

Unit-IV

4.1 Biological databases retrieval tools and systems – sequence similarity searches, FASTA, BLAST, interactive databases searches and PSI-BLAST.

4.2 Multiple sequence alignment and family relationships.

4.3 Protein domain family and protein databases.

4.4 Phylogenetics analysis- tree styles, tree building method, evolution of macromolecular sequence tools for making and drawing trees (phylip and clustlw).

Suggested Readings

Tissue culture and Biotechniques

1. Animal cell culture – A practical approach, (III Edition) Ed. John R. W. Masters. IRL Press.
2. *In vtro*-cultivation of animal cell, biotechnology by open learning (BIOTOL), Butterworth Heinemann Ltd. Linaere house, Jordan Hill Oxford.
3. Introduction to instrumental analysis, Robert Broun, McGraw Hill International Edition.
4. A Biologist Guide to Principle and Techniques of Practical Biochemistry K. Wilson and K.H. Goulding ELBS Edition.
5. Molecular Cell Biology, J. Darnel, H. Lodish and D. Baltimore. W. H. Freeman and Company New York.
6. DNA Techniques by Alcamo.
7. Insect Cell Culturing Engineering, Ed. M. F. A. Goosen, A.J. Daugulis and P.Faulkner.
8. Biotechnlogy - B. D. Sings.
9. Biophysical Chemistry – Upadhyay, Upadhyay and Nath.

Toxicology

1. Animal Clinical Chemistry: A Primer for Toxicologists. G.O. Evans (Ed.) ISBN: 0748403515, Taylor & Francis, 1996.
2. Animal Models in Toxicology. S.C. Gad & C.P. Chengelis (Eds.), ISBN: 0824784561, Marcel Deker, 1992.
3. Annual Reviews of Pharmacology & Toxicology, ISBN: 0824304373, 1997
4. Basic Toxicology: Fundamentals, Target Organ & Risk Assessment. F.C. Lu, ISBN: 1560323809, Taylor & Francis, 1996.
5. Casarett & Doull's Toxicology: The Basic Science of Poisons. C.D. Klaassen (Ed), ISBN: 0071054766, McGraw-Hill, 1996.
6. Comprehensive Toxicology. I. Sipes, C.A. McQueen & A. Gandolfi (Eds.), ISBN: 0080423019, Elsevier Science, 1997.
7. General & Applied Toxicology. B. Ballantyne, T. Mars & P. Turner (Eds), Vol I & II, ISBN: 0333498011, Macmillon/Stockton Press, 1993.
8. Loomi's Essentials of Toxicology, T.A. Loomis & A.W. Hayes, ISBN: 0124556256, Academic Pess, 1996.
9. Encyclopaedia of Toxicology, Chemical and Concepts, P. Wexler, ISBN: 012227220- X, Academic Press, 1998.
10. Dictionary of Toxicology. E. Hogson, J.E. Chambers & R.B. Mailman, ISBN: 1561592161, Groves ic, 1997.

Biostatistics

1. Biostatistics-Arora and Malhan
2. Biostatistics- Jasraj and Gurudeep Raj
3. Biostatistics- P. Ramkrishan
4. Methods in Biostatistics-Mahajan

Bioinformatics

1. Mount W. 2004. Bioinformatics and sequence genome analysis 2nd Editon CBS Pub. New Delhi.
2. Bergman, N. H. Comparative Genomics. Humana Press Inc. Part of Springer Science+BusinessMedia, 2007.
3. Baxevanis, A. D. Ouellate, B. F. F. 2009. Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
4. Campbell A. M. and Heyer, L. J. 2007. Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings.
5. Des Higgins and Willie Taylor 2000. Bioinformatics: Sequence, structure and databanks. Oxford University Press.

6. Rashidi H. H. and Buehler 2002. Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London.
7. Gibas Cynthia and Jambeck P. 2001. Developing Bioinformatics Computer Skills: Shroff Publishersand Distributors Pvt. Ltd. (O'Reilly), Mumbai.

Semester-IV
Paper-XV, Special Group-Entomology-III
Sense organs, social life and Agriculture pests

Unit-I

1.1 Compound eyes- structure and functions.
1.2 Ocelli- structure and functions.
1.3 Sound producing organs: Structure and physiology.
1.4 Light producing organs: Structure and bioluminescent mechanism.

Unit-II

2.1 Mechanoreceptors: Senseroy hairs, campaniform sensilla and chordotonal organs.
2.2 Tympanal organs, Johanson's organ, Chemoreceptors- sensilla trichoidea, sensilla basiconica.
2.3 Pigments and mechanism of colour change, mimicry and camouflage.
2.4 Immunity in insect: Innate immunity and molecular mechanism.

Unit-III

3.1 Social life: Polymorphism, nest building and social behavior in Isoptera.
3.2 Social life: Polymorphism, nest building and social behavior in ants.
3.3 Parasitic Hymenoptera-types and significance.
3.4 Locust migration and swarming.

Unit-IV

4.1 Pest of major crops: Rice, Cotton and Sugarcane-classification, life history, damage and control.
4.2 Pest of fruits: Citrus and Mango-classification, life history, damage and control.
4.3 Pest of vegetables: Cabbage and Brinjal- classification, life history, damage and control.
4.4 Stored grain pests: classification, life history, damage and control measures.

Semester –IV
Paper-XV, Special Group-Fish and Fisheries-III
General studies
Unit-I

1.1 Structure of alimentary canal in teleosts; feeding habits, histology of different parts
1.2 Modification of alimentary canal in relation to feeding habits, digestion and absorption of food.
1.3 Structure of kidney in teleosts: Head kidney and trunk kidney, histology, blood supply
1.4 Osmoregulation in Freshwater forms, Marine forms, Rays and Skates, Diadromous fishes.

Unit-II

2.1 Chaemoreceptors: Structure of olfactory system, morphology of peripheral olfactory organ, cellular composition of olfactory epithelium, olfactory bulb and central projections.
2.2 Structure and functions of taste buds.
2.3 Migration in fishes: Types- Anadromous, Catadromous, Amphidromous, factors responsible for migration (Intrinsic and environmental), periodicity of migration.
2.4 Role of hormones in migration, Orientation and Navigation during migration.

Unit-III

3.1 Structure of male reproductive system
3.2 Mechanism of spermatogenesis and its hormonal control
3.3 Structure of female reproductive system
3.4 Oogenesis, egg development, hormonal control of oogenesis

Unit-IV

4.1 Structure, hormones and functions of pituitary gland in fishes
4.2 Structure, hormones and functions of other endocrine glands.
4.3 Stucture of Hypothalamo-hypophysial system in fishes.
4.4 Neurohormones and their functions.

Semester –IV

Paper-XV Special Group-Aquaculture-
Aquaculture and Management

Unit-I

1.1 Preparation of pond: Liming and manuaring.
1.2 Prestocking management of Nursery, Rearing and stocking ponds.
1.3 Control of aquatic weeds, predatory fishes, weed fishes and insects.
1.4 Post stocking management – stocking density, carrying capacity, enhancement of carrying capacity.

Unit-II

2.1 Nutritional requirements of culturable carps. Supplementary feeding. Artificial feed. Use of growth promoting hormones.
2.2 Transport of live fish seed, Brood fish and food fish.
2.3 Effect of dams on fisheries.
2.4 Development of reservoir fisheries in India.

Unit-III

3.1 Different systems of aquaculture, Monosex culture, cage culture and pen culture.
3.2 Polyculture of Indian and Exotic carps.
3.3 Culture of air breathing fishes.
3.4 Integrated aquaculture: fish-cum-poultry and fish-cum-paddy.

Unit-IV

4.1 Integrated fish farming: fish-cum-duck and fish-cum-pig
4.2 Sewage fed fish culture.
4.3 Cold water fish culture in India.
4.4 Extensive, Intensive, Semi-intensive and super- intensive culture.

Semester - IV

Paper-XV Special Group-Environmental Biology-III
Environmental Pollution and Aquaculture

Unit-I

1.1 Pollution Ecology: definition, sources of pollution, classification of pollutants, primary and secondary pollutants.
1.2 Air pollution: definition, sources, air pollutants and its effects on human health and atmosphere, control of air pollution.
1.3 Water Pollution: definition and sources, water pollutants and its effects, control of water pollution.
1.4 Noise pollution, sources, physiological and psychological effects of noise pollution, control measures of noise pollution.

Unit-II

2.1 Land pollution: definition, sources, effects and control of insecticide pollution.
2.2 Radioactive pollution: definition, sources , effects and control measures of radioactive pollution.
2.3 Biomedical waste: sources, effects and control measures
2.4 Hazardous waste: definition, sources, effects.

Unit-III

3.1 Biological and general effects of pollutants on organism.
3.2 Bioassay studies: definition, purpose , methodology, calculation of LC50 value, significance.
3.3 Bioaccumulation and biomagnifications.
3.4 Biotransformation of xenobiotics.

Unit-IV

4.1 Aquaculture: basic concept of fisheries, marine, inland and brackish water fisheries.
4.2 Indian major carps and their culture: fish, seed resources, transport.
4.3 Planning and management of freshwater fish farm.
4.4 Fishery economics and management: role of fishery co-operative societies, economics of fishery, aquaculture and rural development.

Semester-IV
Paper- Paper-XVI, Special Group-Entomology-IV
Pest control measures and Insects vectors

Unit-I

1.1 Inorganic insecticides: Properties, mode of action and use.
1.2 Chlorinated Hydrocarbons: Properties, mode of action and use.
1.3 Organophosphates: Properties, mode of action and use.
1.4. Natural organic compound and pyrethroids: Properties, mode of action and use.

Unit-II

2.1 Biological control: Historical and theoretical basis of biological control.
2.2 Desirable attributes of natural enemies of pests.
2.3 Parasitoids used in biological control programmes: life cycle and biological relationship.
2.4 Predators used in biological control programmes: life cycle and biological relationship.

Unit-III

3.1 Insect pathogenic bacteria used in biological control programmes, biological relationship, mass production and examples.
3.2 Insect pathogenic viruses used in biological control programmes, biological relationship, mass production and examples
3.3 Use of radiation, chemosterilants, hormones and pheromones in pest control programmes.
3.4 Integrated pest managements: principles, modeling, application and examples.

Unit-IV

4.1 Pest of horse and cattle: Nature of damage, life cycle and control measures.
4.2 Mosquitoes causing disease in man: Pathogens, diseases, mode of transmission and control.
4.3 Flies causing disease in man: Pathogens, diseases, mode of transmission and control.
4.4 Lice and fleas causing disease in man: Pathogens, diseases, mode of transmission and control.

Semester –IV
Paper-XV, Special Group-Fish and Fisheries -IV
Fishery technology and Fish pathology

Unit-I

1.1 Pond management (sitting construction and problems)
1.2 Gear and crafts in inland water
1.3 Conservation of fish, Fish legislation and their importance.
1.4 Water pollution and inland fisheries

Unit-II

2.1 Plankton in relation to fish production,
2.2 Culture of phytoplankton and zooplankton (Daphnia, Artemia, Monia)
2.3 Manufacture and maintenance of Aquarium
2.4 Hybridization and transgenic fish

Unit-III

3.1 Fish marketing: Marketing practices, information, marketing channels and systems
3.2 Domestic and export marketing.
3.3 Sex control and sex reversal under condition and chromosome set manipulation in fish
3.4 Gamete preservation: cryopreservation and its application.

Unit-IV

4.1 Methods of curing and preservation of fish. i. Refrigeration and freezing, ii. Drying, iii. Salting, iv. Smoking, v. Canning

4.2 Fish products and by-products: i. Fish body oil, ii. Fish liver oil, iii. Fish meal, iv. Isinglass, v. Fish protein concentrate, vi. Fish glue, vii. Fish manure

4.3 Fish pathology: i) Signs of sickness and effects on fish, ii) Pathological procedure for diagnosis of fish diseases

4.4 Fish diseases and its control: Biotic (fungal, bacterial and viral etc.) and Abiotic. a) Viral diseases, b) Bacterial diseases, c) Fungal diseases, d) Protozoan diseases

Semester-IV

Paper-XV, Special Group-Aquaculture-IV

Fish Pathology and Fish Genetics

Unit-I

1.1 Biochemical composition of raw fish.

1.2 Nutritional value of raw and preserved fish.

1.3 Fish preservation objective and principles..

1.4 Methods of fish preservation.

Unit-II

2.1 Fish decomposition, rigor mortis and fish spoilage.

2.2 Poisoning, Toxicity and allergies from fish as food.

2.3 Effect of water pollution on fishes.

2.4 Fish products and byproducts.

Unit-III

3.1 Fungal, bacterial, protozoan diseases of farm fish.

3.2 Nutritional diseases of fish.

3.3 Worm and crustacean diseases of farm fish.

3.4 Diseases caused by aquatic pollutants.

Unit-IV

4.1 Fish genetic resources and its application in fisheries management.

4.2 Hybridization, transgenic fish.

4.3 Gene banking and application of genetic engineering in aquaculture.

4.4 Cryopreservation of gametes.

SEMESTER IV

Paper-XV, Special Group-Environmental Biology IV

Man and Environment

Unit-I

1.1 Natural resources: definition, concept , types of natural resources, use and abuse of natural resources.

1.2 Wild life: wild life in India, endangered species of mammals, birds, amphibian and reptiles,

1.3 Causes of wild life depletion, necessity of wild life conservation.

1.4 Modes of conservation, national parks and sanctuaries, strategies for biodiversity conservation, gene pool.

Unit-II

2.1 National resources: minerals, nutrient cycles, exploitation of nutrient resources.
2.2 Biomass, biogas and solar energy.
2.3 Conservation and sustainable development of natural resources, bacteria and biodegradation
2.4 Biodiversity- definition, types, hotspots of biodiversity.

Unit-III

3.1 Conservation of natural resources: potable water criteria, water supply, water borne diseases and control measures, bioremediation of ponds and lakes.
3.2 Process of soil formation, composition, soil profile, soil erosion, methods of conservation of soil.
3.3 Conservation of forest: needs, afforestation, deforestation, agroforestry, forest conservation through law.
3.4 Social forestry and environment.
63

Unit-IV

4.1 Environmental policy, social economic and legal aspects, social forestry, enforcement of anti pollution law.
4.2 Environmental education: environmental education programmes, environmental education in India
4.3 Formal environmental education, stages of environmental education, non formal environmental education.
4.4 Environmental Organizations and agencies.

Semester-IV, Practical-VII,

Special Group-Entomology

1.Anatomical observations, demonstration and detailed explanation of the silkgland in mulberry and non mulberry silkworms with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

2. Anatomical observations, demonstration and detailed explanation of the male and female reproductive system in silk moths with the help of ICT tools/ models/ charts/ photographs etc.

3. Anatomical observations, demonstration and detailed explanation of the salivary, pharyngeal glands and sting apparatus in honey bees with the help of ICT tools/ models/ charts/ photographs etc.

4. Demonstration of disease causing pathogens in insects.

5. Histopathological Study of baculovirus and protozoan infected tissues with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

6. Collection of insect photographs, identification and classification of harmful insects, parasitic hymenopteran and other beneficial insects.

7. Listing of insects of different orders of central India.

8.Study of various systems of insects and their functional significance with the help of ICT tools/ charts/ models/ photographs etc.

9. Preparation of photographic life history of economical important insects.

10. Preparation of insect biodiversity register of a specific area by photographic collection/ observation.

11. Visit to Apiculture, Sericulture, Lac culture centers and entomology research laboratory/center

Distribution of Marks: Total Marks:80

1. Anatomical Observation	15
2. Identification, classification and economic importance of spots (1 to 10)	20
3. Demonstration of microbial pathogen in insect	10
4. Whole mount preparation	10
5. Class record and submission of slides	10
6. Submission of life history	10
7. Viva-voce	05
Total Marks	80
Internal Assessment	20
Total marks	100

Project work 100
(80 marks project evaluation including viva + 20 marks Internal assessment)

Suggested Readings

Entomology

1. Imms General text book of Entomology, Eds. O. W. Richards and R. G. Davis Chapman and Hall, London.
2. General and Applied Entomology, K.K. Nayar, T. N. Ananthkrishan and B.V. Davis Tata McGraw -Hill Co.Ltd. Bombay.
3. The Insect: Structure and function, R.F. Chapman, Cambridge University Press.
4. The Physiology of Insect , Ed. M.Rockstein ,Vol, 1-5, Academic Press, New York.
5. The Physiology of Insect Reproduction, F, Englemann, Pergamon Press, New York.
6. Comprehensive Insect Physiology , Biochemistry and Pharmocology , Eds. G.A. Kerkut and I. A. Gillberd, VOL. 1-13, Pergamon Press, New York.
7. Analytical Biochemistry of Insect, Ed. R. B. Turner, Elsevier, Amsterdam.
8. Insect Hormone, M. J. A. Novak. Chapman and Hall, London.
9. Modern Entomology(Second edition): D. B. Tembhare, Himalaya Publication House, Bombay.
10. Destruction and Useful Insect, Their Hanits and Control, C. L. Metcalf, W. P. Flint and R. I. Metcalf, Mc Grow I Ill Co. New York.
11. Integrated Pest Management, J.L. Apple and R. E. Smith, Plenum Publication Co., New Delhi.
12. An Introduction Of Biological Control RVD Boarscho, P. S. Y. Messenger and A. P. Gaiter, Plenum Publication Co.
13. Text Book of Entomology, K. P. Shivastava, Vol. 1 And 2 Kalyani Publication, Ludhiana.
14. Agriculture Entomology, H. S. Dennis, Timber Press Inc.

15. Entomology and Pest Management, Larry P. Pedigo, Prentice Hall.
16. Text Book of Agriculture Entomology, Alford V. David, Blackwell Science.
17. Biopesticides In Insect Pest Management, S. J. Ignacimulha and Alok Sen , Phoenix Publishing House Pvt, Ltd.
18. Biotechnology in Invertebrate Pathology and Cell culture (Maramorosch, K. ed.). Academic Press, New York.
19. PEBFANS (2003)" (Solomon Raju, A. J. ed.). Andhara University Press, Visakhapatnam.
20. Living Resources for the Millennium 2000 (S. J. William ed.), Students Offset Press, Chennai.

Semester- IV, Practical-VII,

Special Group-Fish and Fisheries

1.Elementary work on surgical ablation with reference to gonads with the help of ICT tools/ charts/ models / photographs etc.

2. Study of normal differential count in fish blood (Source of fish blood**:** Local recognized fish markets).

3. Effect of stress (cold) on differential count in fish blood (Source of fish blood**:** Local recognized fish markets).

4. Effect of stress (hot) on differential count in fish blood (Source of fish blood**:** Local recognized fish markets).

5. Estimation of protein in blood serum of fish (Source of fish blood**:** Local recognized fish markets).

6. Separation of proteins based on molecular weight by SDS-PAGE.

7. Study of permanent histological slides of various fish organs & endocrine glands with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.

8. Study of skeletal system of *Wallago* & *Labeo* with the help of already available skeleton/ ICT tools/ charts/ models / photographs etc.

9. Study of weberrian ossicles in *Heteropneustes fossilis, Clarias batrachus & Wallago* with the help of already available permanent slides/ ICT tools/ charts/ models/ photographs etc.

10. Study of accessory respiratory organs in some air breathing fishes with the help of already preserved material/ ICT tools/ charts/ models/ photographs etc.

11. Assessment of maturity of gonads using already available preserved specimens, permanent slides/ ICT tools/ charts/ models/ photographs etc

Distribution of Marks: **Total Marks:80**

1. Anatomical Observation Surgical ablation of gonads		25
2. Anatomical Observation		10
3. Physiology Experiment		15
4. Spotting		15
5. Viva voce		10
6. Practical Record		05
		80
	Internal Assessment	20
	Total marks	100
	Project work	100

(80 marks project evaluation including viva + 20 marks Internal assessment)

Suggested Readings:

1**.** Fish Physiology Vol. 1 to 13: Hoar H.S. & Randall (Eds.) (1964-1994) Academic press London, New York.
2. The physiology of fishes Vol. 1&2: Brown M.E.(1957) Academic press, New York.
3. Natural history of fishes & systematic of fresh water fishes :P Datta Munshi, J.S. & Shrivastva, M.P.(1988): Narendra pub. House, Delhi.
4. Air breathing fishes of India- Their structure, function and life history : Dutta Munshi,J. S., Hunghes G.M. (1992) .Oxford and JBH publication Co. New Delhi.
5. The freshwater fishes of India, Pakistan, Bangladesh, Burma and Shri Lanka Handbook: Jayaram, K.C. (1981): Zoological Survey of India, Calcutta.
6. Fish migration: Jones, F.R. S. (1968), E.Arnold, London
7. Aquaculture, Bardach, Ryther and Mc Lamy
8. Marine fisheries: D. K. Dal, K. V. Rao
9. Ichthyology: Lagler, K. F., Bardach, J. and Miller, R.(1977) John Wileys and sons.
10. Fish Endocrinology: Matty, A. J. (1985), Chapman and Hall, London.
11. An aid to the identification of common commercial fishes of India and Pakistan:Mishra K. S. (1982).
12. Aquaculture: The farming and husbandry of freshwater and marine organism: Bardach, J.E. (1974). Narendra Publication House, New Delhi.
13. Handbook of breeding of Indian Major Carps by pituitary hormone injection: Chonder,S. L. (1970). Satish book enterprises, Agra.
14. Diseases of fish: Duijin, C:Van Inr. (1973), life books London.
15. Fish and fisheries of India: Jhingran , V. G. (1985). Hindustan Publication Company, New Delhi.
16. Prawns and prawn fisheries of India: Kurian, C.V. and Sebastian, V. O. (19876) . Hindustan Publication Company, New Delhi.
17. The Sea food Industry: Martin, R. E.(1990). Narendra Publication House, New Delhi.
18. Ecological effects of water, applied limnology and pollutant effect: Welch, E. B. (1992).
19. A compemendium of aquaculture technologies: Sinha, V.R. P.(1993). Oxford and JBH publication Co. New Delhi.

Semester –IV Practical- VII,,
Special Group- Aquaculture

1) Study of feeding habits of herbivorous, carnivorous and omnivorous fish by gut content analysis with the help of ICT tools/ models/ charts/ photographs etc.
2) Identification of egg, spawn, fry and fingerlings of Indian carps.
3) Preparation of artificial fish feed.
4) Anatomical observations, demonstration and detailed explanation of reproductive system of carps with the help of ICT tools/ models/ charts/ photographs etc.
5) Identification and classification of palaemonoid prawns, crabs, bivalves, larvivorous and aquarium fishes.
6) Short term bioassay and determination of LC_{50} for fish exposed to pollutant. .
7) Study of pathological changes in gills, liver, kidney and intestine of fish exposed to heavy metals or pesticides with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
8) Biochemical estimation of proteins, lipids, glycogen, DNA and cholesterol.
9) Preparation of bacteriological media and determination of bacterial plate count for skin and gut with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
10) Gram staining of bacteria.
11) Visit to a fish market and collection of fish landing data.

Distribution of marks Total Marks:80

1) Analysis of gut content / preparation of artificial fish feed	10
2) Study of pathological changes in gills, liver, kidney and intestine	10
3) Biochemical estimation / determination of bacterial plate count.	10
4) Gram staining	05
5) Identification of spots (1 to10)	20
6) Dissection / Permanent mounting	10
7) Practical record & submission	10
8) Viva – voce	05
	80
Internal Assessment	20
Total marks	100

Project work 100
(80 marks project evaluation including viva + 20 marks Internal assessment)

Suggested Readings

1. A textbook of fishery science and Indian fisheries- S. B. L. Srivastava
2. Fish and fisheries – Kamleshwar Pandey and J. P Shukala
3. A textbook of fish biology and fisheries – S.S. Khanna and H. R. Singh
4. A text book of fish biology and Indian fisheries- R.P. Parihar
5. General and Applied Ichthyology- S.K.Gupta and P.C.Gupta
6. An introduction to fishes- S. S. Khanna.
7. Fish processing technology – T. K. Govindon.
8. Hand book of breeding of major carps by pituitary hormones – S. L. Chonder.
9. Aquaculture – T. V. R. Pillay.
10. Diseases of cultivable freshwater fishes and their control – N. M. Chokraborty.
11. Fish and fisheries in India - V. G. Jhingran.
12. Indian fishes (Identification of Indian Teleosts) – T. A. Qureshi.
13. Introduction to tropical fish assessment per share, Erik Ursine and Siberian C. Verma.
14. Fish population dynamics – M. Devaraj.

Semester-IV, Practical- VII,,

Special Group-Environmental Biology

1. Bioassay test- toxicity evaluation of heavy metals/pesticides using snail/fish as test animals, determination of LC_{50} value with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
2. Determination of oxygen consumption in normal fish/snail at different temperature.
3. Alteration in the oxygen consumption of fish / snail exposed to pollutants (heavy metals / pesticides).
4. Estimation and proximate composition (Protein / glycogen) in normal and treated fish / snail. (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)
5. Determination of NO_2 and SO_2 in ambient air.
6. Determination of suspended particulate matters in ambient air.
7. Determination of oil and grease by Soxhlet apparatus and separating funnel.
8. Identification of common commercial important inland / marine fishes, Crustaceans and mollusc.
9. Identification of maturity stages in fish.
10. Determination of gonadosomatic index.
11. Study of fecundity of fish.
12. Physiochemical analysis of Soil, pH, moisture.
13. Field work and study tour:

a) Visit to National Institute / Centre of Aquaculture. b) Visit to a fish farm
c) Visit to National park / sanctuary to observed wildlife and maintaining the field diary.
d) Study tour and visit to national Institute of Oceanography.

Distribution of Marks Marks

1. Major experiment	15
2. Minor experiment	10
3. Minor experiment	10
4. Identification and comments on given spots (1-10)	30
5. Class record	10
6. Viva voce	05
	80
Internal Assessment	20
Total marks	100

Project work 100
(80 marks project evaluation including viva + 20 marks Internal assessment)

Suggested Readings

1. The Science of Ecology: Brewer, A. (1998), Sanders Pub. New York.
2. The Science of Ecology: Ehrlich, P. R. & Roughsrden, J. (1987) McMillan Pub. Co. New York.
3. Population Biology: Emlein, J. M. (1984). McMillan Pub. London.
4. Current Ecology: Pattern & Progress: Killawa, J. & Anderson, G.J. (1986), Blackwell Science Publication, Oxford.
5. Basic Ecology: Odum, E. P. (1983), Sanders Pub. New York.
6. Systems of Ecology: Odum, H. T. (1983), John Wiley & Sons, New York.
7. Ecology with Special Reference to Animals and Man: Kendelgh, Prentice Hall Co.
8. National Resources & Conservation: Owen, O. S. (1985) McMillan Pub. New York.
9. Elements of Ecology: Smith, R. L. (1986), Harper & Row Pub. New York.
10. Environmental Physiology: Sonim, N. B. (1974), C. V. Mosby Pub. St. Louis, USA.
11. Environmental Physiology: Philips, J. G. (1975), Blackwell Science Publication, Oxford.
12. Ecology: Ricklefts, R. E. (1973), Thomas Nelson & Sons Ltd.
13. Threatened Animals of India: Tikader, B. K. ZSI Calcultta.
14. Ecology & Field Biology: Smith, R. L. Harper & Rw Pub. New York.
15. Wildlife in India: Sharin, V. B. (1985), Natraj Pub. Dehradun.
16. Fresh Water in India: Kulkarni, K. H. (1957), ICAR, New Delhi.
17. Marine Fishes: Bal, D. V. & Rao, K.V. (1989), Tata McGraw Hill, New York.
18. Textbook of Marine Ecology: Balkrishnan, N. A. & Thumpy, D. N. (1980), McMillan Co.
19. Marine Ecology & Fishes: Cushly, B. H. (1980), Cambridge University Press.
20. Treatise on Limnology: Hutchinson, G.E., (1967), John Willy Pub. New York.

21. Methods of Soil Analysis: De, S. K. (1962), Narayan Pub. House, Allahabad.
22. Fish & Fishes of India: Jhingran, V. G. (1985)
23. **Aquatic Pollution:** Edward A. (2000) Laws. 3rd edition**. John Wiley** and **Sons**, New York.
24. A Manual of Fresh Water Ecology: Santhanam, R., Velayntan, P. & Jagathesan, G. (1989), Daya Pub. House, Delhi.
25. Limnology: Welch, P. S. (1957), McGrall & Hill Co. New York.
26. **Air Pollution: Perkins, H.C.,** (1974) McGraw-Hill, New York.

Syllabus prescribed for M.Sc. Chemistry Semester III

CH-301: Paper IX (Spectroscopy)

60 h (4 h per week): 15 h per unit 80 Marks

Unit - I: Symmetry properties of molecules and group theory: **15h**

Symmetry elements and symmetry operations. Properties of group. Point groups and Schoenflies symbols. Symmetry operations as a group. Matrix representations of groups. Multiplication table for C_{2v}, C_{3v} and C_{2h}. Reducible and irreducible representations. Similarity transformation. Classes of symmetry operations. Great Orthogonality Theorem. Derivation of character tables for H_2O and NH_3 using Great Orthogonality Theorem. Application of character tables in selection rules of IR, Raman and Electronic spectroscopy.

Unit - II: **15h**

A] Mass spectrometry: Theory, ion production(EI, CI, FD, FAB), ion analysis, ion abundance, isotopic contribution, N-rule, types of fission processes, high resolution mass spectrometry, metastable peak, molecular ion peak, Mclaffferty rearrangement, mass spectral fragmentation of organic compounds alkanes, alkenes, alkynes, alcohols, amines, amides, acids, aldehydes, ketones, halides, Structure determination of organic molecules by mass spectrometry

B] Mossbauer spectroscopy: Basic principle, experimental techniques, recoil emission and absorption, source, absorber, isomer shift, quadrupole interaction, magnetic hyperfine interaction, applications in determining electronic structure, molecular structure, crystal symmetry, magnetic structure, surface studies, biological applications.

Unit - III: **15h**

A] Microwave spectroscopy: Classification of molecules on the basis of M.I., rigid and non rigid rotor, effect of isotopic substitution on transition frequencies, stark effect, microwave spectrometer, application in deriving: molecular structure, dipole moment, atomic mass and nuclear quadrupole moment.

B] ESR spectroscopy: Introduction, principle of ESR, ESR spectrometer, hyperfine coupling, zero field splitting, factors affecting g values, Kramer's degeneracy, application of ESR spectra to study free radicals like hydrogen, methyl radical, 1,4 semibenzoquinone, naphthalene, transition metal complexes, biological systems.

Unit IV: **15h**

A] Infrared spectroscopy: Diatomic molecules: 1) Molecules as harmonic oscillator, Morse potential energy function, vibrational spectrum, fundamental vibrational frequencies. Force constant, zero point

energy, isotope effect. The Anharmonic oscillator, the interactions of rotations and vibrations. P,Q,R branches, vibration of polyatomic molecules, selection rules, normal modes of vibration, group frequencies, overtone and combination frequencies. Structure determination of organic molecules by IR spectroscopy.

B] Raman Spectroscopy: Rayleigh scattering. Raman Scattering, classical and quantum theories of Raman effect. Rotational Raman Spectra for linear and symmetric top molecules. Vibrational Raman Spectra, rotational fine structure. Selection rules, coherent antiStokes Raman spectroscopy, Structure determination from Raman and Infra-red spectroscopy.

List of books

1] Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morril, John Wally

2] Introduction to NMR spectroscopy-R. J. Abraham, J. Fisher and P Loftus Wiely

3] Application of Spectroscopy to Organic Compound-J. R. Dyer, Printice Hall

4] Organic Spectroscopy-William Kemp, ELBS with McMillan

5] Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi

6] Organic Spectroscopy-RT Morrison and RN Boyd

7] Practical NMR Spectroscopy-ML Martin, JJ Delpench, and DJ Martyin

8] Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming

9] Fundamentals of Molecular Spectroscopy-CN Banwell

10] Spectroscopy in Organic Chemistry-CNR Rao and JR Ferraro

11] Photoelectron Spectroscopy-Baber and Betteridge

12] Electron Spin Resonance Spectroscopy-J Wertz and JR Bolten

13] NMR –Basic Principle and Application-H Guntur

14] Interpretation of NMR spectra-Roy H Bible

15] Interpretation of IR spectra-NB Coulthop

16] Electron Spin Resonance Theory and Applications-W gordy

17] Mass Spectrometry Organic Chemical Applications, JH Banyon

INORGANIC CHEMISTRY SPECILIZATION

CH-302: Paper X (Special I-Inorganic Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit -I **15h**

A) Essential and trace metals in biological systems: Biological functions of inorganic elements, biological ligands for metal ions. Coordination by proteins, Tetrapyrrole ligands and other macrocycle. Influence of excess and difficiency of V, Cr, Mn, Fe, Co, Cu,& Zn. Genetic defects in the absorption of trace elements. Regulation and storage of trace elements. Role of minerals. Toxic effects of metals.

B) Metal storage, transport and biomineralization with respect to Ferritin, Transferrin and Siderophores, Na^+ /K^+ pump. Role of Ca in transport and regulation in living cells.

C) Medicinal use of metal complexes as antibacterial, anticancer, use of cis-platin as antitumor drug, antibiotics & related compounds. Metal used for dignosis and chemotherapy with particular reference to anti cancer drugs.

Unit-II **15h**

A) Bio-energetics and ATP cycle: DNA polymerization, metal complexes in transmission of energy, chlorophylls, photosystem I and photosystem II in cleavage of water, Model systems.

B) Electron transfer in Biology: Structure and functions of metalloproteins in electron transfer proteins, cytochromes & Fe-S proteins, Non-heme iron proteins; Rubredoxins, Synthetic models. Biological Nitrogen fixation (in vitro and in vivo)

Unit-III **15h**

Transport & Storage of Dioxygen: Heme proteins & oxygen uptake, structure and functions of haemoglobin, myoglobin, hemocyanins & hemerythrin. Perutz mechanism showing structural changes in porphyrin ring system. Oxygenation and deoxygenation. Model compounds. Cyanide poisoning and treatment. Vanadium storage and transport.

Unit-IV **15h**

Metallo enzymes: Apoenzymes, Haloenzyme & Coenzyme. The principle involved and role of various metals ini) Zn-enzyme:- Carboxyl peptidase & Carbonic anhydrase. ii) Fe-enzyme:-Catalase Peroxidase & Cytochrome P-450 iii) Cu-enzyme:-Super Oxide dismutase iv) Molybdenum:-Oxatransferase enzymes, Xanthine oxidase,Co-enzyme Vit.B12, Structure of vitamin B12 Co-C bond cleavage, Mutase activity of co- Enzyme B-12, Alkylation reactions of Methyl Cobalamin. Synthetc model of enzyme action, stability and ageing of enzyme.

List of Books:

1. Akhmetov, N.: General and Inorganic Chemistry.

2. Aylett, B. and Smith, B.: Problems in Inorganic Chemistry, (English University Press)

3. Bertini, et al: Bioinorganic Chemistry (Viva)

4. Charlot, G and Bezier, D.: Quantitative Inorganic Analysis (johnWiley).

5. Douglas, B. E. McDanirl, D. H. et al: Concept and Models of Inorganic Chemistry (4th edt.) J. Wiley

6. Dutt P. K.: General and Inorganic Chemistry.(Sarat Books House)

7. Fenton, David E.: Biocoordination chemistry, Oxford

8. Jolly, W. L. : Inorganic Chemistry (4th edn.) Addison-Wesley.

9. Katakis, D. and Gordon, G.: Mechanism of Inorganic Reactions.(J.Wiley).

CH-303: Paper XI (Special II-Inorganic Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I **15 h**

Crystal Structure of Some Simple Compounds:

i) Ionic Crystals &Their structures, radius ratio rule, effect of polarization on crystals.

ii) Covalent structure type- Sphalerite & Wurtzite.

iii) Geometry of simple crystal AB type: NaCl, CsCl & NiAs, reasons for preference for a particular structure in above AB type of compounds.

iv) AB_2 type: Fluorite, antifluorites, Rutile structures. Li_2O, Na_2O,,$CdCl_2$, CdI_2 structures.

v) Ternary Compounds ABO_3 type: Perovskite, Barium titanate, lead titanate, $CaTiO_3$, Tolerance factor, charge neutrality & deviation structures. $FeTiO_3$.

Unit-II **15h**

A) AB_2O_4 type- compounds: Normal & inverse,2-3 and 4-2 spinel ,packing of oxygen in tetrahedral & octahedral sites, sites occupancy number of site surrounding each oxygen, application of charge neutrality principles, site preferences in spinel, distorted spinel.Hausmannite(Jahn-Teller distortions),Factors causing distortion in spinel.

B) Lattice Defects: Per fect &Imperfect crystals, point defects**,** Interstitial, Schottky defect, Frenkel defect, line defect & other entities, thermodynamics of Schottky & Frankel defects. Dissociation, theory of dislocation, plane defects- Lineage boundary, grain boundary, stacking fault, 3D defects, Defects & their concentrations, ionic conductivity in solids, Non stoichiometric compounds. Electronic properties of Non-stoichiometric oxides.

Unit-III **15h**

Glasses, Ceramics and composite:

Glasses, Ceramics Composites and Nano-materials: Glassy state, glass formers and Glass Modifiers. Glasses, Ceramics, Clay products, Refractories with reference to: preparation, Properties and applications. Microscopic composites, dispersion, strengtheried and particle reinforced, fibre reinforced Composites, microscopic composites, nanocrystaline phase, preparation procedure, special properties and applications.

Unit-IV **15 h**

A) Liquid Crystals: Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematics & smectic mesophases; smectic-Nematic transition clearing temperature-homeotrpic, planer & schlieren textures twisted nematics, chiral nematics, molecular arrngement in smectic A & smectic C phases, optical properties of liquid crystals. Dielectric susceptibility & dielectric constants. Lyotropic phases & their description of ordering in liquid crystals.

CH-305: Practical-V (Inorganic Chemistry Special)

9 h /week Marks: 80

Instrumental methods and Analytical Techniques:

A) Exercise based on experimental technique-

i) Colorimetry and Spectrophotometry: a)Simultaneous determination of manganese ($KMnO_4$) , and Chromium ($K_2Cr_2O_7$) and b) Cobalt and Nickel.

ii) Determination of composition and stability constant of complexes by Job's/continuous variation and mole ratio methods

1. Iron-phenanthroline complex: By Job's method of continuous variation
2. Zirconium-Alizarin Red-S complex: By mole ratio method
3. Copper-Ethylene diamine complex: By slope-ratio method.

iii) $_P$H-metry: stepwise proton-ligand and Metal-ligand stability constant of complexes by Irving Rossotti method.

iv) Polarography: Composition and stability constant of complexes.

v) Flame photometric determination: Na, K and Ca.(Individual or together)

B) Separation and quaqntitative estimation of binary ant ternary mixture by the use of following separation techniques:

i) Paper and thin layer chromatography

ii) Ion exchange

iii) Solvent extraction

iv) Electrophoretic separation

List of Books

1. Day and Underwood: Quantitative Analysis
2. Vogel A.I: A textbook of quantitative Inorganic analysis, Longman.
3. Flaschka: EDTA Titration
4. Meites and Thomas: Advanced Analytical Chemistry.
5. Ewing,G.W.: Instrumental Methods of Chemical Analysis,McGraw-Hill
6. Drago,R.S: Physical Methods in Inorganic Chemistry
7. Christian G.D.: Analytical Chemistry
8. Khopkar S.M.: Basic Concept of Analytical Chemistry.
9. Kolltath and Ligane: Polarography
10. Braun: Instrumental methods of chemical Analysis
11. Willard, Merritt and Dean: Instrumental methods of Chemical Analysis,Van Nostrand
12. Strouts, Crifillan and Wison: Analytical Chemistry.
13. Skoog S.A.and West D.W.: Fundamental of Analytical Chemistry
14. Dilts R.V.: Analytical Chemistry
15. Jahagirdar D.V.- Experiments in Chemistry
16. Chondhekar T.K.- Systematic Experiments in Physical Chemistry,Rajbog S.W.,Anjali Pubn.
17. Wlehov G.J.- Standard methods of Chemical analysis, 6th Ed.
18. Ramesh RandAnbu M,Chemical Methods for Environmenta Analyss:Water and Sedient, Macmillion India.
19. Akhmetov, N.: General and Inorganic Chemistry.
20. Aylett, B. and Smith, B.: Problems in Inorganic Chemistry, (English University Press)
21. Bertini, et al: Bioinorganic Chemistry (Viva)
22. Charlot, G and Bezier, D.: Quantitative Inorganic Analysis (johnWiley).
23. Douglas, B. E. McDanirl, D. H. et al: Concept and Models of Inorganic Chemistry (4th edt.) J. Wiley
24. Dutt P. K.: General and Inorganic Chemistry.(Sarat Books House)
25. Fenton, David E.: Biocoordination chemistry, Oxford
26. Jolly, W. L. : Inorganic Chemistry (4th edn.) Addison-Wesley.
27. Katakis, D. and Gordon, G.: Mechanism of Inorganic Reactions.(J.Wiley).

ORGANIC CHEMISTRY SPECIALIZATION

CH-302: Paper X (Special I-Organic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

UnitI: Photochemistry **15 h**

Interaction of radiation with matter, types of excitation, rate of excited molecules, quenching, Quantum efficiency, quantum yield, transfer of excitation energy, actinometry, singlet and triplet states, experimental methods in photochemistry of carbonyl compounds, and transition, Norrish type I and Norrish type II reactions Paterno–Buchi reaction, Photoreduction, Photochemistry of enones, Hydrogen abstraction rearrangement of unsaturated ketones and cyclohexadienones, Photochemistry of parabenzoquinones, photochemistry of Aromatic compounds with reference to isomerisation additon and substitution Photochemical isomerization of cis and trans alkenes, Photochemical cyclization of reaction, Photo-Fries rearrangement, Photo theory reaction of anilides Barton reaction, Hoffmann-Loefler-Freytag reaction, photochemistry of vision, Applications of photochemical methods in synthesis: Isocumene, Cedrene, Hirsutene

Unit II: Pericyclic Reactions **15 h**

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1, 3, 5-hexatriene, allyl system, classification of pericyclic reaction. FMO approach, Woodward-Hoffman correlation diagram method and Peturbation of molecular orbital (PMO) approach of pericyclic reaction under thermal and photochemical conditions Electrocyclic reactions, conrotatary and disrotatary motion 4n and (4n+2) systems, with more emphasis on [2+2] and [4+2] Cycloaddition of ketones Secondary effects in [4+2] cycloaddition. Stereochemical effects and effect of substituents on rate of cycloaddition reaction, Diels-Alder reaction, 1,3-dipolarcycloaddition and chelotropic reaction. Sigmotropic rearrangement, suprafacial,and antarafacial shift involving carbon moieties, retension and inversion of configuration, [3,3] and [3,5] sigmotropic rearrangements, Claisen, Cope, Sommelet-Hauser rearrangements, Ene reaction.

Unit III **15 h**

A] Oxidation

a) Oxidation of alkanes, aromatic hydrocarbons and alkenes, Dehydrogenation with S, Se, Fremy's salt, DDQ, chloranil and $PhI(OAc)_2$, Oxidation with SeO_2, Epoxidation of olefins, Synthetic application of epoxides, Sharpless asymmetric epoxidation, Dihydroxylation of olefins using $KMnO_4$, OsO_4, Woodward and Prevost dihydroxylation, Oxidative cleavage of olefins, Ozonolysis

b) Oxidation of alcohols: Chromium reagents, pyridinium chlorochromate (PCC), pyridinium dichromate (PDC), Collin and Jones reagent, Combination of DMSO with DCC, $(COCl)_2$, NCS and $(CH_3CO)_2O$ for oxidation of alcohols, Oxidation with MnO_2, Oppenauer oxidation

c) Oxidation of aldehydes and ketones, Conversion of ketones to α, β-unsaturated ketones and α-hydroxy ketones, Baeyer-Villiger oxidation , Chemistry and synthetic applications of $Pb(OAc)_4$, Dess-Martin periiodinane, IBX

B] Reduction

a) Catalytic heterogeneous and homogeneous hydrogenation, Hydrogenation of alkenes, alkynes and arenes, Selectivity of reduction, Mechanism and stereochemistry of reduction, Raney Ni-catalyst, Adam catalyst, Lindlar catalyst, Wilkinson catalyst.

b) Reduction by dissolving metals, Reduction of carbonyl compounds, conjugated systems, aromatic compounds and alkynes. Birch reduction, Hydrogenolysis

c) Reduction by hydride transfer reagents, Meerwein-Pondorff-Verley reduction, Reduction with $LiAlH_4$ and $NaBH_4$, stereochemical aspects of hydride addition, Derivatives of $LiAlH_4$ and $NaBH_4$, Selectivity issues, Diisobutylaluminium hydride (DIBAL-H), Sodium cyanoborohydride, Reduction with boranes and derivatives Reduction with Bu_3SnH., Enzyme catalyzed reduction, Reduction of carbonyl group to methylene, Reduction with diimide and trialkylsilanes

Unit IV: Chemistry of P, S, Si, B, and Ti compounds **15 h**

a) Phosphours and sulphur ylide: Preperation and their synthetic application along with stereochemistry

b) Umpolung concept: Dipole inversion, generation of acyl anion, use of 1,3-dithiane, ethylmethylthiomethylsulphoxide, bis-phenylthiomethane, metallated enol ethers, alkylidene dithiane, ketone thioacetals, 2-propenethiobismethyl thioallyl anion, thiamine hydrochloride based generation of acyl anion

c) Organoboranes- preparation and properties of organoborane reagents e.g. RBH_2, R_2BH, R_3B, 9-BBN, catechol borane. Thexyl borane, cyclohexyl borane, $ICPBH_2$, IPC_2BH, Hydrboration-mechanism, stereo and regeoselectivity, uses in synthesis of primary, secondary tertiary alcohols, aldehydes, ketones, alkenes, Synthesis of EE, EZ, ZZ dienes and alkyenes. Mechanism of addition of IPC_2BH. Allyl boranes- synthesis, mechanism and uses

d) Organo silicon compounds in organic synthesis, Me_3SiCl, Me_3SiH and Paterson synthesis

e) Synthetic methodologies based on titanium compounds

List of books

1] Books as suggested in Semester I for organic chemistry

2] Organic Synthesis, The disconnection approach-S. Warren

3] Designing Organic Synthesis-S. Warren

4] Some Modern Methods of Organic Synthesis-W. Carruthers

5] Advance Organic Chemistry Part-B-F. A. Caray and R. J. Sundberg Plenum Press

6] Protective Group in Organic Synthesis-T. W. Greene and PGM

7] The Chemistry of Organo Phosphorous-A. J. Kirbi and S.G. Warren

8] Organo Silicon Compound-C. Eabon

9] Organic Synthesis via Boranes-H. C. Brown

10] Organo Borane Chemistry-T. P. Onak

11] Organic Chemistry of Boron-W. Gerrard

12] Fundamentals of Photochemistry-K. K. Rohatgi-Mukharji, Wiley Eastern Limited

13] Photochemistry-Cundau and Gilbert

14] Aspects of Organic Photochemistry-W. M. Horspoot

15] Photochemistry-J. D. Calvert

16] Photochemistry-R. P. Wayne

CH-303: Paper XI (Special II-Organic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

A]Terpenoids **15 h**

Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules: Citral, Geraniol, α-terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β-carotene, Vitamin A and H

B] Porphyrins: Structure and synthesis of Haemoglobin and Chlorophyll

Unit II **15 h**

A] Alkaloids

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants

Structure, stereochemistry, synthesis and biosynthesis of the following: Ephedrine, (+)-coniine, Nicotine, Atropine, Quinine, Reserpine and Morphine

B] Prostaglandins: Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE_2 and $PGF_{2\alpha}$

Unit-III **15 h**

A]Steroids

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone and Aldosterone. Biosynthesis of steroids

B] Plant Pigments

Occurrence, nomenclature and general methods of structure determination, isolation and synthesis of Apigenin, Luteolin, Quercetin, Myrcetin, Quercetin-3-glucoside, Vitexin, Diadzein, Butein, Cyanidin-7-arabinoside, Cyanidin, Hirsutidin. Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway

Unit IV: **15 h**

A] Carbohydrate: Types of naturally occurring sugars, deoxy sugars, amino sugars, branched chain sugars, methyl ethers and acid derivatives of sugars, general methods of structure and ring size determination with reference to maltose, lactose, sucrose, starch and cellulose.

B] Amino acids, protein and peptides: Amino acids, structural characteristics, acid base property, stereochemistry of amino acids, optical resolution, Stecker synthesis, peptide and proteins structure of peptide and protein, primary, secondary, tertiary and quaternary structure. Reaction of polypeptide, structure determination of polypeptide, Solid phase peptide synthesis, end group analysis.

List of books

1] Chemistry of Alkloids-S. W. Pelletier
2] Chemistry of Steroids-L. F. Fisher and M. Fisher
3] The Molecules of Nature-J. B. Hendricsion
4] Biogenesis of Natural Compound - Benfield
5] Natural Product Chemistry and Biological Significance- J. Mann, R. S Devison, J. B. Hobbs, D. V. Banthripde and J. B. Horborne
6] Introduction to Flavonoids-B. A. Bohm, Harwood
7] Chemistry of Naturally Occurring Quinines-R. H. Thomson
8] The Systematic Identification of Flavonoids- Marby, Markham, and Thomos
9] Text Book of Organic Medicinal Chemistry-Wilson, Geswold
10] Medicinal Chemistry Vol I and II-Burger
11] Synthetic Organic Chemistry -Gurudeep Chatwal.

12] Organic Chemistry of Natural Products Vol I and II-O. P. Agrawal
13] Organic Chemistry of Natural Products -Gurudeep Chatwal
14] A Textbook of Pharmaceutical Chemistry-Jayshree Ghosh
15] Synthetic Dyes Series -Venkatraman
16] Chemistry Process Industries-Shreve and Brink
17] Principal of Modern Heterocyclic Chemistry-L. A. Paquelte
18] Heterocyclic Chemistry-J. Joule and G. Smith
19] Heterocyclic Chemistry-Morton
20] An Introduction to Chemistry of Heterocyclic Compound-J. B. Acheson
21] Introduction to Medicinal Chemistry-A. Gringuadge
22] Wilson and Gisvold Text Book of Organic Medicinal and Pharmaceutical Chemistry-Ed. Robert F Dorge
23] An Introduction to Drug Design-S. S. Pandey and J. R. Demmock
24] Polymer Science-V. Govarikar
25] Principle of Polymer Chemistry-P. J. Flory
26] An Outline of Polymer Chemistry-James Q. Allen
27] Organic Polymer Chemistry-K. J. Saunders

CH-305: Practical-V (Organic Chemistry Special)

9 h /week Marks: 80

[A] Quantitative Analysis

Student is expected to carry out following estimations (minimum 6 estimations.)

1. Estimation of Vitamin "C" Iodometry.
2. Estimation of Phenol by $KBrO_3$-KBr.
3. Estimation of Amine by Bromate/ Bromide solution.
4. Estimation of Formaldyde by Iodometry.
5. Estimation of Glucose by Benedict's solution.
6. Estimation of given carbonyl compound by hydrazone formation.
7. Estimation of Aldehyde by Oxidation method.
8. Determination of percentage of number of hydroxyl group in an organic compound by acetylation method.

[B] Isolation of Organic Compounds from Natural Source (Any six)

a) Isolation of caffeine from tea leaves.

b) Isolation of casein from milk (the students are required to try some typical colour reactions of proteins)

c) Isolation of lactose from milk (purity of sugar should be checked by TLC and PC and Rf value reported.)

d) Isolation of nicotine dipicrate from tobacco

e) Isolation of cinchonine from cinchona bark

f) Isolation of piperine from black pepper

g) Isolation of lycopene from tomatoes

h) Isolation of β-carotene from carrots

i) Isolation of cysteine from hair

j) Isolation of oleic acid from olive oil (involving the preparation of complex with urea and separation of linoleic acid

k) Isolation of eugenol from cloves

l) Isolation of (+) limonine from citrus rinds

[C] QUALITATIVE ANALYSIS

Separation of the components of a mixture of three organic compounds (three solids, two solids and one liquid, two liquids and one solid, all three liquids and identification of any two components using chemical methods or physical techniques. Minimum 10-12 mixtures to be analyzed.

PHYSICAL CHEMISTRY SPECIALIZATION

CH-302: Paper X (Special I-Physical Chemistry)

60h (4h/week) 15h/unit 80 Marks

UNIT I **15h**

A] Statistical thermodynamics: Concepts of distribution, thermodynamic probability and most probable distribution, ensemble averaging, postulates of ensemble averaging, canonical grand canonical and micro canonical ensembles,corresponding distribution laws using lagranges method of undetermined *multipliers ,* ortho and para hydrogen, principle of equipartition of energy, calculation of average energy

B] Partition function, Translational partition function, rotational partition function, vibrational partition function, electronic partition function, applications of partition functions.

UNIT II **15h**

A] Electrode Interfaces: Quantum aspects of charge transfer at electrode-solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces: Theory of double layer at

semiconductor, electrolyte solution interfaces, structure of double layer interfaces, effect of light at semiconductor solution interface.

B] Electro catalysis: Comparison of electro catalytic activity, importance of oxygen reduction and hydrogen evolution reactions, and their mechanism, volcanoes.

C] Bio-electrochemistry: Threshold membrane phenomena, Nernst Plank equation, Hodges Huxley equations, core conductor models, electrocardiography.

UNIT III **15h**

A] CHEMICAL KINETICS**:** Introduction, complex reactions: reversible, consecutive, concurrent, and branching reactions, free radical and chain reactions, steady state treatment, reaction between H_2-Br_2(thermal and photochemical),H_2-Cl_2, decomposition of ethane, acetaldehyde, N_2O_5, Rice Herzfeld mechanism

B] Fast Reactions: relaxation methods, stopped flow methods, flash photolysis, magnetic resonance method, jump method, relaxation time and numericals.

UNIT IV: **15h**

A]Photophysical phenomenon: Introduction, prompt fluorescence, delayed fluorescence, and phosphorescence, fluorescence quenching: concentration quenching, quenching by excimer and exciplex emission, fluorescence resonance energy transfer between photoexcited donor and acceptor systems. Stern-Volmer relation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisions, quenching and Stern-Volmer equation.

B] Photochemical reactions: photoreduction, photooxidation, photodimerization, photochemical substitution, photoisomerization, photosenitisation, chemiluminescence, photochemistry of environment: Green house effect.

List of books:

1. G.M.Panchenkov and V.P.Labadev, " Chemical Kinetics and catalysis", MIR Publishing
2. E.A. Moelwyn- Hughes, " Chemical Kinetics and Kinetics of Solutions", Academic
3. K.J.Laidler, Chemical Kinetics, Third Edition (1987), Harper and Row, New York
4. J.Raja Ram and J.C.Kuriacose, Kinetics and Mechanism of Chemical Transformations MacMilllan Indian Ltd., New Delhi (1993)
5. 1. J.G. Calvert and J.N. Pitts, Jr., *Photochemistry,* John Wiley and Sons, New York (1966).
6. 2. K. K. Rohtagi-Mukherjee, *Fundamentals of Photochemistry,* New Age International, New Delhi(1986).
7. R. P. Wayne, *Principles and Applications of Photochemistry,* Oxford University Press, Oxford(1988).

8. N. J. Turro, *Modern Molecular Photochemistry,* Univ. Science Books, Sansalito (1991).
9. J. F. L. Lakowicz, *Principles of Fluorescence Spectroscopy,* 2nd Edition (1999), PlenumPublishers, New York.
10. F.W.Sears, " Introdction to Thermodynamics, Kinetic Theory of Gases and statistical mechanics".Addison Wesley
11. M.C.Gupta, Statistical Mechanics
12. Andrew Maczek, *Statistical Thermodynamics,* Oxford University Press Inc., New York (1998).
13. Andrew Maczek, *Statistical Thermodynamics,* Oxford University Press Inc., New York (1998).
14. B.K. Agarwal and M. Eisner, *Statistical Mechanics*, Wiley Eastern, New Delhi (1988).
15. D.A. McQuarrie, *Statistical mechanics*, Harper and Row Publishers, New York (1976).
16. J.O.M.Bokris and A.K.N.Reddy, " Modern Elcrtrochemistry". Wiley
17. S. Glasstone, " Introduction to Electrochemistry" Affilisated East West.
18. D.R.Crow, " The Principle of electrochemistry", Chapman Hall

CH-303: Paper XI (Special II-Physical Chemistry)

60h (4h/week) 15h/unit 80 Marks

UNIT-I: **15h**

A] Radioactive Decay Processes : Alpha decay- penetration of potential barriers, hindered alpha decay, alpha decay energies. Beta Decay- Fermi theory, energy, Curie plots, comparative half-lives, electron capture, selection rules, forbidden transitions, non-conservation of parity, neutrinos. Gamma decay- life-time of excited states.

B] Nuclear Energy : Basic principles of chain reacting systems, the 4-factor formula, Classification of reactors, Breeder reactor, Reactor associated problems, Reactor safety, Fuel cycle, Re-processing of spent fuel, Nuclear waste management

Unit II: **15h**

A] Solid State Reactions: General principle, types of reactions: Additive, structure sensitive, decomposition and phase transition reactions, tarnish reactions, kinetics of solid state reactions, factors affecting the reactivity of solid state reactions. photographic process.

B] Nanoparticles and Nanostructural materials: Introduction,methods of preparation,physical properties,and chemical properties, sol-gel chemistry of metal alkoxide, application of nanoparticles. Nanoporous Materials: Introduction, Zeolites and molecular sieves, determination of surface acidity, porous lamellar solids, composition-structure, preparation and applications.

UNIT-III: Electrochemistry of Solution **15h**

A] Metal/Electrolyte interface : OHP and IHP, potential profile across double layer region, potential difference across electrified interface; Structure of the double layer **:** Helmholtz-Perrin, Gouy Chapman model, Stern, Graham Devanathan- Mottwatts, Tobin, Bockris, Devnathan Models

B] Over potentials, exchange current density, derivation of Butler Volmer equation under near equilibrium and non-equilibrium conditions, Tafel plot

C] Electrical double lever, theories of double layer, electro-capillary phenomena, electro-capillary curve. Electro-osmosis, electrophoreses. Streaming and Sedimentation potentials. Zeta potentials and its determination by electrophoresis, influence of ions on Zeta potential.

UNIT IV: Irreversible Thermodynamics **15h**

Local equilibria,Thermodynamic criteria for non equilibrium states, generalized flux, forces, phenomenological laws, matter flow and current flow, entropy production and entropy flow for different irreversible reactions(e.g. heat flow, chemical reaction and electrochemical reactions), saxen relations, reciprocity relations, coupled reactions- Onsager theorem of microscopic reversibility, irreversible thermodynamics of biological systems.

List of books:

1. C.N.Rao. Nuclear Chemistry
2. B. G. Harvey, *Introduction to Nuclear Physics and Chemistry,* Prentice Hall, Inc. (1969).
3. H.J. Arnikar, *Essentials of Nuclear Chemistry*, 4th Edition (1995), Wiely-Eastern Ltd., New Delhi
4. L.V.Azaroff, " Introduction to solids", McGraw Hill
5. C.Kittel, " Introduction to solid state Physics",Wiley
6. J.O.M.Bokris and A.K.N.Reddy, " Modern Elcrtrochemistry". Wiley
7. S. Glasstone, " Introduction to Electrochemistry" Affilisated East West.
8. D.R.Crow, " The Principle of electrochemistry", Chapman Hall
9. I.Prigoggine, " An Introduction to Thermodynamics of Irreversible Processes," Interscience
10. G. Fridlander, J.W. Kennedy, E.S. Macias and J.M. Miller, Nuclear & Radiochemistry, 3rd Edition (1981) John-Wiley & Sons, New York.

CH-305: Practical-V (Physical Chemistry Special)

9 h /week Marks: 90

Solutions:

1.Study the variation of solubility of potassium hydrogen tartarate with ionic strength using a salt having a common ion and hence determine the mean ionic activity coefficients.

2.Determination of partial molar volume of solute and solvent(ethanol-water,methanol-water,KCl-water mixture)

3.Determination of temp. dependence of the solubility of a compound in two solvents having similar intermolecular interactions(benzoic acid in water and DMSO –water mixture) and calculation of the partial molar heat of solution.

Phase equilibrium:

4. To study the effect of addition of an electrolyte such as NaCl, KCl,Na_2SO_4,K_2SO_4 etc.on the solubility of an organic acid(benzoic acid or salicylic acid).

5. To determine the heat of crystallization of $CuSO_4.5H_2O$

6. To determine the heat of reaction involving precipitation of a salt $BaSO_4$

7. To determine transition temperature of $CaCl_2$ by thermometric method and to determine transition temperature of $CaCl_2$, sodium bromide by solubility method

Kinetics:

8. To determine the activation energy of hydrolysis of an ester by acid.

9. Kinetics of reaction between sodium thiosulphate and KI. Determination of rate constant; study of influence of ionic strength

10. Kinetics of decomposition of H_2O_2 catalysed by iodide ion. Also determination of activation energy of reaction.

Electrochemistry:

11. Estimate the concentration of H_2SO_4, CH_3COOH, $CuSO_4.5H_2O$ in a given solution by carrying out conductometric titration against NaOH solution.

12 .Determine the eq. conductance of strong electrolyte(KCl, NaCl, HCl,KNO_3) at several concentration and hence verify Onsager's equation.

13. Carry out the following precipitation titration conductometrically-

a.50 ml.0.02N AgNO3 with 1N HCl

b.50 ml.0.02N AgNO3 with 1N KCl

c. 50 ml 0.004 N $MgSO_4$ with 0.1 N $Ba(OH)_2$

d. 50 ml 0.002 N $BaCl_2$ with 1 N Li_2SO_4

e. 50 ml.0.02 N $BaCl_2$ with 1N K_2SO_4

Potentiometry:

14.Determination of redox potential of the couples(Fe^{2+}/Fe^{3+},Co^{3+}/Co^{2+},Cr^{3+}/Cr^{2+},MnO_4^-/Mn^{2+}(any two) and equilibrium constant.

15.Study of complex formation by potentiometry e.g.Ag^+-$S_2O_3^{2,-}$,Fe^{3+}-SCN^-,Ag^+-NH_3(any two) and calculation of stability constant.

ANALYTICAL CHEMISTRY SPECIALIZATION

CH-302: Paper X (Special I-Analytical Chemistry)

60h (4h/week) 15h/unit 80 Marks

Unit-I: Radioanalytical Chemistry-I **15h**

Radioactivity-Radiation-Units-Curie, Becquerel, Gray, Rad, Sievert, RBE, REM, Half life, mixed half life, branching decay, different types of radiations and their interactions with matter, radioactive equilibrium, Elementary principles of GM and proportional counters, Gamma Ray Spectrometer, calibration using standard sources, resolution, numericals.

Unit-II: Optical methods of analysis-III **15h**

***Atomic absorption spectroscopy*:** Principle. Atomic energy levels. Grotrian diagrams. Population of energy levels. Instrumentation. Sources: Hollow cathode lamp and electrodeless discharge lamp, factors affecting spectral width. Atomizers: Flame atomizers, graphite rod and graphite furnace. Cold vapour and hydride generation techniques. Factors affecting atomization efficiency, flame profile. Monochromators and detectors. Beam modulation. Detection limit and sensitivity. Interferences and their removal. Comparison of AAS and flame emission spectrometry. Applications of AAS.

Unit-III:Electrochemical methods of analysis-II **15h**

***Stripping Voltammetry*:** Principle and technique in anodic and cathodic stripping voltammetry, applications to metal ion analysis, limitations.

Adsorptive stripping voltammetry: Principle, technique, applications to metal ions and organic analysis. Advantages over anodic stripping voltammetry. Catalytic effects in voltammetry.

Working electrodes: Mercury electrodes, carbon electrodes, film electrodes.

***Cyclic voltammetry*:** Principle and technique. Randles-Sevcik equation. Interpretation of voltammogram-reversible, irreversible and quasi-reversible systems. Applications of cyclic voltammetry in study of reaction mechanism and adsorption processes.

Electrochemical sensors *(Chemically modified electrodes):* Biosensors, catalytic sensors and gas sensors. Comparison of voltammetry with AAS and ICP-AES.

Unit-IV: Miscellaneous techniques-I **15h**

Photoacoustic spectroscopy: Theory. Instrumentation. Advantages over absorption spectroscopy. Chemical and surface applications of PAS.

***Electrochromatography*:** Principles of electrophoresis. Instrumentation. Zone electrophoresis. Curtain electrophoresis. Applications of electrochromatography. Reverse osmosis. Electrodialysis. Capillary electrophoresis. Applications of capillary electrophoresis. Micellar electrokinetic capillary chromatography.

Electrogravimery: Theory of electrolysis. Electrode reactions. Decomposition potential. Overvoltage. Characteristics of deposits and completion of deposition. Instrumentation. Application in separation of metals.

CH-303: Paper XI (Special II-Analytical Chemistry)

60h (4h/week) 15h/unit 80 Marks

Unit-I: Organoanalytical Chemistry **15h**

Elemental analysis: Outline of macro, semi-micro, micro and ultra-micro analysis, semi-micro determination of carbon, hydrogen, halogen, sulphur, nitrogen, phosphorous, arsenic, boron and metals in organic compounds.

Functional group analysis: Semi-micro determination of the following functional groups in organic compounds- hydroxyl, amino, nitro, nitroso, azo, N-acetyl, O-acetyl, methyl, aldehydes, ketones, thio, disulphide, sulphonamide, unsaturation and active hydrogen.

KF reagent: Karl Fischer reagent and its use in analysis of water in organic compounds.

Unit-II: Analysis of ores and cement **15h**

Ores: Composition and analysis of the followings ores- Bauxite, Pyrolusite, Dolomite, Chromite.

Portland cement: Composition, raw material, manufacturing processes, characteristics, analysis.

Unit III: Water pollution and analysis

Sources of water pollution, composition of potable water, importance of water analysis, sampling and sample preservation, physico-chemical analysis of water. Mineral analysis (temperature, pH, conductivity, turbidity, solids, alkalinity, chloride, fluoride, sulphates, hardness), Demand analysis (DO,

BOD, COD, TOC), nutrients (nitrogen-total, nitrate, nitrite, phosphate) and heavy metals (As, Cd, Cr, Hg and Pb). A brief idea of coagulation and flocculation.

Unit-IV: Air pollution and analysis **15h**

Air pollution and analysis-classification of air pollutants, sources of air pollution and methods of control, sampling of aerosols and gaseous pollutants and their effects, SO_2, NO_2, CO, CO_2, particulates-SPM, RSPM, High Volume Sampler, Fabric Filters, Cyclones (direct and Reverse), ESP, ozone layer, Green house effect, Heat Islands, Acid Rain.

List of books:

1. Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)
2. Substoichiometry in Radioanalytical Chemistry: J. Ruzicka and J Stary (Pergamon Press)
3. Introduction to Radiation Chemistry: J. W. T. Spinks and R. J. Woods
4. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
5. Instrumental Methods of Analysis: Willard, Meriit and Dean(Van Nostrand)
6. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
7. Vogel's Text Book of Quantitative Inorganic Analysis: Bassett, Denney, Jeffery and Mendham (ELBS)
8. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
9. Atomic Absorption Spectroscopy: Robinson (Marcol Dekker)
10. Instrumental Methods of Chemical Analysis: Braun (Tata McGraw-Hill)
11. Analysis of Water: Rodier
12. Laboratory manual of water analysis: Moghe and Ramteke (NEERI)
13. Electroanalytical chemistry: Joseph Wang
14. Electroanalytical stripping methods: Brainina and Neyman (Wiley-Interscience)
15. Trace analysis: S. Lahiri (Narosa Publishing House)
16. Electroanalytical Chemistry: Bard (Marcel-Dekker)
17. Chemistry in Engineering and Technology- Vol I and II: J.C. Kuriacose and J. Rajaram (Tata-McGraw Hill)

CH-305: Practical-V (Analytical Chemistry Special)

9 h /week Marks: 80

pH-metry

1. Determination of percent Na_2CO_3 in soda ash by pH-metric titration.

2. Determination of isoelectric point of amino acid.

Conductometry

1. Displacement titration of CH_3COONa with HCl.

2. Precipitation titration of $MgSO_4$ and $BaCl_2$.

Potentiometry

1. Estimation of Cl^-, Br^- and I^- in a mixture.

2. Determination of percent purity of phenol by potentiometric titration with NaOH.

Coulometry

1. Estimation of nickel and cobalt by coulometric analysis at controlled potential.

2. Analysis of antimony (III) with I_3^- .

Polarography

1. Determination of $E_{1/2}$ of Cd^{2+} and Zn^{2+} at DME.

2. Estimation of Cd^{2+} and Zn^{2+} in respective solutions by calibration curve and standard addition methods.

3. Determination of composition /stability constant of complex.

Cyclic voltammetry

Study of cyclic voltammograms of $K_3[Fe(CN)_6]$.

Electrogravimetry

Estimation of nickel and copper individually as well as in mixture.

Polarimetry

1. Inversion of cane sugar in the presence of HCl.

2. Determination of percentage of two optically active substances (d-glucose and d-tartaric acid) in a mixture.

Colorimetry/spectrophotometry

1. Simultaneous determination of chromium and manganese in given mixture.

2. Simultaneous determination of two dyes in a mixture.

3. Estimation of Mn in steel.

4. Estimation of Cu/Ni in alloys.

5. Estimation of iron in water sample using 1,10-phenanthroline.

6. Estimation of Fe(III) in given solution by photometric titration with EDTA (salicylic acid method).

Flame photometry

Estimation of Li, Na, K, Ca in rock/ soil / water samples.

Turbidimetry and nephelometry

1. To determine molecular weight of polymer.

2. Estimation of sulphate in water sample by turbidimetry.

3. Estimation of phosphate by nephelometry.

Radioanalytical techniques

1. *GM-counter*: Plateau, nuclear statistics, half thickness of aluminium absorbers, dead time.

2. *Gamma ray spectrometer*: Calibration using standard sources, determination of half life (Mn-56, I-128, In-116)

3. Experiments based on radiation chemistry: G-value, radiolysis of organic solvents.

Demonstrations

UV-spectrophotometry

CH-304: Paper XII (Elective- Applied Analytical Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Analysis of Pesticides and Fertilizers **15h**

***Pesticides*:** General introduction, analysis of pesticides in general with reference to DDT, Dieldrin, Malathion, Parathion, BHC by different analytical methods such as titrimetric, colorimetric, chromatography and electroanalytical methods.

***Fertilizers*:** Sampling and sample preparation, determination of water, total nitrogen, urea, total phosphates, potassium, acid or base forming quality.

Unit-II: Forensic chemistry **15h**

Introduction. Classification of poisons on the basis of physical states, mode of action and chemical properties with examples of each type. Methods of administration. Action of poisons in body. Factors affecting poisoning. Study of some common poisons used for suicide. Signs and symptoms of As, Pb, Hg and cyanide poisoning. Poisonous effects of kerosene and cooking gas.

Unit-III:Analysis of petroleum and petroleum products **15h**

Introduction, determination of flash and fire point, Pensky Marten's apparatus, cloud and pour point, aniline point, drop point, viscosity and viscosity index, Redwood and Saybolt viscometer, API specific gravity, water and sulphur in petroleum products, carbon residue, corrosion stability, decomposition stability, emulsification, neutralization and saponification number.

Unit-IV: Analysis of alloys **15h**

Definition of alloy. Iron-carbon phase diagram. Types of steel: hypoeutectic, hypereutectic steels, mild steel, and stainless steel. Uses of steel. Composition and uses of brass, bronze and soldering alloy. Analysis of iron, nickel, chromium and manganese in steel. Analysis of copper in brass, zinc in bronze and lead in soldering alloy. Industrial applications of alloys.

CH-306: Practical VI–Elective (Applied Analytical Chemistry)

9 h per week (Marks-80)

1. Analysis of ores: Ca and Mg in Dolomite, Al in Bauxite, Mn in Pyrolusite.
2. Analysis of cement: Silica, alumina, ferric oxide, calcium and magnesium oxide, sodium and potassium oxide.
3. Alloy analysis: Mn in steel-colorimetry, Cu in brass-colorimetry, Ni in alloy- back titration/ extraction-spectrophotometry.
4. Analysis of oils: Carbon residue, Acid value, Saponification value, Iodine value, Viscosity, Flash point, Cloud point, Aniline point.
5. Analysis of soils: pH, alkalinity, conductivity, nitrogen, phosphorous and potassium.
6. Ambient air analysis: SPM, RSPM, SO_x and NO_x in ambient air.
7. Analysis of drugs: Fe in capsule, ascorbic acid in vitamin-C tablet, sulpha drug by diazotization, Mg in milk of magnesia tablet.
8. Bleaching powder: Available chlorine, break point chlorination.
9. Polymer analysis: Molecular weight, Saponification value, Iodine value.
10. Cosmetics analysis: Talcum powder, tooth paste, shampoo.
11. Food: Moisture content by Karl-Fischer titrator, phosphoric acid in cola beverages by pH titration.

List of books

1. ISI Handbook of Food Analysis: Vol.I to X (Bureau of India Standards Publication, New Delhi)
2. Food Analysis: A. G. Woodman (McGraw-Hill)
3. Milk and Milk Products: Eckless, Comb and Nacy (Tata McGraw-Hill)
4. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products: Ranganna (Tata McGraw-Hill)
5. Insecticides- Action and Metabolism: O. Brian (Academic Press)
6. Chemistry of Insecticides and Fungicides: Sree Ramalu, Oxford, IBH,Pub.
7. Analytical Methods for pesticides and plant growth regulators and food additives-(Vol.I to X)Ed. G. Zweing (Academic press)

8. Practical Pharmacognosy: T. N. Vassudevan
9. Aids of analysis of food and drugs: Wicholls
10. Indian Pharmacopoeia-1985
11. British Pharmacopoeia-1990
12. Handbook of Drugs and cosmetics aids: Mehrotra
13. Lynch's medical laboratory technology: S. S. Raphel
14. Basic Food Chemistry: F. Lee (AVI publishing company)
15. Industrial chemistry: B. K. Sharma
16. Parikh's text book of medical jurisprudence, forensic medicine and toxicology, 6th Edn.: C.K.Parikh (CBS publishers and distributors)
17. Clarke's analysis of drugs and poisons: Anthony C Moffat, M David Osselton, Brian Widdop (Pharmaceutical press)
18. A Practical Course in polymer chemistry: S. J. Punea (Pergamon press).
19. The Text book on Petrochemical by Dr. B. K. Bhaskar Rao (Khanna Publishers).
20. Analytical chemistry: A. Gupta (Pragati Prakashan)
21. Applied Chemistry: Vermani and Narula (New Age International)

CH-304: Paper XII (Elective- Nuclear Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Radioactive decay **15h**

Various modes of decay, natural radioactivity, successive radioactive decay and growth kinetics, radioactive equilibrium, half life, half life of mixed radioisotopes, decay schemes, its determination by experimental methods, statistical nature of nuclear radiation, treatment of nuclear data and calculation of standard deviation, probability

Unit-II: Nuclear structure **15h**

mass-energy relationship, nuclear binding energy, semi-empirical mass formula, nuclear stability rules, nuclear properties, mass size, spin and parity, nature of nuclear forces, liquid drop model, shell model, its evidence and advantages, comparison of the two models, calculations based on above.

Energetics of nuclear reaction, cross reaction, comparison with chemical reactions, various types of nuclear reactions, photonuclear, spallation and thermonuclear reaction

Unit-III: Interaction of radiations with matter, detectors **15h**

Interaction with matter and detection of gamma rays with matter by photoelectric, Compton and pai production, interaction of beta particles, neutrons and heavy charged particles, various methods of

detecting nuclear radiations, gas filled counters, ionization chamber, proportional and GM counters, scintillation detector and solid state detector

Unit-IV: Nuclear fission and Fusion **15h**

Probability, mass and charge distribution, release of energy and neutrons, spontaneous fission, nuclear reactors and their uses for power production, brief idea about thermal and fast breeder reactors, reprocessing of nuclear fuel, PUREX process, heavy water- manufacturing and use in reactors. accelerators, nuclear fusion.

Production of isotopes by nuclear reactions, production of new elements, radioactive waste management and disposal

CH-306: Practical VI–Elective (Nuclear Chemistry)

9 h per week (Marks-80)

1. Working of GM counter, plateau, statistics, geometry effects, dead time, energy of beta particle, back scattering
2. Working of gas flow proportional counter, plateau, statistics, geometry effects, dead time, energy of beta particle
3. Working with scintillation counter, gamma ray spectra, energy calibration and resolution, half life determination of single and composite nuclei.
4. Radiochemical separation of ^{234}Th from natural uranium salt and its half life determination
5. Experiment on Neutron Activation Analysis by non-destructive method
6. Dose measurement by Fricke and other chemical dosimeters
7. Radiolysis of potassium nitrate, methyl iodide, carbon tetrachloride-iodine systems
8. Szilard-Chalmers reactions with inorganic and organic systems, potassium permanganate and methyl iodide
9. Some trace experiments like partition coefficient, solubility product, isotopic exchange, isotope dilution analysis, radiochromatography, ion exchange.

List of books:

1. H. J. Arnikar - Essentials of Nuclear Chemistry (Willey Eastern Ltd)
2. G. Friendlander, J. W. Kennedy,E. S. Macias and J. M. Miller-Nuclear and Radiochemistry (Wiley Intersciences, New York)

3. G. R. Choppin and J. Rydberg- Nuclear Chemistry-Principles and Applications(Pergamon press, London)
4. B. G. Harvey-Introduction to Nuclear Physics and Chemistry(Prentice Hall of India)
A. N. Nesmeyanov - Radiochemistry- (Mir Publications)
5. M. N. Sastry-Introduction to Nuclear Science, Affiliated East-West Press, New Delhi
6. G. Hughes- Radiation Chemistry- Oxford University Press, London
I. V. Verschinskii and A. K. Pikeav-Introduction to Radiation Chemistry, Israel Publication, Jerusalem-Robinson (Marcol Dekker)
7. Farhat Aziz and M. A. J. Radgers-Radiation Chemistry-Principles and Applications, VCH Publishers FRC.
8. M. Hassinsky-Nuclear Chemistry and its application, Addison Wesley

CH-304: Paper XII (Elective- Environmental Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit -I: Concept and scope of Environmental Chemistry **15 h**

Biosphere, Lithosphere, Hydrosphere and Atmosphere, Ecological principles- aspects of ecology, classification, types of ecosystems. Biogeochemical cycles- carbon, nitrogen, phosphorous, oxygen, hydrogen, sulphur, iron, sodium, potassium, magnesium, cobalt, mercury, lead, zinc and cadmium.

Thermal pollution—sources, harmful effects and prevention of thermal pollution.

Noise pollution --- sources, effects and control of noise pollution.

Unit-II: Water **15 h**

Origin, physico-chemical properties of water, sources of water, hydrological cycle, criteria of water quality, Water management- water shed management, rain water harvesting, waterpollution- sources, consequences and harmful effects of water pollution, strategies for water pollution control.

Unit-III: Air **15 h**

Major regions of the atmosphere, composition of the atmosphere, temperature inversion and air pollution episodes, photochemistry of the atmosphere, depletion of the stratospheric ozone, green house effect, green house gases, remedial measures for reversion of green house effect, acid rain, photochemical smog, particulate matter.

Unit-IV: **15 h**

Soil

Chemical and mineralogical composition of soil, classification of soil, types of soil- saline and alkaline, physical properties – texture, bulk density, permeability, chemical properties—Ion exchange capacity, soil pH and micro and macro nutrient availability. Soil management—Management of saline and alkaline soil, soil indicator plants,

Radioactive Pollution

Introduction to radiation chemistry, sources of radioactive pollution, effects of radioactivepollution, nuclear disasters in the two decades, protection from radiation, control of radiation.

CH-306: Practical VI–Elective (Environmental Chemistry)

9 h per week (Marks-80)

1. Sampling of water- tap water, well water, over head storage tank water pond water and lake water.
2. Physico-chemical and organoleptic characteristics of the above water samples.
3. Statistical evaluation of the data obtained for optimization of results.
4. Determination of Total solids, Total dissolved solids and total suspended solids and its significance.
5. Determination and comparison of chlorine content in tap water, storage tank and swimming pool.
6. Determination of acidity and alkalinity in water samples.
7. Determination of total, permanent and temporary hardness of water sample.
8. Determination of DO, COD and BOD of water sample.
9. Analysis of chemicals used in water and waste water treatment-Alum, bleaching powder, activated carbon.
10. Analysis of nutrients – Nitrogen (total, ammonia,nitrite and nitrate), Phosphate total
11. Analysis of iron and manganese in a water sample by visual titrimetry.
12. Analysis of copper and nickel in a water sample by spectrophotometry
13. Analysis of different types of soil- pH, conductivity, alkalinity
14. Determination of N,P,K of soil
15. Determination of macro and micro nutrients in soil.

List of books

1. Water analysis : J. Rodier
2. A Text book of Inorganic Analysis : A.I.Vogel
3. Colorimetric Determination of metals : E.B.Sandell
4. Environmental Chemistry : Moore J W and Moore E A. Academic Press, New York, 1976.

5. Environment and Man Vol VII: The Chemical Environment Edited by J Lenihar and W Fleecher Vlackie Publication, 1977.
6. The Chemistry of Environment: R A Horne, Wiley Interscience Publication 1978.
7. Fundamentals of Air Pollution: A C Stern
8. Instrumental Methods of Analysis: Willard,Merrit and Dean
9. Analytical Chemistry: Meites and Thomas
10. Standard Methods for Examination of water and waste water: A E Greenberg, A D Eaton, APHA, AWWA,WEF
11. Chemistry for Environmental Engineering and Science: C N Sawyer, P L McCarty and G F Parkin
12. Laboratory Manual for the Examination of Water, waste water and soil: H H Rupa and H Krist, V C H Pub.
13. Manual on Water and Waste water analysis: D S Ramteke and C A Moghe, NEERI
14. Environmental Chemistry: B K Sharma and H Kaur
15. Environmental Chemistry: A K De
16. Environmental Pollution- Management and control for sustainable Development: R K Khatoliya
17. Environmental Chemistry: A K Bhagi and G R Chatwal

CH-304: Paper XII (Elective- Polymer Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I:Introduction to polymers **15h**

Nomenclature and classification of polymers. Types of polymers- linear, branched, crosslinked, ladder, thermoplastic, thermosetting, fibres, elastomers, natural polymers, addition and condensation polymers.

Stereoregular polymers- atactic, syndiotactic and isotactic.

Unit-II:Molar mass and its determination **15h**

Molecular mass and molar distribution. Number average, mass average, viscosity, average molecular mass and relation between them. Molecular mass distribution. Determination of molecular mass- Osmometry (membrane and vapour phase), light scattering, gel permeation chromatography, sedimentation and ultracentrifuge, viscosity method and end-group analysis.

Unit III: Physical characteristics of polyemers **15h**

Morphology and order in crystalline polymers. Configuration of polymer chains, crystal structure of polymers. Morphology of crystalline polymers, strain-induced morphology, crystallization and melting. The glass transition temperature (Tg), relationship between T_g and T_T, Effect of molecular weight,

dilments, chemical structure, chain topology, branching and cross linking. Methods of determination of glass transition and crystallinity of polymers.

Unit IV: Commercial polymers **15h**

A) Organic polymers: Commercial polymers, synthesis and and application of polyethylene, polyvinyl chlorides, polyaimdes, polyesters, phenolic resins and eposy resins.

B) Functional polymers: Fire retarding polymers and conducting polymers.

CH-306: Practical VI–Elective (Polymer Chemistry)

9 h per week (Marks-80)

1. Synthesis of polymers:
    a) Synthesis of Thiokol rubber (condensation)
    b) Urea-formaldehyde (condensation)
    c) Glyptal resin: glycerine phthalic acid (crosslinked Polymer Chemistry)
    d) Polyacryonitril (bulk polymerization)
    e) Polyacryonitril (emulsion polymerization)
    f) Polymethylomethacrylate (emulsion of suspension Polymer Chemistry)
    g) Nylon-66 (interfacial polycondensation)
    h) Coordination polymers
    i) Conducting polymer (electro- or peroxodisulphate oxidation)
2. Characterization of polymers:
    a) End-group analysis
    b) Viscosity and molecular mass
    c) Density of polymer by flotation methods
    d) IR spectra.
3. Purification and fractionation of polymer, polystyrene, Nylon 66, PMMA.
4. Magnetic and electrical properties of polymers, magnetic susceptibility and electrical conductivity of coordination and conducting polymers.
5. Thermal analysis and degradation of polymers
    TGA: Isothermal and non-isothermal
    DTA: Glass transition temperature and melting point
6. Crystallinity of polymers by density measurement.

7. Swelling and solubility parameters of polymers.
8. Synthesis of Graft-Polymers and its characterization by density and IR spectra.
9. Dielectric behavior of polymers.
10. Kinetics of polymerization:
    a) Polycondensation
    b) Peroxide initiation polymerization.

List of books:

1. Textbook of polymer science: F.W. Billmayer Jr. Wiley.
2. Polymer science: V.R. Gowarikar, N. V. Viswanathan and J. Sreedhar, Wiley-Eastern.
3. Fractional monomers and polymers: K Takemoto, Y. Inaki, and R.M. Ottam Brite.
4. Contemporaty polymer chemistry: H.R. Alcock and F. W. Lambe, Prentice Hall.
5. Principles of polymer Chemistry: Flory, Cornell Univ. press.
6. Introduction to polymer chemistry: R. B. Seymour, McGraw Hill.
7. Principles of polymerization: Odian.
8. A first course in polymer chemistry: A. Strepikheyew, V. Derevistkay and G. Slonimasky, Mir Publishers, Moscow.
9. Laboratory preparation of macro chemistry: EMM effery, McGraw Hill Co.
10. A practical course in polymer chemistry: S.J. Punea , Pergamon Press.

CH-304: Paper XII (Elective- Medicinal Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

UNIT-I: **15 h**

A] Biological response to drug, significance of drug metabolism in medicinal chemistry ,Prodrugs, computer aided drugs, molecular modelling and drug design, Clinical studies, medical formulations ,Stereochemistry and drug development

B]Cardiovascular Drugs: Introduction, cardiovascular diseases, Synthesis of nitrate,verapami, methyldopa, atenolol.

UNIT-II: **15 h**

A] Antineoplastic Agent: Introduction, classification,cancer chemotherapy, cancer causing chemicals, role of alkylating agents and antimetabolites in treatment of cancer, hormone and natural products. Synthesis of melphalan , thiotepa, lomustine

B] Antidiabetic Agents- Type-I and Type-II diabetes, Insulin, thiazolidinediones, Synthesis of ciglitazone.

UNIT-III: **15h**

A] Local Anti-infective drug: Introduction and general mode of action. Synthesis of sulphonamides, ciprofloxacin, norfloxacin, dapsone ,amino salicylic acid, isoniazid, ethionamide, ethambutal, econozole, griseofulvin.

B] Diuretics: Introduction, mode of action, loop diuretics. Synthesis of Bumetanide, Frusemide, Ethacrynic acid, clorexolone Quinethazone.

C] Analgesics and Antipyretics: Introduction, mode of action, evaluation of analgetic agents.

Synthesis of: Aspirin, salsalate, phenacetin, phenylbutazone, Indomethacin, Analgin.

UNIT-IV: **15 h**

A] Psychoactive drugs: Introduction, CNS depressants, Introduction and mode of action of Barbiturates, Benzodiazepenes, hydantoins, butyrophenones, buspirone, CNS Stimulants, Synthesis of Phenobarbital, thiopental sodium ,diazepam, lorazepam, bromazepam, ethosuximide

B]Coagulant and Anticoagulants: Introduction, factors affecting coagulant and anti-coagulant. Mechanism of Blood coagulation and Anticoagulation. Structure of Vitamin K1, Vitamin K2 and heparin. Synthesis of Coumarins and indanediones.

CH-306: Practical VI–Elective (Medicinal Chemistry)

9 h per week Marks-80)

1. Volumetric estimation of Ibuprofen.
2. Estimation of aspirin by volumetric and instrumental methods.
3. Analysis of ascorbic acid in biological/tablet sample.
4. Determination of paracetamol by colorimetry.
5. Analysis of ampicillin trihydrate.
6. Determination of vitamin B12 in commercial sample by spectrophotometry.
7. Determination of phenobarbitone in given cough syrup.
8. Determination of tetracycline in given capsule.
9. Determination of iron, calcium and phosphorus from milk or drug sample.
10. Determination of glucose by glucometer.
11. To perform I.P. monograph of tablet.

12. Estimation of uric acid in serum and urine.
13. Estimation of chloride in serum and Urine.
14. Estimation of liver glycogen.
15. Determination of blood cholesterol.
16. Determination of creatinine and creatine in blood/Urine.
17. Separation and determination of sulpha drugs in tablets or ointments.

Preparation of Drugs: Synthesis, purification and identification of (8-10) of the following drugs.

1. Benzocaine from p-nitrobenzoic acid.
2. Dapsone from diphenyl sulphone.
3. Paracetamol from p-nitro phenol.
4. Uracil from sulphanil amide.
5. Diphenyl hydantion from benzoin.
6. Aluminium asprin from salicylic acid.
7. 4,6-diphenyl-thiazine from chalcone.
8. 6/8 nitro coumarin from resorcinol.
9. Copper aspirin from salicylic acid.
10. N-acetyl parabanic acid.
11. Nerolin from 2-naphthol
12. Phenothiazine from diphenylamine
13. Umbelliferon from resorcinol
14. Benzylidene from benzaldehyde and aniline
15. 1-phenyl-1,2-pentadine-3-one from benzaldehyde
16. 1,5 diphenyl-1,3-pentadiene-2-one from benzaldehyde
17. 1,3-diphenyl-prop-2-ene-1-one
18. 3-methy pyrazol-5-one from ethylacetoacetate
19. 6-methyl uracil
20. Sulphanilamide from acetanilide

List of books:

1. Text book of organic medicinal chemistry-Wilson,Geswold
2. Medicinal chemistry Vil I and II-Burger
3. A textbook of pharmaceitical chemistry-Jayshree Ghosh
4. Introduction to medicinal chemistry-A Gringuadge

5. Wilson andGisvold text book of organic medicinal and pharmaceutical chemistry-Ed.Robert F Dorge
6. An introduction to drug design-SS Pandey,and JR Demmock
7. Goodman and Gilmans pharmacological basis of therapeutics- Stragies for organic drug sythesis and design-D Lednicer
8. Textbook of Medicinal Chemistry- A. Kar
9. Medicinal Chemistry – D Sriram and P.Yogeeswari

CH-307: Seminar-III

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 20 marks (1 credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.

GONDWANAUNIVERSITYGADCHIROLI
SEMESTERSYSTEMSYLLABUS
FOR
M.Sc.Part II
Subject- Zoology,Semester-III,
Paper IX-Parasitology

Unit-I

1.1 Spirochaetesand Ricketsia-Life cycle, modeoftransmission, infection and treatment.

1.2 *Vibrio cholerae*-Life cycle, modeof transmission, infection and treatment.

1.3 *Clostridium titani*-Lifecycle, mode oftransmission, infection and treatment.

1.4 *Yersinia pestis*(Plaguebacteria) -Lifecycle,mode oftransmission, infection and treatment.

Unit-II

2.1Influenza and H1 N1viruses-Lifecycle, modeof transmission, infection and treatment.

2.2 Polio virus -Lifecycle, modeof transmission, infection and treatment.

2.3 Dengue andHepatitis-Lifecycle, mode oftransmission, infection and treatment.

2.4 Rabies virus-Lifecycle, modeof transmission, infection and treatment.

Unit-III

3.1 *Entomoeba*-Lifecycle, modeof transmission, infection and treatment.

3.2 *Trypanosoma*-Lifecycle, mode oftransmission, infection and treatment.

3.3*Leishmania*-Lifecycle, modeof transmission, infection and treatment.

3.4 *Giardia* and *Tricomonas*-Lifecycle, mode oftransmission, infection and treatment.

Unit-IV

4.1*Wuchereria*and *Trichinella*-Lifecycle, mode oftransmission, infection and treatment

4.2 Malaria: pathogen vectors and mode oftransmission, infection and treatment

4.3 Epidemic typhus:-pathogen vectorsand modeof transmission, infection and treatment.

4.4 Toxins and antitoxin.

Paper-X,Immunology

Unit-I

1.1 Immunesystem- innate andadaptiveimmunity.
1.2 Cellsand organsofimmunesystem– hematopoiesis, primaryand secondarylymphoid organs.
1.3 Antigensand antibodies– antigenicity, immunogenicity, antigen– antibodyinteractions, superantigens, antibodydiversity.
1.4 Organization ofimmunoglobulin genes– antibodystructure, heavy, light, kappa,lambdachain generearrangements.

Unit-II

2.1 Complement system– classical,alternative and lectin pathways, regulation ofcomplement system, biological consequencesofcomplement activation.
2.2 Major HistocompatibilityComplex (MHC)- general organizationand inheritanceoftheMHC, MHC moleculesand genes, cellulardistribution andregulationofMHC expression.
2.3 Tcells -maturation, activation and differentiation, Tcell receptors.
2.4 B cells - maturation, activation and differentiation, B cell receptors.

Unit-III

3.1 Cytokines - propertiesofcytokines, cytokinereceptors, cytokinesecretionbyTH1 and TH2 subsets, cytokine-related diseases, therapeuticusesofcytokinesand their receptors.
3.2 Cell mediatedcytotoxicresponses– effectormechanisms, leukocyte activation andmigration.
3.3 Hypersensitivityreactions – types, prevalence, factors, mechanismsoftypeIto IV hypersensitivityreactions.
3.4 Immunetolerance andautoimmunity – central, peripheralandacquiredtolerance, organ specific autoimmunediseases, animalmodels, treatment ofautoimmunediseases.

Unit-IV

4.1 Transplantation immunology– blood antigens, transplantation rejection, graft rejection, familial grafting, tissuetyping, crossmatching, immunosuppression.
4.2 Tumorimmunology– typesand rolesoftumor antigens, immuneresponsetotumor, tumor evasion ofimmunesystem, cancer immunotherapy.
4.3 Immuneresponseto infectiousdiseasesandimmunedefeciences– bacterial, fungal, viral, parasiticdiseasesand AIDS.
4.4 Applicationsofimmunologyand immunotechniques– immunotherapies,immunizationand vaccineproduction, precipitation reaction, agglutination reaction, radioimmunoassay, ELISA.

M.Sc.IISemester-III,
Practical-V,ParasitologyandImmunology

Section-A

1.Studyofdifferent typesofparasiticprotozoan'swith thehelpofalreadyavailablepermanent slides/ ICT tools/ Models/Charts/ Photographsetc.

2. Studyofdifferent typesofparasitichelminthes with thehelpofalreadyavailablespecimens, permanent slides/ ICT tools/ models/charts/ photographsetc.

3. Studyofdifferent typesofinsect vectors with thehelp ofalreadyavailablespecimens, permanent slides/ ICT tools/ models/charts/ photographsetc.

4. Identification and studyof variousectoandendoparasites withthehelp ofalreadyavailable permanent slides/ ICT tools/ models/charts/ photographsetc.

5. Studyofdifferent typesofinsect vectorsand theirmouth parts withthehelpofalreadyavailable specimens, permanent slides/ ICT tools/models/ charts/ photographsetc.

6. Studyoflifecyclesof variousparasites withthehelp ofalreadyavailablespecimens, permanent slides/ ICT tools/ models/charts/ photographsetc.

Section-B

7. Antigen-antibodyreaction.

8. Preparation oftissuesectionsofthymus, spleen, and lymph nodes. (Sourceoftissue: Animal wastesfromlocal recognized slaughter houses/ poultryfarms/ fish marketsetc.)

9.Immunological diagnosisof pregnancy.

10. Agargel diffusion.

11. Demonstration of immunoelectrophoresis.

12.Identification ofTand Bcells.

13. Demonstration ofMast cells. (Sourceoftissue:Animal wastesfromlocalrecognized slaughter houses/ poultryfarms/ fish marketsetc.)

Distribution ofmarks Total: 80

1.Identification andcomments on spot (1 to 10) …….	20
2. Demonstration ofGram + ve (Positive), Gram– ve (Negative) bacteria……..	10
3. Antigen-antibodyreaction/Agargel diffusion/diagnosis of pregnancy……	10
4. T and B cells identification/Mast celldemonstration…….	15
5. Submission ofslides and collection……	10
6. Practical record ……..	10
7. Viva-voce……...	05

Suggested Readings

Parasitology

1. Brock Biologyof Microorganisms(Ed. IX) M. T. Madigan J. M. Martinkoand J. Parker. Prentice Hall International Publication.
2. TheNematodeParasitein Vertebrate, W. Youleand Maplestone.
3. General Parasitology, V. A. Dogiel.
4. Helminthology, E. C.Fausy.
5. Platyhelminthesand Parasitisium, D.R.Birt.
6. Animal Parasite- O.W. Aisen
7. ParasiticProtozoa, J.P.KreierandJ.R. Baker. Allen and UnwinPress.
8. Medicaland VeterinaryProtozoalogyM. G. Kathering,A. JamespaulandV.Zaman. Churchill Livingstone.

Immunology

1. Immunology– R. C. Kubyet al..
2. Immunology- Tizzard.
3. Immunology-. Roitt, Brostoffand D. Male.
4. Microbiology- M. T. Pelzer. Jr.E. C. S. ChanandN. R. Krieg.TataMcGraw-Hill
5. Immunology- Abbas

M.Sc.IISemester-III

Paper-XI, SpecialGroup-Entomology-I

Insect Morphologyand Physiology

Unit-I

1.1 Integument:molecularstructure, moultingand sclerotization.

1.2 Morphologyofhead, thorax andabdomen.

1.3 Appendages: antennae, legsand genitalia.

1.4 Wingstructureand mechanism of flight.

Unit-II

2.1 Mouth parts: type, morphologyand feedingmechanism.

2.2 Structureofalimentarycanal and salivaryglands, mechanism ofdigestion.

2.3 Respiratorysystem: tracheal,aquatic and plastron respiratorymechanism.

2.4 Circulatorysystem: organs, mechanism ofcirculation,haemolymph- cellular andchemical composition. Functionsofhaemocytes.

Unit-III

3.1 Excretorysystem: organsand physiologyofexcretion.

3.2 Nervoussystem: structure andanatomyofbrain and ventral nerve cord.

3.3 Neuroendocrinesystem: structure and function,roleinmetamorphosisandreproduction.

3.4 Exocrineglands: Pheromonesand allomones-chemistryand functions.

Unit-IV

4.1 Reproduction:male and femalereproductive system, structureoftestisandovary, mechanismof spermatogenesisand vitellogenesis.

4.2 Specialized reproductivemechanism:viviparity,polyembryony, paedogenesisand parthenogenesis.

4.3 Earlyembryonicdevelopment up to germband formation.

4.4 Metamorphosis:typesoflarvae and pupae.

Paper-XI,SpecialGroup-Fishand Fisheries-I
Generalstudies

Unit-I

1.1 Origin and Evolutionof fishes: Fossil record,classification,cyclostoms, ostracoderms, placoderms, Sharklikefisher, Bonyfishes

1.2 Development ofjawsand limbsin fishes.

1.3 Classificationand generalcharactersofPlacoderms: Acanthodii, Coccostei, Pterychthyes, Stegoselachii, Palaeospondyli.

1.4 Affinities ofPlacodermsand fossil record.

Unit-II

2.1 Classificationand generalcharactersofElasmobranch/Chondrichthyes: Sharksand Rays, Holocephali

2.2 AffinitiesofElasmobranchs, specializedcharactersofElasmobranchs.

2.3 Classificationand generalcharactersofActinopterygii/Rayfinned fishes:Palaeonisciformes,Polypteriformes, Acipenseriformes, Amiiformes, Teleostea (Osteoglossomorpha, Elopomorpha, Clupeomorpha,Euteleostei)

2.4 AffinitiesofActinopterygiians.

Unit-III

3.1 Dipnoi: Generalcharacters,classification, origin, fossil Dipnoiansand distribution ofDipnoians.

3.2 Specialized charactersofDipnoi, Blood vascularsystem ofProtopterusandaffinitiesof Dipnoians.

3.3 Respiratorysystem: Structureof gillsin fishes, gill histology

3.4 Blood supplyand modeofrespiration and gaseousexchangeinteleosts.

Unit-IV

4.1 Accessaryrespiratoryorgans: Origin ofair breathingorgans; skin, buccopharynxoperculararcavity, air bladder

4.2 Mechanism ofair breathing, function ofaccessoryrespiratoryorgan.

4.3 Air bladder: Origin, Development, typesofair bladder;physostomous, physoclists, structureof gassecreatingcomplex

4.4 Blood supplyto air bladder and functionsofair bladder

Paper- XI,SpecialGroup-Aquaculture-I
FreshwaterAquaculture

Unit-I

1.1 Aquaculture: Definition, importanceand presentstatusin India.

1.2 Physicochemical conditionsofpond water.

1.3 Biological conditions– Aquaticvegetation, Association ofmacro vegetation.

1.4 Plankton: Seasonal distribution, Diurnalmovement and itsrolein fisheries.

Unit-II

2.1 Pond soil, Chemical conditions.

2.2 Pond ecosystem: Trophiclevel, food chain and food web in pond.

2.3 Methodsofproductivitymeasurement.

2.4 Planningandconstruction of fresh water fish farm.

Unit-III

3.1 Biologyofculturable indigenouscarps.

3.2 Biologyofculturableexoticcarps.

3.3 Reproductivesystem and breedingbehavior in Indian carps.

3.4 Fisheriesofmajor river systemsin India.

Unit-IV

4.1 Reverinecollectionof fish seed.

4.2 Fish breedingin wet and drybundhs.

4.3 Induced breedingbyhypophysation.

4.4 Hatchingtechniquesand typesofhatcheries.

Paper: XI
SpecialGroup-EnvironmentalBiology-I
Ecosystemsand Communities

Unit-I

1.1 Ecosystem: Structureand functionsofmarine and freshwater ecosystems, grassland, desertand forest ecosystems, abioticand biotic componentsofecosystems.

1.2 Energyflow: Y shaped and universalmodel.

1.3 Food chain, food web, ecologicalpyramid-typesand diversity.

1.4 Planktons: nature, distribution, seasonal succession, beneficialand harmfuleffects, qualitative and quantitative estimation

Unit-II

2.1 Nekton, Benthos:nature, distribution andanalysis, Periphyton- definition,collection, preservationand importance.

2.2 Eutrophication: Definition, types, effectsandcontrolmeasures.

2.3 Biogeochemical Cyclesin Nature- GaseousCycles: Water, Carbonand Oxygen cycle.

2.4 SedimentaryCyclesinnature- Nitrogen, sulphurand Phosphoruscycles.

Unit-III

3.1 Productivity: concept,Primaryand secondaryproductivity, measurement ofproductivity bylight and dark bottlemethod, factorsaffectingprimaryand secondaryproductivity.

3.2 Bioticcommunity: definition, concept andcharacteristicsofcommunity, community structure, stratificationand periodicity, ecotoneandedge effect.
3.3 Ecologicalniche, ecotype, ecophene and ecologicalindicators.
3.4 Ecological succession:definition,typesand processofecological succession, significance.

Unit –IV

4.1 Biosphere: Major biomesoftheworld with emphasison Indian biomes.
4.2 Biometeorology: scope and factors
4.3 Water and soilasessential factorsfor themeteorological studies.
4.4 Radiantenergy, temperature andlight.

Semester –III
Paper-XII,SpecialGroup-Entomology-II
Classification and IndustrialInsects

Unit-I

1.1 Modern schemeofinsectclassification and general charactersof various Orders.
1.2 General charactersandclassificationofThysanura and Collembola.
1.3 General charactersandclassificationofMallophaga and Siphunculata.
1.4 General charactersandclassificationofSiphonaptera.

Unit-II

2.1 General charactersandclassificationofOrthoptera.
2.2 General charactersandclassificationofHemiptera.
2.3 General charactersandclassificationof Lepidoptera.
2.4 General charactersandclassificationofColeoptera.

Unit-III

3.1 Mulberrysilkworm*Bombyxmori*, life cycle, silkglandand silk proteins.
3.2 Silkwormrearing, cocoon harvestingand seed production.
3.3 Bacterialand viraldiseasesin silkworm.
3.4 Lacinsect-biology, laccultivationand economicimportance.

Unit-IV

4.1 Tasarsericulture- life cycle, host plant, rearing, cocoon formationand silkproduction.
4.2 Erisericulture- life cycle, host plant rearingand silk production.
4.3 Honeybee- types, life cycle, colonyformation and apiaryproducts.
4.4 Beekeeping- movable framehive, beerearing management and diseases.

Paper-XII,SpecialGroup-Fish and Fisheries-II
Applied fisheries

Unit-I

1.1 Fresh water fisheriesof India, Riverineand Reservoir fisheries.
1.2 Estuarineand Marine fisheriesof India.
1.3 Breedingof Indian Major carps: i Natural breeding, ii Induced breeding, iiiMethodsofobtaining eggs, spawn, fryand fingerlingsfromnaturalresources.
1.4 Neuroendocrine control ofcarp reproduction.

Unit-II

2.1 Cultureofexoticfishes– commoncarp, Composite culture.
2.2 Monoculture, Monosexculture.
2.3 Integrated Fish farming – Poultry, Duck,Fish rice culture.
2.4 Sewagefed fisheries

Unit-III

3.1 Catfish culture
3.2 Troutculture
3.3 Ornamentalfish culture: i) Oviparous,ii) Livebearers.
3.4 Cultureofseaweedsand Spirulina.

Unit-IV

4.1 Pearlculture
4.2 Oyster culture: i) Species- edibleii) Culturemethods.
4.3 Prawn culture(Lifecycleand breeding)
4.4 Frogculture

Paper- XII,SpecialGroup-Aquaculture-II
Aquacultureand RuralDevelopment

Unit-I

1.1 Cultureof zooplankton
1.2 Prawn culture&Methodsofbreeding
1.3 Cultureofcrabs
1.4 Pearlculture/ Oyster culture

Unit-II

2.1 Development and advancement ofaquaculturein India.
2.2 Larvivorousfishesin relationto publichealth.
2.3 CultureofExotic and transplanted fishes
2.4 Breedingand careoffresh water aquarium fishes.

Unit-III

3.1 Definition ofeconomicsand application ofeconomicprinciplesto aquaculture.
3.2 Aquaculture and ruraldevelopment in India.
3.3 RoleofFFDAin development ofaquaculturein India.
3.4 Fisheryextension techniques.

Unit-IV

4.1 Socio-economicstatusof fishermencommunity.
4.2 Fisheriesco-operativesand their rolein fish production andmarketing.
4.3 Organization and operational problemsin fisheriesco-operativesocieties.
4.4 Fisherylegislation andtheirrolein fisherydevelopment.

Paper-XII
SpecialGroup- EnvironmentalBiology-II Adaptations, Population dynamics,and AnimalBehaviour

Unit-I

1.1 Adaptations of animals with referenceto physical conditions: temperatureand light.
1.2 Chemical conditions: oxygen,carbon dioxide.
1.3 Physiological process:osmoregulation and thermoregulation.
1.4 Physiological process:Bioluminescence and Echolocation.

Unit-II

2.1Influenceof physicalenvironment on organism:viscosity, surfacetension, salinity, pressure, buoyancyand surface film animals.
2.2 Biological Rhythms:photoperiodism, biological clock, annual and lunar periodicity.
2.3 Mimicryand protectivecolouration: definition ofmimicry, kinds of mimicry.
2.4 Batesionand mullerian mimicryand significance.

Unit-III

3.1 Population dynamics: population structure, pattern of population distribution, population growth and densityrelationship, population fluctuations and dispersal of population.
3.2 Dispersal:Barriers ofdispersal, means of dispersal, migration.
3.3Intersepecificrelationship: mutualism, commensalism, parasitism, synergism, antagonism and competition.
3.4 Preyand Predator relationship

Unit-IV

4.1Intraspecific relationship: aggregations and social organization.

4.2 Animal behavior: innate orinherent behavior,learned behavior, visinand behavior, sound and behavior.
4.3 Social behaviour: mating, family, andgroupbehavior, advantages of social behavior
4.4 Genetic, hormonaland evolutionaryaspects ofbehavior.

(M.Sc. Part-II) Semester-III,Practical-VI,SpecialGroup-Entomology

1. Anatomical observations, demonstrationand detailed explanation ofthevariousorgansand systemsin insects such ascockroach, grasshopper, cricket, molecricket, redcotton bug, honeybee, beetle, housefly, butterfly/ mothandcaterpillars with thehelp of ICT tools/ models/charts/ photographsetc.

2. Histological studyofalimentarycanal, salivaryglands, gastriccaecae, malpighian tubules, testis, ovary, sex accessory glands, exocrineglands, endocrineglands, brain and other gangliawith thehelp ofalreadyavailablepermanent slides/ ICT tools/ models/ charts/ photographsetc.

3. Wholemount preparation ofinsect partsusinginsectsfrom agriculturalwastesor withthehelp of alreadyavailablepermanent slides/ ICT tools/charts/ photographs/ modelsetc.

4. Insectstudy- preservation, identification,classificationandcharactersup to familiesbelongingto orders- Odonata, Orthoptera, Dictyoptera,Hemiptera, Lepidoptera, Coleoptera, Hymenoptera, Diptera etc.with thehelpofalreadyavailablemuseum specimens, permanentslides/ ICT tools/ charts/ photographs/modelsetc.

5. **Physiological Experiments:**
a) Differential andtotal haemocytescount.
b) Qualitativesurveyofdigestive enzymesin salivaryglands. c) Qualitativesurveyofdigestive enzymesin gut.
d) Estimation oftotal proteins/carbohydrates/lipidsin haemolymph/tissues.
e) Detection ofuricacid asend product ofexcretionin terrestrialinsects.
f) Chromatographicseparation of freeaminoacidsin haemolymph.
g) Separation ofhaemolymph proteinsbyelectrophoresisand specificproteinbyblotting. h) Estimation ofNa^+andK^+in haemolymphbyflamephotometer.
i) Estimation ofDNA andRNAin haemocytes/tissues.

6. Visitstoagriculturalfields,national parksand forestsfor collection and observationsofinsects arecompulsory.
Note: Student should submitinsect collection and about10 morphological and10 histological Slide preparationsatthetimeofexamination.

DistributionofMarksTotal: 80

1. Anatomical observation ……. 15
2. Physiological Experiment ……. 10
3. Identification ofhistological slidesandinsects(1-15) ……. 30
4. Permanent stained preparation ……. 05
5. Classrecordsandinsectcollection …….. 10
6. Submission ofhistological slides……. 05
7. Viva-voce…….. 05

Internal Assessment 20

Total marks 100

Semester-III, Practical-VI, SpecialGroup-FishandFisheries

1. Identification oflocal fishesupon species.
2. Anatomical observations, demonstrationand detailed explanation of fish in general, reproductive and urinogenital system, Endocrineglands with thehelp of ICT tools/ models/ charts/ photographs etc.
3. Studyofcranial nervesin*Wallago*and *Labeo*with thehelp ofalreadyavailablepermanent slides/ ICT tools/ models/charts/photographsetc.
4. Identification of various stagesof fryand fingerlingsofmajor carps with thehelp ofalready availablepreserved material, permanent slides/ charts/ models/ photographs/ ICT toolsetc.5 5.
5..Permanentpreparationof various scalesusingwastesfromrecognized fish markets.
6. Estimation ofdissolveoxygen in water sample.
7. Estimation ofCO_2in water sample.
8. Estimation ofchloridesamplein water.
9. Estimation ofprotein inblood of fish (Sourceof fish blood: Local recognized fish markets).
10. Estimation ofsodium in blood of fish (Sourceof fish blood: Local recognized fish markets).
11. Estimation ofpotassium in blood of fish (Sourceof fish blood: Local recognized fish markets).

DistributionofMarks:Marks

1. Anatomical observation ……. 15
2. PhysiologyExperiment…… 15
3. MountingofScale…… 05
4. Identification of fishes…… 30
5. Practical Record …… 10
6. Vivavoce…… 05

Total Marks 80

Internal Assessment20

Totalmarks100

Semester-III,Practical-II,

SpecialGroup-Aquaculture

1)Physicochemical analysis of pond water for determination ofpH, Turbidity, DO,FreeCO2, Ammonia, Alkalinity, Hardness, Nitratesand Phosphates.

2)Physicochemical analysis of pond soil to determineits texture,pH, particlesize, available nitrogen, phosphorus andfreeCaCO3.

3)Qualitative and quantitative studyof planktonand benthos.

4)Studyof foodchain infresh waterpond ecosystem.

5)Estimation of primaryproductivitybylightanddark bottle method.

6)Identification oflocalfish fauna.

7)Identification andclassification ofIndian andexoticcarps.

8) Estimation of fecundity.

9) Dissection ofcarp /catfish to collect pituitary.

10) Preparation of fish pituitaryextract anddetection ofdosesfor injection.

11) Visit toafish seed hatchery.

DistributionofmarksMarks

1) Analysisofpond water……15
2) Analysisofpond soil ……..10
3) Quantitative analysisof plankton / detection ofprimaryproductivity…… 10
4) Estimation ofFecundity…….. 05
5) Identification ofspots(1 to10)……20
6) Dissection/Permanentmounting…….. 05
7) Practical record &submission ……10
8) Viva– voce……05

Total Marks 80

Internal Assessment20

Totalmarks100

Semester –III, Practical-II,

SpecialGroup-EnvironmentalBiology

1. Samplingofwater determination ofpH, temperature andturbidity.
2. Plankton study- collection and analysisof zooplanktons(Quantitative and qualitative analysis)
3. Identification ofcrustaceans, insects, snailsfrom fresh water /lake/ pond
4. Identification ofcommon aquaticweeds, predatoryfishesand harmful insectsfromthe pond.
5. Studyofindicationofpollution- estimation ofBODand COD.
6. Determination ofprimaryproductivitybylight and dark bottlemethod.
7. Estimation ofdissolved oxygen in water samplebywrinkler's method.
8. Estimation ofcarbon dioxidefromgiven water sample.
9. Determination ofrelativehumiditybyhygrometer/ psychrometer.
10. Determination ofwindvelocitybyanemometer.
11. Physico-chemical analysisofwater for determination ofalkalinity, hardness, nitritesand phosphates.
12. Estimation ofSodiumand potassium byflamephotometry.
13. Identification ofbenthic andperiphytonicorganisms.

DistributionofMarksMarks

1. Major experiment	15
2. Minor experiment	10
3. Minor experiment	10
4. Identification and comment on given spots(1-10)	30
5. Classrecord	10
6. Vivavoce	05
	80
Internal Assessment	20
Totalmarks	100

GONDWANA UNIVERSITY, GADCHIROLI

BOARD OF STUDIES IN ZOOLOGY

SUBMISSION OF

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR POST GRADUATE (M. Sc.) PROGRAMME

FROM SESSION 2016 - 17

Gondwana University, Gadchiroli

Scheme and syllabus under choice based credit system.
Syllabus for M. Sc. Zoology (Semester with choice based credit system) w e f 2016-17 Academic Session.

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in Zoology

M. Sc. Zoology Semester I

Code	*Theory / Practical*	Teaching scheme (Hours / Week)			*Credits*	Examination Scheme					
						Duration in	Max. Marks		*Total Marks*	Minimum Passing Marks	
		Th	*Pract*	*Total*			*ernal*	*terminal*		*Th*	*Prac*
Core 1	Paper 1: Structure and Function of Invertebrates	4	-	4	4	3	80	20	100	40	
Core 2	Paper 2: General Physiology	4	-	4	4	3	80	20	100	40	
Core 3	Paper 3: Cell Biology and Genetics	4	-	4	4	3	80	20	100	40	
Core 4	Paper 4: Advanced Reproductive Biology	4	-	4	4	3	80	20	100	40	
Pract. Core 1 & 2	Practical 1: Based on theory Paper 1 & 2	-	8	8	4	3-8*	80	20	100		40
Pract. Core 3 & 4	Practical 2: Based on theory Paper 3 & 4	-	8	8	4	3-8*	80	20	100		40
Seminar 1	Seminar 1	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**480**	**125**	**625**	**170**	**80**

M. Sc. Zoology Semester II

Code	*Theory / Practical*	Teaching scheme (Hours / Week)			*Credits*	Examination Scheme					
		Th	*Pract*	*Total*		*Duration in*	Max. Marks		*Total Marks*	Minimum Passing Marks	
							xternal	*terminal*		*Th*	*Pract*
Core 5	Paper 5: Structure and Function of Vertebrates	4	-	4	4	3	80	20	100	40	
Core 6	Paper 6: Comparative Endocrinology	4	-	4	4	3	80	20	100	40	
Core 7	Paper 7: Molecular Biology and Biotechnology	4	-	4	4	3	80	20	100	40	
Core 8	Paper 8: Advanced Developmental Biology	4	-	4	4	3	80	20	100	40	
Pract. Core 5 & 6	Practical 3: Based on theory Paper 5 & 6	-	8	8	4	3-8 *	80	20	100		40
Pract. Core 7 & 8	Practical 4: Based on theory Paper 7 & 8	-	8	8	4	3-8 *	80	20	100		40
Seminar 2	Seminar 2	2	-	2	1			25	25	10	
	TOTAL	**18**	**16**	**34**	**25**		**480**	**145**	**625**	**170**	**80**

Gondwana University, Gadchiroli

Changes in practical curriculum as per UGC Notification No. F.14-6/2014 (CPP-II) Dated 1st August 2014

(w.e.f. academic session 2016-17)

Important Instructions

I. Use of animals for dissection for practical purpose in the curriculum is banned by UGC vide its notification No. F.14-6/2014 (CPP-II) dated 1st August 2014. It is now essential to use necessary alternatives to stop dissection and promote and orient students towards the knowledge component rather than skill development using ICT and available resources without disturbing natural habitat. To understand anatomy of any animal, virtual dissection of the animal should be conducted through various computer simulations. These digital learning devices and available resources are to be used to demonstrate the dissection of the animals and other laboratory exercises and to evaluate the students at the time of examination and to ensures compliance of the aforesaid notification.

II. Those institutions which are already having Zoology museum / Permanent Slides / Skeleton and Loose Bones of any animals should use them till they last. No new specimens/ slides or any other laboratory material procured from animal source shall be purchased for conducting practicals mentioned here- in above. If needed, they should purchase charts/ models/ photographs or digital sources as alternatives.

III. During regular practical and practical examination, for anatomical observations, demonstration and detailed explanation of the given system of Invertebrate/ Vertebrate animal, the student will expose/ explain the given system of the animal and draw, label and comment on it.

IV. During regular practical and practical examination, for mounting of given material and permanent stained preparation, the student is expected to describe the process and/or identify, draw, label and describe the given material.

Semester-I **(CREDIT - 4)**

Paper-I, Structure and function of Invertebrates

Unit-I

1.1 Classical and molecular taxonomic parameters, species concept, systematic gradation of animals, nomenclature, modern scheme of animal classification into sub-kingdom, division, section, phyla and minor phyla.

1.2 Ultrastructure of protozoan locomotory organs (pseudopodia-cytoplasmic organells, flagella, cilia and pellicularmyonemes) and mechanism of various modes of locomotion.

1.3 Dermal cells and skeletal organization in calcareous sponges, Hexactinilida and Demospongiae (Porifera).

1.4 Polymorphism and metagenesis in coelenterate. Types of polyps, medusa and metamorphosis.

Unit-II

2.1 Origin of metazoan-colonial, syncytial and molecular theories.

2.2 Reproductive system-structure and mechanism of reproduction in *Dugesia*, *Fasciola*, *Taenia*and*Ascaris*.

2.3 Formation, Evolution and significance of coelom, metamerism and symmetry in classification of animals, particularly coelomata.

2.4 Evolution of nephridia and mechanism of excretion (nitrogenous excretory products, transport of water and salts) in Polychaeta, Oligochaeta and Hirudinea of Annelida.

Unit-III

3.1 *Peripatus*(Onychophora) structure, affinities and taxonomic position.

3.2 Respiratory organs in Arthropoda. Mechanism of gaseous exchange in tracheal respiration in Insecta and gill respiration in Crustacea.

3.3 *Neopilina*(Monoplacophora): structure, affinities and taxonomic position.

3.4 Neuroanatomy in Gastropoda, Bivalvia and Cephalopoda.

Unit-IV

4.1 Water vascular system in Echinodermata: structure and functions.

4.2 Larval forms in Echinodermata: Metamorphosis and phylogenetic significance.

4.3 General account and affinities of Ctenophora and Rotifera.

4.4 General account and affinities of Entoprocta and Ectoprocta.

Semester-I

Paper-II, General Physiology **(CREDIT - 4)**

Unit-I

1.1 Enzyme: Classification, mechanism of enzyme action. Factors affecting enzyme action, regulation of enzyme activity, activators and inhibitors.

1.2 Respiratory pigments- types, distribution and properties, structure of haemoglobin and mechanism of O_2 transport.

1.3 Neurotransmitters: chemical nature, biosynthesis and mechanism of synaptic transmission.

1.4 Colour change mechanism: Chromatophores and melanophores- structure, physiology and significance.

Unit-II

2.1 Bioluminescence: light producing organs- distribution in invertebrates and vertebrates, physiology and significance.

2.2 Thermoregulation in poikilotherms and homeotherms, adaptations and regulatory mechanisms.

2.3 Osmoregulation in Pisces and Amphibia, mechanism of salt and water transport by gills and kidney.

2.4 Molecular mechanism of peptide and steroid hormonal action. Membrane receptors and signal transduction.

Unit-III

3.1 Myogenic and neurogenic heart, Cardiac cycle- Phases of cardiac cycle, ECG pace maker, and heart valves.

3.2 Digestion and absorption of carbohydrate, proteins and lipids in the gastrointestinal tract.

3.3 Carbohydrates- classification and metabolism- glycogenesis, glycogenolysis, glycolysis, TCA cycle, electron transport system and oxidative phosphorylation.

3.4 Lipids- classification and metabolism- oxidation of fatty acids, cholesterol metabolism. Proteins- classification and metabolism- oxidative deamination, decarboxylation and transamination of amino acids, arginine-ornithin cycle.

Unit-IV

4.1 Hydromineral metabolism-water electrolyte balance, mineral metabolism in bone and egg shell formation.

4.2 Cerebrospinal fluid: Chemistry and functions.

4.3 Mechanism of reflex action.

4.4 Physiology of environmental stress and strain- tolerance, avoidance, resistance and physiological adaptations.

Semester-I

Paper-III, Cell Biology and Genetics (CREDIT - 4)

Unit-I

1.1 Membrane structure and function - structure of model membrane, lipid bilayer, membrane protein diffusion, osmosis, active transport, uniport, multiport, symport, antiport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

1.2 Structural organization and functions of cell organelles- nucleus, mitochondria, endoplasmic reticulum, Golgi complex, lysosomes and peroxisomes.

1.3 Structure and Functions of microfilaments, microtubules and their role.

1.4 Cell division and cell cycle - phases of cell cycle, checkpoints of cell cycle, regulation of cell cycle, mitosis, meiosis.

Unit-II

2.1 Cell signaling - hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, Receptor protein- tyrosin kinase and ion chanel receptors.

2.2 Signal transduction pathways, primary and secondary messenger systems, regulation of signaling pathways.

2.3 Cellular communication - general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix and integrins.

2.4 Cancer - genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis.

Unit-III

3.1 Mendelian, non-Mendelian inheritance - mono / dihybrid inheritance, types of dominance, multiple allelism, probability, exercises for solving genetics problems.

3.2 Extensions of Mendelian principles - codominance, incomplete dominance, gene interactions, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

3.3 Quantitative Genetics - polygenic traits and mode of inheritance, analysis of variation, genetic and environmental factors, heritability, inbreeding and consequences, co-efficient of inbreeding and consanguinity.

3.4 Mutation - types, causes and detection, mutant types- lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants.

Unit-IV

4.1 Structural and numerical alterations of chromosomes - deletion, duplication, inversion, transversion, translocation, ploidy and their genetic implications.

4.2 Extra chromosomal inheritance - cytoplasmic inheritance, inheritance of mitochondrial genes, maternal inheritance.

4.3 Microbial genetics - recombination in bacteria and gene mapping, transformation, conjugation, transduction (generalized and specialized), fine structure mapping of genes.

4.4 Human genetics- pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

Semester-I

Paper-IV, Advanced Reproductive Biology (CREDIT - 4)

Unit-I

1.1 Various methods of asexual and sexual reproduction in Protozoa.

1.2 Regeneration in *Hydra*, *Digesia* and Annelid worms; Morphogenesis and hormonal control.

1.3 Metamorphosis in insects: Partial and complete metamorphosis, metamorphic forms- nymph, larvae and pupae.

1.4 Mechanism of vitellogenesis in insects.

Unit-II

2.1 Spermatogenesis: Process, hormonal control and ultra-structure of spermatozoa of man.

2.2 Mechanism of oogenesis: Process, biochemical events, hormonal regulation.

2.3 Cytological and molecular events of fertilization.

2.4 Types of cleavage, blastulation, gastrulation and embryonic induction.

Unit-III

3.1 Male accessory sex glands in mammals: structure, secretion and functions.

3.2 Semen- biochemical composition and sperm abnormality.

3.3 Sperm capacitation and decapacitation- molecular mechanism and significance.

3.4 Pheromones and sexual behavior in mammals.

Unit-IV

4.1 Neurohormonal control of fish reproduction and mechanism of vitellogenesis.

4.2 Molecular induction (Morphogenetic gradients) and organizer concept.

4.3 Cryopreservation of gametes, embryo and test-tube baby.

4.4 In vitro fertilization (IVF) and its significance.

Semester I, Practical-I, Structure and Function of Invertebrates and General Physiology (CREDIT - 4) Section-A

1 Study of museum specimens using already available specimens in the museum/ charts/ models/ photographs/ digital alternatives etc.

Classification upto order and comments on the specimens representing all phyla.

2 Anatomical Observations

Anatomical observations, demonstration and detailed explanation of a) D**igestive system** of Earthworm, Leech, Cockroach, Silkworm and Honey bee b) N**ervous system** of Prawn, Cockroach, Silkworm and Honey bee and c) R**eproductive system** of Earthworm, Leech, Cockroach and Honey bee with the help of ICT tools/ Models/ Charts/ Photographs etc.

3 Mounting- Whole mount preparation of plankton and/or study of permanent preparationof the following with the help of already available permanent slides/ ICT tools/ charts/ photographs etc**.**

a. Earthworm – Nerve ring, ovary, spermatheca, nephridia.
b. Leech – jaws, ciliated organ.
c. Cockroach – Mouth parts, Salivary glands, trachea.
d. Prawn –Appendages, Statocyst.
e. Protozoans- rhizopods , flagellates , ciliates (fresh water forms).
f. Porifera – Spicules and gemmules of fresh water sponges.

g. Crustaceans and rotifers - Planktonic copepodes, cladoceran, ostracoderm and rotifers.

h. Larval forms of the free living invertebrates.

i. Larval forms of parasitic invertebrates.

4 Study of permanent Invertebrate slides

a. Porifera – T.S. and L.S. of *Sycon*, gemmules, spongianfibres, spicules

b. Coelenterata – T.S. of *Hydra* , T.S. of Sea anaemon, Ephyra larva

c. Helminths – T.S. of *Planaria*, T.S. of *Taenia* , scolex W.M., Mature , gravid proglotids , T.S. of male and female *Ascaris*, W.M of *Ancylostoma* , *Enterbios*, *Dracunculus,Wuchereria*

d. Annelida -T.S. of *Nereis*, T.S. of Earthworm, T. S. of Leech.

e. Arthropod larvae – Nauplius, Zoea, Metazoea, Megalopa, Mysis.

f. Mollusca – T.S. of foot, Veliger and Glochidium larva.

g. Echinodermata- pedicellarae, T.S. of arm of star fish, Bipinnaria, Auricularia larva.

h. Hemichordata – T.S. through collar, proboscis, trunk and branchio-genital regions. Tornaria larva.

Section-B

Physiology experiments –

a. Total leucocyte count and differential leucocyte count.

b. Total R.B.C. count.

c. Demonstration of action of salivary amylase, trypsin, pepsin.

d. Demonstration of rate of O_2 consumption in aquatic animals, under various environmental stresses.

e. Demonstration of haemoglobin concentration in normal and pathological condition.

f. Estimation of sodium, potassium and chloride in blood and excretory organs by Colorimeter or flame photometer (Source of blood: Local recognized pathology laboratory).

g. Estimation of glucose in blood by spectrophotometer or Colorimeter (Source of blood: Local recognized pathology laboratory).

h. Estimation of total blood proteins by spectrophotometer or Colorimeter (Source of blood: Local recognized pathology laboratory).

i. Estimation of cholesterol in blood by spectrophotometer or Calorimeter (Source of blood: Local recognized pathology laboratory).

Distribution of Marks:		**Marks**
1.	Anatomical observations	05
2.	Stained permanent preparation:	05
3.	Identification and comment on the spots (1-10)	20

4.	Physiology experiment (Major)	15
5.	Physiology experiment (Minor)	10
6.	Submission of stained permanent slides	05
7.	Class Record	10
8.	Viva-voce	10

	Total marks	80

Semester-I, Practical-II, Cell Biology, Genetics and Advanced Reproductive Biology (CREDIT - 4)

Section-A

1. Study of mitotic metaphasic chromosomes in plant material.
2. Preparation of human karyotypes by using photographs/pictures.
3. Demonstration of Barr body in human female leucocytes.
4. Demonstration of polytene chromosome in dipteran larvae with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
5. Problems on genetics based on monohybrid/dihybrid ratios, sex linked inheritance and blood groups.
6. Study of various human genetic traits.

Section-B

1 Study of meiotic chromosomes and spermatogenesis in grasshopper with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

2 Demonstration of oogenesis in earthworm/ fish/ rat ovary with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

3 Semen analysis: physical viscosity, pH, liquefaction time, agglutination test, motility and sperm count (Source of semen: Government artificial insemination centre).

4 Sperm vitality study using suitable stains (Source of semen: Government artificial insemination centre).

5 Hypo-osmotic swelling (HOS) for the assessment of normal semen.

6 Study of vaginal smear in rat by temporary mounting (methylene blue) or by permanent stained (Haematoxylin-eosin) with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

7 Histology of male and female reproductive organs and accessory reproductive glands with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

Distribution of Marks		**Marks**
1.	Cytological preparation	15
2.	Problems on genetics (any two)	15
3.	Spermatogenesis/oogenesis/sperm vitality	10
4.	Sperm count/vaginal smear/hypo-osmotic test for fertility	10
5.	Identification and comment on spots (1-5)	10
6.	Class record	10

7.	Viva-voce	10

	Total marks	80

- **Suggested Readings**

Structure and function of Invertebrates

1. Hyman L.H. The Invertebrate Vol. I, Protozoa through Ctenophora. McGraw-Hill Co., New York.
2. Barrington E.J.W. Invertebrate structure and function. Thomas Nelson and sons Ltd., London.
3. Jagerstein G. Evolution of Metazoan life cycle . Academic press, New York and London.
4. Hyman L.H. The invertebrate vol. 2 McGraw-Hill Co., New York.
5. Hyman L.H. The invertebrate vol. 8 McGraw-Hill Co., New York.
6. Barnes R.D. Invertebrate Zoology W.B. Saunders and Co., Philadelphia
7. Russet Hunter W.D.D. biology of higher invertebrate The Macmillan Co. Ltd., London.
8. Hyman L.H. The Invertebrates, smaller coelomate groups. Vol. 5 McGraw-Hill Co. New York.
9. Read C.P. Animal Parasitism. Prentice Hall. New-Jersey.
10. Kudo R.R. (1966) Protozoology, Charler, C. Thomas Springfield, Illinois.
11. Barradailes L.A. and potts F.A. Invertebrates (1961) The Eastham L.E. S. Saunders, Cambridge University Press, Cambridge.
12. Russel W.D. Hunter, Biology of lower invertebrates McMillan, New York.
13. Marshall A.J. and Williams W.D. (1972) J. B. Zoology of Invertebrates ,ElBs and McMillan, London.
14. Gtryyrt V. and Graham A. A Functional anatomy of Invertebrates. Academic press, New York.
15. Backlemiccher W.N. Principles of comparative anatomy of Invertebrates Oliver and Boyed Edinberg.
16. Hadisi J. The Evolution of Metazoa. Pergamon Press, Oxford.
17. Dales R.P. Annelids, Hutchinson, London.
18. Green J. Biology of Crustacea, Wither by, London.
19. Morton J. E. Mollusca, Hutchinson, London.
20. Nichols D. Echinodermata, Hutchincon, London.

General Physiology

1. Text Book of Physiology & Biochemistry: Bell, G.E. & Davidson, J.N. &Emslie D. Smith, 1922.
2. Medical Physiology: A Wiley Medical Publication, John Wiley & Sons, New York.
3. Mineral Metabolism: Comar, C.L. & Felix Bronner (1961) Acad Press, New York & London.
4. A Text Book of General Physiology: Dayson (1964): Little Brown & Co. Boston.

5. Animal Physiology: R. Eckert & D. Randall (1983) 2nd Edn., W.H. Rexeman& Co.
6. Biochemistry & Physiology of the Cell: (2nd Edn.), M.A. Edwards & K.A. Hassall (1980) Mc. Graw Hill Co.
7. The Physiology of Cells: Cuthe F. (1968): The Macmillan Co.
8. Textbook of Medical Physiology: Guyton, A.G. (1968). 7th Edn. Saunders Pub.
9. Samson Wrights Applied Physiology: Oxford University Press.
10. Comparative Animal Physiology C.L. Prosser, W.B. Saunders & Company.
11. Animal Physiology: Mechanism & Application, R. Eckert, W.H. Freeman & Company.
12. General & Comparative Animal Physiology: W.S. Hoar.
13. Medical Physiology: W.F. Ganong (1981): 10th Edn. Lange Medical Publications.
14. Principles of Anatomy and Physiology: Tortora Grabowski, 9th Edn. John Willey & Sons.
15. Reproductive Physiology of Vertebrates: Van Tienhoven, A. (1983): 2nd Edn. Cornell Univ. Press, New York.

Cell Biology and Genetics

1. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication.
2. Molecular Biology by Turner P. C. and McLennan , Viva Books Pvt. Ltd.
3. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd.
4. Molecular Biology by Freifelder D., narosa publication House.
5. Gene VI by Benjamin Lewis, Oxford press.
6. Gene VIII by Benjamin Lewis, Oxford press.
7. Molecular biology of Gene by Watson J. D. et. al., Benjamin publication.
8. Molecular cell Biology by Darnell J. Scientific American Books USA.
9. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc.
10. Genetics Vol. I and II by Pawar C. B., Himalaya publication.
12. Essentials of Molecular Biology by Freifelder D., narosa publication House.
13. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell J., W. H. Freeman and Co.
14. The Cell: Molecular Approch by Cooper G. M.
15. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication.

Advance reproductive Biology

1. Developmental Biology. 2nd Edition. Leon W. Browwer Saunders College publishing.
2. Current Topics in Developmental Biology eds. R. A. Pedersen and G. P. Schatten.
3. Principles of animal developmental biology: S. C. Goel, Himalaya Publishing House.
4. Developmental Biology, S.F. Gilbert. 4thEdn. Sinauer Associates Inc. Publishers.
5. An Introduction to Developmental Biology: D. A. Ede.
6. Principles of developmental: Paul Weiss edited by Hafner publishing company New York.
7. Cells into organs. 2nd Edition. The forces that shape the Embryo. John Philip Trinkaus ed. Tom Aloisi.

8. Principles of development: Lewis Wolpert et al. 1998. Oxford University Press.
9. Foundations of Embryology. B. M. Patten & B. M. Carlson. Tata McGraw Hill Publishing Company Ltd., New Delhi.
10. An Introduction to Embryology: Balinsky (1981) 5th Ed. (CBS College Publishing).
11. Embryonic and foetal development. Cambridge University Press by Austin and Short, 1982, 1994 2nd Ed.
12. Marshall's Physiology of Reproduction Longmont, Green and Co. London Vol. 1 & 2. Lamming 1984, 2000.

Semester-II

Paper- V, Structure and Function of Vertebrates (CREDIT - 4)

Unit-I

1.1 Origin and ancestry of Chordata.
1.2 General organization and affinities of Cephalochordata.
1.3 Structure, development and metamorphosis of Amoecoetus.
1.4 General characters and affinities of Dipnoi.

Unit-II

2.1 Organs and mechanism of respiration in Pisces and Amphibia.
2.2 Vertebrate integument and its derivatives.
2.3 Appendicular skeleton (Limbs and girdles) in Amphibia, Reptilia, Aves and Mammals.
2.4 General body organization and classification in Chelonia.

Unit-III

3.1 Evolution of urinogenital organs in vertebrates.
3.2 Origin of Birds.
3.3 Cetacia: general characters and adaptations.
3.4 Comparative anatomy of the brain in vertebrates (teleost, frog, lizard, fowl and rat).

Unit- IV

4.1 Autonomous nervous system in vertebrates: structure and functions.
4.2 Evolution of heart in vertebrates.
4.3 Sense organs in vertebrates.
4.4 Evolution of Man.

Semester-II

Paper-VI, Comparative Endocrinology (CREDIT - 4)

Unit-I

1.1 Hormones and functions in Coelentereta and Helminths.
1.2 Neurosecretory system in Annelida: structure, hormones and functions.
1.3 Neuroendocrine system in Mollusca: structure, hormones and functions.
1.4 Hormones and functions in Echinodermata.

Unit-II

2.1 Neuroendocrine system in crustacean; structure and hormones.

2.2 Endocrine control of metamorphosis, reproduction and colour change mechanisms in crustacea.

2.3 Cephalic neuroendocrine system in insects: structure and hormones.

2.4 Endocrine control of metamorphosis and reproduction in insects.

Unit-III

3.1 Pineal organ: structure, hormones and functions.

3.2 Hypothalamo hypophysial system: structure, hypothalamic nuclei, hormones and function.

3.3 Pituitary: cell types, hormones and functions.

3.4 Thyroid: Structure, hormones and function.

Unit-IV

4.1 Parathyroid ultimobranchial glands: Structure, hormones and regulatory mechanisms.

4.2 Gastro-entero-pancreatic endocrine system: endocrine pancreas and gastro intestinal tract: endocrine cells, hormones and functions.

4.3 Adrenal gland: structure, hormones and functions in vertebrates.

4.4 Gonadal hormones in vertebrates and their hormonal actions, feedback mechanisms.

Semester-II

Paper-VII, Molecular Biology and Biotechnology (CREDIT - 4)

Unit-I

1.1 Cot ½ and Rot ½ values, organelle genome, DNA structure, forms of DNA.

1.2 DNA replication – molecular mechanisms of prokaryotic and eukaryotic DNA replication, regulation of replication.

1.3 DNA damage and repair – types of DNA damages, excision repair system.

1.4 Mismatch repair, recombination repair, double strand break repair, and transcription coupled repair.

Unit-II

2.1 Transcription- prokaryotic and eukaryotic transcription, RNA polymerases, transcriptional unit, initiation, elongation, termination, transcriptional factors.

2.2 Regulation of transcription – Operon, positive and negative control, attenuation phage strategies, anti-termination, response elements and inducible elements.

2.3 Translation - prokaryotic and eukaryotic translation, genetic code, altered code in elongation, termination factors, fidelity of translation, post translational modifications.

2.4 Mobile DNA elements – transposable elements, IS elements, P elements, retroviruses, retrotansposons.

Unit-III

3.1 Antisense and ribozyme technology – initiation of splicing, polyadenylation, molecular mechanisms of antisense molecules, miRNA, siRNA, gene silencing.

3.2 Isolation and sequencing of DNA, gene amplification, PCR, RAPD, RFLP, Maxam-Gilbert, Sanger's dideoxy methods.

3.3 Splicing and Cloning – Cloning vectors for recombinant DNA technology- plasmids, cosmids, phagemids, YACS, gene replacement, restriction enzymes.

3.4 Hybridization techniques – Southern- Northern hybridization, microarray.

Unit-IV

4.1 Medical biotechnology- Application of restriction fragment length polymorphism (RFLP) in forensic science, disease prognosis and genetic counseling.

4.2 Agricultural biotechnology- biofertilizers, bioinsecticides, biogas.

4.3 Immunobiotechnology-Hybridoma technology and monoclonal antibodies.

4.4 Industrial and Environmental biotechnology-microbial production of fermentation products, enzymes, antibiotics, single Cell proteins and biosensors.

Semester-II

Paper-VIII, Advanced Developmental Biology (CREDIT - 4)

Unit-I

1.1 Implantation in Mammals.

1.2 Foetal membranes- types structure and functions.

1.3 Placenta-types, structure, functions. Hormones of placenta and their functions.

1.4 Metamorphosis in Amphibia: morphogenetic and biochemical mechanism, hormonal control.

Unit-II

2.1 Regeneration in vertebrates: tail, limb, lens and retina.

2.2 Apoptosis- mechanism and significance.

2.3 Ageing- mechanism, concepts and models.

2.4 Polymorphism (caste differentiation) in insect (Termites, Honey bees and Ants).

Unit-III

3.1 Multiple ovulation and embryo transfer technology (MOET).

3.2 Application of embryonic stem cells, clinical and economic significance.

3.3 Embryonic sexing, cloning, screening for genetic disorder diagnosis (ICSI, GIFT etc.)

3.4 Cloning of animals by nuclear transfer.

Unit-IV

4.1 Immunocontraception- fertilization, inhibition and pregnancy termination.

4.2 Classical contraceptive techniques: Physical, chemical, surgical and IUCD devices.

4.3 Anti-androgen and anti-spermiogenic compounds (LDH-CY and SP-10)

4.4 Role of mutants and transgenics in human welfare.

Semester-II, Practical-III, Structure and Function of Vertebrates and Comparative Endocrinology (CREDIT - 4)

Section-A

1 **Study of museum specimens using already available specimens in the museum/ charts/ models/ photographs/ digital alternatives etc.**

Classification of vertebrates up to order and comments on the specimens representing all phyla.

2 **Anatomical Observations**

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc.

a) Brain and cranial nerves- Fish/ Rat. b) Arterial and venous systems- Fish/Rat c) Urinogenital system- Fish/Rat. d) Reproductive systems- Fish/Rat. e) Internal ear in fish, Weberian ossicles in fish, accessory respiratory organs in fish.

3 **Mounting:** Study of Stained Permanent preparation of scales, ampullae of Lorenzini, otolith, striated muscles and cartilage of fish using animal wastes from local recognized fish markets or with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

4 **Microtomy, Histology and Skeleton**

a. Fixation, embedding, sectioning and staining of the internal organs of vertebrates (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)

b. Study of slides of internal organs of vertebrates with the help of already already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

c. Axial and appendicular skeleton of fowl and rabbit using already available skeleton/ ICT tools/ models/ charts/ photographs etc.

Section-B

1 **Microtomy** - Fixation, embedding, sectioning and staining of the endocrine gland (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)

2 **Histological study** – a) Histological slide of endocrine glands and gonadal endocrine components, EM structure of endocrine gland. b) Identification of pituitary cell type. c)

Identification of α, β, γ, cells of Islets of Langerhans with the help of already available permanent slides/ ICT tools/ charts/ photographs etc.

3 **Anatomical Observations-** Anatomical observations, demonstration and detailed explanation of the endocrine glands in a) Cockroach and b) Endocrine glands- pituitary,

thyroid parathyroid, adrenal in fish/rat with the help of ICT tools/ models/ charts/ photographs etc.

.

Distribution of Marks		**Marks**
1.	Anatomical observations of fish/rat	10
2.	Stained permanent preparation:	05
3.	Identification and comment on the spots (1-10)	20
4.	Submission of stained permanent slides	05
5.	Anatomical observations of Endocrine glands	10
6.	Histological staining of endocrine gland	10
7.	Class Record	10
8.	Viva-voce	10

	Total marks	80

Semester-II, Practical –IV, Molecular Biology, Biotechnology and Developmental Biology (CREDIT - 4)

Section-A

1. Demonstration of glycogen/ carbohydrate- PAS reaction (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
2. Demonstration of DNA: Feulgen's reaction (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
3. Demonstration of DNA: RNA: Methyl Green- Pyronin reaction (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
4. Demonstration of Lipid: Sudan Black B staining (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
5. Demonstration of Protein: HgBP staining (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
6. Histochemical analysis of alkaline phosphatase (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
7. Histochemical analysis of acid phosphatase (Source of tissue: Animal wastes from local recognized slaughter houses/ poultry forms/ fish markets etc.)
8. Biochemical estimation of sugar: O-toluidine method (Source of blood: Local recognized pathology laboratory)
9. Biochemical estimation of protein: Lowrey's method (Source of blood: Local recognized pathology laboratory)
10. Biochemical estimation of DNA: Diphenylamine method (Source of blood: Local recognized pathology laboratory)
11. Biochemical estimation of RNA: Orcinol method (Source of blood: Local recognized pathology laboratory)To perform tests for qualitative analysis of saliva
12. To perform tests for qualitative analysis of bile

13. Demonstration of separation of amino acids by paper chromatography and TLC

Section-B

1 Study of the reproductive system in mammals with the help of ICT tools/ models/ charts/ photographs etc.

2 Study of different types of eggs on the basis of their yolk content.

3 Study of developmental stages of live eggs of Lymnea or any gastropod with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

4 Study of developmental stages of insects/ fishes with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

5 Study of developmental stages of frog with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

6 Chick embryo mounting by window method.

7 Study of developmental stages of chick through slides and whole mounts.

8 Morphological study of different types of placenta with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

9 Histological study of placenta with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.

10 Sperm count from any domestic animal (Source of semen: Government artificial insemination centre).

Distribution of Marks		**Marks**
1.	Histochemical demonstration of DNA/RNA protein / carbohydrate/lipids/enzymes	15
2.	Estimation of sugar/protein/DNA/RNA/ qualitative analysis of saliva/bile	15
3.	Whole mount preparation of chick embryo/sperm count.	10
4.	Preparation of development stages of live eggs of Lymnea	10
5.	Identification and comment on spots (1-5)	10
6.	Class record	10
7.	Viva voce	10
	Total marks	80

- **Suggested Readings**

Structure and function of Vertebrates

1. Alexander R.N., The Chordata, Cambridge University Press London.
2. Barrington EJW, The Biology of Hemichordates and Protochordates, Oliver and Boid Edinberg.
3. Bourne G.H., The structure and function of nervous tissue Academic press New York.
4. Kingslay J.S, Outlines of Comparative anatomy of vertebrates, Central Book Depot, Allahabad.
5. Honyelli A.R. The Chordates Cambridge University Press, London

6. Smith H.S. Evolution of Chordate structure, Hold Rinehart and Wintoin Inc. New York
7. Walter H.A. and Sayles L.D. Biology of Vertebrates Macmillan and co. New York
8. Romer A.S. Vertebrate body W.P. Sanders co., Philadelphia.
9. Young J.Z. Life of Vertebrates Oxford University Press, London.
10. Young J.Z. Life of Mammals Oxford University Press, London.
11. Colbert E.H. Evolution of Vertebrates John Wiley and sons Inc. New York.
12. Kent C.J. Comparative anatomy of Vertebrates.
13. Waterman A.J. Chordate Structure and Functions Macmillan Co. New York.
14. Montagna W. Comparative anatomy clarenden press, Oxford
15. Weichert C.K. Preach W. Elements of Chordates anatomy McGraw-Hill book co., New York.
16. Lovetrup S. The phytogeny of Vertebrates John Wiley and sons Inc., London.
17. Joysey K.A. and Kemp T.S. Vertebrate Evolution Oliver and Boyd, Edinberg.
18. Romer A.S. Vertebrate Paleontology University of Chicago Press, Chicago.
19. Newman Phylum Chordata.
20. Goodrich E.S. Structure and development of vertebrates. Dover publications Inc., New York
21. Hard disty M.W. and Potter I.C. Biology of Lampreys Academic Press Newyork
22. T.B.of Zoology Parker and Haswell W.A. Mac millon co. Ltd. London
23. The Biology of Amphibia Noble G.K. Dover Publication Inc Newyork

Comparative Endocrinology

1. General & Comparative Endocrinology: E.J.W., Barrington, Oxford, Clarendon Press.
2. Text Book of Endocrinology: R.H. Williams, W.B. Saunders.
3. Endocrine Physiology: C.R. Martin, Oxford University Press.
4. Comparative Endocrinology: A Gorbman et al, John Wiley & Sons.
5. Medical Physiology: W.F. Ganong (1981): 10th Edn. Lange Medical Publications.
6. Principles of Anatomy and Physiology: Tortora Grabowski, 9th Edn., John Willey & Sons.
7. Reproductive Physiology of Vertebrates: Van Tienhoven, A. (1983): 2nd Edn. Cornell Univ. Press, New York.
8. The Pituitary Gland: Imura, H. (1994), 2nd Edn., Comprehensive Endocrinology Revised Series Raven, New York.
9. Comparative Vertebrate Endocrinology: Bentley, P.J. (1976) Cambridge University Press, Cambridge.
10. General & Comparative Endocrinology: E.J.W., Barrington, Oxford, Clarendon Press.
11. Text Book of Endocrinology: R.H. Williams, W.B. Saunders.
12. Comparative Vertebrate Endocrinomental: Bentely, P.J. (1976) Cambridge University Press, Cambridge.
13. Invertebrate endocrinology: D. B. Tembhare, Himalaya publishing House (2012)

Molecular Biology and Biotechnology

1. Harper's Review of Biochemistry, Prentice Hall.
2. Principles of Biochemistry by Lehninger and Nelson, CBS publications and Distributors.
3. The Biochemistry "Students companion" by Allen J. Scism, Prentice Hall.
4. Fundamentals of Biochemistry by Jain J. L., S. Chand Publication.
5. Principles of Biochemistry by Zubay J. L., WM. C. Brown Publishers.
6. Principles of Biochemistry by Horton, Prentice Hall.
7. Concept of Biochemistry by Boyer R., Coel publication co.
8. Harper's Biochemistry eds.Murray, R. K. P. and Granner, D. K. Prentice Hall.
9. Biochemistry by Mathews C. K. and Van Holde K. E., Benjamin C. publishing Co.
10. Biochemistry by Garrett R. H. and Grisham C. M., Saunders College publication.
11. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication.
12. Molecular Biology by Turner P. C. and Mc Lennan , Viva Books Pvt. Ltd.
13. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd.
14. Molecular Biology by Freifelder D., narosa publication House.
15. Gene VI by Benjamin Lewis, Oxford press.
16. Gene VIII by Benjamin Lewis, Oxford press.
17. Molecular biology of Gene by Watson J. D. et. al., Benjamin publication.
18. Molecular cell Biology by Darnell J. Scientific American Books USA.
19. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc.
20. Genetics Vol. I and II by Pawar C. B., Himalaya publication.
21 Essentials of Molecular Biology by Freifelder D., narosa publication House.
22. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell J., W. H. Freeman and Co.
23. The Cell: Molecular Approch by Cooper G. M.
24. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication.

Gamete and Developmental Biology

1. Developmental Biology. 2nd Edition. Leon W. Browwer Saunders College publishing.
2. Current Topics in Developmental Biology eds. R. A. Pedersen and G. P. Schatten.
3. Principles of animal developmental biology: S. C. Goel, Himalaya Publishing House.
4. Developmental Biology, S.F. Gilbert. 4th Edn. Sinauer Associates Inc. Publishers.
5. An Introduction to Developmental Biology: D. A. Ede.
6. Principles of developmental: Paul Weiss edited by Hafner publishing company New York.
7. Cells into organs. 2nd Edition. The forces that shape the Embryo. John Philip Trinkaus ed. Tom Aloisi.
8. Principles of development: Lewis Wolpert et al. 1998. Oxford University Press.
9. Foundations of Embryology. B. M. Patten & B. M. Carlson. Tata McGraw Hill Publishing Company Ltd., New Delhi.

10. An Introduction to Embryology: Balinsky (1981) 5th Ed. (CBS College Publishing).
11. Embryonic and foetal development. Cambridge University Press by Austin and Short, 1982, 1994 2nd Ed.
12. Marshall's Physiology of Reproduction Longmont, Green and Co. London Vol. 1 &2. Lamming 1984, 2000.

GONDWANA UNIVERSITY

GADCHIROLI

SYLLABUS

BOTANY

M.Sc. Part-II

Semester III & IV

M. Sc. Botany Syllabus

Semester IV

Course code/name: Paper- XIII : Plant conservation, IPR and Ethnobotany

Module I

Plant biodiversity – Concept of Biodiversity; Types (Species, Genetic, Ecosystem diversity. Present status in India

Origin of Biodiversity; values of Biodiversity; loss of Biodiversity.

Megabiodiversity Centers with special emphasis on Western Ghats and Indo-Burma region

Biodiversity and agriculture; Bioprospecting; commercial values of Biodiversity.

CBD – General account

Module II

IUCN – General account, categories, Commissions, role in conservation; Red Data Book

CITES – General account, CITES & International trade

Strategies for conservation

Protected areas concept: Sanctuaries, National parks, Man and Biospere programme, Biosphere reserves

Tiger reserves with reference to Melghat Tiger Project, Tadoba Andhari Tiger Reserve and Pench)

Wetlands – Types, Importance, Measures taken for conservation at National and International levels, Ramsar Convention

Mangroves – Types, Zonations, Importance, Measures taken for conservation at National and International levels

Module III

Coral Reefs – Types, importance, artificial reefs, conservation measures

Legislative framework for protection

Principles and practices for *Ex- situ* conservation, Botanical gardens, Field Gene Banks, Seed Banks.

In-vitro repositories, Cryobanks,

General accounts and activities of national institutes like Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Department of Biotechnology (DBT) and their role in plant conservation

Module IV

Intellectual property right; patenting: basic requirement, novelty, public domain; plant variety ptotection act; farmers right protection act; WTO with reference to biotechnological affairs

Ethnobotany: Definition, scope and significance. Status in India Major tribes of Maharashtra – Madia, Korku, Gond, Bhil, Varli (information on customs, traditions, plants used as medicines, scarcity food); Important medicinal plants used by tribals in Vidarbha; Sacred groves and their role in conservation.

M. Sc. Botany Syllabus

Semester IV

Course code/name: Paper- XIV : Plant resource utilization, Bioethics, Biosafety, Plant breeding and Biostatistics

Module 1:

Centres of diversity of domesticated plants; Green revolution.

Important fire wood and timber yielding plants; qualities of timber plant, Non-wood forest products (NWFPs) such as Bamboos and rattans

Origin, evolution and uses of food crop (rice and pigeonpea), Fibre crop (Cotton, jute), Vegetable oil yielding crop (Safflower, Sunflower),Sugar and biomass crop (Sugarcane, Beet)

Source, types and uses of – gums, resins, tannins and dyes

A brief account of major spices, condiments, narcotics, mastigatories and fumitories and beverages

Fodder and forage plants

Medicinal and aromatic plants

General account of petrocrops

Module 2:

Sampling-Sampling procedure, homogenization of samples, samples size, Selection of random sample, Limitation of analytical methods

Types of data, Frequency distribution, Measure of central values - Mean, median and mode, **Measures of dispersion** - range , mean deviation , standard deviation, coefficient of variation, moment, Statistical Inference of Qualitative & Quantitative Variables, level of significance, Chi square test & its applications, One-Way ANOVA, Two way ANOVA, t-test

Module 3:

Population genetics: Hardy-Weinberg equilibrium and deviations from it; quantitative trait loci (Kernel colour in wheat, corolla length in *Nicotiana longifera*).

Plant breeding: Methods of breeding sexulally (self and cross pollinated) and vegetatively propagated crops; heterosis and inbreeding depression and their genetic basis; use of male sterility in hybrid production.

Bioethics: Professional ethics, ethical decision making and ethical dilemmas

Module 4:

Biosafety in the laboratory institution: Laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, prudent biosafety practices in the laboratory/ institution

Biosafety regulations in the handling of recombinant DNA processes and products in institutions and industries, biosafety assessment procedures in India and abroad

Biotechnology and food safety: The GM-food debate and biosafety assessment procedures for biotech foods & related products, including transgenic food crops, case studies of relevance.

Ecological safety assessment of recombinant organisms and transgenic crops, case studies of relevance (Eg. Bt cotton).

Biosafety assessment of biotech pharmaceutical products such as drugs/vaccines etc.

International dimensions in biosafety: Catagena protocol on biosafety, bioterrorism and convention on biological weapons

Suggested Readings :

1. Arora, P. N. & Malhon, P. K., 1996 Biostatistics. Himalaya Publishing House, Mumbai.
2.
3. Campbell, R. C. 1974 Statistics for Biologists. Cambridge University Press, Cambridge.
4. Cochran, W. G. Sampling Techniques, Wiley estern Ltd, New Delhi.
5. Daniel, W.W. 2004, Biostatistics. 8th Edn. Wiley
6. Donald T. Haynie, Biological thermodynamics. Cambridge University Press, 1st edition.
7. Felller, W. Introduction to probability theory and its applications, Asia Publ. House, Mumbai.
8. Glover, T. and Mitchell, K. 2002, An introduction to Biostatistics. McGraw-Hill , N.Y.
9. Intellectual Property Rights - Brigitte Anderson, Edward Elgar Publishing
10. Intellectual Property Rights and the Life Sciences Industries - Graham Dutfield, Ashgate Pub.
11. WIPO Intellectual Property Handbook
12. Intellectual Property Rights - William Rodelph Cornish, David Clewelyn
13. Biotechnology-The science and the business Mosses V, Cape RE,2nd edn., CRC press 2000.
14. Patterns of Entrepreneurship - Jack M. Kaplan
15. Indian Patents Law, Mittal, D.P. (1999) Taxmann, Allied Services (p) Ltd.
16. Handbook of Indian Patent Law and Practice - Subbaram , N. R. , S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.

Websites:1. Intellectual Property Today : Volume 8, No. 5, May 2001, www.iptoday.com

2. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000. www.ipmatters.net/features/000707_gibbs.html

SPECIALIZATION

Molecular Biology and Plant Biotechnology

Semester IV

Course code/name: Paper-XV : Molecular Biology and Plant Biotechnology (special) I

Module I:

DNA replication: DNA **r**eplication in prokaryotic organism – Initiation, elongation, and termination, DNA replication in eukaryotes – origin, replication form, replication proteins, Comparative account of DNA replication in prokaryotes and eukaryotes, DNA replication proteins

DNA damage and repair: Types of DNA damage, factors for DNA damage,

Repair system: Single base change, direct repair, mismatch repair, SOS response.

Module II:

Isolation of gene and nucleotide sequence: DNA manipulation enzymes; General methods of gene isolation.

Molecular probing: Recombinant DNA libraries (gDNA and cDNA, oligonucleotide probes); nucleic acid hybridization (southern, northern, dot-blot and slot-blot); antibodies as probe for proteins (immunoblotting or western blotting, immunoprecipitation, southwestern screening).

Module III:

Splicing of foreign DNA into cloning vector: Vectors for prokaryotes; ligation.

Introduction of foreign DNA into host cell: Transformation; transfection; transgenesis

Isolation of genes or protein products from clones: Expression vectors-Characteristics; vectors producing fusion proteins

Polymerase chain reaction: Types of PCR's and their applications in molecular biology

Module IV:

Sequence alignment and phylogenetic trees: Dot plots, sequence similarity, pairwise and multiple alignment, significance of alignment, phylogeny and phylogenetic trees and evolution.

Genomics: Definition; genome analysis (genetic polymorphisms, genetic mutations); microarray technology and applications (gene expression and diseases).

Proteomics: Protein stability and folding; application of hydrophobicity; DALI (Distance-matrix alignment); Protein structure- evolution, classification, prediction and modeling, prediction of function. DNA microarrays, mass spectrometry, network and graphs, protein complexes and aggregates, protein interaction networks, regulatory networks.

Practicals:

1. Detection of DNA damage by mutagens
2. Bacterial transformation and selection of transformed cells.
3. To detect molecular polymorphism of different species
4. To demonstrate the presence of particular polypeptide by Western blotting.
5. To design PCR primers for isolation of given gene and to clone it in the given vector.
6. Amplification and sequencing of nr DNA by PCR
7. To find the sequences of a given protein in SWISS-Prot, Uni-Prot
8. To work out the sequence from given autoradiogram and to identify it from GeneBank by BLAST method.
9. To generate Pairwise and multiple sequence alignment of a given organisms
10. To generate phylogenetic tree using given sequences.
11. To predict a protein from given sequence by using online tools from NCBI.

Suggested Readings(for laboratory exrcises)

1. Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
2. Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics.
3. McEntyre, J.; Ostell, J., editors Bethesda (MD) The NCBI Handbook: National Library of
4. Medicine (US), NCBI; 2002-2005
5. Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.
6. Tools & updated literature available at www.ncbi.com

References: Online journals available on UGC V-SAT programme.

Suggested Readings:

1. Alberts, Bruce; Johnson Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter,
2. Peter, C. 2002 Molecular Biology of the Cell, Garland Science, New York and London.
3. Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
4. Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics
5. Bergman, N.H 2007 Comparative Genomics_Humana Press Inc., Part of Springer Science+ Business Media
6. Brown, T. A. 1999. Genomes, John Wiley & Sons(Asia) Pvt. Ltd., Singapore

7. De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.
8. Glover, D.M. and. Hames, D.B 1995 DNA Cloning : A practical approach, R.L. Press, Oxford.
9. Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.
10. Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
11. Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.
12. Lehninger' Principles of biochemistry-Nelson, Cox, 4th Edn., W.H.Freeman and Co.,2005.
13. Lewin, B. 2000 Gene VII Oxford Univ. press, New York.
14. Lewin, B. 2010 Gene X Oxford Univ. press, New York.
15. Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA
16. Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi
17. Old and Primrose , 1994, Principles of gene manipulation. Blackwell Scientific Publ.
18. Raymond Schuler and Zielinski, E. 2005, Methods in plants Molecular biology - Acad. Press.
19. Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA
20. Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.
21. Shaw, C.H. 2006, Plant Molecular Biology: A practical approach. Panima Pub. Corp.
22. Stryer, Berg, Biochemistry- 6th Edition, W. H. Freeman and Co.,2007.
23. Voet, D.; Voet, J.; Biochemistry – 3rd Edn. John Wiley and sonsInc., 2004.
24. Wilson Keith and Walker John 2005 Principles and techniques of biochemistry and molecular biology, 6th Ed. Cambridge University Press, New York.
25. Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

M. Sc. Botany Syllabus

Semester IV

Course code/name: Paper- XVI:(Molecular Biology and Plant Biotechnology(Special) II

Module I:

Transgenics : Cloning vectors for higher plants; Methods for gene transfer, *Agrobacterium tumefaciens* mediated- Basis of tumor formation, features of Ti and Ri plasmids, mechanisms of DNA transfer, role of virulence genes, use of Ti and Ri genetic markers, use of reporter genes and introns; Direct DNA transfer; particle bombardment; electroporation; microinjection; macroinjection; liposomes; electrophoretic; pollen tube method; pollen transformation; PEG method; transformation of monocots; transgene stability and gene silencing; chloroplast transformation.

Module II:

Applications of transformation: Herbicide resistance; insect resistance; Bt genes, disease resistance; Nutritional quality; biopesticides and biofertilizers; hazards and safety regulations for transgenic plants.

Metabolic engineering through transgenic plants: Production of secondary metabolites; industrial enzymes; biodegradable plastics (PHB and any other); edible vaccines; antibody production and other important drugs.

Module III:

Plant tissue culture: History, Culture types: Callus culture, organ culture, suspension culture for production of secondary metabolites, protoplast culture, fusion and somatic hybrids, Somatic embryogenesis, anther and pollen culture, haploid plants, somaclonal variations, organogenesis (direct and indirect).

Gene expression: Gene expression in Mitochondria, chloroplast, yeast

Regulation of gene expression: Regulation of gene expression in translation and post-translation level

Module IV:

Nitrogen fixing genes: Organization, function and regulation of nitrogen fixing genes in *Klebsiella*, *hup* genes.

DNA fingerprinting and marker assisted breeding: RFLP maps; linkage analysis; RAPD markers; STS; SSR (microsatellites); ISSR; SCAR (sequence characterized amplified regions); SSCP (single strand conformational polymorphism); AFLP; QTL: map based cloning; molecular marker assisted selection

Cleaner Biotechnology: Pollution control through genetically modified organisms.

Practicals:

1. Agrobacterium *tumefaciens* mediating gene transfer in a suitable plant
2. Elisa testing of Bt gene in cotton
3. Induction of secondary metabolite synthesis in suspension culture.
4. Isolation of secondary metabolites by gel filteration.
5. Purification of plant metabolite/ protein by column chromatography.
6. Use of RAPD/RFLP/SSCP etc. markers to detect molecular polymorphism of different species.
7. Isolation and protein profiling in different plant species by SDS-PAGE.
8. Raising of suspension culture and plotting of growth curve.
9. Bacterial transformation and selection of transformed cells.
10. DNA ligation and analysis of ligated DNA on agarose gel (cloning and analysis using GUS gene.
11. Study of expression of inducible genes at biochemical level.
12. Organogenesis and somatic embryogenesis using appropriate explants and preparation of artificial seeds.
13. Demonstration of anther culture.

Suggested Readings (for laboratory exrcises)

1. Gelvin, S. B. and Schilperoort, R. A (eds) 1994. Plant Molecular Biology Manual, 2nd edition. Kluwer Academic Publishers, Dordrecht, The Netherlands.
2. Glick, B. R. and Thompson, J. E. 1993, Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.
3. Glover, D. M. and Hames, B. D.(Eds) 1995. DNA Cloning 1: A Practical Approach: Core Techniques, 2nd edition PAS, IRL Press at Oxford University Press, Oxford.
4. Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.
5. Hall, R. D. (Ed.), 1999. Plant Cell Culture Protocols. Humana Press. Inc. New Jersey, USA.
6. Maniatis et al. Molecular cloning Vol. I, II and III. Cold-Spring Harbor Lab Press.
7. Sambrook and Russel. 2001. Molecular cloning Vol. 1-3 CSH press.
8. Shaw, C. H. (Ed.) 1988, Plant Molecular Biology : A Practical Approach. IRl Press, Oxford.
9. Smith, R. H. 2000. Plant Tissue Culture : Tecniques and Experiments. Academic Press, New York.

References: Online journals available on UGC V-SAT programme.

Suggested Readings:

1. Alberts, Bruce; Johnson, Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter,
2. Bhojwani SS and Rajdhan MK 1996 Plant tissue culture: Theory and Practice. Elsevier Sci. Publ., New York
3. Peter c2002 Molecular Biology of the Cell, New York and London: Garland Science.
4. Callow, J. A., Ford-Lloyed, B. V. and Newbury, H. J. 1997. Biotechnology and Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.
5. Charlwood, B. Y. and Rhodes, M.V. 1999 Secondary products from plant tissue culture, Clarendon Press. Oxford.
6. Chrispeeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture. Jones & Barlett Publishers, Boston, USA.
7. Collins HA and Edwards S 1998 Plant cell culture. BIOS Sci. Publ., Oxford UK
8. Dicosmo F and Misawa, M. 1996 Plant Cell culture: Secondary metabolism towards industrial application, CRC press, Boca Raton, NewYork.
9. Glazer, A. N. and Nikaido, H. 1995. Microbial Biotechnology. W. H. Freeman & Company, New York, USA.
10. Gustafson, R. J. 2000. Genomes. Kluwer Academic Plenum Publishers, New York, USA.
11. Henry, R. J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK.
12. Jain SM, Sopory SK and Veilleux RE 1996 In vitro haploid production in higher plants. Vols. 1-5. Kluwer Acad. Publ., The Netherlands
13. Kurz, W.G.W 1989 Primary and Secondary metabolism of plant and Cell cultures, Springer Verlag, Berlin.
14. Old, R. W. and Primrose, S. B. 1989. Principles of Genome Analysis. Blackwell Scientific Publications. Oxford, UK.
15. Primrose, S. B. 1995. Principles of Genome Analysis. Blackwell Scientific Ltd., Oxford ,UK.
16. Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.
17. Shantharam, S. and Montgomery, J. F. 1999. Biotechnology, Biosafety, and Biodiversity. Oxford & IBH Publication Co., Pvt., Ltd., New Delhi.

SPECIALIZATION

Reproductive Biology of Angiosperms

Semester IV

Course code/name: Paper XV : Reproductive Biology of Angiosperms (Special) I

Module I:

General: Need for reproductive system as experimental material, Interdisciplinary approaches: genetic and molecular perspective,

Anther: Structure, anther wall;: endothecium, middle layer, tapetum-Structure, types-structure-function relationship, role of tapetum, microsporogenesis- sporogenous cells cytoplasmic reorganization during sporogenesis (Ultrastructural changes), molecular biology of meiosis, DNA and RNA synthesis, Protein synthesis, meiosis specific genes. Pollen tetrad development, pollen wall proteins, adaptive significance of pollen wall,

Module II:

Male gametophyte development: formation of vegetative and generative cells, differential behavior of sperms, gene expression during pollen development.

Pollen: Physiological and biochemical aspects, pollen storage, viability causes for loss of viability. pollen abortion and male sterility, structural, developmental and functional aspects of male sterility environmental factors, role of mitochondrial genome in male sterility, gametocides.

Module III:

Pistill: Carpel determination, ovule and its structural details.

Megasporogenesis: Meiosis, functional megaspores, organization of female gametophyte structure of the embryo sac, egg, synergid-ultrastructure, role central cell, antipodal cell, haustoria, cytoskeleton of the embryo sac, enzymatic isolation of embryo sac, types of embryo sac, nutrition of embryo sac.

Module IV:

Pollination-pollination mechanism, biotic and abiotic pollination, floral attractants and rewards,

Pollen-pistil interaction; The stigma-Types and structure, stigmatic exudates, style-transmitting tissue, canal cell, post pollination events (stigma receptivity, pollen adhesion, pollen hydration, pollen germination and pollen tube growth, biochemistry of pollen germination, RNA and protein metabolism during pollen tube, calcium gradient in the pollen tube (Chemotropism) pollen allelopathy.

Incompatibility: General concept, self incompatibility (Intraspecific type) heteromorphic, homomorphic types, mechanism of self compatibility, importance of self compatibility, methods of overcoming self incompatibility, Parasexual hybridization,

M. Sc. Botany Syllabus

Semester IV

Course code/name: Paper XVI : Reproductive Biology of Angiosperms (Special) II

Module I:

Fertilization: Cellular nature of sperm, the sperm cytoskeleton, the male germ unit, isolation and characterization of sperm, growth of the pollen tube through the style, passage of sperm into the embryo sac, fussion of nuclei, double fertilization, triple fussion, unusual features. In-vitro approaches to the study of fertilization-Intra-ovarian pollination, test tube fertilization, in-vitro fertilization, placental pollination, Gynogenesis.

Endosperm: types of endosperms, ruminate endosperm, cytological status. endosperm haustoria, chemical composition of endosperm, food reserve in endosperm, role of endosperm in embryo development, endosperm mutants.

Module II:

Embryogenesis: Zygote and its ultra-structure, milieu of the developing embryo, symmetry and polarity, rest period in zygote embryonic formulae, embryonomic law.
Suspensor-Ultra structure of suspensor cells, cytology of suspensor cell, physiology and biochemistry of suspensor; Nutrition of embryo- nutrient supply of the zygote, embryo-endosperm relation.

Polyembryony: Defination, causes, classification, induction of polyembryony, practical importance of polyembryony.

Module III:

Apomixis: Defination, causes, classification, - Diplospory, Apospory, pseudogamy, autogamous development of endosperm, causes of apomixes, significance.

Parthenocarpy: Defination, causes, practical importance

Mellitopalynology : Pollen analysis of honey, Role of apiary in crop production.

Biotechnology: Concept and scope of biotechnology; Cell structure, cellular totipotency

Anther and pollen culture,

Ovule and nucellus culture

Endosperm culture and its practical applications

Embryo culture: Techniques, nutritional aspects of embryo culture morphological and physiological considerations, culture of mature embryo and proembryo.

Somatic embryogenesis: historical background, embryogenesis from callus, direct embryogenesis- recurrent embryogenesis; cytology of somatic embryogenesis, nutritional factors, hormonal factors.

Module IV:

Protoplast culture and somatic hybridization- isolation of protoplast, culture methods, fussion of protoplast, selection of fussion products, consequences of fussion, production of Cybrids and hybrids.

Biotransformation and production of useful compounds through cell culture, factor affecting yield, biotransformation, bioreactors, perspective.

Practicals :

1) Study from the permanent preparations.
   a) Development and structures of anther pollen.
   b) Structure of ovule, types, megasporogenesis, embryo sac types.
   c) Development of endosperm, types.
   d) Structure and development of embryo- types
   e) Pericarp and seed coat structure from sections and macerations.
   f) Sketching of ovular structure, embryo sac, anther wall, embryo with the help of camera lucida.
2) Techniques, Familiarity with phase contrast, polarizing, fluroscence and electron microscopy, wholemounts, fissection and macerations, permanent double stained microtome sections, photo microscopy.
3) Preparation of dissected wholemounts of endothecium, tapetum, endosperm and embryo, squash preparations of tapetum, microspore mother cells, dyads, tetrads pollinia and massulae. Study of mitosis and meiosis and identification of various stages.
4) Study of different pollen using acetolysed and non acetolysed pollen, preparation of permanent slides for morphological study. (polarity, symmetry, shape, size, aperture, sporoderm stratification: minimum 15 slides to prepare).
5) Interpretation of electron micrographs (SEM, TEM) of pollen.
6) Short term exercises on pollen production, viability and their percentage of germination. Rate of growth of germ tube to be studied in a given period.
7) Viability of seed through germination, biochemical and excised embryo methods.
8) Cytology of pollen inhibition in self and interspecific incompatibility, application of some technique to overcome incompatibility.
9) Experiments on intra- ovarian pollination.
10) Experiments on plant tissue culture. Technique- washing. Sterilization, preparation of media, storage of media, inoculation, callus initiation, proliferation.
11) Responses of calli to stress condition viz. temp, (low, high), moisture, salinity.
12) Induction of androgenesis through anther culture.
13) Physiology of embryo development, using electropheratic and histochemical methods embryo culture.
14) Somatic embryogenesis
15) Protoplast culture.

Suggested Readings:

1. Asker S. 1979, Progress in apomixis research. Hereditas 91, 231-240.
2. Barnier, G. 1986, The flowering process as an example of plastic development. Soc. Expt.. Biol. 40: 257-286.
3. Barth, F.G. 1991, insects and flowers, Princeton Univ. Press. Princeton.
4. Battaglia, E. 1963. Apomixis In recent advances in the embryology of angiosperms (ed P. Maheshwari), pp- 264, Intt. Soc. Plant Morphologists, Univ. Delhi.
5. Bhandari N. N. 1984, The microsporangium in embryology of angiosperms (ed B.M. Johri) Springer- Verlag, Berlin, pp. 53-121.
6. Bhandari N.N., M. Bhargava and P. Chitralekha 1986, Cellularization of free nuclear endosperm of *Pappaver somniferum* L. Phytomorphology, 36, 357-366.
7. Bhojwani S.S. and M.K. Rajdan 1983, Plant tissue culture, Theory and Practice Elsevier, Amsterdam.
8. Boesewinkel F.D. and Boman F. 1984, The seed structure in embryology of angiosperms (ed B.M.Johri), Springer- Verlag, Berlin, pp. 567-610.
9. Bouman F. 1984 The ovule in embryology of angiosperms (ed B.M.Johri), Springer-Verlag, Berlin, pp. 123-157.
10. Cartson P.S., Smith N.H., Dearing R.D. (1972) Parasexual interspecific plant hybridization. Proc. Nat. Acad. Sci. USA, 69, 2292-2294.
11. Cartson P.S. (1973) The use of protoplasts of genetic research. Proc. Nat. Acad. Sci. USA, 70, 598-602.
12. Chitralekha P. and N.N. Bhandari 1991, Post fertilization development of antipodal cells in *Ranunculus scferatus*. Phytomorphology 41, 200-212.
13. Ciampolini F.M., Nepi and E. Pacini 1993, tapetum development in *Cucurbita pepo* (Cucurbitaceae) Pt. Syst. Evol. (Suppl) 7-13-22.
14. Cocking E.C. 1960, A method for the isolation of plant protoplasts and vacuoles. Nature (London) 187-927-929.
15. Cocking E.C. 1970, Virus uptake, cell wall regeneration and virus multiplication in isolated plant protoplasts. Int. Rev. Cytol 28-89-124.

SPECIALIZATION

Mycology and Plant pathology

M. Sc. Botany Syllabus

Semester IV

Course code/name: Paper- XV : Mycology and Plant pathology (special) I

MODULE I: General Microbiology :

Bacteria – Morphology, size, shape, structure, Characters of Eubacteria, Actinomycetes, Archaebacteria, Bacterial nutrition, reproduction.

Viruses – General Characteristics, structure, classification (LHI System), replication (lytic cycle & lysogeny)

Rikettsia – General characters

MODULE II: Mycorrhiza :

Kinds of mycorrhizae : Ectotrophic and endotrophic mycocrhizae, their morphology and anatomy. V A - mycorrhiza. Importance of mycorrhiza in Agriculture.

Rhizoshere and phyllosphere - General concept and importance.

Medical Mycology - Dermatophytic fungi - Knowledge of common dermatophytes and human diseases caused by them viz. *Tinea pedis. Tinea capitis*, *Tinea barbae. Tinea*, *corporis* and *Tinea manuum*, Non-dermatophytes.

MODULE III: Production of Metabolites By Fungi:

Industrial Fungal Metabolites:

Antibiotics - Penicillin, Cephalosporin, Griseofulvin, Industrial production. of Penicillin

Enzymes -. Amylase, proteases, Lipases, Pectinases, Cellular and xylanases.

Organic acids - Critic acid, Gluconic acid, lactic acid, kojic acid. Itaconic acid.

Non Industrial Fungal Metaboilites :

i) Phytoalexins ii) Mycotoxins

MODULE IV :Fungi as welfare to human beings:

Fungi in food processing

Fungi in Medicine

Fungi as food - edible mushrooms, methods of their cultivation and economic importance.

Concept of biodeterioration and Biodegradation

Biodeterioration of noncellulosic materials.

Biodeterioration of cellulosic materials.

Role of microorganisms in Biodegradation of organic wastes. Factors affecting the process of Biodegradation.

M. Sc. Botany Syllabus

Semester IV

Course code/name: Paper- XVI : Mycology and Plant Pathology (special) II

Module 1:

History : Milestones in phytopathology with particular reference to India. Major epidemics and their social impacts. Historical developments of chemicals, legislative, cultural and biological protection measures including classification of plant diseases.

Physiological and Molecular Plant Pathology

Altered metabolism of plants under biotic and abiotic stresses. Molecular mechanisms of pathogenesis: recognition phenomenon, penetration, invasion, primary disease determinant.

Module II: Principles of Plant pathology

Principles of plant pathology- Importance, nature, classification and general symptoms of plant diseases.

Koch's Postulates: Pathogenecity of microorganisms and pathogenesis.

Host parasite relationship and Interaction, mechanism of infection, path of infection. .

Defence mechanism in host plants against pathogens - morphological or structural defence mechanism, Biochemical defence mechanisms, defence, role of phenolic compounds, enzymes and toxins,

Epidemiology and forcasting of plant diseases- the form of epidemic conditions for decline of epidemic, methods used in forecasting. .

Principles and methods of plant disease control - cultural methods, chemical methods, Biological control , integrated pest management (IPM), Biopesticides.

Module III :

A Detailed study of the Diseases of the following crops caused by fungal pathogens with effective control measures.

Diseases of Cereals :

Seedling blight of cereals, Smut of wheat, Foot rot of wheat, Loose smut, Covered smut of Barley, False smut of rice, Leaf spot of rice, Downey mildew of jowar, Green ear disease of Bajra, Ergot of Bajra, Downey mildew of maize.

Diseases of Vegetable crops with special reference to the important diseases of the following:

Chilli, Brinjal, Tomato, Potato, Coriander, Ginger, Onion, Bhindi.

General knowledge of post harvest diseases of fruits and vegetables and their control.

Diseases of Oil Seed Crops:Viz. - Linum, Seasamum, Groundnut, Mustard and Sunflower

Diseases of Fruit Trees-

With special reference to important diseases of the following Citrus, Apple, Mango, Papaya., Banana and Grapes.

Module- IV :Bacterial Diseases of Plants:

Important Pathological aspects of the following bacterial diseases.

Bacterial blight of rice, Tundu disease of wheat, Angular leaf spot of cotton, stalk rot of maize, Fire blight of Apple, Bacterial soft rot of fruits and Vegetables. .

Viral Diseases of Plant :

Bunchy top of Banana, Leaf curl of Papaya, Yellow vein mosaic of Bhindi. Mosaic of .Cucurbits, Viral diseases of Tobacco, Potato and Tomato.

Mycoplasma Diseases of Plants :

Citrus greening, Rice yellow dwarf: Little leaf of Brinjal, Sandal Spike.

Nematode Diseases of Plants :

General knowledge of plant parasitic nematodes and Important nematode diseases viz. Root knot of Vegetables, Ear cockle of wheat..

Laboratory Exercises:

1. Principles & working of tools, equipments and other requirements in the Mycology & Plant Pathology laboratory.
2. Micrometry and measurement of organisms.
3. Sterilization Processes viz. moist heat, dry heat, chemical and radiation.
4. Drawing of Camera Lucida diagrams and knowledge of computer based photomicrography and image processing
5. Preparation of different cultural media for cultivation of Fungi and Bacteria.
6. Monitoring and analysis of Aeromycoflora.
7. Isolation & identification of Phyllosphere mycoflora.
8. Demonstrate antifungal activities of different antibiotics and leaf, flower and root extract.
9. Study of toxicity of fungi in relation to seed germination, and seedling abnormality.
10. Cultivation of Mushrooms.
11. Demonstration on biodegradation of organic waste.
12. Isolation of Soil fungi by soil plate (War cup) and serial dilution (Walksman) method.
13. Isolation and identification of Rizosphere mycoflora.
14. Isolation of external and internal seed borne mycoflora by blotter and Agar Plate method. Cereals, pulses, oil seeds, fruit seeds.
15. Demonstration of Koch's Postulate.
16. Monographic study of locally available plant diseases caused by fungi (atleast 10).
17. Study of locally available crop plant diseases caused by Bacteria (Five)
18. Study of locally available plant diseases caused by viruses & Phytoplasma (Five)
19. Demonstration of morphological & physiological changes in disease plants.
20. Preparation and presentation of herbarium of pathological specimens available in the region (Atleast 20)
21. Field visit to different localities

Visit to Agriculture University, Plant Pathological research centers

Suggested Readings .

1. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
2. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.
3. Alexopoulos, C.J. (1962). Introductory Mycology John Wiley Eastern Pvt.Ltd.
4. Alexopoulos, C.J. and Mims C.W. (1979). Introductory Mycology 3rd Edition, John Wiley and Sons, Inc. Wiley, New York.
5. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York
6. Aneja, K.R. (1993) Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
7. Bessey, E.A. (1950) Morphology and Taxonomy of Fungi. The Blakiston co. Philadelphia.
8. Bilgrami, K.S. and H.C.Dube (1985) A text Book of Modern Plant Pathology, Vikas Publication House, New Delhi.
9. Barnett, J.H. (1968) Fundamentals of Mycology. The English Language Book Society and Edward Arnold Publication, Limited.
10. Dube, R.C. and D.K.Maheshwari (1999) A.Text Book of microbiology, S.Chand & Co. Ltd.
11. Dube, R.C. and D.K.Maheshwari (2000) Practical Microbiology - S.Chand & Co. Ltd.
12. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.
13. Jha, D.K. (1993) A Text Book of Seed Pathology, Vikas Publication House.
14. Mehrotra, R.S. (1989) Plant Pathology, Tata McGraw Hill.
15. Mehrotra, R.S. and K.R.Aneja (1998) An Introduction to Mycology, New Age Intermidiate Press.
16. Pelzer, M.J. , Jr.Cahn, E.C.S. and N.R.Krieg (1993) Microbiology, Tata McGraw Hill.
17. Preece and Dickeson. Ecology of leaf surface microorganism Academic Press, New York.
18. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall of India.
19. Raychoudhari, S.P. and Nariani, T.K. (1977) Virus and Mycoplasma Diseases of Plant in India, Oxford and IBH Publication Co.
20. Schlegel, H.G. (1996) General Microbiology, 7th Edition, Cambridge University Press.

21. Snowdon, A.L. (1991) A colour Atlas of Post harvest diseases & disorders of fruits & vegetables Vol.I & II Wolfe Scientific, London.
22. Sunder Rajan, S. (2001) Tools and Techniques of Microbiology, Anmol Publ.New Delhi.
23. Thind, T.S. (1998) Diseases of field crops and their management, National Agricultural Technology, Information Centre, Ludhiana.
24. Vaidya, J.G. (1995) Biology of the fungi, Satyajeet Prakashan, Pune.
25. Walker, J.G. (1952) Diseases of Vegetables Crops. McGraw Hill, New York.
26. Walker, J.C. (1968) Plant Pathology, McGraw Hill, New York.
27. Eggins, H.O.W. and Allsop (1975) The Filamentous Fungi Vol. I Industrial Mycology (Biodetoriation and Biodegradation by Fungi) Eds. J.E. Smith and D.R. Berry Edward Arnold, London.
28. Emmons, C. W., C. H. Bin ford, J.P. Utz and Know Chung (1977) Medical Mycology, Lea and Febigo, Philadelphia.
29. Holliday, P. Fungus disease of tropical plants (1980), Cambridge University Press, Cambridge.

On line Journals available on UGC -VSAT

SPECIALIZATION

Palaeobotany

M. Sc. Botany Syllabus

Semester IV

Course code/name:Paper- XV : Palaeobotany (special) I

MODULE – I:

Introduction to the science of Petrology- The earth zones, chemical composition of earth crust. The classification of rocks i.e.Endogenetic and Exogenetic (igneous, metamorphic and sedimentary) and their brief account.Glaciations, volcanic eruption and earthquake.

MODULE –II

Geological column and time scale.Physiography of India.Fossilisation, modes of preservation, preparation and age determination and techniques.Systematics, reconstruction and nomenclature. Life in Precambrian, greening of earth –speculation.

MODULE –III:

Study of Rhyniopsida (primitive vascular plants) Cooksonia, Steganotheca, Uskiella, Renalia, Horniophyton, Aglophyton, Zosterophylopsida (ancestors of microphyllous plants) Zosterophyllum, Sawadonia, Asteroxylon. Prelycopods and Lycopsida-Hebaceous Lycopods of Devonian –Baragwanthia, Protolepidodendron and Miadesmia, Arborescent Lycopods of Carboniferous-study of Lepidodendrales members.

MODULE –IV:

Shpenopsida-Its origin and evolutionary consideration .Study of Hyeniales and Sphenophyllales .Horsetails and their relatives-Calamitales members.Filicopsida-Study of primitive ferns and their relatives- Cladoxylales, Stauropteridales, Zygopteridales.Filicales-classification and study of its members, Coenopteridales-Ankyropteris. Marratiales - Psaronius.

Suggested Laboratory and Field Exercises for Paper I

1. Stratigraphy Maps of the India and World
2. Geological Maps of India
3. Geological column and time scale.
4. Study of different rocks.
5. Different techniques to study fossils. (Ground sectioning, peel technique) Study different types of fossils
6. Study of plant fossils as per syllabus based on specimens and slides.
7. Study of Rhyniopsida (primitive vascular plants)
8. Arborescent Lycopods of Carboniferous-study of Lepidodendrales members
9. Sphenophyllales, Calamitales members.
10. Studyofprimitive ferns and their relativesCladoxylales,Stauropteridales,Zygopteridales.Filicales-Coenopteridales-Ankyropteris.Marratiales - -Psaronius
11. Preparation of practical record.

M. Sc. Botany Syllabus

Semester IV

Course code/name: Paper- XVI : Palaeobotany (special) II

MODULE –I:

Gymnospermopsida-- Study of Aneurophytales and Archaeopteridales.Gymnosperm and early evolution (Archeosperma, Elkinsia, and Morentia) of seed habit stages in evolution. Study of Pteridosprmales-Lyginopteridaceae, Medullosaceae, Cycadeoidales-Cycadeoidaceae, Williamsoniaceae, Wielandiellaceae.and Fossil Cycads (Nilssonia, Baenia, Androstrobus).

MODULE -II:

Gymnosper- Caytoniales, Glossopteridales, Penntoxylales.fossil Cordaitales, Voltziales and phylogenenetic consideration of all the orders.

MODULE –III:

Study of Deccan Intertrappean flora of India. Formation of Deccan traps and Intertraps, age and its floristic composition in relation to Pteridophytes, Gymnosperms and Angiosperms.Palecimate and Paleogeography of Deccan Intertraps.

MODULE – IV:

Paleopalynology-Important features of spores and pollen morphology, their role in stratigraphy and in exploration of coal and oil.Palaeopalynological studies, microfossils and its application.Paleoecology and paleogeography.

Indian Gonwana-Its stratigraphy and classification (Two fold and three fold). Index fossil.

Suggested Laboratory and Field Exercises for Paper II

1. Study different types of fossils
2. Study of plant fossils as per syllabus based on specimens and slides.
3. Gymnosperm- Caytoniales, Glossopteridales, Penntoxylales.fossil Cordaitales.
4. Lyginopteridaceae, Medullosaceae, Cycadeoidales-Cycadeoidaceae, Williamsoniaceae, Wielandiellaceae.and Fossil Cycads (Nilssonia, Baenia, Androstrobus).
5. Study of Deccan Intertrappean flora of India. Pteridophytes, Gymnosperms and Angiosperms-flowers and fruits.
6. Important features of spores and pollen morphology and technique to study them (Maceration)
7. Study of wood anatomy of fossils.
8. Exploration and excursion to different fossiliferous localities.
9. Preparation of practical record/submission of collection and tour report of excursion.

SPECIALIZATION

Palynology

Semester IV

Course code/name:Paper- XV : PALYNOLOGY (special) I

MODULE -I: -

General aspects of Palynology: -Historical background, Definition , basic concepts, scope, inter-relationship with other branches of Botany, Applications, Indian work on Palynology, Palynological centres in India.

Microsporogenesis : Stamen initiation, anther differentiation- anther initiation, anther wall, Tapetum, structure and functions, its role in pollen development, Functions of callose wall, pollen/microspore and wall development, production and deposition of sporopollenin.

Pistil : Structure and function of stigma and style, stigma receptivity and its importance.

MODULE II: -

Pollination Biology -Origin of pollination biology/anthecology, Spore and pollen dispersal in lower plants and gymnosperms,

Pollination in angiosperms- types of pollination, floral adaptation to different pollinators (mode, style) flowers pollinated biotically (Hymenoptera, Diptera, Coleoptera, Lepidoptera, birds, bats) and abiotically (wind, water), pollination-plant interactions and evolution of breeding systems, special devices associated with pollinator attraction - pollen, nectar, Elaiophores, resin glands, osmophores, floral scent and perfume flowers.

Palaeopalynology: - Palynomorphs, their preservation in diverse lithic types, techniques involved in the recovery and concentration of spores and pollen from clays, shales, coals and lignites. Maceration techniques, Application of Palynology in relation to oil and coal exploration. Role of spores and pollen in stratigraphy, index spores.

MODULE III: -

Phylogeny of Pollen and spores, **Systematic palynology**-monocotyledoneae and dicotyledoneae, evolutionary trends among pollen grains based on palynotaxonomical works,

Palynology of spores / pollen- Algae, Fungi, Bryophytes, Pteridophytes and pollen types of Gymnosperms.

Pollen morphology of Angiosperms.: -

Introduction- Pollen units, polarity, symmetry, Shape, size, Apertures size, shape of the pollen grain, saccate pollen grain, sporoderm stratification, Apertures-NPC System of classification, Apertural types, Exine ornamentation, LO analysis

Pollen wall morphogenesis, evolutionary trends in exine structure, trends of evolution in apertural pattern,

Techniques for the preparation of pollen slides, Light and scanning election microscopic studies of pollen, significance of SEM and TEM studies.

MODULE -IV:

Melittopalynology- pollen analysis of honey-methods, qualitative and quantitative, social behaviour of honey bees, floral fidelity, foraging behavior, geographical and floral origin of honey, its' chemical analysis, adulteration of honeys, physical characteristics of honey, honey quality standard, deterioration of honey, heavy metal contamination in honey, honey as environmental monitors, honey and allergy, unifloral and multifloral honey, pollen toxicity,

Applied Palynology with special reference to Agriculture and Horticulture - Bees as pollinators, role of apiaries in crop production. Bee keeping and enhanced honey production, recognition of areas suitable for honey production, use of honey in medicine, cosmetics, confectionary and other applications, pollen loads, analysis, Bee pollen, chemical composition, utility, and its role in curing various human ailments.

M. Sc. Botany Syllabus

Semester IV

Course code/name: Paper- XVI : Palynology (Special) II

MODULE –I: Pollen physiology and biochemistry-

Pollen production,

Pollen viability, tests for pollen viability,

Pollen germination of pollen in *vivo* and in *vitro*, germination requirements, germination of 3-nucleated pollen grain, effect of pH and light, effects of hormones and other substances radiation effect, release of metabolites in germination and tube growth, Role of boron and calcium in pollen germination,

Chemical composition of pollen wall and pollen contents (amino acids, proteins, carbohydrates, lipids, vitamins, pectin, DNA, RNA, ascorbic acid, flavones, pigments etc.) in pollen and pollen tube at different steps in germination & their significance, pattern of pollen tube elongation,

Fine structure inside the tube, pollen culture movements of nuclei-and formation of callose plug, promotion and inhibition of pollen tube, elongation, pollen enzymes and isozymes,

MODULE –II: Pollen biotechnology and genetics

Pollen storage-Factors affecting viability in storage, freeze-drying of pollen, storage of pollen in organic solvents, causes of decreased viability in storage and pollen germination.

Pollen - pistil interaction - significance, self incompatibility (regulation of fertilization).Pollen allelopathy, chemotropism, Pollen herbarium,

Pollen biotechnology & crop production- Anther / pollen culture, production of haploids

Genetics of pollen: Genetic segregation of pollen, pollen sterility- genic and cytoplasmic male sterility, factors involved in male sterility. Male sterility through recombinant DNA technology.

Forensic palynology- Introduction, methodology, role in criminology, problems

MODULE –III: Aerobiology

Introduction, Historical background, applications of Aeropalynology Aeromycology Aerophycology. Importance in medical field, importance of aero mycological studies in various types of crop infection by spores, disease forecasting , aerobiological work in India and abroad.

Intramural and extramural studies, different devices to collect spores, pollen grains such as kite, balloons, trap air strips and slides, volumetric samplers, culturing techniques, analysis of data and their processing, seasonal changes of air-spora

Indoor environments, Sick buildings & hazards, occupational environment and immunology,Outdoor airspora, characteristics, identification,

MODULE –IV: Airborne allergens

Introduction, allergens and their types, Impact of airborne materials on human system, Lung as particulate sampler,

Source, causes, symptoms of Pollen allergy, fungal spore allergy, dust mite allergy, algal allergy other allergies, Prevention and cure, isolation & culturing of spores, mites, algae.

antibodies to human immunoglobulin, types, and significance in diagnosis of allergy,diagnosing allergic diseases based on total and specific IgE determinations, radio immunoassay,(RAST, PRIST, ECP-immuoassay technique), ELISA (competitive, Double-antibody sandwich, indirect ELISA),Western blotting, allergen standardization, Testing and treatment, pollinosis, nasobroncheal allergy, Immunotherapy and prevention of allergy, pollen calendar and daily census of airborne pollen, circadian periodicities of pollen, Correlation between aerobiological, clinical and meteorological data.

LIST OF PRACTICALS: -

Section A. Basic aspects / Pollen Morphology

1. To study structure of stamen
2. Study of permanent slides of microsporogenesis
3. Field study on different pollination mechanism
4. To study structure of pistil
5. Preparation of glycerin jelly
6. Preparation of pollen- Acetolysis technique
7. Preparation of pollen – Wodehouse technique.
8. Study of pollen types using acetolysed and non-acetolysed pollen. Pollen morphology polarity, symmetry, shape, size, sporoderm stratification aperture NPC (To study the pollen types from at least 30 different species, Angiosperms preparation of permanent slides.)
9. Preparation and palynological description in technical language (at least 10 species of Angiosperms).
10. Interpretation of selected electron micrographs (SEM, TEM) of pollen.
11. Preparation, description and identification of spores of Algae, Fungi, Bryophytes, Pteridophytes and pollen types of Gymnosperms.

Section B. Aeropalynology/Melittopalynology/Palaeopalynology

12. Use of pollen traps to study local air-spora.
13. Analysis of aerospora slides.
14. Preparation of reference slides by different techniques, culture method (culture of fungi/Algae)
15. Preparation of slides honey samples
16. Analysis of honey samples for qualitative and quantitative study of pollen contents.
17. Estimation of pollen load from bee hive or bees/ pollinator
18. Analysis of coal samples for microfossils with special reference to pollen and spores.
19. Preparation of allergenic extract of pollen.

Section C Pollen Physiology/ecology/biochemistry/ecology. (Expt. No.29 is compulsory)

20. To study pollen production and pollen viability of the given flowers.
21. To study percentage of pollen germination & rate of pollen tube growth.
22. To study different techniques of pollen storage
23. Effect of temperature and relative humidity on viability of stored pollen
24. Effect on Boron and Calcium on pollen germination and tube growth.
25. Semi-vivo technique to study pollen germination and pollen tube growth.
26. Multiple staining for localizing pollen tubes in the pistil
27. To study pollen germination and pollen tube growth in the pistil by employing aniline-blue fluorescence method
28. Cytochemical localization of esterase on stigma surfaces
29. Cytochemical analysis of pollen and pollen tube for various metabolites like proteins, amino acids, carbohydrates, starch, ascorbic acid, DNA, RNA, lipids, lignin, pectin, cellulose, etc (at least five metabolites)
30. Study of pollen contents by paper chromatography/TLC.
31. Colorimetric estimation of proteins/carbohydrates of pollen grains
32. To separate pollen proteins by SDS-PAGE electrophoresis
33. Enzyme bioassay in pollen grains.

Suggested Readings .

1. Afzelius, B.M. 1956 Electron-microscope investigation into exine stratification *Grana Palynologica* (N.S.) 1:2,
2. Agashe S. N. – Paleobotany (1997) – Plants of the past their evolution paleoenvironment and applications inexploration of Fossil.
3. Agashe S. N. – Palynology and its Applications – Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Alexander M.P. (1969). Differential staining of aborted and non-aborted pollen *Stain Technol* 44:117-122.
5. Alexander, M.P. (1987). A method for staining pollen tubes in pistil. Stain Technol 62, 107-112.
6. Alexander, M.P., Ganeshan S. (1990). An improved cellophane method for *in vitro* germination of recalcitrant pollen. *Stain Technol* 64:225-227. Archaeology, *Rev. Palaeobot. Palynol* 21:171-185,
7. Baker, H.G. 1954. Aperture membranes in Studies of Pollen Morphology and Taxonomy. *Newphytologist, 54(3),*
8. Banerjee, U.C. 1965,*et al*. Exine plasticity during pollen grain maturation. *J.palynol.:* 70-89,
9. Banerjee, U.C. 1967.U!trastructure of the tapetal membranes in grasses. *Grana paIynologia: 7,2-3,*
10. Bhattacharya K., Majumdar M. and Gupta Bhattacharya S. (2006). A text book of Palynology.New Central Book Agency(P) Ltd.,Kolkata

11. Bhojwani, S .S. and S.P. Bhatnagar. 1978. The Embryology of Angiosperms. Vikas Publishing House, New Delhi,
12. Bir Bahadur 1998. Nectary biology. Datt sons publications, Nagpur Bombay,
13. Brooks. J. and G. Sha'w. 1978. Sporopollenin: A review of its chemistry, palaeochemistry and Geochemistry. *Grana. 17(2)* : 91-98.
14. Caulton Eric, Agashe S. N. - Pollen and Spores applications with special emphasis on Aerobiology and Allergy-
15. Chowdhary, J.B. and T.M. Varghese. 1968. Pollen sterility in crop plants- A review *Palyn. Bull.*IV (2).
16. Colombo P.M., Lueehin F., Colombo B. (1977). On the control of the population effect on in vitro assays of pollen germination. *J Exp. Bot*. 28:425-438.
17. Cresti, M., Gori P., Pacini E. (eds.) (1988) Sexual reproduction in higher plants. Springer, Berlin Heidelberg New York Tokyo.
18. Cronquist, A. 1968. The evolution and classification of flowering plants, Nelson, London
19. Dafni Amots, Hesser Michel, Paeini Ettore – Pollen and Pollination- Springer Wien New York
20. Davis. P.H. and V.H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London,
21. Dumas C, Knox R.B. (1983). Callose and determination of pistil viability and incompatibility. *Theor Appl. Genet* 67: 1 -10.
22. Echlin, P. Pollen. 1968. *Scientific American 218(4),*
23. EI-Gazzar and M.K. Hamza. 1973. Morphology of the twin Pollinia of Asclepiadaceae. *Pollen et spores* XV (3-4)
24. Erdtman, G, (1956) "Lo-analysis" and "Welcker's rule". *Sven Bot. Tidskr*. 50:1-7.
25. Erdtman, G. 1945. Pollen Morphology and Plant Taxonomy IV Labiatae, Verbenaceae, Avicenniaceae. *Svensk Botanisk Tidskrift. 39(3),*
26. Erdtman, G. (1966). Pollen morphology and plant taxonomy angiosperms hafner. New York.
27. Erdtman, G. (1969). Handbook of Palynology. Hafner, New York
28. Erdtman, G. 1943. An Introduction to Pollen Analysis. Chronica Botanica Co., Waltham, Mass. pp. 239,
29. Erdtman, G. 1952. Pollen Morphology and Plant Taxonomy (An Introduction to Palynology-1, Angiosperms). Aimqvist, and Wicksell, Stockholm,
30. Erdtman, G. 1956. Current Trends in Palynological Research Work *Grana Palynologica* (N.S.) 1:2,
31. Erdtman, G. 1960. The Acetolysis method revised description *Su. Bot. Tidskr.* 54(4).
32. Erdtman, G. 1964. Palynology. In: W.B. Turrill (Editor) Vistas in Botany. Macmillan Go., New York, Vol. 4:23-54,
33. Erdtman. G.1945. Pollen Morphology and Plant Taxonomy V on the occurrence of tetrads and dyads. *Su. Bot. Tidsker.* 39(3),
34. Faegri, K. 1956. Recent trends in Palynology. *Totan. Rev.* 22:639-644

35. Faegri, K. 1975..(3rd Revised Ed.) Text Book of Pollen Analysis. Blackwell Scientific Publ. Oxford,
36. Faegri, K. and J.Iversen. 1964. (2nd ed.) Text Book of Pollen Analysis. Blackwell Scientific Publ. Oxford.
37. Faegri. K. 1978. What is Polar axis? *Grana1*7: 15-16
38. Ferguson, I.K. and J. Muller (Editors). 1976. The evolutionary significance of the exine. *Linn. Soc. Symp. Ser*. No. I Academic press, London,
39. Heslop-Harrison, J. (1987). Pollen germination and pollen tube growth. *Int. Rev. Cytol*. 107:1-78.
40. Heslop-Harrison, J. 1962.Origin of Exine. *Nature,* 195 (4846): 1069-1071
41. Heslop-Harrison, J. 1971. (Editor). Pollen: Development & Physiology. Butterworths, London,
42. Heslop-Harrison, J. 1976. The adaptive significance of the exine. Academic Press. London, *Linn. Soc. Symp. Ser* 1:27-37,
43. Heslop-Harrison, Y. (1981). Stigma characteristics and Angiosperm taxonomy. *Nord J. Sot.* 1:401-420.
44. Heslop-Harrison. J. Heslop-Harrison, Y., Shivanna K.R. (1984). The evaluation of pollen quality and a further appraisal of the fluorochromatic (FCR) test procedure. *Theor. Appl. Genet* 67:367-375.
45. Heywood, V.H. 1967. Plant Taxonomy, Studies in Biology No. 5 Edward Arnold (Publ.) London,
46. Hyde, H.A. anrl D, A. Williams. 1945. 'Palynology', *Nature.* . 155-265, London
47. Iwanami, Y,, Sasakuma, T., Yamada, Y. (1988). Pollen: illustrations and scanning electron micrographs. Kodansha (Tokyo) and Springer, Berlin Heidelberg New York Tokyo
48. Jain A., Shivanna, K.R. (1988a). Storage of pollen grains in organic solvents: effect of organic solvents on ieaching of phospholipids and its relationship to pollen viability. *Ann. Bot*. 61:325-330
49. Jain A., Shivanna, K.R. (1988b). Storage of pollen grains in organic solvents. Effects of solvents on pollen viability and membrane integrity. *J. Plant Physiol*. 132:499-502.
50. Jain A., Shivanna, K.R. (1989). Loss of viability during storage is associated with changes in membrane phospholipid. *Phytochemistry* 28: 999-1002.
51. Knox,R.B., Singh, M.B. (1987). New perspectives in pollen biology and fertilization. Ann. Bot. Suppl. 4:15-37.
52. Knox. R.B., Williams, E.G., Dumas, C. (1986). Pollen, pistil and reproductive function in crop plants. *Plant Breed. Rev*. 4:9-79.
53. Koch, K.F. (1972). Fluorescence microscopy. Instruments and applications. Ernst, leitz. Wetzlar, Germany.
54. Maheshwari, P, 1978. An Introduction to the Embryology of Angiosperms, Tata McGraw-Hill Publ. Co. New Delhi
55. Mascarenhas, J.P. 1975. The biochemistry of angiosperm pollen development, *Bot. Rev* 41(3)
56. Mascarenhas. J.P. (1989). The male gametophyte in flowering plants. *Plant Cell* 1:657-664.

57. Moore, P.D., Webb. J.A. (1978). An illustrated guide to pollen analysis. Hodder and Stoughton, London.
58. Mulcahy, D.L., Ottaviano, E., (eds.). (1983). Pollen: biology and implications for plant breeding, Elsevier Biomedical, New York.
59. Muller, J. 1979. Form and Function in Angiosperm Pollen. *Ann. Missouri. Bot. Gard.*-66(4)
60. Nair, P K.K. 1965. Trends in the morphological evolution of pollen and spores. *Journs. Indian. Bot. Soc.* XLIV (4):
61. Nair, P.K.K. 1965.Pollen morphology 'of some families of monochlamydeae, *Bot. Notiser:* 118(3) Lund,
62. Nair, P.K.K. 1966.Essentials of Palynology. Asia Publ. House, Bombay,
63. Nair, P.K.K-. 1970.Pollen morphology of Angiosperms. Scholar Publ. House, Lucknow,
64. Nair. P.K.K. 1965.Pollen Grains of Western Himalayan Plants. Asia Publ. House. of pollen vedamse Book (P) Ltd. New Delhi.
65. P. K. K (1970). Pollen morphology of angiosperms. Scholar, Lucknow,
66. Pant, D. D. 1954. Suggestions for the classification and nomenclature of fossil spores and pollen grains. *Bot. Rev.* 20(1). 30-60,
67. Plummer, D.T (1987), An introduction to practical biochemistry (3rd edn). MeGraw-Hill. London (Tata Mc-Graw-Hill Edition, 1988).
68. Praglowski, J. 1971. Reticulate and allied exines. *Grana, 11(2):*
69. Ramanna, M.S.(1973). Euparol as a mounting medium for preserving fluorescence of aniline blue in plant material. *Stain Technol* 48.103-105.
70. Rangaswamy, N.S. (1977). Applications of *in vitro* pollination and in vitro fertilization. In.. Reinert J., Bajaj. YPS (eds.). Applied and fundamental aspects of plant cell tissue and organ culture. Springer, Berling**,** Heidelberg. New York, pp**.** 412-425.
71. Rowley, J.R. 1967. Fibrils, microtubules and lamellae in Pollen grains. Rev. *Palaeobotan. Palynol* 3:213-226,
72. Rowley,'J.R. 1975. Germinal, Apertural Formation in Pollen. *Taxon.* 24(l): 17-25,
73. Saad, S.I. 1963.sporoderm Stratification: The 'Medine' a distinct third layer in the pollen wall. *Pollen et spores.* 5: 17 -38
74. Shivanna, K, R. (1982,). Pollen-pistil-interaction and control of fertilization. In: Johri B.M. (ed.). Experimental embryology of vascular plants. Springer, Berlin Heidelberg New York, pp, 131-174.
75. Shivanna, K.R. (1985). Some applied aspects of pollination biology. Biol. Mem. II: 113-119.
76. Shivanna, K.R. and Johri, B M 1989. The Angiosperm Pollen:Structure and Function. Wiley Eastern Ltd., New Delhi
77. Shivanna, K.R. and Rangaswami, N.S. 1992. Pollen Biology: A laboratory manual. Narosa Publishing House, New Delhi.
78. Shivanna, K.R. Cresti, M. (1989). Effects of high humidity and temperature stress on pollen membrane and pollen vigour. *Sex Plant Reprod*. 2:137-141.

79. Shivanna, K.R., Heslop-Harrison, J. (1981). Membrane state and pollen viability. *Ann. Bot*. 47:759-779.
80. Shivanna. K.R., Linskens, H.F., Cresti, M. (l991a). Responses of tobacco pollen to high humidity and heat stress: germination in vitro and in *vivo*. *Sex Plant Reprod* 4: 104-109
81. Shukla, A.K., M.R.Vijayraghwan and B.Chaudhari (1998). Biology
82. Sowunmi, M.A. 1976. The potential value of Honey in palaeopalynology and
83. Sporne, K.R. 1972. Some observations on the evolution of pollen types in dicotyledons. *Newphytol.* 71:181-185,
84. Stanley, R.G. and H.F. Linskens. 1974. Pollen. Biology, Biochemistry management, Springer-Verlag, Berlin,
85. Stanley, R.G., Linskens, H.F. (1974). Pollen: biology. Biochemistry and management. Springer, Berlin Heidelberg New York.
86. Stanley, R.G., Search, R.W. (1971). Pollen protein diffusates. In Heslop-Harrison-J. (Ed.) Pollen: development and physiology. Butterworths, London, pp 174-176.
87. Steer, M.W, Steer, J.M. (1989). Pollen tube tip growth. *New Phytol*. 111:323-358
88. Swamy, B.G.L. and K.V. Krishnamurthy. 1980 From Flower to Fruit. Tata McGraw- Hill Publisher,
89. Takhtajan A.L. 1980. Outline of the classification of flowering plants (Magnoliophyta). *Bot.rev.* 46(3):
90. Talde U.K. 1994.Advances in Mycology and Aerobiology- Dr S T Tilak commemoration volume.
91. Thanikaimoni, G. (1978). Pollen morphological terms proposed definition-I ln Proc. IV Int. Palynol. Conf, Lucknow, Vol. 1, pp. 228-239.
92. Tilak S.T. 1982. Aerobiology, Vaijyanti Prakashan, Aurangabad
93. Tilak S.T.1989. Recent researches in Ecology, Environment and Pollution. Today & Tomorrow Pub., New Delhi
94. Tilak S.T. 1987 "Air monitoring practical Manual", Vaijanti Prakashan, Aurangabad.
95. Tilak S.T. 2009. Aeromycology. Bharati Printing Press, Pune.
96. Tilak S. T. 1989. Atlas of airborne pollen grains and fungal spores. Vaijayanti Prakashan, Aurangabad.
97. Tilak S. T. 1989. Env. Ecology and Aerobiology. Today & Tomorrow's Printers, New Delhi.
98. Tilak S T and Pande B N 1997. Aerobiology. Satyajeet Prakashan, Pune.Van Campo, M. 1967. Pollen at classification, *Rev. Palaeobotan. Palynol* 3:65-71.
99. Van, Campo, M. 1966-67. *et al*. Suppl. Electron microscopy's contribution to the Knowledge of the structure of acetolysed pollen grains, I. *Palyn Bull. II* and III
100. Vishnu-Mittre. 1964.Contemporary thought in Palynology. *Phytomolphology. 14(l):*
101. Walker, J.W. 1947.Evolution of exine structure in the pollen of primitive angiosperms. *Amer. J. Bot* 61(8):
102. Walker, J.W. and J.A. Dolyle. 1975. The basis of angiosperm phylogeny: Palynology. *Ann. Missouri. Bot. Gard*, 62. 664-723,

103. Walker, J.W. Aperture evolution in the pollen of primitive angiosperms. *Amer. J. Bot.* 61(10): 197b.
104. Walton, John. 1940. An Introduction to the Study of Fossil Plants. Adam and Charles Black, London
105. Wodehouse, R.P. 1935.Pollen Grains. McGraw Hill and Co. New York
106. Wodehouse, R.P. 1936. Evolution of Pollen Grains. *Bot. Rev.* 2- 67-89.
107. Zenkteler, M. (1980). Intra-ovarian and in *vitro* pollination. In. Vasil I, K. (ed.) Perspectives in plant cell and tissue culture. *Int. Rev. Cytol. Suppl*. 11 B: 137-156.

Practical Schedule :

Semester III

PRACTICAL V

Time : 6 Hours — Full marks : **80**

Q. 1	To perform the given Ecological exercise - [A]	15
Q. 2	Soil analysis/Ecological adaptation - [B]	10
Q. 3	One experiment from paper X - [C]	15
Q. 4	One experiment from paper X - [D]	10
Q. 5	Spotting: [E] (Paper IX), [F] (Paper IX), [G] (Paper X), [H] (Paper X)	20
Q. 6	Viva-voce	5
Q. 7	Practical Record	5

Semester III

PRACTICAL VI

Time : 6 Hours — Full marks : **80**

Q. 1	One experiment from paper XI – [A]	15
Q.2	One experiment from paper XI – [B]	10
Q.3	To describe the given plant in technical language with floral formula and floral diagram [C]	15
Q. 4	To prepare the generic/family key [D]	10
Q. 5	To identify the species of the given plant using the standard flora [E]	5
Q. 6	Spotting: [F] (Plant biotechnology), [G] (Plant biotechnology), [H] (Angiosperms)	15
Q. 7	Viva-voce	5
Q. 8	Practical Record and tour report	5

Semester IV

PRACTICAL VII
(on special paper)

Full marks : **80**

Q. 1	Experiment from paper - I	10
Q. 2	Experiment from paper - II	10
Q. 3	Experiment from paper - I	10
Q. 4	Experiment from paper - II	10
Q. 5	Spotting: E (paper - I), F (paper - I), G (paper -II), H (paper - II)	20
Q. 6	Viva-voce	10
Q. 7	Practical Record	10

Semester IV

PRACTICAL VIII

Full marks : **80**

PROJECT

GONDWANA UNIVERSITY

GADCHIROLI

SYLLABUS

BOTANY

M. Sc. Part-I and II

(Semester with credit based Pattern)

(w.e.f. session 2012-13)

APPENDIX – 1

Scheme of teaching under credit based semester system for M. Sc. Program in BOTANY.

M.Sc. I

Sr. No.	Semester	Course code / Paper	Course / paper	Title of course/ paper	Teaching Scheme		
					Theory (Hrs.)	Practical (Hrs.)	No. of Credits
1	I	BOT T I	I	Microbiology Algae & Fungi	4	--	4
2		BOT T II	II	Bryophytes & Pteridophytes	4	--	4
3		BOT T III	III	Gymnosperms and Paleobotany	4	--	4
4		BOT T IV	IV	Cytology & Genetics	4	--	4
6		BOT P I	PRACT.I	Algae, Fungi, Bryophytes	--	8	4
7		BOT P II	PRACT.II	Pterido, Gymno-Paleo, Cytology, Genetics	--	8	4
8		Seminar –I			2	--	1
8	II	BOT T V	I	Plant Physiology and Biochemistry	4	--	4
9		BOT T VI	II	Plant Development and Reproduction	4	--	4
10		BOT T VII	IIII	Cell & Molecular Biology- I	4	--	4
11		BOT T VIII	IV	Angiosperms - I	4	--	4
13		BOT P III	PRACT. III	Plant Physiology , Biochemistry, and Growth & Dev.	--	8	4
14		BOT P IV	PRACT. IV	Cell & Mol. Bio. I and Angio- I	--	8	4
		Seminar –II			2	--	1

Scheme of teaching under credit based semester system for M. Sc. Program in BOTANY.
M.Sc. II

Sr. No.	Semester	Course code / Paper	Course / paper	Title of course/ paper	Teaching Scheme		
					Theory (Hrs.)	Practical (Hrs.)	No. of Credits
15	III	BOT T IX	I	Plant Ecology	4	--	4
16		BOT T X	II	Cell and Molecular Biology - II	4	--	4
17		BOT T XI	III	Plant Biotechnology	4	--	4
18		BOT T XII	IV	Angiosperms - II	4	--	4
20		BOT P V	PRACT. V	Ecology, Cell & Mol. Biology-II	--	8	4
21		BOT P VI	PRACT. VI	Plant biotechnology & Taxonomy - II	--	8	4
		Seminar - III			2	--	1
22	IV	BOT T XIII	I	Plant Conservation, IPR & Ethnobotany	4	--	4
23		BOT T XIV	II	PRU, Biosafety, Bioethics, Biostat. & Pl. Breed.	4	--	4
24		BOT T XV	III	Special paper-I	4	--	4
25		BOT T XVI	IV	Special paper -II	4	--	4
27		BOT P VII	PRACT. VII	On Special Paper I & II	--	8	4
28		BOT P VIII	PRACT. VIII	Project	--	8	4
		Seminar IV			2	--	1

1. In each semester student will have to give seminar on any topic relevant to the syllabus encompassing the recent trends and development in that field. The topic of the seminar will be decided at the beginning of each semester in consultation with supervising teachers. The students have to deliver the seminar on the hour duration which will be followed by discussion. The seminar will be open to all the teachers of the department invitees and students.
2. The students will have to carry out the research based project work in lieu of practical in the **fourth semester** in the department or depending on the avaibility of placement, he/she will be attached to any of the national/ regional/ private research institute / organization for the duration of the fourth semester. The student will be randomly allotted the priority number for the selection of the supervisor at the begining of the third semester. The student in consultation with supervisor will finalize the topic of the project work at the third semester.
3. These course can be taught by person having post graduate qualification in relevant / equivalent subjects/ or having teaching / research experience in that particular area.

APPENDIX – 2

Scheme of the examination under credit based semester system for M. Sc. Program in BOTANY.

M.Sc. I (Sem – I & II)

SN	Semester	Course / Paper	Title of paper	Duration of paper / hrs.		Maximum marks		Total marks	Credits
				T	P	Ex	In		
1	I	I	Microbiology, Algae and Fungi	3		80	20	100	4
2		II	Bryophytes and Pteridophytes	3		80	20	100	4
3		III	Gymnosperms and Paleobotany	3		80	20	100	4
4		IV	Cytology and Genetics	3		80	20	100	4
5		Pract. I	Microbiology, Algae and Fungi and Bryophytes		6	80	20	100	4
6		Pract. II	Pteridophytes, Gymnosperms, Paleobotany, Cytology and Genetics		6	80	20	100	4
7			**Seminar**					25	1
8	II	V	Plant physiology and Biochemistry	3		80	20	100	4
9		VI	Plant Development and Reproduction	3		80	20	100	4
10		VII	Cell and Molecular Biology- I	3		80	20	100	4
11		VIII	Angiosperms- I	3		80	20	100	4
12		Prac. III	Plant physiology, Biochemistry, Plant Development and Reproduction		6	80	20	100	4
13		Prac. IV	Cell and Molecular Biology- I and Angiosperms- I		6	80	20	100	4
14			**Seminar**					25	1

Scheme of the examination under credit based semester system for M. Sc. Program in BOTANY.

M.Sc. II (Sem –III & IV)

SN	Semester	Course / Paper	Title of paper	Duration of paper / hrs.		Maximum marks		Total marks	Credits
				T	P	Ex	In		
15	III	IX	Plant Ecology	3		80	20	100	4
16		X	Cell and Molecular Biology- II	3		80	20	100	4
17		XI	Plant Biotechnology	3		80	20	100	4
18		XII	Angiosperms- II	3		80	20	100	4
19		Pract. V	Plant ecology, Cell and Molecular Biology- II		6	80	20	100	4
20		Pract. VI	Plant Biotechnology and Angiosperms- II		6	80	20	100	4
21			**Seminar**					25	1
22	IV	XIII	Plant conservation, IPR and Ethnobotany	3		80	20	100	4
23		XIV	Pl. Res. Uti., Bioethics, Biosafety, Pl. Breed. & Biostat.	3		80	20	100	4
24		XV	Special Paper I	3		80	20	100	4
25		XVI	Special Paper II	3		80	20	100	4
26		Pract. VII	On Special Paper I & II		6	80	20	100	4
27		Pract. VIII	Project		6	80	20	100	4
28			**Seminar**					25	1

1. In each semester student will have to give seminar on any topic relevant to the syllabus encompassing the recent trends and development in that field. The topic of the seminar will be decided at the beginning of each semester in consultation with supervising teachers. The students have to deliver the seminar on the hour duration which will be followed by discussion. The seminar will be open to all the teachers of the department, invitees and students.
2. The students will have to carry out the research based project work in lieu of practical in the fourth semester in the department or depending on the avaibility of placement; he/she will be attached to any of the national/ regional/ private research institute / organization for the duration of the fourth semester. The student will be randomly allotted the priority number for the selection of the supervisor at the end of the third semester. The student in consultation with supervisor will finalize the topic of the project work at the third semester.
3. The regular full time teacher of the department / contributory teacher approved by University / scientist of Government / private research laboratory appointed by University as a contributory teacher and having M.Phil. or Ph. D. degree can supervise the project work of the student .

APPENDIX – 3

Rules and Regulations for the Credit and Semester system in Post Graduate Teaching Department Botany of University.

I . GENERAL ADMINISTRATION OF THE CREDIT AND SEMESTER SYSTEM.

1. There shall be a Coordinator committee for Credit and Semester system, with Head of the Department as its chairperson, consisting of not less than three teachers of the department. The committee will be nominated by Vice Chancellor. This committee will take appropriate decisions, from time to time. This committee will forward these recommendation to appropriate authority, in case such approvals are essential.
2. Any issue not covered by this set of Rules and Regulations , but covered by the Rules previously existing shall be governed by the rules existing before the commencement of these Rules .
3. Any issue arising out of the implementation of the Credit and Semester system which are of the specific nature , which dose not need the approval of any authority and Vice Chancellor shall be resolved by the departmental coordination committee.
4. The coordination committee shall from time to time consider suggestion received from Faculty , Student and Examination Section and wherever the matter pertains to the overall functioning of the Credit and Semester system, shall recommended new rules , modification in existing rules or clarification there of .

II. ADMISSION AND CONDUCTION OF THE CREDIT SYSTEM .

1. The M. Sc. Degree of Botany will be awarded who complete the total of 100 credits (sciences) in the minimum of two years .
2. Each credit will be equivalent to (i.e. 15 hrs.).
3. The department can announce the seminar course to introduce student to research done by the faculty. Seminar credits are to be conducted through discussion and presentation by the students and the personal guidance of the teacher . Seminar shall not exceed a maximum 2 credits. These credits will be evaluated as internal assessment .
4. The Departmental Coordination Committee-
    a. Will nominate the faculty of each course to be taught in the department .
    b. Will approve a plan for evaluation prepared by the faculty for the credits concern as a internal continuous assessment of 50 % from among the 12 given in the III below. Ordinarily the teacher may opt for an internal assessment procedure other than the written exams.
    c. Will evolve the norms of evaluating oral examination whenever necessary in relation to term paper assignment ;
    d. Will take appropriate decisions in the cases of readmissions of student during the transition from old to revised syllabus by deciding which credit from the revised syllabus was equivalent to credit from the old syllabus;

e. Will revise the syllabus at least five years.

5. There will be no mid-way change to over to credit system to noncredit or external examination or vice versa.

III. EXAMINATION RULES

1. Each course will have
   a. 50 % of marks as a semester and examination of three hours.
   b. 50 % marks for internal (i.e. in- semester) assessment.
2. The student has to obtain 40% marks in the combined examination of in- Semester assessment and semester – end assessment with a minimum passing of 30 % in both these separately .
3. To pass, a student shall have to get minimum aggregate 40% marks (E and above on grade point scale) in each course.
4. If a student misses an internal assessment examination he/ she will have a second chance with the permission of the teacher concerned. Such a second chance with the permission of the teacher concerned. Such a second chance shall not be the right of the student; it will be the discretion of the teacher concerned to give or not to give second chance to a student to appear for internal assessment.
5. Students who have failed semester-end exam may reappear for the semester-end exam only twice in subsequent period. The student will be finally declared as failed if he/she does not pass in all credits within a total period of four years. After that such students will have to seek fresh admission as per admission rules prevailing at that time.
6. A student can‘t register for the third semester, if he/ she fails to complete all credits of the total credits expected to be ordinarily completed within two semesters.
7. Internal marks will not change. A student can not repeat internal assessment.
8. There shall be revaluation of the answer script of semester end theory examination only as per the existing ordinance in force. There shall not be revaluation of the internal assessment papers and practical examination.
9. While marks will be given for all examination, they will be converted into grades. The semester end and final grade sheets and transcripts will have only grades and grade point average.
10. The project will consist of not more than ten percent of the total credits for the degree course.
11. Each credit will have an internal (continuous) assessment of 50% of marks and a teacher must select a variety of procedures for examination such as:
    i. Written test and / or Mid term test (not more than one for each course);
    ii. Term paper ;
    iii. Journal / lecture / library notes ;
    iv. Seminar presentation ;
    v. Short quizzes ;
    vi. Assignments ;
    vii. Extension work;

viii. Research projects by individual student or group of students;

ix. An open book test (with the concern teacher deciding what books are to be allowed for this purpose).

12. The system for evaluation will be as follows: Each assignment will be evaluated in terms of grades. The grades for separate assignments and the final semester end examination will be added together and then converted into grade and later a grade point average. Results will be declared for each semester and final examination will give grade and grade point average.

Marks (out of 100)	**Grade**	**Grade point**
100 to 75	O: Out standing	06
74 to 65	A: Very Good	05
64 to 55	B: Good	04
54 to 50	C: Average	03
49 to 45	D: Satisfactory	02
44 to 40	E: Pass	01
39 to 00	F: Fail	00

13. Final Grade Points

Grade Points	**Final Grades**
5.0 TO 6.0	O
4.50 TO 4.99	A
3.50 TO 4.49	B
2.50 TO 3.49	C
1.50 TO 2. 49	D
0.50 TO 1.49	E
0.00 TO 0.49	F

14. Calculation of average grade points and cumulative grade points average **(CGPA)** :

Grade Point Average = Total Grade Point Earned X Credits hrs. for each course

---

Total Credit Hours

Cumulative Grade Point Average

GONDWANA UNIVERSITY

GADCHIROLI

SYLLABUS

BOTANY

M.Sc. Part-II

M. Sc. Botany Syllabus

Semester III

Course code/name: PAPER –IX : Plant Ecology

Module I:

Vegetation organization: Concepts of community and continuum, analysis of communities (analytical ad synthetic characters): interspecific associations, concept of ecological niche.

Vegetation development: Temporal changes (cyclic and non-cyclic); mechanism of ecological succession (relay floristics and initial floristic composition; facilitation, tolerance and inhibition models); changes in ecosystem properties during succession, Autecology.

Module II:

Ecosystem organization: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological effeciencies); litter fall and decomposition (mechanism, substrate quality and climatic factors); global biogeochemical cycles of C, N, P, and S; mineral cycles (pathways, processes, budgets) in terrestrial and aquatic ecosystems.

Module III:

Air, Water and Soil pollution: Kinds; sources; quality parameters; effects on plant and ecosystems.

Climate change: Greenhouse gases (CO_2, CH_4, N_2O, CFCs; sources, trends and role); ozone layer and ozone hole; consequences of climate change (Global warming, sea level rise, UV radiation).

Module IV:

Ecosystem stability: Concept (resistance and resilence); Ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion; environmental impact assessment; ecosystem restoration.

Ecological management: Concepts; sustainable development; sustainability indicators.

Practicals:

1. A trip to the grass land/ forest/ water body to get acquainted with their plant species.
2. Distribution pattern of different plant species determined by Quadrat/ Transat/ Point centered Quarter methods.
3. Qualitative parameters of distribution of plant species, Frequency, Density, Basal cover, dominance, Abundance and IVI.
4. Analysis of soils of two different areas i.e. Cropland and forest/ grassland for certain nutrients, CO_3, NO_3, Base deficiency.
5. Analysis of water quality for physical properties like colour, BOD, COD, O_2, CO_2 contents etc.

6 Study of adaptations in plants of Hydrophytic, Xerophytic and Halophytic zones.

Suggested Readings:

1. Ambasht R.S. 1968. Freshwater ecosystem- Manual of Ecology 123-137 (See Misra KC et al 1968)
2. Ambasht R.S. 1966 Conservation Ecology, Abs Proc School on Plant Ecol (Full paper in press Oxford and IBH Calcutta).
3. Ambasht R.S. 1995 A text book of plant ecology Student and co. Varanasi-5
4. Anderson JM Ecology for environmental sciences: biosphere ecosystems and man
5. Billings WB 1964 Plants and the ecosystem Macmillan & co, London.
6. Clements FE 1916 Plant succession, An analysis of the development of vegetation. Carnegie Institute of Washington.
7. Cragg JB 1968 The theory and practice of conservation, IUCN Publ, New Series No. 12, 25-35.
8. Dash MC 1993 Fundamentals of Ecology WB Saunders and co. Philadelphia USA.
9. Deangelis DL Energy flow, nutrient cycling and ecosystem resilience. Ecology 56, 238-43.
10. Dwivedi Rama Shankar 1968. The decomposer system manual of ecology See Misra KC et al 1970)
11. Frankel OH, Soule ME, 1981, Conservation and Evolution, Cambridge Univ Press.
12. Grace J 1983, Plant atmosphere relationships. Champman & Hall.
13. Greig Smith P 1983, Quantitative plant ecology, Univ California Press, California.
14. Hutchings MJ (ed) 1988, Plant population biology, Blackwell.
15. Hutchinson GE 1978, An introduction to population ecology. Yale Univ. Press.
16. Kochhar PL 1986 Plant Ecology Ratan prakashan, Mandi, Agra.
17. Krebs GJ 1972 Ecology Harper and Row Publ, New York.
18. Kumar HD 1994 Modern concepts of ecology. Vikas publishing house pvt ltd, New Delhi.
19. May RM (ed) 1981 Theoretical Ecology, Blackwell.
20. Odum EP 1963 Ecology Holt Reinhart and Winston Inc.
21. Odum EP 1983 Basic Ecology, Saunders Publ Philadelphia.
22. Reynolds CS 1984 The ecology of phytoplankton, Cambridge Univ Press
23. Silverton JW 1982 Introduction to plant population ecology, Longman.
24. Southwick CH 1983 (ed) Global Ecology Sinauer.
25. Whittaker RH 1975 Communities and Ecosystems (2nd ed) MacMillan, New York.

M. Sc. Botany Syllabus

Semester III

Course code/name: Paper- X : Cell and Molecular Biology- II

Module I:

Ribosomes: Structure and function

Transcription & Translation: Transcription in prokaryotic and eukaryotic cells, plant promoters, transcription factors, types of RNA and their function, splicing, mRNA transport, rRNA biosynthesis; translation in prokaryotic and eukaryotic cells, structural levels of proteins, post-translational modification; structure and role of tRNA.

Module II:

Gene structure and expression: Fine structure of gene, Cis-trans test; fine structure analysis in eukaryotes; introns and their significance, RNA splicing; regulation of gene expression in pro- and eukaryotes.

Protein sorting: Machinery involved, vesicles, coat proteins; protein targeting to plastids, mitochondria, peroxisomes, nucleus, vacuoles; modification during transport.

Module III:

Genome organization in prokaryotes and eukaryotic organelles: Phage genome, genetic recombination in phage and mapping phage genes; mapping of bacterial genes through transformation, conjugation and transduction; genetics of mitochondria and chloroplast.

Genetic recombination and genetic mapping: Recombination, independent assortment and crossing over; molecular mechanism of recombination, role of RecA and RecBCD enzymes; site-specific recombination; chromosome mapping, linkage group, genetic markers, construction of molecular maps, correlation of genetic and physical maps; Somatic cell genetics - an alternative approach to gene mapping.

Module IV:

Cell cycle and apoptosis: Control mechanisms, role of cyclins and cyclin dependent kinases; retinoblastoma and E2F proteins; cytokinesis and cell plate formation; programmed cell death in plants; regulation in plant growth and development.

Signal transduction: Overview, receptors and G- proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascades, diversity in protein kinases and phosphatases.

Techniques in cell biology: Electrophoresis, immunotechniques, FISH, GISH, confocal microscopy

Practicals:

1. Isolation of nuclei and identification of histones by SDS-PAGE.
2. Isolation of chloroplast and demonstration of two subunits of RUBISCO by SDS PAGE
3. Restriction digestion of plant DNA, its separation by agarose gel electrophoresis, visualization by ethidium bromide staining.
4. To study in vitro transcription.
5. To study in vitro translation.
6. To study conjugation in bacterial cells.
7. To detect the presence of specific antigen by ELISA
8. Isolation of RNA and quantification by spectrophotometric method.

References: Online journals available on UGC V-SAT programme

Suggested readings:

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999. Molecular Biology of Cell, Garland Publishing, Inc., New York.
2. Buchanan, B.B., Gruissem, W. and Jones, R. L. 2000 Biochemistry and Molecular Biology of Plants. American Soc. Of Plant Physiologists, Maryland, USA.
3. De Robertis, E.D.P. and De Robertis, E.M.F. Cell and Molecular Biology 8th Ed. B. I. Waverly Pvt. Ltd., New Delhi.
4. Karp, G. 1999 Cells and Molecular Biology; Concepts and Experiments. John Wiley & Sons, Inc., USA.
5. Khush, G.s. 1973 Cytogenetics of Aneuploids, Academic Press, New York, London
6. Kleinsmith, L.J. and Kish, V.M. 1995 Principles of Cell and Molecular Biology (2nd Edi.) Harper Collins Coll. Publisher, New York, USA.
7. Lewin, B. 2000 Gene VII Oxford Univ. press, New York.
8. Lodish, H., Berk, A. Zipursky, S. L. Matsudaira, P., Baltimore, D. and Darnell, J. 2000 Molecular Cell Biology Edi. W.H. Freeman and Co., New York, USA.
9. Malacinski, G. M. and Freifelder, D. 1998 Essentials of Molecular Biology (3rd Edi.) Jones and Bartiet Pub. Inc., London.
10. Russel, P. J. 1998 Genetics (5th Edi.) The Banjamin/ Cummings Publishing Com. Inc., USA
11. Sunstad, D. P. and Simmons, M. J. 2000 Principles of Genetics (2nd Edi.) John Wiley & Sons Inc., USA.
12. Tamarin, R. H. 2001 Principles of Genetics 7th Edi. The McGraw−Hill Companies.

13. Wolf, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.
14. Gerhard, Krauss, Wieley, VCH Third revised edition, Biochenmistry of Signal Transduction and Regulation.

M. Sc. Botany Syllabus

Semester III

Course code/name: Paper- XI : Plant Biotechnology

Module I:

Recombinant DNA technology: Gene cloning and principles and technique; vectors- types and their properties; construction of DNA libraries; splicing of insert into the vector; screening of DNA libraries and introduction of the recombinant DNA into the host cells.

Genetic engineering of plants: Aims, strategies for development of transgenics (with suitable examples); Agrobacterium- the natural genetic engineer; T-DNA and transposon mediated gene tagging.

Module II:

Microbial genetic manipulation: Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.

Genomics and proteomics: Molecular markers for introgression of useful traits; high throughput sequencing; functional genomics; Protein profiling and its significance**.**

DNA synthesis; DNA sequencing; polymerase chain reaction; DNA fingerprinting

Module III:

Plant tissue culture: Basic concepts; Principles and scope; tissue culture media; callus induction and cell suspension; aspects of morphogenesis; haploid and triploid production; production of somatic embryos; applications of plant tissue culture; protoplast isolation and culture; production of cybrids

Transgenic production: Methods to introduce gene in plants; selection of transformed plants/explants; salient achievements in crop bioteachnology.

Module IV:

Bioinformatics: Introduction, History, Definition and applications of bioinformatics.

Database: Types and classification of databases – Primary Databases (Nucleic acid sequence, protein sequence, protein structure), Secondary databases (Genomic, cDNA, Organellar, gene expression), special databases (Human, *Escherichia coli*, *Saccharomyces*

cerevesaie and *Arabidopsis thaliana*), Literature database (PubMed, OMIM), Information Retrieval system (Entrez). Other databases: GeneBank, KEGG, Taxonomy databases

Data analysis, prediction and submission tools and their uses: ORF finder**,** Blasts, FASTA, RASMOL, Prediction of pro- and eukaryotic genes and promoters (Genscan); protein structure (SWISS-Prot, pfam, PDB, PIR); **sequin**, webin, AutoDep tools.

Practicals:

1. Growth characteristics of *E.coli* using plating and turbidimetric methods.
2. Isolation of plasmid from *E.coli* and its quantification.
3. Restriction digestion of the plasmid and estimation of the size of various DNA fragments.
4. Cloning of a DNA fragment in a plasmid vector, transformation of the given bacterial population and selection of recombinants.
5. Co-cultivation of the plant material (e.g. leaf discs) with *Agrobacterium* and study GUS activity histochemically.
6. Preparation of media for plant tissue culture.
7. To surface sterilize the given seeds/explant for tissue cultural manipulation.
8. To isolate protoplast and determine its viability.
9. To fuse the protoplast for production somatic hybrid.
10. Demonstration of DNA sequencing by Sanger's dideoxy method.
11. To search literature of different organisms and genes from NCBI.
12. Use of various tools to retrieve information available from NCBI
13. To retrieve gene and protein sequences of various organisms from NCBI.
14. To locate gene(s) on chromosomes for a given disease/disorder.

Suggested Readings (for laboratory exrcises)

1. Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics, John-Wiley and Sons Publications, New York.
2. Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
3. Gelvin, S. B. and Schilperoort, R. A (eds) 1994. Plant Molecular Biology Manual, 2nd edition. Kluwer Academic Publishers, Dordrecht, The Netherlands,
4. Glover, D. M. and Hames, B. D.(Eds) 1995. DNA Cloning 1: A Practical Approach: Core Techniques, 2nd edition PAS, IRL Press at Oxford University Press, Oxford.
5. Hackett, P. B. Fuchs, J. A. and Messing, J. W. 1988. An Introduction to Recombinant DNA Techniques. Basic Experiments in Gene Manipulation. The Benjamin/cummings Publishing Co., Inc. Menlo Park, California.

6. Maniatis et al. Molecular cloning Vol. I, II and III. Cold-Spring Harbor Lab Press.
7. Shaw, C. H. (Ed.) 1988, Plant Molecular Biology : A Practical Approach. IRl Press,
8. Oxford.

References: Online journals available on UGC V-SAT programme.

Suggested Readings:

1. Baxevanis, A. D., Davison, D. B.; Page, R. D. M.; Petsko, G. A.; Stein, L. D. and Stormo, G. D. 2008 Current Protocols in Bioinformatics, John-Wiley and Sons Publications, New York.
2. Baxevanis, A. D. and Ouellate, B. F. F. 2009 Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.
3. Brown, T. A. 1999. Genomes, John Wiley & Sons(Asia) Pvt. Ltd., Singapore.
4. Callow, J. A., Ford-Lloyed, B. V. and Newbury, H. J. 1997. Biotechnology and
5. Plant Genetic Resources: Conservation and Use, CAB International, Oxon UK.
6. Chrispeeels, M. J. and Sadava, D. E. 1994, Plants, Genes and Agriculture. Jones & Barlett Publishers, Boston, USA.
7. Glazer, A. N. and Nikaido, H. 1995. Microbial Biotechnology. W. H. Freeman & Company, New York, USA.
8. Gustafson, R. J. 2000. Genomes. Kluwer Academic Plenum Publishers, New York, USA.
9. Henry, R. J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK.
10. Jain, S. M., Sopory, S. K. and Veilleux, R.E. 1996. *In vitro* Haploid Production in Higher Plants, Vols. 1-5, Fundamental Aspects and Methods. Kluwer Academic Publishers, Dordrecht, The Netherlands.
11. Jolles, O. and Jornvall, H. (eds) 2000. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
12. Kartha, K. K. 1985. Cryopreservation of Plant Cells and Organs. CRC Press, Boca Raton, Florida USA.
13. Kingsman, S. M. Genetic Engineering : An Introduction to Gene Analysis and Exploitation in Eukaryotes, Blackwell Scientific Publications, Oxford, 1998
14. Mount W. 2004 Bioinformatics and sequence genome analysis 2nd Edi. CBS Pub. New Delhi
15. Old, R. W. and Primrose, S. B. 1989. Principles of Genome Analysis. Blackwell Scientific Publications. Oxford, UK.
16. Primrose, S. B.1995. Principles of Genome Analysis. Blackwell Scientific Ltd., Oxford, UK.
17. Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press, New York, USA.
18. Watson, J. , Tooze and Kurtz Recombinant DNA: A short course

M. Sc. Botany Syllabus

Semester III

Course code/name: Paper- XII : Angiosperms- II

Module I:

General account, distinguished characters, floral variation and evolution, affinities of :- Magnolidae, Hamamelidae, Dilleniidae, Rosidae, Asteridae, circumscription as per Cronquist,1968

Module II:

Alismatidae, commelinidae, Aracidae, Lilidae; Interesting features and systematic position of Cucurbitaceae, Cactaceae, Asteraceae, Amentiferae, Lemnaceae, Palmae, Orchidaceae.

Module III:

Probable ancestors of angiosperms, primitive living angiosperms, speciation and extinction, IUCN categories of threat, distribution and global pattern of biodiversity.

Module IV:

Biological diversity concept and levels, role of biodiversity in ecosystem functions and stability, Endemism, hotspots and hottest hotspots, invasions and introductions, local plant diversities and its socioeconomic importance.

Practicals:

1. Description of a specimen from representative, locally available families.
2. Description of a species based on various specimens to study intra specific variation: collective exercise.
3. Description of various species of a genus, location of key characters and preparation keys at generic level.
4. Location of key characters and use of keys at family level.
5. Field trips within and around the campus; compilation of field notes and preparation herbarium sheets of such plants, wild or cultivated as are abundant.
6. Training in using floras herbaria for identification of specimens described in the class.
7. Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.

Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparation of dendrograms.

Suggested Readings :

1. Devis, P.H. and Heywood, V. H. 1973. Principles of angiosperms taxonomy. Robert E. Kreiger Pub. Co. Newyork.
2. Grant, V. 1971. Plant Speciation, Columbia University press, London.
3. Grant W. F. 1984**.** Plant Biosystematics. Academic press, London.
4. Harisson, H.J. 1971. New concept in flowering plant Taxonomy. Hickman educational books Ltd. London.
5. Hislop-Harisson, J. 1967. Plant Taxonomy. English Language Book Sco. And Edward Arnold Pub. Ltd, UK.
6. Heywood, V. H. and Moore, D. M. 1984. Current concepts in Plant Taxonomy. Academic Press, London.
7. Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co. New York.
8. Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw- Hill Book Co., New York.
9. Nordentam, B., El Gazaly, G. and kassas, M. 2000. Plant systematic for 2ft century. Portlant press. Ltd, London.
10. Radford, A. E. 1986. Fundamentals of plant systematic. Harper and Raw publication, USA.
11. Solbrig, O.T. 1970. Principles and methods of plant Sytematics. The Macmillan Co. Publication Co. Inc., USA.
12. Woodland, D. W. 1991. Contemporary Plant Syatematics, Pentice Hall, New Jersery.
13. Takhtajan, A. L. 1997. Diversity and classification of Flowering Plants. Columbia University Press, New York.
14. Stebbins, G. L. 1974. Flowering Plants-evolution Above species Level. Edvard Arnold Ltd, London.
15. Joncs, A. D. and Wibins, A. D. 1971. Variation and adaptation in Plant species Hickman and Co.
16. Jones, S. B., Jr.and Luchsinger, A. E. 1986. Plant Systematics (gd edition). McGraw Hill Book Co., New Delhi.

.

.

-

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

for

B.Sc.

BOTANY

SEMESTER – VI

(With effect from : 2014-15)

GONDWANA UNIVERSITY
GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS
FOR
B.Sc. BOTANY
(With effect from : 2014-15)

B.SC.

SEMESTER –VI :	Paper – I: Plant Physiology, Growth and development	50 marks
	Paper – II: Ethnobotany and Applied Botany	50 marks
	Practical – II: Based on Paper – I & II of Semester –VI	30 marks
	Internal Assessment: Based on Assignment/Seminar & Unit Test	20 marks

B.Sc.
BOTANY
SEMESTER – VI
Paper – I
Plant Physiology, Growth and development

UNIT- I :

Photosynthesis: Photosynthetic pigments, action spectra, Red drop and Emerson enhancement effect, cyclic and non-cyclic photophosphorylation, C3, C4 and CAM pathway, factors affecting photosynthesis.

UNIT- II :

Respiration: Structure of ATP, aerobic and anaerobic respiration, respiratory substrates and R. Q., glycolysis, citric acid cycle, ETS, oxidative phosphorylation, factors affecting respiration

UNIT- III :

Growth and development: Defination, phases of growth and development.

Plant growth regulators: Introduction and Role of auxin, cytokinins, gibberilins, ABA and ethylene

Plant movements: Tropic and nastic movements

UNIT- IV :

Photoperiodism: Concept, Short-day plant, Long-day plants, Day-neutral plants.

Physiology of flowering : role of florigen,vernalization.

Phytochromes : Pr and Pfr forms, circadian rhythms and biological clock

Senescence and abscission : Definition and general account

Seed dormancy: Causes and role, methods to break seed dormancy

SEM –VI

Paper – I

Plant Physiology, Growth and development

Suggested Laboratory Exercises

Plant Physiology Experiments : (Any Six)

1. To demonstrate that the light is necessary for photosynthesis (Ganong's light screen)
2. To demonstrate that the light, chlorophyll and CO_2 is necessary for photosynthesis (By Moll's half leaf experiment)
3. To demonstrate fermentation by Kuhne's tube
4. To demonstrate aerobic respiration
5. To demonstrate the evolution of CO_2 in respiration
6. To demonstrate the part of energy is released in the form of heat during respiration
7. To separate chloroplast pigments by solvent method and preparation of their absorption spectra
8. To separate chloroplast pigments by paper chromatography
9. To measure rate of photosynthesis by Wilmott's bubbler/Simple bubbler under variable conditions of light, temperature and CO_2 concentrations.
10. To determine RQ of different respiratory substrates.

Plant Growth and Development Experiments : (Any Four)

1. To demonstrate seed viability test by T.T.C. (Triphenyl-Tetrazolium-chloride)
2. To demonstrate the phenomenon of nastic movement in *Mimosa pudica/Biophytumn sensitvum* plants.
3. To demonstrate the measurement of growth of germinating pea seeds
4. To demonstrate the phenomenon of gravitropism (geotropism), phototropism and hydrotropism
5. To demonstrate effect of auxin, cytokinin, GA, ABA and ethylene using appropriate plant materials.
6. To study the various methods of breaking seed dormancy.

B.Sc.

BOTANY

SEMESTER – VI

Paper – II

Ethnobotany and Applied Botany

UNIT-I : **Ethno-Botany :**

Introduction, Definition, Concept & Relevance

Branches of Ethnobotany

Methodology and Importance of Ethnobotany in Research and Conservation

Ethnic societies of India and World & their contribution

UNIT-II : **Ethno-Botany :**

Plants of Ethnobotanical importance: classification of ethno botanical plants on the basis of their use.

Medicinal plants and narcotics (Name of plant, family and parts used- at least Five Plants)

Ethno-botanical Importance: Source of - vegetables, fruits and seeds

(Five each)

UNIT-III : **Applied Botany :**

Agroforestry: Introduction, useful plants for Agroforestry such as *Eucalyptus*, Teak, Bamboo, *Terminalia tomentosa*

Bio Fertilizers: Culture of Blue-Green alga, Spirulina

Composting: Introduction and methods

Vermiculture: Introduction, Vermicomposting and its Application.

UNIT-IV: Applied Botany :

Floriculture: Introduction and its Application.

Mushroom culture: Introduction and its Application

Apiculture: Introduction and its Application

SEM –VI

Paper – II

Ethnobotany and Applied Botany

Suggested Laboratory Exercises

Ethnobotany Experiments :

To study the locally available plants used by the natives for the ailments of various diseases. (any five)

1. Plant used to cure the arthritis
2. Plant used to cure the Piles
3. Plant used to cure the Jaundice
4. Plant used against snake bites
5. Plant used to cure the Diabetes
6. Plant used against Fever
7. Plant used against Scorpion/ insect bite

To study the methods of cultivation of medicinally important plants.

1. *Aloe vera* (Korphad)
2. *Chlorophytum borivilianum* (Safed Musli)
3. *Withania somnifera* (Ashwagandha)
4. *Asparagus* (Satavari)
5. *Adhatoda vasica* (Adulsa)

Applied Botany Experiments: (Any Four, One from each category is compulsory)

Vermiculture:

1. To study and demonstrate Vermicomposting technique.

2. To study the construction of Vermicomposting unit.

Floriculture:

3. To study and demonstrate Floriculture technique.
4. To study the cultivation practices of commercially important flowers. (any four)
5. To study the construction of Green House Unit.

Mushroom culture:

6. To study and demonstrate Mushroom culture technique.
7. To study the construction of Mushroom culture unit.

Apiculture:

8. To study and demonstrate Apiculture technique.
9. To study the construction of Apiculture unit.

Note: Frequent Field visits are necessary

Schedule for Practical Examination

SEMESTER – VI

Time: 5 Hours Max. Marks: 30

Q. 1 To Perform given Physiology Experiment [A] & report the findings	05 Marks
Q. 2 To perform the given Experiment [B] on plant growth and development & report the findings	04 Marks
Q. 3 Comment and note on ethno medicinal uses of given plants [C]	05 Marks
Q. 4 Comment and note on Experiment [D] on applied aspects of Botany	04 Marks
Q. 5 Spotting :	04 Marks

E - Plant Physiology

F - Growth and development
G - Ethnobotany
H – Applied Botany

Q. 6 Viva - Voce 03 Marks

Q. 7 Practical Record & Excursion Report 05 Marks

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

for

B.Sc.

BOTANY

SEMESTER – V

(With effect from : 2014-15)

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

FOR

B.Sc. BOTANY

(With effect from : 2014-15)

B.Sc.

SEMESTER – V :	Paper – I	: Plant Physiology and Biochemistry	50 marks
	Paper – II	: Plant Ecology	50 marks
	Practical – I	: Based on Paper – I & II of Semester- V	30 marks
	Internal Assessment	: Based on Assignment/Seminar & Unit Test	20 marks

B.Sc.
BOTANY
SEMESTER – V
Paper – I
Plant Physiology and Biochemistry

UNIT- I :

Plant Water Relations : Properties of water, diffusion, osmosis and plasmolysis. water potential

Ascent of sap : water conduction through xylem (bulk flow hypothesis, root pressure theory, cohesion-adhesion theory)

Transpiration: Defination, types, Stomatal opening and closing mechanisms, K theory, factors affecting transpiration, significance, guttation

Phloem transport: Munch hypothesis

UNIT- II :

Mineral Nutrition : Role and deficiency symptoms of N,P,S,K,Ca,Mg,Fe,Zn,Cu,Mn,macro & micro-Nutrients,

Theories of absorption of solute in plants:

Active absorption : The Carrier Concept

Passive absorption : Ion exchange Theory and Donnan equilibrium Theory

Nitrogen Metabolism : Sources of Nitrogen to plants, Biological Nitrogen Fixation (Root Nodule Formation & Mechanism), Importance of Nitrate Reductase

UNIT- III :

Carbohydrates: Definition, properties and role, Aldoses and ketoses; structure of monosaccharides (glucose), disaccharides (sucrose), polysaccharides (cellulose and starch)

Lipids: Definition, properties and role; Structure and uses of fatty acids, oils and waxes, phospholipids, sphingolipids, sterols

Lipid metabolism: Beta- oxidation and Glyoxylate cycle

UNIT- IV :

Aminoacids : Chemical structure of amino acids, peptide bond and primary structure of protein

Basics of Enzymology : Nomenclature (IUB System), Characteristics and properties of Enzymes, Holoenzyme, Apo-enzyme, Co-enzyme, & Co-factors, Regulation of Enzyme Activity (Enzyme-Substrate Complex Theory), Mechanism of Action (Lock & Key Model, Induced Fit Model)

SEM –V

Paper – I

Plant Physiology and Biochemistry

Suggested Laboratory Exercises

Plant Physiology Experiments : (Any seven)

1. To demonstrate the phenomenon of dispersion
2. To demonstrate the phenomenon of adsorption
3. To demonstrate the phenomenon of imbibition
4. To demonstrate the root pressure
5. To demonstrate that the amount of water absorbed and the amount of water transpired is approximately equal.
6. To study the permeability of plasma membrane using different concentration of organic solvents.
7. To determine the osmotic potential of vacuolar sap by plasmolytic method
8. To compare the rate of transpiration from two surfaces of a leaf –
   By bell jar method
9. To compare the rate of transpiration from two surfaces of a leaf –
   Cobalt chloride method.
10. To determine the path of water (ascent of sap)
11. To separate amino acids from plant material by paper chromatography and their identification by comparison with standards

Plant Biochemistry Experiments : (Any three)

1. To study the enzyme activity of *Catalase* in suitable plant material as influenced by temperature
2. To study the enzyme activity of *Peroxidase* in suitable plant material as influenced by temperature
3. To study activity of Enzyme *Amylase* from germination Barley/ Wheat grains.

4. Colorimetric/ Spectrophotometric estimation of sugars and starch (Carbohydrates in suitable plant materials)
5. To prepare the standard curve of protein and determine the protein content in plant samples.

B.Sc.
BOTANY
SEMESTER – V
Paper – II
Plant Ecology

UNIT-I :

Ecology : Plant and Environment, branches of ecology and significance of ecology
Climatic Factors : Atmospheric , Light , Temperature
Edaphic Factor : Pedogenesis (process), Soil profile, Soil properties (physical and chemical)
Biotic Factor : Interactions between plants and animals, Interaction between plants growing in a community, Interactions between plants and soil microorganisms.

UNIT-II :

Ecosytem : Structure, Biotic & Abiotic Components, Food chains, Food web, Ecological pyramids, elargy flow.
Biogeochemical Cycles : Water, Carbon, Nitrogen
Environmental Pollution : Air, Water and its control, definition, effects on plants.

UNIT-III :

Autecology : definition, parameters and importance, growth curve, interaction among population, ecad, ecotype- characteristics and importance
Synecology : life forms, community dynamics, study of community (analytical and synthetic characters).

UNIT-IV :

Plant succession : Definition, Causes of succession, Climax concept, Monoclimax and Polyclimax theories, Hydrosere, Xerosere.

Plant adaptations : Morphological, Anatomical & Physiological adaptations of Plant in response to Water : Hydrophytes, Xerophytes, Mesophytes, Epiphytes, Halophytes.

Phytogeography : Distribution, Botanical zones or Phytogeographic regions of India (Name, distribution area, typical vegetation)

SEM –V

Paper – II

Plant Ecology

Suggested Laboratory Exercises

Ecology Experiments :

(Note: Any Ten experiments; Experiment No. 01 is compulsory)

1. To study the ecological characters (morphological and anatomical) of the following plant. (Use permanent micro-preparations /transparencies/specimens/natural habitats for the study)
   - **Hydrophytes:** *Hydrilla, Vallisneria, Nymphaea, Potamogeton, Eichhornia,* and *Trapa* (Any four).
   - **Xerophytes:** *Acacia auriculiformis, Parkinsonia, Muehlenbeckia, Ruscus, Asparagus, Kalanchoe, Euphorbia nerifolia, Opuntia, Nerium, Casuarina*. (Any four).
   - **Halophyte :** *Rhizophora*
   - **Epiphyte :** Orchid (*Vanda*)
   - **Parasite :** *Cuscuta*
2. To determining the minimum size and number of quadrats required for reliable estimate of biomass in vegetation.

3. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkiaer's Standard Frequency Diagram.
4. To estimate Importance Value Index for vegetation on the basis of relative frequency, relative density, and relative biomass.
5. To measure the vegetation cover through point-frame method.
6. To measure the above-ground plant biomass in a vegetation.
7. To determine the Kemp's constant for dicot and monocot leaves and to estimate leaf-area-index of a community.
8. To estimate bulk density and porosity of different soil samples.
9. To determine moisture content and water holding capacity of different soil samples.
10. To study the vegetation structure through profile diagram.
11. To estimate transparency, pH and temperature of different water bodies.
12. To measure dissolved oxygen content in polluted and unpolluted water samples.
13. To estimate salinity of different water samples
14. To determine the percent leaf-area-injury of different leaf samples collected around polluted and non-polluted sites.
15. To estimate dust-holding capacity of the leaves of different plant species

Schedule for Practical Examination

SEMESTER – V

Time: 5 Hours Max. Marks: 30

Q. 1 Perform given Physiology Experiment [A] & report the findings 05 Marks

Q. 2 To perform the given Biochemistry Experiment [B] & report the findings 04 Marks

Q. 3 Prepare temporary mount of the Ecological material [C] & report the findings 05 Marks

Q. 4 To perform the given Ecological Experiment [D] , draw well labelled diagrams and write about its morphological and anatomical characteristics 04 Marks

Q. 5 Spotting : 04 Marks

E - Plant Physiology
F - Biochemistry
G - Ecology (morphology)
H - Ecology (anatomy)

Q. 6)Viva Voice 03 Marks

Q. 7) Practical Record & Excursion Report 05 Marks

TOTAL MARKS – 30

GONDWANA UNIVERSITY, GADCHIROLI

B.Sc.-I Semester I (Chemistry)

(Effective from 2012-13)

1) There will be two theory papers in chemistry in every semester which carry 50 marks each and duration of paper is 3 hrs.
2) There will be internal assessment of 20 marks per semester.
3) There will be practical examination of 4-5 hours duration and carries 30 marks.

So, the total marks allotted to the chemistry subject per semester is 150 marks.

Theory (100 marks) + Internal assessment (10+10 marks) + Practical (30 Marks) = 150 marks (total)

4) Student should have to pass in theory, practical & Internal Assessment separately (Minimum passing percentage in every case is 35%)
5) The internal assessment will be based on Attendance, Home assignment, Unit test, Terminal test and participation in departmental activities.

The following syllabi are prescribed on the basis of six lectures per week and six practical periods per batch per week. Each theory paper consists of four units of twelve lectures per unit.

THEORY PAPER PATTERN FOR VARIOUS SEMESTER

Semester No.	Paper –I	Paper-II
1S	Inorganic Chemistry	Organic Chemistry
2S	Organic Chemistry	Physical Chemistry
3S	Inorganic Chemistry	Physical Chemistry
4S	Inorganic Chemistry	Organic Chemistry
5S	Organic Chemistry	Physical Chemistry
6S	Inorganic Chemistry	Physical Chemistry

Marking pattern

Que.-1 (From Unit 1) – (A-5 Marks + B-5 Marks)= 10 Marks or
(a-2 ½ + b-2 ½ + c-2 ½ + d-2 ½)= 10 Marks

Que.-2 (From Unit 2) – (A-5 Marks + B-5 Marks)= 10 Marks or
(a-2 ½ + b-2 ½ + c-2 ½ + d-2 ½)= 10 Marks

Que.-3 (From Unit3) – (A-5 Marks + B-5 Marks)= 10 Marks or
(a-2 ½ + b-2 ½ + c-2 ½ + d-2 ½)= 10 Marks

Que.-4 (From Unit4) – (A-5 Marks + B-5 Marks)= 10 Marks or

(a-2 ½ + b-2 ½ + c-2 ½ + d-2 ½)= 10 Marks

Que.-5 Solve any 10 out of 12 short answer question each carry one mark

(3 short question from each unit)

B.Sc. Part I (Semester - I)

Paper – I (Inorganic Chemistry)

Total marks : 50 Total Lectures : 48

Note : Figures to the right hand side indicate number of lectures

Unit I

(A) Atomic Structure : Idea of de-Broglie matter waves, Heisenberg's uncertainty principle, Schrodinger wave equation, significance of Ψ and Ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, atomic orbitabls, shapes of s, p and d-orbitals, Aufbau and Pauli's exclusion principle, Hund's multiplicity rule, electronic configuration of the elements and ions.

[6 L]

(B) Periodic Properties : Atomic and ionic radii, ionization energy, electron affinity and electronegativity - definition, trends in periodic table and applications in predicting and explaining the chemical behavior, factors affecting ionization potential. Pauling's and Mulliken's scales of electronegativity, effective nuclear charge and Slater's rules with some exercise.

[**6 L]**

Unit II

(A) Covalent Bond : Valance bond theory and its limitations, directional characteristics of covalent bond, overlap criteria of bond strength, Bond energy, bond strength, bond order and bond angle. Various types of hybridization and shapes of simple inorganic molecules and ions. Valance shell electron pair repulsion (VSEPR) theory to NH_3 H_3O^+, SF_4 ClF_3 ICl^-_4 and H_2O.

[**6 L]**

(B) Molecular Orbital Theory : LCAO approximation, wave equation for molecular orbitals, difference between bonding and antibonding MOs in terms of energy and electron density distribution curves, order of energy levels in MOs. MO diagrams for homonuclear diatomic molecules of hydrogen, helium and second row of periodic table. Concept of non-bonding MOs in HF molecule, Coulson's MO diagram of CO and NO.

[**6 L]**

Unit III

(A) s – Block Elements : Comparative study of s – block elements with respect to: i) Atomic & ionic radii, ii) Ionisation Energy iii) Electron Affinity iv) Electronegativity v) Reducing property. Diagonal relationship between Li & Mg, Salient features of hydrides, Salvation and Complexation tendencies including their functions in biosystems.

[6 L]

(B) p-Block Elements : Comparative study of p – block elements with respect to: i) Atomic & ionic radii, ii) Ionisation Energy iii) Electron Affinity iv) Electronegativity v) Oxidation State. Diagonal relationship between Be & Al, Preparation, properties and structure of hydrides of 5^{th} group elements. Nature and bonding in phosphorous trioxides (P_2O_3), phosphorous pentaoxide (P_2O_5) and oxyacids of phosphorous.

[6 L]

Unit IV

(A)**Hydrides of boron:** Structure and bonding in diborane and borazine, Classification and applications of carbides. **[6 L]**

(B)Basic properties of Iodine, interhalogen compounds : Preparation and structure of ClF, ClF_3, IF_5 & IF_7. Polyhalides : Classification and structure of I_3^-, I_5^-, I_7^- and ICl_4^-.

[2 L]

(C)**Chemistry of noble gases :** Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon fluorides and oxyflurides. **[4 L]**

B.Sc. Part I (Semester - I)

Paper – II (Organic Chemistry)

Total marks : 50 Total Lectures : 48

Note : Figures to the right hand side indicate number of lectures

Unit I

Structure And Bonding In Organic Molecules, Reactive Intermediates, Mechanism Of Organic Reactions.

(A) Definition and unique Properties of organic compounds and their classification. Covalent bond, Hybridization in organic molecules (sp, sp^2, sp^3), bond length, bond angles, bond energies. **[3 L]**

(B) Types of Reagents and Reactive Intermediates : Homolytic and Heterolytic fission, Electrophiles and Nuculeophiles Carbocations, Carbanions and free radicals, their generation stability and reactions. **[4 L]**

(C) Electronic Displacements : Inductive effect, Electromeric effect, Resonance and Hyperconjugation (definition, examples and applications of these effects) **[3 L]**

(D) Types of Reactions : (In brief with suitable example of each)

a) Addition, b) Elimination c) Substitution d) Rearrangement reactions **[2 L]**

Unit II

Stereochemistry Of Organic Compounds :-

A) Concept of isomerism, Type (Structural chain, position, functional group and stereo isomerism) Representation of organic. Molecules zig–Zag structures, projection formulae (Saw horse - Andiron), Newman, Fisher and Dotted – wedge **[2 L]**

B) Optical isomers – Isomer number and tetrahedral carbon atom, chirality, optical isomerism with one and two asymmetric carbon atoms (Tartaric acid), Polarimeter. Specific rotation. Enantiomerism R & S Nomenclature **[3 L]**

C) Racemisation, resolution and its methods, inversion and retention of configuration, Asymmetric synthesis [2 L]

D) Geometrical isomerism – Defination condition for geometrical isomerism, cis-trans and E-Z nomenclature, physical and chemical properties of geometrical isomerism of maleic and fumaric acid and 1-butene. [3 L]

E) Conformation isomerism in alkanes, free rotation about carbon carbon single bond, conformation of ethane, butane, relative stability of different conformation

[2 L]

Unit - III

Alkane, Cyloalkane, Alkene And Diene :-

A) Alkane : Nomenclature laboratory methods of preparation by Wurtz reaction, Kolbes reaction and decarboxylation of carboxylic acid, Industrial methods of preparations. Physical properties, reactions of alkanes. Combustion, cracking, LPG, Octane Numbers, Free radical mechanism of halogenations of methane. **[3L]**

(B) Cyclolkanes : Nomenclature, Method of formation (3-6 member rings), a) Freund's method, b) Dickmann's method. Chemical reactions of cycloalkanes : Oxidation, Aromatization and Chlorination. Baeyer's strain theory, theory of strainless rings.

[3 L]

C) Alkene : Nomenclature, preparations, dehydration of alcohols and dehydro halgenation of alkyl halide. Physical properties Reactions of alkenes, hydroboration, oxidation, epoxidation, ozonolysis hydration, hydroxylation, Polymerization of alkenes (ethylene and propylene) Ionic and Free radical mechanism of addition reaction of alkenes, Markownikoffs rule and peroxide effect

[4L]

(C) Diene : Nomenclature and classification, Method of formation and Chemical reactions 1-2 and 1-4 additions and Diels-Alder reaction of Conjugated dienes. [2L]

Unit - IV

Aromatic Hydrocarbons And Aromaticity

A) Nomenclature, Isomerism of Aromatic Compounds **[1 L]**

B) Structure and Orbital diagram of benzene, Aromaticity and Huckel's rule. **[3 L]**

C) Mechanism of Electrophilic Aromatic Substitution : Nitration, Nuclear and Side Chain Halogenations, Birch Reduction. Friedal Craft Alkylation and Acylation **[4L]**

D) Orientation : Effect of substituent groups. Activating and deactivating groups. Directing influence of following groups in the light of modern electronic theory

(-OH, -Cl, -NO_2, -COOH and –CH_3 groups) **[4L]**

Semester - I

Chemistry Practical

Total Laboratory Session : 30 **Total Marks : 30**

Inorganic Chemistry – **12 Laboratory Sessions**

Semi micro qualitative analysis of inorganic salt mixture containing two acidic radicals of different group and two basic radicals of same groups. At least six mixtures to be given, Analysis of basic radicals to be done by using spot test reagents.

Following radicals to be given

Carbonate, Nitrite, Sulphite, Sulphide, Sulphate, Chloride, bromide, iodide nitrate, silver (1), Mercury (II), lead (II) copper (II), bismuth (III), mercury (I) , cadmium (II), tin (II) arsenic (III), antimony (III), iron (III), chromium (III), aluminium (III), nickel (II), cobalt (II) manganese (II) zinc (II), calcium (II) strontium (II), barium (II), magnesium (II)

Organic Chemistry Practical : **12 Laboratory Sessions**

A) Determination of boiling point of following compounds – Ethanol and benzene. Mixed melting point determination Urea – Cinnamic acid mixture of various compostitions (1:4, 1:1, 4:1). Simple distillation of ethanol – water mixture using water condenser

B) Qualitative Analysis of simple Organic Compound

Detection of extra elements (N, S, and halogen), Functional group detection (Phenolic -OH, Carboxylic acid –COOH. Aldehyde – CHO, Keto , Carbohydrates, Amine, Amides, Nitro and Anilide)

Distribution of Marks for Practical Examination

Time 4-5 hours (One Day Examination) Marks 30

Inorganic Chemistry (Exercise) ……..……. 12

Organic Chemistry (Exercise)

(Element : 4 M, Functional group: 4 M. & M.Pt./ B. Pt. 4 M)…… 12

Viva-Voce ……..…. 03

Record ……..…. 03

Total : 30 marks

B.Sc. Part – I (Semester - II)

Paper – I (Organic Chemistry)

(Effective from session 2012-13)

The examination in Chemistry of second semester shall comprise of two theory papers internal assessment and practical examination. Theory papers will be of 3 hrs. duration and carry 50 marks each. The Internal assessment will carry 20 marks. The practical examination will be of 4 - 5 hours duration and carry 30 marks.

The following syllabus is prescribed on the basis of twelve lectures per unit and 6 practical periods per batch per week. Each theory paper has been divided into 4 units. There shall be one question in every unit with internal choice for each 10 marks and fifth one compulsory question covering all the syllabus of four units.

B.Sc. Part – I (Semester - II)

Paper – I (Organic Chemistry)

Total Lectures : 48, Total Marks : 50

Note : Figures to the right hand side indicate number of lectures.

Unit- I

Halogen Derivates

A) **Alkyl Halides** : Synthesis of ethyl bromide from ethane and ethylene. Reactions of ethyl bromide (submission and elimination). Mechanism of SN^1, SN^2 and E_1, E_2 reactions. Elimination verses substitution. [**4L]**

B) Alkenyl Halides : Synthesis and reactions of vinyl, allyl and benzyl chlorides. Comparison of reactivity of vinyl and allyl chloride. [**4L]**

C) Aryl Halides : Synthesis and reactions of Chlorobenzenes. Mechanism of Nucleophilic (benzene) substitution reaction comparison of reactivity of chlorobenzene and benzyl chloride. [**4L]**

Unit II

Alcohols, Phenols and Ethers :

A) Alcohols : Synthesis and reactions of ethyl alcohol. Ethylene glycol and Glycerol. Mechanism of Pinacol – Pinacolone rearrangement. [**5L]**

B) Phenols : Classification and nomenclature of phenols. Methods of formations a) from Cumene, b) from benzene, Acidic character. Comparative acidic strength of alcohols and phenols. Reaction of Phenols. Electrophilic aromatic substitution.

a) Acetylation b) Carboxylation (Kolb's reaction.) c) Fries rearrangement (with mechanism) d) Claisen Rearrangement e) Gatterman Synthesis f) Hauben-Hoesch reaction g) Reimer – Tiemann reaction. [**5L]**

(C)Ethers: Introduction, synthesis and reactions of diethyl ether. Relative relativities of alcohols and ethers. [**2L]**

Unit III

Aldehyde and Ketone

A) Nomenclature, Structure and reactivity of the carbonyl group. [**1L]**

B) Synthesis of aliphatic aldehyde and ketone by oxidation and dehydrogenation of alcohols, from carboxylic acid, acid chloride. Grignard reagent and from alkene.

[2L]

Synthesis of aromatic aldehyde (Benzaldehyde) by Resenmund reduction Gatterman Koach reaction Reimer – Tiemann reaction and from nitrils and ketone (Benzophenone) by Friedel Craft's acylation or benzoylation. [**3L]**

C) Physical properties and Chemical reactions such as nucleophilic addition reaction, oxidation and reduction and some miscellaneous reactions like Aldol condensation and cross Aldol condensation. Cannizzaro's reaction, Benzoin, Perkin, Knovenagel condensations and their mechanism. Condensation with ammonia and its derivatives. Wolff-Kishner reduction, Wittig and Mannich reactions. [**6L]**

Unit IV

Polymer Chemistry

A) Principles of Polymer Chemistry. Industrial Practices and application. Classification of Polymers. General Methods of polymerization: Addition (chain growth) and Condensation (step growth) polymerization, Mechanism of Additional Polymerization. Addition free radical, cationic and anionic polymerization, Copolymerization – Block and Graft Copolymers.

[**3L]**

B) Natural rubber, Vulcanization of rubber, Synthetic rubbers – Neoprene SBR, Buna N rubber.

[3L]

C) Molecular mass of polymers. Biodegradable polymers – polyhydroxy butyrate (PHB), Polylactic acid (PLA). **[2L]**

D) Some commercially important polymers – a) addition polymers – Polyethene, polypropene, polystyrene, b) condensation polymers – Polyester, Polyamide, Phenol- formaldehyde and melamine formaldehyde resin. [**4L]**

B.Sc. Part - I (Semester – II)

Paper – II (Physical Chemistry)

Unit – I

(A) Mathematical Concepts : Logarithmic relations, curve sketching, Linear graphs calculation of slopes, differentiation of functions like kx ex, xn sin x log x etc. maxima and minima, partial differentiation, Integration of useful / relevant functions. Permutations and combinations (introductory), Factorials, Concept of units with references to C.G.S. and S.I. units Inter conversion of units. [**6L]**

(B) Nuclear Chemistry : composition of Nucleus, Mass defects, nuclear binding energy, Average binding energy per nucleon, explanation of nuclear stability on the basis of graph between average binding energy per nucleon and atomic mass number, Nuclear reactions : Fission and Fusion. Nuclear models : Liquid drop model, Shell model and comparison between them. Explanation of fission by liquid drop model. Applications of radioisotopes. [**6L]**

Unit – II

Gaseous State

(A) Postulates of kinetic theory of gases, derivation of kinetic gas equation, deduction of various gas laws from kinetic gas equation, Qualitative discussion of the Maxwell – Boltzmann distribution of molecular velocities. Effect of temperature on molecular velocities. Different types of molecular velocities (Most probable RMS and average) and expressions for them. Their inter relationships. Mean free path collision diameter and collision number.

[6L]

(B) Ideal gas and real gases, behavior of real gases, deviations from ideal behaviors, explanation of the terms – Compressibility factors and Boyle temperature. Causes of deviation from ideal behaviors. Van der Waal's equation of state, explanation of state, explanation of behavior of

real gases. Critical phenomenon (P-V isotherms of real gases). Continuity of states. The isotherms of Vander Waal's equation, Relationship between critical constants and Van der Waal's constants Reduce equation of state law of corresponding state.

[6L]

Unit III

Liquid State

(A) Intermolecular forces, structure of liquids (a qualitative description), structural differences between solids, liquids and gases, liquid crystals, difference between liquid crystals, solid and liquid. Classification, structure of Nematic and Cholestric phases, Thermographic and seven segment cell. [**6L]**

(B) Properties of Liquid i) Surface tension : Explanation, methods of determination, Capillary rise method and drop number method, Parachor value and its application ii) Viscosity, Explanations, coefficient of viscosity, Effect of temperature on Viscosity, relative viscosity, specific and intrinsic viscosity. Method of determination by Ostwald viscometer.

(iii) Refractive index : specific refraction, molar refraction and chemical constitution Method of determination by Abbe's Refractometer. [**6L]**

Unit - IV

Chemical Kinetics

(A) Concept of reaction rate, factors affecting the rate of a reaction – concentration temperature, pressure, solvent light, catalyst. Mathematical characteristics of zero, first and second order reactions. Pseudo order reactions. Half life and mean life of reaction with examples. Determination of order of reaction – method of integration, differential method, method of half life period and isolation method. Experimental methods based on conductometry, polarimetry etc. Effect of temperature on rate of reaction, Arrhenius equation concepts of activation energy.

[**6L]**

(B) Collision theory of bimolecular reactions (hard sphere model). Transition state theory Expression for rate constant based on equilibrium constant and thermodynamic aspects.

[**3L]**

(C) Catalysis : Characteristics of **catalysed** reactions, classification of catalysis with examples (Homogeneous, Gas phase, liquid phase catalysis, Heterogeneous catalytic reaction, enzyme catalysis, Autocatalysis etc.) [**3L]**

Semester II

Chemistry Practical

Total Laboratories Sessions 30 **Total Marks : 30**

Organic Chemistry Practical's – 12 Laboratory Sessions

A) Purification of an impure organic compound by crystallization / Sublimation method and determination of melting point of purified sample (Five compounds (1) Phthalic acid, 2) Acetanilide, 3) Benzoic acid, 4) Phenylthiourea 5) Naphthalene.

Note: i) Students should report the melting point of sample before and after crystallization / Sublimation.

ii) Solvents like water, water + alcohol, Alcohol can be selected for crystallization.

B) Organic Preparations (Any Five)

1. Preparation of acetanilide (Acetylation of Aniline)
2. Preparation of Benzanilide (Benzoylation of Aniline)
3. Preparation of Iodoform from ethanol or Acetone.
4. Preparation of m-di-Nitrobenzene (Nitration)
5. Preparation of tri-Bromoaniline from Aniline (Bromination)
6. Preparation of Benzoic acid from Benzamide (Hydrolysis)
7. Preparation of Benzoic acid from Benzaldehyde (oxidation)
8. Preparation of Semicarbazone from Acetone.

Note :

a) Student should perform the single stage preparation with the help of given procedure.

b) Melting point and percentage yield should be reported.

c) The sample should be submitted.

d) Students should recrystalize the sample with suitable solvent.

e) Student should know the reaction and its mechanism of given single stage preparation.

f) Organic Chemistry.

Physical Chemistry Practical: 12 Laboratory Sessions

Expt. 1. To determine relative coefficient of viscocity of the given liquid by Ostwald viscometer.

Expt. 2. To determine percentage composition (v/v) of the given mixture of ethyl alcohol and water by viscocity measurement.

Expt. 3 To determine surface tension of liquid by stalagmometer.

Expt. 4 To determine parachor value of $-CH_2$ group by stalagmometer.

Expt. 5. To compare cleaning power of detergents by stalagmometer.

Expt. 6. To determine refractive index of the given liquid by Abb's refractometer.

Expt. 7 To determine the specific reaction rate of the hydrolysis of methyl acetate catalyzed by H^+ ions at room temperature.

Expt. 8 To determine specific reaction rate of hydrolysis of ethyl acetate catalyzed by base at room temperature (Saponification).

Distribution of Marks for Practical Examination :

Time 4-5 hours (One Day Examination) Marks 30

Organic Preparation (Exercise)	……. 12
Physical Chemistry (Exercise)	……. 12
Viva- Voce	……. 03
Record	……. 03

	Total : 30

Reference Books Recommended (Common for Semster – I and Semester – II)

1. Principles of Inorganic Chemistry by Puri. Sharma and Kalia – *S. Naginchand & Co. Delhi.*
2. Text book of Inorganic Chemistry by A. K. De. *Wiley East Ltd.*
3. Selected Topies in Inorganic Chemistry by Malik, Tuli and Madan – *S. Chand and Co.*
4. Modern Inorganic Chemistry by R. C. Agrawal, *Kitab Mahal.*
5. Instrumental Methods of analysis by Chatwal and Anand, *Himalaya Publishing House.*
6. Concise Inorganic Chemistry by J. D. Lee, *ELBS.*
7. Inorganic Chemistry by J. E. Hoheey – *Harper and Row.*
8. Fundamental concepts of Inorganic Chemistry by E. S. Gilreath, *McGraw Hill book Co.*
9. Modern Inorganic Chemistry by W. L. Jolly, *McGraw Hill Int.*
10. Chemistry Facts, Patterns and Principles by Kneen, Rogers and Simpson, *ELBS.*

11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, *Tata McGraw Hill.*

12. Inorganic complex compounds by Murmann, Chapman and Hall.

13. Text book of Inorganic Chemistry by K. N. Upadhayaya, *Vikas Publishing House, Delhi.*

14. Advanced Practical Inorganic Chemistry by Gurdeep Raj. *Goel Publishing House, Meerut.*

15. Co-Ordination Chemistry by D. Banerjee, *TMH Publication.*

16. Text book of Inorgnaic Chemistry by Marathe, Bhadange, Mopari and Kubade.

17. Organic Chemistry by R. T. Morrison and R. T. Boyd, 6^{th} edition, *PHI.*

18. Organic Chemistry by Pine, 5^{th} edition.

19. Inorganic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor – *Willey Eastern.*

20. Organic Chemistry by S. K. Ghosh.

21. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.

22. Spectroscopy of Organic Compounds by P. S. Kalsi.

23. Stereochemistry and Mechanism through solved problems by P.S. Kalsi.

24. Organic Chemistry by TWG Solomons, 4^{th} edition, *John Wiley.*

25. Hand book of Organic Analysis by H. J. Clarke, Arnold Heinmen.

26. Text book of Practical Organic Chemistry by A. I. Vogel.

27. Text book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahaja, Toshinwal.

28. Text book of Organic Chemistry by P.S. Kalsi published by *Macmillian India Ltd. 1999, Delhi.*

29. Comparative Practical Organic Chemistry (Qualitative Analysis) by V. K. Ahluwalia and Sunita Dhingra, Orient Longman.

30. Comprehensiv Practical Organic Chemistry (Preparation and Qualitative Analysis) by V. K. Ahluwalia and Renu Agrawal. Orient Longman.

31. Physical Chemistry : Walter J. Moore, 5^{th} edn. New Delhi.

32. Physical Chemistry : G. M. Barrrow, *McGraw Hill, Indian Edn.*

33. Principle of Physical Chemistry : Maron and Prutton.

34. Principles of Physcial Chemistry : Puri and Sharma

35. Physical Chemistry : P. W. Atkins, 4^{th} Edn.

36. Text book of Physical Chemistry : P. L. Sony O. R. Dhrma.

37. Physcal Chemistry : Levine
38. Practical Physical Chemistry : Palit and De.
39. Practical Physical Chemistry : Yadao
40. Practical Physical Chemical : Khosla.
41. Laboratory Mannual of Physical Chemistry : W. J. Popiel
42. Chemistry for Degree Student, Dr. R.L. Madan, *S.Chand and Co. New Delhi.*
43. F.Y. B.Sc. Inorganic Chemistry : Semester-I by Dr. S.B. Rewatkar, Dr. E.L.Ramteke, Y.P. Thawari & S.M.Sontakke – *Shell Publication, Nagpur.*
44. F.Y. B.Sc. Organic Chemistry : Semester-I by Y.P.Thawari, Dr. S.B. Rewatkar, S.M.Sontakke, Dr. E.L.Ramteke,– *Shell Publication, Nagpur.*
45. F.Y. B.Sc. Organic Chemistry : Semester-II by Y.P.Thawari, S.M.Sontakke, Dr. S.B. Rewatkar, T.D. Kose,– *Shell Publication, Nagpur.*
46. F.Y. B.Sc. Physical Chemistry : Semester-II by T.D.Kose, Dr. S.B. Rewatkar, S.M.Sontakke, Y.P.Thawari, – *Shell Publication, Nagpur.*
47. F.Y. B.Sc. Practical Chemistry : Semester-I by Dr.S.B. Rewatkar, Dr. E.L.Ramteke, Dr. K.R. Lanjewar, Y.P.Thawari, – *Shell Publication, Nagpur.*
48. F.Y. B.Sc. Practical Chemistry : Semester-II by Dr.S.B. Rewatkar, Dr. E.L.Ramteke, Dr. K.R. Lanjewar, Y.P.Thawari, – *Shell Publication, Nagpur. (Proposed)*
49. Inorganic Chemistry B. Sc. Part I, Sem-I by Dr. N.E. Kathale, S. V. Madhamshettiwar, Dr. D. B. Patil.
50. Physical Chemistry B. Sc. Part I, Sem-II by Dr. N.E. Kathale, S. V. Madhamshettiwar, Dr. D. B. Patil.

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

for

B.Sc.

BOTANY

www.Qxpdf.com

(With effect from : 2012-13)

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

FOR

B.Sc. BOTANY

(With effect from : 2012-13)

B.Sc.

SEMESTER – I :	Paper – I	: Diversity of Microbes and Algae	50 marks
	Paper – II	: Diversity of Fungi, Lichens, Bryophytes and Plant pathology	50 marks
	Practical – I	: Based on Paper – I & II Of Semester – I	30 marks
	Internal Assessment	: Based on Assignment/Seminar & Unit Test	20 marks

SEMESTER – II :	Paper – I	: Pteridophyta, Palaeobotany and Gymnosperms	50 marks
	Paper – II	: Angiosperm : Morphology & Anatomy	50 marks
	Practical – II	: Based on Paper – I & II Of Semester – II	30 marks
	Internal Assessment	: Based on Assignment/Seminar & Unit Test	20 marks

www.oxpdf.com

GONDWANA UNIVERSITY
GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS
FOR
B.Sc. BOTANY

SEMESTERWISE DISTRIBUTION OF MARKS

Sr.No.	Class	Semester	Theory Paper Marks		Internal Assessment	Practical Marks	Total Marks
			Paper I	Paper II			
1	B.Sc. Part I	I	50	50	20	30 (assess internally)	150
2		II	50	50	20	30 (assess externally)	150
3	B.Sc. Part II	III	50	50	20	30 (assess internally)	150
4		IV	50	50	20	30 (assess externally)	150
5	B.Sc. Part III	V	50	50	20	30 (assess internally)	150
6		VI	50	50	20	30 (assess externally)	150
			300	**300**	**120**	**180**	**900**

SEMESTERWISE WORKLOAD :

CLASS	SEMESTER	PAPER	WORKLOAD/WEEK	
			Theory	Practical
B.Sc. I	I	I	3	6
		II	3	
	II	I	3	6
		II	3	
B.Sc. II	III	I	3	6
		II	3	
	IV	I	3	6
		II	3	
B.Sc. III	V	I	3	6
		II	3	
	VI	I	3	6
		II	3	

www.oxgdf.com

PATTERN OF EXAMINATION

Theory :

Two theory papers of 50 marks each and of three hours duration will be conducted at the end of each semester.

Practicals :

1. One Practical examination of 30 marks and of five hours for each semester will be conducted at the end of the same semester.
2. Practical examination of semesters I, III and V will be conducted by Internal examiner only.
3. Practical examination of semesters II, IV and VI will be conducted by Internal & external examiners both.
4. Internal assessment of the student will be done on the basis of evaluation report from the concerned teacher and will be done at the end of each semester.
5. Distribution of 20 marks for internal assessment is as under –

Assignment/Seminar	10 marks
Unit Test	10 marks

Botanical Excursion :

Botanical Excursion is compulsory for B.Sc. I, II & III year students. One long excursion in or out of state and as many as short field visits to the places of Botanical interest, one is in each term are compulsory.

One teacher and one non-teaching staff for 20 students are taken for Botanical Excursion. If there are female students in a batch of twenty students, one additional lady teacher is permissible for excursion. T.A. and D.A. for tor teacher and non-teaching staff participating in excursions should be paid as per university rules. Tour report duly certified by teacher concerned and Head of the Department should be submitted at the time of practical examination.

Practical Course :

Botany practical course is to be covered in 26 practicals of 3 periods each as per the given schedule. These practicals are to be performed by the students. Each practical is to be supplemented by permanent slides/preserved or fresh specimens / materials / charts / herbarium sheet wherever necessary.

www.Oxpdf.com

Details of Practical Examination :

A) Every student must produce a certificate from Head of the Department of his/her college, saying that he/she has completed practical course in satisfactory manner. The student should record his/her observations and report of each experiment in the journal. The journal is to be signed periodically by teacher-in-charge & certified by Head of the Department at the end of the semester. Students have to submit their certified journal and tour report at the time of practical examination. Practical Examination should be of five hours duration and shall test a candidate in the following respect.

1. Practical study of external & internal structure of different plant types and their classification
2. Making temporary or permanent stained preparations and identification
3. Study of plant families as per syllabus
4. Study of Anatomical material with temporary or double stained preparation
5. Spotting of the specimens/ slides as per syllabus
6. Physiology experiments as per syllabus
7. Ecology experiments as per syllabus
8. Identification and setting of biochemical experiments

www.Oxpdf.com

GONDWANA UNIVERSITY
GADCHIROLI

SEMESTER SYSTEM PATTERN

BOTANY

Question Paper Pattern

Time : 03 hrs. **Total Marks : 50**

Question 1. Write notes on : 02 x 05 = 10
OR 01 x 10 = 10

A) Unit I	OR	A) Unit II
B) Unit I		B) Unit II

Question 2. Write notes on : 02 x 05 = 10
OR 01 x 10 = 10

C) Unit III	OR	C) Unit IV
D) Unit III		D) Unit IV

Question 3. Write notes on : 04 x 2 ½ = 10

a. Unit I	OR	e. Unit I
b. Unit II		f. Unit II
c. Unit III		g. Unit III
d. Unit IV		h. Unit IV

Question 4. Write notes on : 04 x 2 ½ = 10

a. Unit I	OR	e. Unit I
b. Unit II		f. Unit II
c. Unit III		g. Unit III
d. Unit IV		h. Unit IV

Question 5. Write <u>any ten</u> questions in one or two lines only 01 x 10 = 10
(Diagrams are NOT necessary)

a. Unit I	g. Unit III
b. Unit I	h. Unit III
c. Unit I	i. Unit III
d. Unit II	j. Unit IV
e. Unit II	k. Unit IV
f. Unit II	l. Unit IV

www.oxpdf.com

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS
FOR
B.Sc.
BOTANY
(With effect from : 2012-13)

DETAILS OF THE SYLLABUS

www.oxpdf.com

GONDWANA UNIVERSITY
GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

FOR

B.Sc. BOTANY

B.Sc.

SEMESTER – I

Paper – I

Diversity of Microbes and Algae

UNIT – I : 1. General characteristics of life

2. Viruses : i. General characteristics & nature of viruses

ii. Classification of viruses based on host

iii. Modes of transmission of viruses

iv. Structure and multiplication (Lytic & Lysogenic cycle) of T_4-Bacteriophage.

v. Ultra structure of TMV

vi. Economic importance

3. Mycoplasama : Structure, characteristics & pathogenecity

UNIT – II : 1. Bacteria : i. Morphology of Bacteria (size and shape)

ii. Cell structure

iii. Classification (on the basis of Gram Staining)

iv. Reproduction (Asexual and Sexual)

v. Economic importance

2. Cyanobacteria : i. General character (unicellular and filamentous) Chroochocaceae eg. *Gloeocapsa*, Nostacaceae eg. *Nostoc*

ii. Ultrastructure

iii. Reproduction

iv. Economic importance

UNIT – III : 1. Concept of plant kingdom – Cryptogams and Phanerogams

2. Algae : i. General characters

ii. Classification (G.M. Smith, 1955)

iii. Economic importance

iv. Life history of – Chlorophyceae eg. *Chlamydomonas*

eg. *Oedogonium*

UNIT – IV : 1. Life history of – Charophyceae eg. *Chara*

Xanthophyceae eg. *Vaucheria*

Phaeophyceae *eg. Ectocarpus*

Rhodophyceae *eg. Batrachospermum*

Note : Developmental stages not expected.

www.Oxpdf.com

GONDWANA UNIVERSITY
GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

FOR

B.Sc. BOTANY

B.Sc.

SEMESTER – I

Paper – II

Diversity of Fungi, Lichens, Bryophyta and Plant Pathology

UNIT – I : 1. Fungi : i. General characteristics

ii. Classification (G. C. Ainsworth, 1971)

iii. Life history of – Mastigomycotina eg. *Albugo*

Zygomycotina eg. *Mucor*

UNIT – II : 1. Fungi : i. Life history of – Ascomycotina eg. *Penicillium*

Basidiomycotina eg. *Puccinia*

Deuteromycotina eg. *Cercospora*

ii. Economic importance

2. Lichens : i. General characteristics

ii. Types (Crustose, Foliose, Fruticose)

iii. Economic importance

UNIT – III : 1. Bryophyta : i. General characteristics

ii. Classification (Smith)

iii. Economic importance

iv. Life history of – Hepaticopsida eg. *Riccia*

Anthocerotopsida eg. *Anthoceros*

Bryopsida eg. *Funaria*

UNIT – IV : 1. Plant Pathology : i. Classification of plant diseases (Viral, Bacterial, Fungal)

ii. Study of following diseases with respect to host pathology, symptoms, management and control measures.

a) Viral Disease : Mosaic of Tobacco (TMV)

b) Fungal Disease : Red rot of Sugarcane (*Colletotrichum fulcatum*)
:Brown spot of rice (*Helminthosporium oryzae*)
: Loose smut of wheat (*Ustilago hordei*)

c) Bacterial disease : Bacterial Blight of Cotton (*Xanthomonas compestris*)

Note : Developmental stages not expected.

www.oxpdf.com

B.Sc.
(BOTANY)

SEMESTER – I

REFERENCE BOOKS

1 Smith, K. M. : Plant Viruses [1992] 6th Ed. (University Book Stall, New Delhi)
2 Tortora, G.E.B.R.Funke, C. L. Case [1997] : Microbiology, An Introduction, 6th Ed. (Addison Neslley Logman, Inc.)
3 Dubey, RC, DK Maheshwari [1999] : Text Book of Microbiology (S. Chand & Co.)
4 Sharma, P.D. [1993] : Microbiology and plant pathology (Rastogi & Co.)
5 Clifotn, A [1958] : Introduction to the Bacteria (McGraw Hill & Co. N.Y.)
6 Carr, N. J. and B. A. Whitton [1973] : The Biology of Blue Green Algae (Univ. of California press, Berkeley)
7 Fogg, G.E.W.D. P. Stewart, P. Ray and A.E. Walsby [1973] : The Blue – Green Algae (Academic Press, London)
8 Bold, H.C.C.J Alexopoulos and T Delevoryas [1980] : Morphology of Plants and Fungi (Harper and Row Publishers, N.Y.)
9 Singh, V.P. C. Pande, D. K. Jain [1995] : A Text Book of Botany (Rastogi & Co. Meerut)
10 Ganguly, Kar : College Botany, Vol II (New Central Book Agency, Calcutta)
11 Bold, H. C. and M. J. Wynne [1978] : Introduction of Algae : Structure and Reproduction (Prentice Hall of India, Pvt. Ltd.)
12 Chapman, V. J. [1962] The Algae (Macmillan and Co. Ltd.)
13 Dodge, J. D. [1973] : The Fine Structure of Algal Cell (Academic Press, London)
14 Kumar, H. D. and H. N. Singh [1982] : A text book of Algae (Affiliate East-West Press, Pvt. Ltd., New Delhi)
15 Prescott, G. W. [1969] : The Algae-A Review (Moughton miffin Cop)
16 Round, F. E. [1973] : The Histology of the Algae, 2nd Ed. (Edward Arnold)
17 Sharma, O. P. [1992] : Text Book of Thallophytes (McGraw Hill Publishing Co.)
18 Smith, G. M. [1971] : Cryptogamic Botany, Vol. I Algae and Fungi (TMH)
19 Vasishtha, B. R. [1990] : Algae (S. Chand & Co. New Delhi)
20 Bhatia, Algae
21 Alexopoulos, C. J. and G. W. Min & M. Blackwell, Indrodctory Mycology, CBS distributors & publishers, Delhi
22 Dube, H. C. [1990] introduction to Fungi (Vikas Publishing House Pvt. Ltd, Delhi)
23 Sharma, P. D. [1991] : The Fungi (Rastogi & Co. Meerut)
24 Vasishta, B. R. [1990] : Fungi (S. Chand & Co. New Delhi)
25 Sharma, O. P. : Fungi (TMH)
26 Agrios, G. N. 1997 Plant Pathology, 4th ed. (Harcourt Asia PTE Ltd. Academy Press)
27 Ainsworth, G. C. 1971 Ainsworth and Bisby's Dictionary of the Fungi, 6th ed. (Commonwealth Mycological Institute, Kew Surrey)
28 Mehrotra, R. S. and Aneja, K. R. 1990 : An Introduction to mycology (Wiley Estern Ltd.)
29 Prem puri [1980] : Bryophyta (Atma Ram & Sons Delhi)
30 Ram Udar [1970] : An Introduction ot Bryophyta (Shashidhar Malviya Prakashan, Lacknow)
31 Vashishtha, B. R. [1992] : Bryophyta (S. Chand & Co. New Delhi)
32 Parihar, N. S. [1997] The Biology and Morphlogy of Bryophytes (Central Book Depot, Allahabad)
33 Sporne, K. R. J : The Morphology of Bryophytes (Hutchinson University, London)
34 Srivastava H. N. [2006] : Diversity of Microbes & Cryptogams (Pradeep Publications, Jalandhar)
35 Pandey, B. P. [2007] : Botany for Degree Students (S. Chand & Co. New Delhi)

www.oxpdf.com

B.Sc.

Botany Practicals

SEMESTER – I

Laboratory Exercises :

Make use of the permanent micropreperation, transparencies, photographs, temporary mounts, etc.

1) Study of Compound and Dissecting microscope
2) Study of bacterial forms and permanent micropreparations
3) Gram staining of Bacteria
4) Study of Cyanobacteria (Nostoc)
5) Study of Algae : (i) *Oedogonium*
   (ii) *Chara*
   (iii) *Voucheria*
   (iv) *Ectocarpus*
   (v) *Batrachospermum*
6) Study of Fungi : (i) *Albugo*
   (ii) *Mucor*
   (iii) *Penicillium*
   (iv) *Puccinia*
   (v) *Cercospora*
7) Study of Lichens : Crustose, Foliose & Fruticose
8) Study of Bryophyta : (i) *Riccia*
   (ii) *Anthoceros*
   (iii) *Funaria*
9) Study of Plant Diseases: (i) Viral Mosaic Disease of Tobacco (TMV)
   (ii) Red rot of sugarcane
   (iii) Brown spot of rice
   (iv) Loose smut of wheat
   (v) Bacterial disease on cotton

www.oxpdf.com

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

FOR

B.Sc. BOTANY

B.Sc.

SEMESTER – I

PRACTICAL

Based on Theory Papers of Semester-I

[Time 5 hours] [Marks – 30]

Que 1 : Gram- stain the bacterial strain / stain the **Cyanobacterial** material [A] and Identify? 03 marks
(Writing not necessary)

Que 2 : Identify & classify the given **Algal** material [B](Writing 2 marks, Slide preparation 2 marks) 04 marks

Que 3 : Identify & classify the given **Fungal** material [C] (Writing 2 marks, Slide preparation 2 marks) 04 marks

Que 4 : Identify & classify the given **Bryophytic** material [D] (Writing 2 marks, Slide preparation 2 marks) 04 marks

Que 5 : Spotting – Identification 1/2 mark and characters 1/2 mark 10 marks

E)	Bacteria	J)	Fungi
F)	Cyanobacteria	K)	Bryophyta
G)	Algae	L)	Bryophyta
H)	Algae	M)	Plant pathology
I)	Fungi	N)	Plant pathology

Que 6 : Practical Record (3 marks) 05 marks
Excursion Report (2 marks)

Note : Well labelled diagrams are expected wherever necessary

www.oxpdf.com

GONDWANA UNIVERSITY
GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS
FOR
B.Sc. BOTANY

B.Sc.

SEMESTER – II

Paper – I

Pteridophyta, Paleobotany and Gymnosperm

UNIT – I : 1. Pteridophyta : i. General characteristics
ii. Classification (G. M. Smith)
iii. Types of stele
iv. Life history of – Psilophyta eg. *Rhynia*
Lycophyta eg. *Selaginella*

UNIT – II : 1. Pteridophyta : Life history of – Arthrophyta eg. *Equisetum*
Filicophyta eg. *Marsilea*
2. Concept of Heterospory and Seed habit
3. Telome theory

UNIT – III : 1. Paleobotany : i. Geological time scale
ii. The process of fossilization
(Replacement theory, Infiltration theory)
iii. Types of fossils (Impression, Compression and Ptrification)
iv. Fossil gymnosperm : (a) *Glossopteris*(Pteridospermatophyta)
(b) *Cycadeoidea* (Cycadopsida)

UNIT – IV : 1. Gymnosperm : i. General characteristic
ii. Classification (Sporne, 1965)
iii. Life history of – Cycadales eg. *Cycas*
Coniferales eg. *Pinus*

Note : Developmental stages not expected.

www.oxpdf.com

GONDWANA UNIVERSITY
GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

FOR

B.Sc. BOTANY

B.Sc.

SEMESTER – II

Paper – II

Angiosperms : Morphology and Anatomy

UNIT – I : Morphology of Angiosperm: 1. Mode of living (Autotrophic and Heterotrophic)

2. Habit : Erect forms, weak forms

3. Root : i. Normal root (Tap and Fibrous)

ii. Modified root (Modification of Tap and Adventitious roots)

4. Stem : i. Branching pattern

ii. Modification of stem

5. Leaf : i. Parts of foliage leaf

ii. Lamina – shape, margin, apex, base surface, texture, venation.

iii. Types of leaves (simple and compound)

iv. Modification of leaves

v. Phyllotaxy

vi. Stipules

UNIT – II : Morphology of Angiosperm: 1. Inflorescence : Types – (Racemose, Cymose and Special)

2. Flower : i. Flower is a modified shoot evidences

ii. Types (Neuter, Achlamydeous, Monochlamydeous, Dichlamydeous, Sessile & Pedicellate, Cyclic and Acyclic)

iii. Parts of flower (Perianth, Calyx and its modification, Corolla, Aestivation, Anderocium, Gynoceium)

iv. Floral formula and Floral diagram

3. Fruit : Types of fruit

www.Oxpdf.com

UNIT – III : Anatomy : 1. Meristems : i. Classification (based on origin and position)

ii. Root apical Meristem (Newman Theory)

iii. Shoot apical Meristem

(Tunica-Carpus Theory)

2. Tissue : Types (Simple, Complex, and Secretary)

3. Vascular Bundle : Types

4. Xylem : Structure and function

5. Phloem : Structure and function

6. Cambium : Structure and function

7. Periderm : Structure and function

UNIT – IV : Anatomy : 1. Primary structure :

i. Dicot root eg. *Sunflower*

ii. Monocot root eg. *Maize*

iii. Dicot stem eg. *Sunflower*

iv. Monocot stem eg. *Maize*

v. Dicot leaf eg. *Sunflower*

vi. Monocot leaf eg. *Maize*

2. Secondary structure :

Dicot stem eg. *Moringa*

3. Anamolous secondary growth in stem:

i. Bignonia

ii. Boerhaavia

iii. Dracaena

4.. Anamolous secondary growth in root:

eg. *Beta vulgaris*

www.oxpaf.com

B.Sc.
(BOTANY)
SEMESTER – II

REFERENCE BOOKS

1 Parihar, N. S. [1997] The Biology and Morphology of Pteridophytes (Central Book Depot, Allahabad)
2 Rashid, A. [1989] : An Introduction to Pteridophyta (Vikas Publishing House Pvt. Ltd., New Delhi)
3 Sharma, O. P. [1990] : Text Book of Pteridophyta (Mcmillan India Ltd.)
4 Cutter, E. G. 1971, Plant Anatomy Experiment and Interpretation Part II. Organs. Edward Anrnold, London
5 Esau, K. 1979 Anatomy of seed Plants, 2nd Edn. John Wiley and Sons New York
6 Esau, K. Plant Anatomy John Wiley and Sons New York
7 Fahn, A. 1974 Plant Anatomy, 2nd Edn. Pergamon Press, Oxford.
8 Mauseth, J. D. 1988. Plant Anatomy. The Benjamin/Cimmings Publishing Compan Inc. Menlo Park, California, U.S.A.
9 Bhatnagar, S. P. and Moitra A. 1996 Gymnosperms. New Age International Limited, New Delhi
10 Davis, P. H. and Heywood V. H. 1963. Principals of Angiosperm Taxonomy. Oliver and Boyd London.
11 Gifford, E. M. and Foster A. S. 1988. Morphology and Evolution of Vascualr Plants. W. H. Freeman & Company, New York.
12 Heywood, V. H. and Moore D. M.(eds)1984. Current concepts in plant Taxonomy. Academic Press London
13 Jeffrey, C. 1983. An Introduction of plant Taxonomy. Cambridge University Press, Cambridge, London.
14 Jones, S. B. Jr. and Luchsinger A. E. 1985. Plants systematic (2nd Edn.). McGaw Hill Book Co. New York.
15 Maheshwari, J. K. 1963. Flora of Delhi. CSIR, New Delhi
16 Radford, A. E. 1986 Fundamentals of plant systematic. Harper And Raw, New York
17 Singh, G. 1999. Plant systematic : Theroy and practice. Oxford and IBH Pvt. Ltd., New Delhi
18 Sporne, K. R. 1965. The Morphology of Gymnosperms. Htchinson University Library Press, London
19 Stace, C. A. 1989. Plant Taxonomy and Biosystematics (2nd Edn.). Edward Arnold, London.
20 Stewart, W. N. and G. W. Rothwell 1993 : Paleobotany and the Evolution of Plants, 2nd Edn. Cambridge University Press.
21 Thomas, P. 2000. Trees : Their Natural History. Cambridge University Press.
22 Pande, P. B. Text Book of Botany. S. Chand & Co.
23 Bierhorst, D. W. [1971] : Morphology of Vascular Plants. Macmillon & Co. N. R.
24 Dutta, S. C. 1989. Systematic Botany. Wiley Eastern Co.
25 Mukerjee, S. K. 1984. College Botany Vol. III New Central Book Agency, Calcutta.
26 Dutta, A. C. – College Botany
27 Naik, V. N. – Taxonomy of Angiosperm
28 Shrivastava, H. N. [2006] : Pradeep's Botany Vo. II (Pradeep Publication, Jalandar)

www.oxodi.com

B.Sc.

Botany Practicals

SEMESTER – II

Laboratory Exercises :

Make use of the permanent micropreperation, transparencies, photographs, temporary mounts, etc.

1) Study of Pteridophytes :
   (i) *Selaginella*
   (ii) *Equisetum*
   (iii) *Marsilea*
2) Study of types of fossils (Impression, Compression and Petrification)
3) Study of fossil Gymnosperms : (i) *Glossopteris*
   (ii) *Cycadeoidea*
4) Study of Gymnosperms :
   (i) *Cycas*
   (ii) *Pinus*
5) Study of Vegetative Morphology of Angiosperms :
   (i) Root (Type, modification)
   (ii) Stem (Branching pattern, modification)
   (iii) Leaves (Type, phyllotaxy, venation, modification)
6) Study of Reproductive Morphology of Angiosperms :
   (i) Infloresence (Types : Racemose, Cymose & Special)
   (ii) Flower (Types, parts of flower)
   (iii) Fruit (Types)
7) Study of Anatomy of primary structure in :
   (i) Dicot : Root, stem & leaf eg. Sunflower
   (ii) Monocot : Root, stem & leaf eg. Maize
8) Study of Anatomy of secondary structure in Dicot stem eg. *Moringa*
9) Study of Anamolous secondary growth in stems of :
   (i) *Bignonia*
   (ii) *Boerhaavia*
   (iii) *Dracaena*
10) Study of Anamolous secondary growth in root eg. Beet

www.oxpdf.com

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

FOR

B.Sc. BOTANY

B.Sc. Part I

SEMESTER – II

PRACTICAL

Based on Theory Papers of Semester-II

[Time 5 hours] [Marks – 30]

Que 1 :	Identify & classify the given **Pteridophytic** material [A](Writing 2 marks, Slide preparation 2 marks)	04 marks
Que 2 :	Identify & classify the given **Gymnospermic** material [B] (Writing 2 marks, Slide preparation 2 marks)	04 marks
Que 3 :	Explain the vegetative morphology of given **Angiospermic** material [C]	04 marks
Que 4 :	Prepare double stained permanent mount/s of the given **Angiospermic** material [D] and identify giving diagnostic characters](Writing 3 marks, Slide preparation 3 marks)	06 marks
Que 5 :	Spotting - Identification 1/2 mark and characters 1/2 mark	06 marks

E) Pteridophyta

F) Paleobotany

G) Gymnosperm

H) Vegetative Morphology of Angiosperm

I) Reproductive Morphology of Angiosperm

J) Anatomy

Que 6 :	Practical Record…….02	06 marks
	Excursion Report……02	
	Vice-voce ……02	

Note : Well labelled diagrams are expected wherever necessary

www.oxpdf.com

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

for

B.Sc.

BOTANY

SEMESTER- III

(With effect from: 2013-14)

www.oxpdf.com

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS
FOR
B.Sc. BOTANY
(With effect from: 2013-14)

B.Sc.

SEMESTER – III

Paper – I	: Taxonomy & Diversity of Angiosperms	50 marks
Paper – II	: Reproductive Biology of angiosperms & Plant Resources	50 marks
Practical – I	: Based on Paper – I & II Of Semester- III	30 marks
	Internal Assessment : Based on Assignment/ Seminar & Unit test	20 marks

www.oxpdf.com

B.Sc.
BOTANY
SEMESTER – III
Paper – I
Taxonomy & Diversity of Angiosperms

UNIT – I :

1) Angiosperms: Origin (Bennettitalian Theory).
2) Example of primitive angiosperm – *Magnolia*.
3) Fossil Angiosperms : Flower-*Sahanianthus*, Fruit-*Enigmocarpon*.
4) Botanical Nomenclature: Principles, rules, taxonomic ranks, typification.
5) Brief History of classification: Theophrastus and Linnaeus

UNIT – II :

6) Classification of Angiosperms: Types (Artificial, Natural and Phyllogenetic), System proposed by Bentham and Hooker and its Merits & Demerits
7) Herbarium Techniques: Classical and Virtual (Digital)

UNIT – III :

8) Diversity of flowering plants: Dicot families – Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Caesalpiniaceae, Mimosaceae, Solanaceae

UNIT – IV :

9) Dicot families (contd.) – Lamiaceae, Apocynaceae, Asclepiadaceae, Asteraceae & Euphorbiaceae
10) Monocot families – Liliaceae, Poaceae and Orchidaceae

www.oxpaf.com

B.Sc.

BOTANY

SEMESTER – III

Paper – II

Reproductive Biology of Angiosperms & Plant Resources

UNIT- I :

1. Structure of Anther, Microsporogenesis and Male gametophyte
2. Structure of Pistil, Megasporogenesis and Female gametophyte (Polygonum type).
3. Types of Embryosac (Mono, bi & tetrasporic)
4. Structure and types of Ovules.
5. Pollination : types , contrivances of self and cross pollination, Attractions and Rewards
6. Pollen –pistil interaction and self-incompatibility
7. Double fertilization and Triple fusion

UNIT- II :

8. Seed : Endosperm and its types, Embryo and its types , development of dicot embryo (Onagrad type)
9. Significance of seed: suspended animation, ecological adaptations, unit of genetic recombination & replenishment
10. Seed dispersal strategies

UNIT- III :

11. Plants as a Natural Resources: Food, fiber, wood, tannins, dyes, rubber, gum, resins, fumicatories & masticatories, medicinal plants, vegetable oils & fats, sugars & starches, waxes, cellulose, beverages, spices & condiments etc.
12. Management Practices: Need.
13. Methods of Management: sustainable utilization, gene bank, participatory management, *in-situ* and *ex-situ* conservation.

UNIT- IV :

14. Utilization of plant resources:

i. Bio- diesel: Process of oil extraction, process of biodiesel production. e.g., *Pongamia pinnata* (karanji), *Jatropha curcus* (Chandrajyoti)

ii. Essential oils: Process of oil extraction and commercial uses of *Cymbopogon citratus* (lemon grass oil) , *Vetiveria zizanioides* (Khus)

iii. Gum : Harvesting and commercial uses of *Acacia nilotica* (Babhul) and *Sterculia urens* (Karu)

iv. Spices: Cultivation, processing and commercial uses of Turmeric (Haldi), *Capsicum spp*. (Chilli)

www.oxpdf.com

B.Sc.

SEMESTER – III

SUGGESTED LABORATORY EXERCISES

Make use of the permanent micro preparations, specimens, transparencies, photographs, temporary mounts, etc.

1. Study of *Sahanianthus, Enigmocarpon*
2. Study of locally available plants belonging to families included in the syllabus
3. Structure of anther, ovule, endosperm and embryo-sac
4. Types of ovules
5. To calculate the percentage pollen germination in the given specimen e.g. *Catharanthus roseus, Datura stramonium.*
6. Virtual (Digital) herbarium and collection of plant resources available in the area
7. Demonstration of oil extraction from *Pongamia pinnata*
8. Processing of Turmeric
9. Estimation of **Capsicin** from *Capsicum spp.* (chilli)

NOTES:

1. Frequent field visits in the surrounding areas to study the vegetation are necessary.
2. One long excursion is necessary along with excursion report duly signed by HOD.
3. The teacher should prevent students from collecting plants from the wild and submitting for practical examination, instead the students should asked to prepare the field report [photographic evidences, virtual (Digital) herbarium can be given.]

www.oxpdf.com

B.Sc.

SEMESTER – III

Schedule for Practical Examination

Time: 5 Hours Max. Marks: 30

Q 1. Describe in technical language the given angiospermic material. Classify and Identify the Family giving reasons. 06 Marks

Q 2. Write floral formula and draw floral diagram of the given Flower, 03 Marks

Q 3. Demonstrate the process of oil extraction of the given material. 06 Marks

Q 4. Calculate the percent pollen germination in given specimen. 03 Marks

Q 5. Spotting

[A] Fossil Angiosperms

[B] Herbarium tool

[C] Embryology

[D] Plant Resources

[E] Plant Resources 05 Marks

Q 6. Viva-voce 02 Marks

Q 7. Practical Record & Excursion Report 05 Marks

TOTAL- 30 Marks

NOTE: Well labelled diagrams are expected wherever necessary

www.oxpdf.com

B.Sc.

(BOTANY)

SEMESTER – III

REFERENCE BOOKS

1 Davis, P. H. and Heywood V. H. 1963. Principals of Angiosperm Taxonomy. Oliver and Boyd London.

2 Gifford, E. M. and Foster A. S. 1988. Morphology and Evolution of Vascualr Plants. W. H. Freeman & Company, New York.

3 Heywood, V. H. and Moore D. M.(eds)1984. Current concepts in plant Taxonomy. Academic Press London

4 Jeffrey, C. 1983. An Introduction of plant Taxonomy. Cambridge University Press, Cambridge, London.

5 Jones, S. B. Jr. and Luchsinger A. E. 1985. Plants systematic (2nd Edn.). McGaw Hill Book Co. New York.

6 Maheshwari, J. K. 1963. Flora of Delhi. CSIR, New Delhi

7 Radford, A. E. 1986 Fundamentals of plant systematic. Harper And Raw, New York

8 Singh, G. 1999. Plant systematic : Theroy and practice. Oxford and IBH Pvt. Ltd., New Delhi

9 Dutta, S. C. 1989. Systematic Botany. Wiley Eastern Co.

10 Stace, C. A. 1989. Plant Taxonomy and Biosystematics (2nd Edn.). Edward Arnold, London.

11 Stewart, W. N. and G. W. Rothwell 1993 : Paleobotany and the Evolution of Plants, 2nd Edn. Cambridge University Press.

12 Thomas, P. 2000. Trees : Their Natural History. Cambridge University Press.

13 Pande, P. B. Text Book of Botany. S. Chand & Co.

14 Mukerjee, S. K. 1984. College Botany Vol. III New Central Book Agency, Calcutta.

15 Dutta, A. C. – College Botany

16 Naik, V. N. – Taxonomy of Angiosperm

17 Shrivastava, H. N. [2006] : Pradeep's Botany Vo. II (Pradeep Publication, Jalandar)

18 Ugemuge, N.R. 1986. Flora of Nagpur District. Shree Prakashan, Nagpur

www.oxpdf.com

19 Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. Vikas Publishing House, Delhi

20 Proctor, P.H. , Evert, R.F. and Eichhorn, S.E. 1999. Biology of Plants, 5th Edn. W.H.Freeman and Co. , Worth Publisher, New York

21 Maheshwari, P. , 1950. An Introduction to Embryology of Angiosperms. Tata McGrew Hill Publishing Co. , New Delhi

22 Dr. T.N.More, Dr.K.N.Dhumal, H,S.Patil , Dr.S.S.Gadekar and Dr.A.D.More, 2011. A Text Book of Plant Diversity and Plant Resources , Management and Utilization. Nirali Prakashan , Pune

23 Kocchar, S.L. 2000. Econoic Botany in Tropics, 2nd Edn., *Macmillan India Ltd., New Delhi*

24 Sambarmrthy, A.V.S.S. and Subramanyam, N.S. 1989. A text Book of Economic Botany *Wiley Eastern Ltd, New Delhi*

25 Sundarraj D Daniel and G. Thulssidas. 1993 2nd Edn., *Macmillan India Ltd., New Delhi*

26 Sharma, O.P. 1996. Hill's Economic Botany (adapted by O.P. Sharma) *Tata McGraw-Hill Co. Ltd., New Delhi*

27 Simpson, B.B. and Conner-Ogorzaly, M. 1986. Economics Botany-Plants in Our World, *McGraw-Hill Book Company, New York*

28. Kocchar, S.L. 2000. Econoic Botany in Tropics, 2nd Edn., *Macmillan India Ltd., New Delhi*

29. Council of Scientific & Industrial Research. 1986. The Useful Plants of India. *Publications ad Information Directorate, CSIR, New Delhi*

30. Sharma, O.P. 1996. Hill's Economic Botany (adapted by O.P. Sharma) *Tata McGraw-Hill Co. Ltd., New Delhi*

31. Swaminathan, M.S. and Kocchar, S.L. (eds) 1989. Plant and Society. *Macmillan Publications Ltd., London*

32. *Pandey P. B. Economic Botany, S. Chand & Co.,*

www.oxpgr.com

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

for

B.Sc.

BOTANY

SEMESTER- IV

(With effect from: 2013-14)

www.oxpdf.com

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS
FOR
B.Sc. BOTANY
(With effect from: 2013-14)

B.Sc.

SEMESTER –IV

Paper – I	: Cell Biology, Genetics and Plant Breeding	50 marks
Paper – II	: Molecular Biology and Biotechnology	50 marks
Practical – II	: Based on Paper – I & II of Semester – IV	30 marks
Internal Assessment	: Based on Assignment/ Seminar & Unit test	20 marks

www.oxgat.com

B.Sc.

BOTANY

SEMESTER – IV

Paper – I

Cell Biology, Genetics and Plant Breeding

UNIT I:

1. Structure of typical plant cell
2. Cell envelop: Ultrastructure and functions of cell wall and plasma membrane
3. Cell organelles: Ultra structure and functions of Nucleus, mitochondria, plastids, endoplasmic reticulum, Golgi complex, vacuoles
4. Microbodies: Lysosomes, peroxysomes, glyoxysomes
5. Cell division: Mitosis, Meiosis with respect to plants.

UNIT II:

6. Mendelism : law of seggregation, law of independent assortment
7. Interaction of genes –with reference to plants
   a) Allelic interaction : incomplete dominance (1:2:1)
   b) Non-allelic interaction : Complementary gene (9:7), supplementary gene (9:3:4),
8. Extra nuclear genome: Presence & functions of Mitochondrial & plastid DNA

UNIT III:

9. Linkage –Definition, Gene theory of Morgan, types of linkage – complete and incomplete, Significance
10. Crossing over: Definition, theories (Breakage and reunion, copy choice), Significance
11. Variation in chromosome number: Polyploidy (auto- and allo-), aneuploidy (nullisomics, monosomics, trisomics and tetrasomics), Significance
12. Structural changes in chromosome: Deletion & deficiency, duplication, inversion and translocation

UNIT IV:

13. Mutation: Spontaneous and induced, substitution and frame-shift mutations, physical and chemical mutagens, application of induced mutations in crop improvement
14. Plant Breeding- Definition and objective, Pure line selection, Hybridization (emasculation, bagging, crossing, labelling), Clonal selection, Heterosis (Definition and scope)

www.oxoti.com

B.Sc.

BOTANY

SEMESTER – IV

Paper – II

Molecular Biology and Biotechnology

UNIT – I : Molecular Biology:

1. DNA: Introduction, DNA as Genetic Material (Experiments of Griffith , Harshey and Chase), Structure of DNA (The Double Helix) , Forms of DNA(A, B & Z).
2. DNA- Protein Interaction (Nucleosome Model, Packaging of DNA) ,
3. RNA : Structure, types and function
4. Replication of DNA

UNIT –II : Molecular Biology:

5. Genetic Code :- Characteristics, Wobble Hypothesis
6. Protein synthesis : Transcription, translation
7. Satellite DNA and Repetitive DNA
8. RNA Processing

UNIT –III : Genetic engineering:

1. Tools and techniques of recombinant DNA technology, cloning vectors (Plasmids, Bacteriophage and Agrobacterium), Restriction enzymes and Ligases
2. Genomic and c-DNA library
3. Gene structure: Structure of prokaryotic and eukaryotic gene, Jumping genes(transposons), e.g. Ac/Ds elements in Maize, Regulation of gene action in Prokaryotes (Lac operon Concept)

UNIT – IV : Tissue culture:

4. History and applications, Basic aspects of plant tissue culture
5. Methods of Sterilisation,
6. Nutrient Medium (MS and White),
7. Types of explants , Cellular Totipotency, Differentiation, Morphogenesis
8. Organogenesis , Somatic Embryogenesis, Artificial Androgenesis, Protoplast Culture, Micropropogation, e.g., Banana, Eucalyptus

www.0xpdf.com

B.Sc.
SEMESTER – IV
SUGGESTED LABORATORY EXERCISES

Make use of the permanent micro preparations, specimens, transparencies, photographs, temporary mounts, etc.

1. Examination of various stages of mitosis and meiosis using appropriate plant material (i.e. Onion root tips and flower buds respectively)
2. Working out of Laws of inheritance using dry seeds / plastic beads by applying Chi-square ($\chi 2$) test.
3. To get acquainted with the Laboratory organization.
4. To get acquainted with tools of genetic engineering, laboratory equipments, apparatus and instruments in biotechnology laboratory.
5. To study the different methods of sterilization.
6. Media preparation required for culture.
7. To study the structure of following vectors on the basis of photographs and diagrams: Plasmid, Bacteriophage and *Agrobacterium*
8. To demonstrate the technique of micropropogation by using different explants e.g., axillary bud and shoot meristem.
9. To demonstrate the technique of anther culture.
10. To isolate protoplast from different tissues using commercially available enzymes.

NOTE:

1. Frequent Industrial/ Laboratory visits are necessary

2. Submit Industrial/ Laboratory visit report duly signed by HOD.

www.oxpdf.com

B.Sc.
SEMESTER – IV
Schedule for Practical Examination

Time: 5 Hours Max. Marks: 30

Q 1. Prepare semi-permanent squash/smear of given material and identify the stage.

04 Marks

Q 2. Prove Mendel's laws of inheritance by using coloured plastic beads/ seeds and Apply Chi-square ($\chi 2$) test. 04 Marks

Q 3. Prepare the culture media required in the tissue culture laboratory. 04 Marks

Q 4. Perform an experiment from plant tissues culture.

06 Marks

Q 5. Spotting

[A] Cell Biology (Mitosis/Meiosis)

[B] Genetics/Plant Breeding

[C] Laboratory instruments/equipment

[D] Tissue Culture

[E] Vector Identification 05 Marks

Q 6. Viva-voce 02 Marks

Q 7. Practical Record & Industrial visit Report 05 Marks

TOTAL- 30 Marks

NOTE: Well labelled diagrams are expected wherever necessary

www.oxpdf.com

GONDWANA UNIVERSITY, GADCHIROLI

B.Sc : Part- II (Semester-IV)

SUBJECT - CHEMISTRY

Paper-I (Inorganic Chemistry)

Total Lectures: 48 **Marks:50**

Note: Figures to the right hand side indicate number of lectures.

Unit-I

A) Chemistry Of Lanthanides: Position in periodic table, electronic configuration, oxidation state, atomic and ionic radii, Lanthanide contraction and its consequences, complex forming tendency. Occurrence and isolatic of lanthanides (ion-exchange and solvent extraction methods). [8L]

B) Chemistry Of Actinides: Position in periodic table, chemistry of actinides with respect to electron configuration, oxidation states, atomic and ionic radii. [4L]

Unit-II

A) Coordination Compounds: Distinction among simple salts, double salts and coordination compound, Werner's coordination theory and its experimental verification. Sidwick's electronic interpretation, EAN rule with examples, Nomenclature of coordination compounds. Chelates: classification and their application, Valence bond theory of transition metal complexes. [9L]

B) Isomerism In Coordination Compounds: Structural isomerism and stereoisomerism in coordination compounds. [3L]

Unit-III

A) Gravimetric Analysis: Defination, Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as barium sulphate. Co-precipitation and Post Precipitation. (Definition, types and factors affecting) [4L]

B) Hard Acid And Soft Acids And Bases: Classification of acids and bases as hard and soft. Pearson's SHAB Concept and its applications. Acid-base strength of hardness and softness, Symbiosis. Theoretical basis of hardness and softness, electronegativity and hardness and softness. [4L]

C) Green Chemistry: Introduction, goals of green chemistry, significance of green chemistry, basic compounds of green chemistry, atom economy, functional group approaches to green chemistry, industrial applications of green chemistry [4L]

Unit-IV

A)Oxidation And Reduction: Use of redox potential data: Analysis of redox cycle, redox stability in water:- Froast, Latimer and pourba diagram, principle involved in the extraction of the element. [8L]

B) General Principles of Metallurgy: Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froath floatation and electromagnetic separation. Calcination, roasting, smelting and refining of metals. Meaning of terms-hydrometallurgy and pyrometallurgy. [4L]

Semester - IV

Paper-II (Organic Chemistry)

Unit-I

Electromagnetic Spectrum: Absorption Spectra

Ultraviolet(UV) absorption spectroscopy: Principle, Absorption Law(Lamberts-Beer's), Molar Absorptivity, Presentation and analysis of UV spectra, Types of electronic transitions, effect of Conjugation, concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shift.

Infra Red (IR) spectroscopy: Principle, Types of Molecular vibrations, Hooke's law, selection rule, intensity and position of IR band, measurement of IR spectrum (instrumentation), Finger-print region, characteristic absorption of various functional groups and interpretation of IR spectrum of simple organic compounds. [12 L]

Unit-II

A) Carboxylic Acid: Nomenclature, structure and bonding, physical properties: acidity of carboxylic acids, effect of substituent's on acidic strength, preparation and reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction, reduction of carboxylic acids decarboxylation mechanism of decarboxylation. Dicarboxylic acids: succinic acid, phthallic acid. Methods of formation and effect of heat and dehydrating agents. [6L]

B) Carboxylic Acid Derivatives: Structure and nomenclature of acid chloride, esters, amides(urea) and acid anhydride. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution, formation of carboxylic acid derivatives, chemical reaction. Mechanism of esterification and hydrolysis (acidic & basic) [6L]

Unit-III

A) Nitro Compound: Preparation of nitroalkanes and nitroarenes, chemical reactions of nitroalkanes, mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium. Picric acid. Halonitroarenes: reactivity. [4L]

B) Amino Compounds: Structure and nomenclature of amines: Separation of mixture of primary, secondary and tertiary amines. Structural features affecting the basicity of amines. Amine salts as phase transfer catalyst, preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of

aldehydic and ketonic compounds, Gabriel-thalimide reaction, and Hoffman-broamamide reaction. Reaction of amine: electrophilic aromatic substitution in aryl amine, reaction of amine with nitrous acid. Diazonium salt: stability & preparation of benzene diazonium chloride, mechanism of diazotization, replacement of diazo group by H, OH, F, Cl, Br, NO_2, CN, groups. Reduction of diazonium salt to hydrazine, coupling reaction and its synthetic applications. [8L]

Unit-IV

A) Quantitative Analysis: Estimation of C, H, N, S & X (Only principle and calculation), Calculation of Empirical and molecular formula. [4L]

B) Organic Synthesis Via Enolates: acidity of α-H, alkylation of diethyl malanoate and ethyl acetoacetate. Synthesis of ethyl acetoacetate (AAE): Claisen condensation, Keto-enol tautomerization of AAE. [4L]

C) Organometallic Compounds: Synthesis, structure and chemical reaction of organo Mg, Zn & Li compounds. [4L]

Semester - IV

Chemistry Practical

Time: 4-5 hrs Total Marks- 30

Inorganic Chemistry: Gravimetric Analysis

1) Estimation of Ba as $BaSO_4$
2) Estimation of Ni as Ni-DMG complex
3) Estimation of Zn as $ZnNH_4PO_4$
4) Estimation of Al or Al_2O_3 in potash alum
5) Estimation of Fe as Ferric oxide in the solution of Mohr's salts.

Organic Chemistry: Identification of an organic compound (having not more than one functional group) through element test, functional group test, determination of M.P./B.P. & Preparation of derivative with M.P. determination

Inorg. Exp. (12 Marks) + Organic Exp. (12Marks) + Viva (3Marks) + Record (3Marks) = 30 Marks

Reference Books:

1) Advanced Inorganic Chemistry Volume I & II by Satyaprakash, Tuli, Basu
2) Selected Topics in Inorganic Chemistry by Malik, Tuli, Madan.
3) Modern Inorganic Chemistry by Madan.
4) Concise Inorganic Chemistry by J.D. Lee *ELBS.*
5) Inorganic Chemistry by J.E. Huheey- *Harper & Row*
6) Fundamental concepts of Inorganic Chemistry by E.S. Gilreath *McGraw Holl book co.*
7) Modern Inorganic Chemistry by W.L. Jolly *McGraw Holl Int.*
8) Chemistry Fact Patterns & Principles by Kneen Rogers and Simpson *ELBS.*
9) Theorotical Principles of Inorganic Chemistry by G.S. Manku *Tata McGraw Hill*
10) Organic Chemistry by Morrison and Boyd, Print ice ha 11.
11) Analytical Chemistry-R. Gopalan-Sultan Chand.
12) Physico Chemical Techniques of Analysis – P.B. Janarthanam Vol – I & II- *Asian Publication*
13) Instrumental Methods of Chemical Analysis _ B.K. Sharma – *Goel Publication*
14) Organic Chemistry by L.G.Wa de. *Print ice hall.*

15) Organic Chemistry Vol. I, II, III by S.M. Mukharji, S.P. Sing and R.P. Kapoor

16) Fundamental of Organic Chemistry by Solomon, *John willey*

17) A Text book of Organic Chemistry by Bahl and Bahl.

18) A Text book of Organic Chemistry by P.L. Soni.

19) A Text book of Organic Chemistry by Tewari Mehrotra.

20) Stereochemistry by P.S. Kalsi.

21) Organic Chemistry by I.L. Finar.

22) A text book of Practical Chemistry for B.Sc. By V.V.Nadkarny, A.N. Kothare and Y.V. Lawande.

23) Advanced practical inoraganic chemistry by O.P. Agarwal.

24) Vogels Text Book of Qualitative Analysis.

25) Synthetic dyes by Gurudeep and Chatwal.

26) Organic chemistry by S.M. Kapoor. vol. II and III

27) Organic chemistry by Morrison and Boyed.

29) Organic chemistry by Arun Bahl and B.S. Bahl.

30) S.Y. B.Sc. Inorganic Chemistry : Semester-IV by Dr. S.B. Rewatkar, Dr. E.L.Ramteke, S.M.Sontakke, Y.P.Thawari, – *Shell Publication, Nagpur.*

31) S.Y. B.Sc. Organic Chemistry : Semester-IV by Y.P.Thawari, S.M.Sontakke, Dr. S.B. Rewatkar, Dr. E.L.Ramteke,– *Shell Publication, Nagpur.*

32) Inorganic chemistry B.Sc. II, Sem – IV Paper – I by Dr. N.E. Kathale, S. V. Madhamshettiwar, Dr. D. B. Patil.

33)S.Y. B.Sc. Practical Chemistry : Semester-IV by Dr. S.B. Rewatkar, Y.P.Thawari, A. B. Dhote, Dr. K. R. Lanjewar – *Shell Publication, Nagpur.(Proposed)*

GONDWANA UNIVERSITY, GADCHIROLI

B.Sc: Part - II (Semester-III)

SUBJECT - CHEMISTRY

Paper-I (Inorganic Chemistry)

Total Lectures: 48 **Marks:50**

Note: Figures to the right hand side indicate number of lectures.

Unit-I

A) Ionic Solids: Ionic structures, radius ratio effect & coordination number, Limitation of radius ratio rule, Lattice energy and Born-Haber cycle. Salvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rules.

[6L]

B) Metallic Bonding: Free electron theory and properties of metals, valance bond theory and Band theory to explain nature of conductors, insulators & semiconductors (intrinsic and extrinsic). [3L]

C) Hydrogen Bonding : Classification and effect of hydrogen bonding on viscosity, solubility, Melting point and boiling point [3L]

Unit-II

A) Chemistry Of First Transition Series Elements: Properties of the elements of first transition series with reference to their electronic configuration, atomic and ionic radii, ionization potential, Variable oxidation state, Magnetic properties, Colour, Complex formation tendency and Catalytic activity. [8L]

B) Chemistry Of Elements Of Second And Third Transition Series: Electronic configuration of 4d and 5d transition series. Comparative treatment with 3d-analogus (Groups Cr-Mo-W, Fe-Rn-Os, Co-Rh-Ir, Ni-Pd-Pt) in respect of oxidation states, magnetic behavior and stereo chemistry. [4L]

Unit-III

A) I) Errors In Chemical Analysis: Random and systematic errors, explanation of terms accuracy and precision, uncertainty, absolute and relative errors, mean, median definition average and standard deviation, significant figures, Numeral problems.

II) Statistical Test Of Data : Q-test 2.5d and 4d rules for the rejection of data, Numerical problems. [6L]

B) Theory Of Volumetric Analysis

i) Acid-Base Titration: Types of acid-base titration, theory of acid-base titration

a) Ostwald's theory b) Quinonied Theory, choice of suitable indicators for different acid-base titrations.

ii) Redox Titration: General principles involved in redox titrations. Theory of redox indicators-external and internal

iii) Complexometric Titration: Theory of complexometric titration, metallochrome indicator.

[6L]

Unit-IV

A) Non-aqueous solvent: Classification of solvents and general characteristics reaction in Non-aqueous solvents with reference to liquid ammonia and liquid sulphur dioxide.

[3L]

B) Fertilizers: Classification, chemical fertilizers with examples, advantages and disadvantages of chemical fertilizers, manuares and compost and their advantages over chemical fertilizers. [3L]

C) Portland cement : Raw materials, general composition of ordinary Portland cement, methods of manufacturing of cement i) Dry process ii) Wet process, reactions taking place in rotary kiln, properties of cement, additives for cement thermochemical changes taking place during cement formation, characteristics of constitutional compounds, composition of constitutional compounds, mortars, concrete and curing.

[6L]

B.Sc : Part - II (Semester-III)
Paper-II (Physical Chemistry)

Unit-I

Thermodynamics -I

(A) Recapitulation of thermodynamic terms: system, surrounding types of system (closed open & isolated), Thermodynamic, variables, intensive & extensive properties, thermodynamic processes (isothermal, adiabatic, isobaric, cyclic, reversible & irreversible) State function & path functions, properties of state functions (exact differential, cyclic rule), integrating factor, concept of heat & work. [3L]

(B) Statements of first law of thermodynamics, definition of internal energy & enthalpy, heat capacity at constant volume & at constant pressure, Joule-Thomson experiment, Joule Thomson coefficient & Inversion temperature, calculations of W,Q,ΔE & ΔH for expansion of gases for isothermal & adiabatic conditions for reversible process, carnot's cycle & its efficiency, thermodynamic scale of temperature.

[5L]

(C) Thermochemistry: Heat of reaction, standard states, relation between heat of reaction at constant volume & at constant pressure, Hess's law of constant heat of summation & its applications, bond dissociation energy & its calculations from thermochemical data, variation of heat of reaction with temperature (Kirchoff's equation).

[4L]

Unit-II

Thermodynamics-II

(A) Second law of thermodynamics : Need for second law of thermodynamics, statements of second law of thermodynamics, concept of entropy, entropy as a state function of V & T,P&T, entropy change in phase change for ideal gas, entropy as criteria of spontaneity & equilibrium.

[4L]

(B) Free energy functions: Helmholtz free energy (A) & Gibb's free energy (G) & their properties, standard free energies, effect of temperature on free energy (Gibb's-Helmholtz equation) & its applications, A&G as criteria for thermodynamic equilibrium.

[4L]

(C) System of variable composition: partial molar quantities, chemical potential, Van't-Hoff's reaction isotherm, relation between standard free energy change & equilibrium constant (thermodynamic derivation of law of mass action), effect of temperature on equilibrium constant (reaction isochore) [4L]

Unit-III

Phase Equilibria

(A) Phase rule: statement of phase rule, definition of phase, component and degree of freedom, derivation of phase rule, clapeyron equation & its application in deciding slopes of line for two phase equilibria, applications of phase rule to two phase equilibria of i) water system, ii) sulphur system& iii) Pb-Ag system. [6L]

(B) Liquid-Liquid mixtures: Ideal liquid mixtures, Raoults law of ideal solutions, Henry's law, non-ideal systems, azeotropes: HCl -H_2O & ethanol-water system.

Partial miscible liquids: Phenol-water system, trimethylamine-water, nicotine-water system, lower & upper consolute temperature, effect of impurity.

Immiscible liquids: Steam distillation, Nernst distribution law, Limitations, deviations & applications. [6L]

Unit-IV

Solid State

Laws of crystallography-

i) Law of constancy of interfacial angles

ii) Law of rationality of indices

iii) Law of symmetry, symmetry of elements in crystals.

Unit cell, space lattice, orientation of lattice plane (Miller indices).

Bravais lattices, crystal systems, X-ray diffraction by crystal, derivation of Braggs' equation. Determination of crystal structure of NaCl, KCl and CsCl

Lane's method and powder method. [12 L]

B.Sc. Part – II

Semester-III

Chemistry Practical

Time-4-5hrs Total-30 Marks

Inorganic Chemistry

Volumetric Analysis (Preparation of standard solution by weighing is compulsory).

1) Calibration of fractional weights.

2) Preparation of standard solution by weighing

3) Preparation of 0.001 M solution from 0.1M solution by dilution

4) Estimation of Fe (II) by dichromate using internal indicator (n-phenyl Anthranilic acid)

5)Determination of acetic acid in commercial vinegar using NaOH

6)Determination of alkali content –antacid tablet using HCl.

7)determination of zinc by complexometric titration with EDTA

8) Determination of total hardness of water (permanent and temporary) by EDTA

Physical Chemistry

1) To determine heat of solution of KNO_3

2) To determine heat of ionisation of weak acid (acetic acid)

3) To determine the solubility of benzoic acid at different temperature and to determine heat solution of benzoic acid.

4) To determine heat of solution of solid calcium chloride and calculate lattice energy of calcium chloride from its enthalpy change by using Born –Haber cycle.

5) To construct the phase diagram of three component system (Acetic acid –chloroform-water)

6) To determine the critical solution temperature of partially miscible liquids (phenol-water systems.)

7) To study the distribution of Iodine between water and carbon tetra chloride/kerosene.

8) To study molecular state of benzoic acid in benzene and water.

Inorg. Exp. (12Marks) + Physical Exp. (12Marks) + Viva (3 Marks) + Record (3Marks)=30 Marks

Reference Books:

1) Principles of Inorganic Chemistry by Puri, Sharma and Kalia – *S Naginchand & Co, Delhi.*

2) Text book of Inorganic Chemistry by A.K. De, *Wiley East Ltd.*

3) Selected Topics in Inorganic Chemistry by Malik Tuli and Madan- *S Chand & co.*

4) Modern Inorganic Chemistry by R.C. Agrawal , *Kitab Mahal*.

5) Instrumental Methods of analysis by Chatwal and Anand *Himalaya Publishing House.*

6) Concise Inorganic Chemistry by J.D. Lee *ELBS.*

7) Inorganic Chemistry by J.E. Huheey- *Harper & Row*

8) Fundamental concepts of Inorganic Chemistry by E.S. Gilreath *McGraw Holl book co.*

9) Modern Inorganic Chemistry by W.L. Jolly *McGraw Holl Int.*

10) Chemistry Fact Patterns & Principles by Kneen Rogers and Simpson *ELBS*.

11) Theorotical Principles of Inorganic Chemistry by G.S. Manku *Tata McGraw Hill*

12) Inorganic complex compounds by Murmann Chapman & Hall.

13) Text book of Inorganic Chemistry by K.N. Upadhyaya, *Vikas Publishing House, Delhi.*

14) Advanced Practical Inorganic Chemistry by Gurdeep Raj, *Goel Pulishing House, Meerut.*

15) Co-ordination Chemistry by D. Banerjee, *TMH Publication.*

16) Elements of Analytical Chemistry-R. Gopalan, P.S. Subramanian, K. Rengarajan-*S. Chand and sons (1997)*

17) Fundamentals of Analytical Chemistry-D.A. Skoog and D.M. West-*Holt Reinhard and Winston Publication-IV Edition (1982)*

18) Instrumental Methods of Chemical Analysis-Chatwal-Anand-*Himalaya Publishing house-(2000)*

19) Analytical Chemistry-R. Gopalan-Sultan *S-Chand.*

20) Physico Chemical Techniques of Analysis – P.B. Janarthanam Vol – I & II- *Asian Publication.*

21) Instrumental Methods of Chemical Analysis _ B.K. Sharma – *Goel Publication*

22) Robert de Lavie, A spreadsheet workbook for Quantitative Chemical Analysis, *Mcgraw-Hill*

23) Physical Chemistry: Walter, J. Moore, 5^{th} edn., New Delhi.

24) Physical Chemistry: G.M. Barrow, *McGraw Hill, Indian Edn.*

25) Principles of Physical Chemistry: Maron and Prutton

26) Principles of Physical Chemistry: Puri, Sharma and Pathaniya.

27) Text book of Physical Chemistry: P.L. Sony, O.P. Dharma.

28) Physical Chemistry: Levine.

29) Practical Physical Chemistry: Palit and De.

30) Practical Physical Chemistry: Yadao.

31) Practical Physical Chemistry: Khosla.

32) Laboratory Manual of Physical Chemistry W.J. Popiel.

33) S.Y. B.Sc. Inorganic Chemistry : Semester-III by Dr. S.B. Rewatkar, Dr. E.L. Ramteke, T. D. Kose – *Shell Publication, Nagpur.*

34) S.Y. B.Sc. Physical Chemistry : Semester-III by T.D. Kose, Dr. S.B. Rewatkar, Dr. E. L. Ramteke– *Shell Publication, Nagpur.*

35) S.Y. B.Sc. Practical Chemistry : Semester-III by Dr. S.B. Rewatkar, Y.P.Thawari , A. B. Dhote, Dr. K. R. Lanjewar – *Shell Publication, Nagpur.*

Gondwana University, Gadchiroli

Semester Pattern Syllabus for

B. Sc. III year, Semester V

CHEMISTRY

GONDWANA UNIVERSITY, GADCHIROLI

CHEMISTRY SYLLABUS

B.Sc. Part III (Semester-V)

(Effective from 2014-15)

Paper –I (Organic Chemistry)

Total Lectures : 48 Marks : 50

Note:- Figure to right hand side indicates number of lectures.

UNIT- I

Spectroscopy

Nuclear Magnetic Resonance (NMR) spectroscopy. Proton Magnetic Resonance spectroscopy. Basic idea about Instrumentation. Solvent used. Nuclear shielding and deshielding, Chemical shift, Spin-spin splitting and Coupling constant. Areas of signals. Interpretation of NMR spectra of organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,2 dibromo ethane, ethyl acetate, toluene, acetophenone, acetyl acetone. Problem pertaining to the structure elucidation of simple organic molecules by NMR technique. [12 L]

UNIT- II

A) Heterocyclic Compounds :

Molecular orbital picture and aromaticity of furan, thiophene, pyrrole and pyridine. Methods of synthesis of pyridine. Mechanism of electrophilic and nucleophilic substitution reaction of pyridine. Chemical reaction of pyridine. Structure of pyridine. Comparison of basicity of pyrrole and pyridine. Introduction to condensed five and six membered heterocycles. Preparation and reactions of Indole, Quinoline and Isoquinoline with special reference to Fischer Indole synthesis, Skraup synthesis and Bischler Napieralski synthesis. [8 L]

B) Reagents :

Method of preparation and chemical reactions of

i) 1,3 Dithiane Anionon – umpolung

ii) Sulphur Ylides.

iii) LDA (Lithium diisopropyl amide)

iv) Woodward and Prevost Hydroxylation [4 L]

UNIT- III

A) Carbohydrates : Definition, classification and reaction of glucose, Determination of structure of glucose. Determination of ring size of glucose by Haworth methylation process.

Epimerisation, mutarotation, conversion of glucose into fructose and vice-versa. Chain lengthening of aldose by Killiani's synthesis, and chain shortening of aldoses(Wohl's degradation). [6 L]

B) Amino Acids, Peptides & Proteins :

Classification, structure and stereochemistry of amino acids. Acids base behavior, isoelectric point and electrophoresis.

Structure and nomenclature of peptides and protein. Classification of proteins. Denaturation of Protein. Structure determination of proteins (primary and secondary). [4 L]

C) Fats, Oils & Detergents : Natural fats, edible and industrial oils of vegetable origin, Glycerides, hydrogenation of unsaturated oils, Definition of Saponification value. Iodine value. Acid value, Soaps, Synthetic detergents, Alkyl and aryl sulfonates.

[2 L]

UNIT- IV

A) Synthetic Dyes : Colour and constitution (Witt's theory, electronic concept) Classification of Dyes based on chemical constitution. Synthesis and uses of methyl orange Congored, Crystal violet, Phenolphthalein and Alizarin, indigo dye.

[6 L]

B) Drugs :- Definations, qualities of ideal drugs. Basic terminology of drugs (i) Analgesic (ii) Antipyretic (iii) Antibiotics (iv) Tranquilizer (v) Anaesthetic (vi) Antihistaminic (vii) Hormones (viii) Vitamins (ix) Narcotics and Non-Narcotics (Only Definations).

Synthesis and Applications of (i) Aspirin (ii) Paracetamol (iii) Chloroquine (iv) Chloramphenicol (v) Phenobarbital, and their side effects.

Uses of detol, Chloramin-T , Calmpose, Classification of antibiotics with examples.

[6 L]

Semester V

Paper –II (Physical Chemistry)

UNIT- I

Electrochemistry – I :

Electrical transport : Conductance in metals (electronic) & in electrolyte solutions (ionic conductance), conductivity of electrodes, specific, equivalent and molar conductance, measurement of equivalent

conductance, variation of equivalent & specific conductance with dilution, mobility of ions & Kohlrausch's law, Arrhenius theory of electrolyte dissociation & its limitation, Debye-Huckel theory (elementary treatment).Relaxation effect, Electrophoretic effect and Onsagar equation.

B) Migration of ions, velocity of ions & change in concentration around electrode, transport number : definition & determination by Hittorfs method & moving boundary method, factors affecting transport number of ions, relation between transport number & ionic conductance. Application of Kohlrausch's law & conductance for the determination of degree of dissociation, dissociation constant of acids, solubility of sparingly soluble salt, conductometric titrations (Acid-base & precipitation titrations) . [12 L]

UNIT-II

Electrochemistry – II :

(A) Galvanic cells, irreversible & reversible cells, emf of cells & its measurement, calculation of thermodynamic quantities of a cell reactions (ΔG, ΔH & ΔS & equilibrium constant)

[4 L]

(B) Types of reversible electrodes : gas electrode, metal-metal ion electrode, amalgam electrode, metal insoluble salt-anion, redox electrodes, Half cell reactions, Nerns't equation, calculation of cell emf from single electrode potential, reference electrodes, standard electrode potential. Concentration cells with & without transference, liquid-junction potential, salt bridge & its functions, Applications of emf measurements in : (i) pH- determination using hydrogen electrode,

quinhydrone electrode & glass electrode (ii) potentiometric titration(Acid –Base and Redox titrations). [8 L]

UNIT-III

Quantum Mechanics

A) Failure of classical mechanics : Explanation on the basis of Black body radiation, Photoelectric effect, heat capacity of solids and Bohr's model of Hydrogen atom (No derivation). Plank's quantum theory. De Broglie's hypothesis (Derivation and experimental proof). Heisenberg's uncertainty principle (Explanation and experimental proof).

B) Introduction to wave functions (Ψ), well behaved wave functions. Interpretation of wave function (Ψ) and its square (Ψ^2). Schrodinger wave equation. Normalized and orthogonal wave functions (only qualitative idea no problems). Introduction to operators. Postulates of quantum mechanics, Derivation of Schrodinger wave equation from postulates of quantum mechanics. Partical in a one dimensional box : derivation of energy and normalized wave function. Graphical representation of Ψ and its square Ψ^2. Applications of particle in a one dimensional box. Numerical problems. [12 L]

UNIT-IV

A) Solutions And Colligative Properties :

Methods of expressing concentration of solutions, Raoults law of relative lowering of vapour pressure, molecular mass determination from relative lowering of vapour pressure. Osmosis, osmotic pressure and its measurement by Barkeley and Hartley method.Determination of molecular mass from osmotic pressure. Elevation of boiling point, determination of molecular mass from elevation of boiling point. Depression of freezing point. Determination of molecular mass from depression of freezing point. Van't Hoff factor, degree of dissociation and association of solute. [8 L]

B) Magnetic Properties :

Electron spin angular momentum, spin quantum number, electron as magnetic dipole, magnetic moment of electron, Bohr magneton, relation between magnetic moment and number of unpaired electrons. Magnetic properties of substances. Diamagnetism, paramagnetism, ferromagnetism,

determination of magnetic susceptibility using Gouy method. Determination of magnetic moment of paramagnetic substances. Applications of magnetic susceptibility measurements.

[4 L]

Semister - V

Chemistry Practicals

Time 4-5 hrs Total Marks 30

- **Organic Chemistry**

A) Separation and identification of organic compounds from the given binary mixture.

B) 1. Estimation of glucose.
   2. Estimation of amide.
   3. Saponification value of oil.

C) 1. Preparation of aspirin.
   2. Preration of paracetamol.

Distribution Of Marks :-

1) Binary mixture + estimation. [A + B ; 8M + 4M]

   Or

2) Binary mixture + preparation [A + C; 8M + 4M]

- **Physical Chemistry**

1) To determine the strength of strong acid and a week acid in a given mixture conductometrically by titrating it with standard alkali solution.
2) To determine the solubility and solubility product of a sparingly soluble salt conductometrically.
3) To titrate potentiometrically ferrous ammonium sulphate solution using potassium dichromate solution as titrate and calculate the redox potential of Fe^{2+}/Fe^{3+} system on hydrogen scale.
4) To determine the dissociation constant of weak acid potentiometrically by titrating it against alkali.
5) To study the saponification of ethyl acetate conductometrically.

6) Determination of apperent degree of dissociation of an electrolyte (NaCl) in aqueous solution at different concentration by Ebullioscopy.

Distribution Of Marks For Practical Examination

Time 4-5 hours (One Day Examination) Marks 30

Organic Chemistry (Experiment) ..…..…. 12
Physical Chemistry (Experiment) ……..... 12
Viva-Voce ……. 03
Record ……. 03

Total : 30 marks

References :

1) Chemistry for Degree Student, Dr. R. L. Madan, S. Chand and Co. New Delhi.
2) Organic Chemistry by R. T. Morrison and R. T. Boyd, 6th edition, PHI.
3) Organic Chemistry by Pine, 5th edition.
4) Inorganic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor – Willey Eastern.
5) Organic Chemistry by S. K. Ghosh.
6) Reaction Mechanism in Organic Chemistry by S. M. Mukharjee and S. P. Singh.
7) Spectroscopy of Organic Compounds by P. S. Kalsi.
8) Stereochemistry and Mechanism through solved problems by P.S. Kalsi.
9) Organic Chemistry by TWG Solomons, 4th edition, John Wiley.
10) Hand book of Organic Analysis by H. J. Clarke, Arnold Heinmen.
11) Text book of Practical Organic Chemistry by A. I. Vogel.
12) Text book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahaja, Toshinwal.
13) Text book of Organic Chemistry by P.S. Kalsi published by Macmillian India Ltd. 1999, Delhi.
14) Practical Organic Chemistry by F. G. Mann. B. C. saunders, Orient Longman.
15) Comparative Practical Organic Chemistry (Qualitative Analysis) by V. K. Ahluwalia and Sunita Dhingra, Orient Longman.
16) Comprehensiv Practical Organic Chemistry (Preparation and Qualitative Analysis) by V. K. Ahluwalia and Renu Agrawal. Orient Longman.
17) Physical Chemistry : Walter J. Moore, 5th edn. New Delhi.
18) Physical Chemistry : G. M. Barrrow, McGraw Hill, Indian Edn.
19) Principle of Physical Chemistry : Maron and Prutton.
20) Principles of Physcial Chemistry : Puri and Sharma
21) Physical Chemistry : P. W. Atkins, 4th Edn.
22) Text book of Physical Chemistry : P. L. Sony O. R. Dhrma.
23) Physical Chemistry : Levine

24) Practical Physical Chemistry : Palit and De.
25) Practical Physical Chemistry : Yadao
26) Practical Physical Chemical : Khosla.
27) An introduction to synthetic drugs, Himalaya publishing house by Sing and Rangnekar.
28) Spectroscopy, Goel Publushing house by B. K. Sharma.
29) T.Y. B.Sc. Organic Chemistry : Semester-V by – *Shell Publication, Nagpur.(Proposed)*
30) T.Y. B.Sc. Physical Chemistry : Semester-V by – *Shell Publication, Nagpur.(Proposed)*
31) T.Y. B.Sc. Practical Chemistry : Semester-V by – *Shell Publication, Nagpur.(Proposed)*

Gondwana University, Gadchiroli

Semester Pattern Syllabus for

B. Sc. III year, Semester VI

CHEMISTRY

GONDWANA UNIVERSITY, GADCHIROLI

CHEMISTRY SYLLABUS

B.Sc. Part III (Semester-VI)

(Effective from 2014-15)

Paper –I (Inorganic Chemistry)

Total Lectures : 48 Marks : 50

Note:- Figure to right hand side indicates number of lectures.

UNIT-I

A) Metal Ligand Bonding In Transition Metal Complexes:

Limitations of Valency bond theory, Crystal field theory: Splitting of d-orbital in octahedral,tetrahedral and square planar complexes. Factors affecting the Magnitude of 10Dq,Crystal field Stabilisatation Energy of Octahedral and Tetrahedral complexes (Numericals)

[8 L]

B) Electronic Spectra Of Transition Metal Complexes :

Jahn Teller Effect, Selection Rules (Laporte and Spin selection Rules).Hole Formalism Principle. Electronic spectrum of $[Ti(H_2O)_6]^{3+}$ and $[Cu(H_2O)_6]^{2+}$ complex ions [4L]

UNIT-II

A) Magnetic Properties Of Transition Metal Complexes :

Method of determining of Magnetic Susceptibility by Gouy's Method. Spin only formula and orbital contribution to magnetic moment.Magnetic properties of Octahedral and Tetrahedral complexes with respect to CFT. Numericals on magnetic moments.

[6 L]

B) Thermodynamic And Kinetic Aspect Of Metal Complexes :

Thermodynamic and Kinetic stability of metal complexes, their relation. Stepwise stability and overall stability constant and their relationship, Factors affecting the Stability of complexes. Determination of composition of Fe(III)-SSA complex by Mole Ratio and Job's Method.

[6 L]

UNIT-III

A) Colorimetery And Spectrophotometery:

Principles of photometery: Beer-Lamberts Law, And its deviation. Types of colorimeter and spectrophotometer with simple schematic diagrams. Application of colorimeter and spectrophotometer in quantitative analysis with reference to estimation of Cu(II) as Cu-ammonia complex. [6 L]

B) Separation Techniques:

a) Chromatography: Classification, Principle, Technique and Application of Paper and Column Chromatography.

b) Ion- Exchange: Types of ion exchange resins, Equilibria and ion exchange capacity, Application in separation of binary mixtures.

c) Solvent Extraction: Principle and Classification , Factors influencing extraction and application in chemistry. [6 L]

UNIT-IV

A) Organometallic Chemistry :-

Definition, Nomenclature and Classification of Organometallic compounds. Preparation properties and application of Alkyl and Aryls of Al, Hg and Sn. A brief account of metal ethylenic complexes (Structure only).Homogeneous Hydrogenation (Wilkinson's Catalyst reaction). [4 L]

B) Bioinorganic Chemistry:

Essential and Trace elements in biological processes, Metallo porphyrins with special reference to structure and role of Hemoglobin and Myoglobin in transport of Oxygen. Biological role of Na^+ and K^+ and Ca^{2+} metal ions. [4 L]

A) Basic Principal Of Soil Chemistry :-

Introduction of soil and its type, Chemical Analysis of soil, Collection of soil Sample, Method of analysis, Soil pH, Soil Salinity, Organic carbon, available phosphorous and potassium. Lime requirements. [4 L]

Semester VI

Paper II : Physical Chemistry

UNIT-I

A) Quantum Chemistry :- Schrodinger wave equation for hydrogen atom, separation in to three equations (without derivation, in terms of r, and Φ), Total wave function for hydrogen atom in terms of radial and angular wave functions, energy of hydrogen atom (no derivation). Hydrogen like wave functions, radial wave functions and angular wave functions. Interpretation of quantum, numbers. Concept of orbital and radial probability distribution curves for 1s, 2s, 2p, 3p and 3d orbitals. [6 L]

B) Molecular Orbital Theory : Criteria for forming M. O. from A. O., LCAO-MO method for H_2^+ molecule, expression for energy levels for bonding and antibonding wave functions. Normalized wave functions for bonding and antibonding (no derivation).Physical pictures of bonding and antibonding wave functions. Introduction to M. O. theory for H_2 molecule (Qualitative treatment, without derivation). Introduction to Valance bond theory for H_2 molecule. [6 L]

UNIT-II

A) Photochemistry :-

Interaction of radiation with matter, difference between thermal and photochemical process, Beer –Lamberts, laws of photochemistry : Grothus-Draper law, Stark-Einstein law, Jablonski diagram depicting various processes (nonradiative and radiative) fluorescence, phosphorescence, chemiluminesence, quantum yield, determination of quantum yield of reactions, causes for low and high quantum yields. Some examples of photochemical reactions (e.g. Photochemical decomposition of Hydrogen iodide, Photosynthesis of HBr from H_2 and Br_2 and photosynthesis of HCI from H_2 and Cl_2 Photosensitized reactions. Energy transfer processes.

[8 L]

B) Dipole Moment :-

Electrical dipole moment, polarizatrion of molecules (Clasius Mosotti equation), orientation of dipoles in an electric field. Determination of dipole moment. Bond moments. Group moments for benzene derivatives. Application of dipole moment to (i) % ionic character (ii) Shape of molecules, (iii) study of geometrical isomers and (iv) substituted benzene molecules.

[4 L]

UNIT-III

Spectroscopy

A) Rotational Spectroscopy :

Introduction to spectroscopy, Dipole moment and Rotational Spectra. Rotational spectra of diatomic molecules, Energy levels of rigid rotor. Selection rule for transition between energy levels. Expression for wave number (cm^{-1}) of spectral lines in terms of rotational constant (B) and rotational quantum number (J). Intensity of spectral lines. Application of rotational spectra for determination of bond length of diatomic molecules. Introduction to non-rigid rotor.

[6 L]

B) Vibrational Spectroscopy :

Energy levels of simple harmonic oscillator, Energy level diagram, relative populations of energy levels. Selection rule for pure vibrational spectra (harmonic oscillations), Force constant. Anharmonic oscillator, Morse equation, selection rules, idea of overtones. Degrees of freedom and normal modes of vibration for polyatomic molecules. Idea of vibrational frequencies of different functional groups.

[6 L]

UNIT-IV

A) Surface Chemistry :-

Adsorption, Chemisorptions, Application of adsorption, adsorption of gases by solid, freundlich adsorption isotherm , Langmuirs theory of adsorption, Adsorption from solution , Adsorption chromatography. [6 L]

B) Colloidal Chemistry:-

Type of colloidal system , its classification, lyophilic and lyophobic sol, partical size range, preparation of colloidal solution by condensation method , ultra filtration, properties of colloidal system, charge on colloidal particles, gold number, electrical properties: electrophoresis and electro Osmosis, Surfactant definition, types , miscelle concentration, effect of temperature on CMC.[6 L]

Semister - VI

Chemistry Practicals

Time 4-5 hrs Total Marks 30

- **Inorganic Chemistry**

Group A) Preparation of following complexes :

i)Potasium trioxalato ferrate (III) $K_3[Fe(C_2O_4)_3].H_2O$

ii)Copper tetramine complex $[Cu(NH_3)_4] . 2H_2O$

Group B) Colorimetery :

i) Jobs method of determination of composition of Fe- SSA complex

ii) Mole Ratio Method of determination of composition of Fe- SSA complex

Group C) i) Ion exchange method, separation and estimation of Mg (II) and Zn (II).

ii) Chromatographic separation of binary mixtures(at least Two) containing Cu(II), Co(II) and Ni(II) ions by paper chromatography and determination of Rf values.

Note :- Any two experiment from group A, B and C (One from each group) are compulsory in examination.

- **Physical Chemistry**

1) To verify Beer-Lambert law for $KMnO_4$ / $K_2Cr_2O_7$ and determine the concentration of the given solution of $KMnO_4$ / $K_2Cr_2O_7$.
2) To verify law of refraction for mixture (glycerol-water) using Abbe's refracto meter.
3) To determine the specific rotation of a given optically active compound by polarimeter. (D-glucose, D / L Lactic acid).
4) To determine molecular mass of a non-volatile solute by Rast method.
5) To verify the frendlich adsoption isotherm by acetic acid on activated charcoal.

Distribution Of Marks For Practical Examination

Time 4-5 hours (One Day Examination) Marks 30
Organic Chemistry (Experiment) ……...…. 12
Physical Chemistry (Experiment) ……. 12

Viva-Voce …… 03
Record …… 03

Total : 30 marks

References :

1. Principles of Inorganic Chemistry by Puri. Sharma and Kalia – S. Naginchand & Co. Delhi.
2. Text book of Inorganic Chemistry by A. K. De. Wiley East Ltd.,
3. Selected Topies in Inorganic Chemistry by Malik, Tuli and Madan – S. Chand and Co.
4. Modern Inorganic Chemistry by R. c. Agrawal, Kitab Mahal.
5. Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
6. Concise Inorganic Chemistry by J. D. Lee, ELBS.
7. Inorganic Chemistry by J. E. Hoheey – Harper and Row.
8. Fundamental concepts of Inorganic Chemistry by E. S. Gilreath, McGraw Hill book Co.
9. Modern Inorganic Chemistry by W. L. McGraw Hill Int.
10. Chemistry Facts, Patterns and Principles by Kneen, Rogers and Simpson, ELBS.
11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
12. Inorganic complex compounds by Murmann, Chapman and Hall.
13. Text book of Inorganic Chemistry by K. N. Upadhayaya, Vikas Publishing House, Delhi.
14. Advanced Practical Inorganic Chemistry by Gurdeep Raj. Goel Publishing House, Meerut.
15. Co-Ordination Chemistry by D. Banerjee, TMH Publication.
16. Text book of Inorgnaic Chemistry by Marathe, Bhadange, Mopari and Kubade.
17. Physico Chemical Techniques of Analysis – P.B. Janarthanam Vol – I & II- Asian Publication
18. Instrumental Methods of Chemical Analysis _ B.K. Sharma – Goel Publication
19. Robert de Lavie, A spreadsheet workbook for Quantitative ChemicalAnalysis, Mcgraw-
20. Physical Chemistry: Walter, J. Moore, 5^{th} edn., New Delhi.
21. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.

22. Principles of Physical Chemistry: Maron and Prutton

23. Principles of Physical Chemistry: Puri, Sharma and Pathaniya.

24. Text book of Physical Chemistry: P.L. Sony, O.P. Dharma.

25. Physical Chemistry: Levine.

26. Practical Physical Chemistry: Palit and De.

27. Practical Physical Chemistry: Yadao.

28. Practical Physical Chemistry: Khosla.

29. Laboratory Mannual of Physical Chemistry W.J. Popiel.

30. Principles of Soil Science : M. M. Rai (4^{th} addition) McMillan publication.

31. Advance physical chemistry : J. N. Gurtu & A. Gurtu, Pragati prakashan, Meerut.

32. T.Y. B.Sc. Inorganic Chemistry: Semester-VI by – *Shell Publication, Nagpur.(Proposed)*

33. T.Y. B.Sc. Physical Chemistry : Semester-VI by – *Shell Publication, Nagpur.(Proposed)*

34. T.Y. B.Sc. Practical Chemistry : Semester-VI by – *Shell Publication, Nagpur.(Proposed)*

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

for

B.Sc.

Mathematics

SEMESTER – V I

(With effect from : 2014-15)

a

SYLLABUS

B. Sc. III (Semester – VI)

Paper – IV (Compulsary)

MAT 304 : Analysis

Total Marks : 75 (60+15)

UNIT – I

Metric space, subspace of metric space, open set, Cauchy's sequence, complete Metric space, compactness.

UNIT – II

Riemann Integral, Integrability of continuous and monotonic function,

The Fundamental theorem of integral calculus, Mean value theorem of integral calculus.

UNIT – III

Complex integration, Cauchy's integral theorem, Cauchy integral formula, singularity, Residue theorem.

UNIT – IV

Fourier Transform:-

Dirichlet condition, The Fourier series, The Fourier integral, Finite Fourier sine & cosine transform, Infinite Fourier transform, Infinite Fourier sine & cosine transforms, some properties of Fourier transform, partial differential equations

Reference Books :-

1. Prof. T. M. Karade, J. N. Salunke, K. S. Adhav and M. S. Bendre, Analysis, Sonu Nilu, Bandu Soni Layout, Gayatri road, Parsodi, Nagpur.
2. Prof. T. M. Karade, Complex Analysis, Sonu Nilu, Bandu Soni Layout, Gayatri road, Parsodi, Nagpur.
3. I. M. Apostol, Mathematical Analysis, Narosa Publishing House. New Delhi, 1985.
4. E. C. Tichmarch, Theory of functions.

5. R. R. Goldberg, Real Analysis, Oxford & I. B. H. Publishing Co., New Delhi, 1970.
6. S. Lang. Undergraduate Analysis, Springer-Verlag, New Youk. 1970.
7. D. Somasundaram and B. Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House. New Delhi, 1997.

SYLLABUS

B. Sc. III (Semester – VI)

Paper – V (Optional)

MAT 305 : Special Relativity - II

Total Marks : 75 (60+15)

UNIT – I

Tensor Analysis - Coordinate transformations, Summation Convention, The Kronecker delta, Covariant, Contravariant and mixed tensor, symmetric and skew symmetric tensors, Fundamental operations on tensors, metric tensor, conjugate metric tensor.

UNIT – II

Christoffels symbols, Transformation of christoffels symbols, covariant derivatives, Absolute derivative, Geodesics, Curvature tensor, Ricci tensor, Einstein tensor, The Bianchi identity.

UNIT – III

Relativistic Mechanics : Variation of mass with velocity Equivalence of mass and energy, Transformation Eq^{n} for mass, momentum and energy, Energy momentum four vectors, Relativistic force and transformation equation for its components, Relativistic Lagrangian and Hamiltonian Relativistic eq^{n}of motion of particle.

UNIT – IV

Electromagnetism : Maxwell's equation in vacuum, Transformation equations for density of electric charge and current, propagation of electric and magnetic field strength, Transformation equations for electromagnetic four potential vector, Lagrangian for a charged particle in an electromagnetic field. Lorentz force. The electromagnetic field tensor Maxwell's eq^{n} in tensor form, Lorentz force on a charged particle.

Reference Books :-

1. Lectures on Special Relativity

   Prof. T. M. Karade, K. S. Adhav and Maya S. Bendre, Sonu Nilu.

2. C. Moller, The Theory of Relativity, Oxford Clarendon Press, 1952.

3. P. G. Bergmann, Introduction to the theory of relativity, Prentice Hall of India, Pvt. Ltd. 1969.

4. I. I. Anderson, Principle of relativity Physics, Academic Press, 1967.

5. Murray R. Spiegel, Theory and Problems on vector Analysis SIJ Metrics and Introduction to Tensor Theory, Shaum's outline Series, Me. Gra. Hill Book Company.

SYLLABUS
B. Sc. III (Semester – VI)
Paper – VI (Optional)
MAT 306 : Number Theory and Discrete Mathematics

Total Marks : 75 (60+15)

UNIT – I

Diophantine equation ax + by = c congruence, Fermat's theorem, Wilson's theorem.

UNIT – II

Linear congruencies simultaneous linear congruence. Higher degree congruenes order of integers (mod m)

UNIT – III

Basic concept of graph theory undirected and directed graph, Simple graph, multi graph, pseudo graph Degree of vertex indegree and outdegree sub graphs and isomorphic graph, paths cycles, connectivity. Trees and their Properties spanning tree. BFS Algorithm DFS algorithm properties Binary trees.

UNIT – IV

Lattices and Boolean Algebra

Definition and Examples. Some properties of lattices, sub lattices. Direct product and homomorphism. Some Special Lattices Boolean algebra Definition and Examples sub algebra, Direct product and homomorphism.

Text Book: - For (Unit I & II)

Number Theory
S G Telang, Edited By M. G. Nadkarni & J. S. Dani
Tata McGraw-Hill Pubkishing Company Limited (New Delhi)

For (Unit III & IV)

Discrete Mathematical Structures with Applications to Computer Science
J. P. Tremblay, R. Manohar
Tata McGraw-Hill Edition

Reference Books:

1. An Introduction to the Theory of Numbers ± I. Niven and H. Zuckerman
   1980, 4th Edition, John Wiley & Sons, New York.
2. Elementary Number Theory & Its Applications ± Kenneth Rosen
   1987, 2nd Edition, Reading Mass Addison ± Wesley.
3. Discrete Mathematical structures by Bernard Kolman, Robert C. Busby, Sharon Ross, Prentice- Hall of India
4. Discrete Mathematics and its applications by Kenneth H.Rosen, Tata McGraw- Hill

GONDWANA UNIVERSITY, GADCHIROLI.

STUDY COMMITTEE IN MATHEMATICS
B.SC. I (MATHEMATICS)
SEMESTER WISE SYLLABUS

WITH EFFECT FROM
2012-13

SYLLABUS
B.SC. PART I SEMESTER I
PAPER I
MAT 101: ALGEBRA AND TRIGONOMETRY

TOTAL MARKS: 75 (60+15)

Unit I

De-Moivre's theorem and its applications, Square root of complex number. Inverse circular and hyperbolic functions. Logarithm of complex quantity. Summation of series.
C+iS methods based on binomial, Geometric, Exponential, Sin x and Cos x.

Unit II

Definition of rank of a matrix. Theorems on consistency of a system of linear equations Application of matrices to a system of linear (homogeneous and non-homogeneous equations) Eigen values, Eigen vectors and characteristic equation of a matrix.
Caley Hamilton's theorem

Unit III

Relation between roots and coefficients of a general polynomial equation in one variable
Transformation of equations. Descarte's rule of signs. Solution of cubic equations
(cardon method)

Unit IV

Divisibility, Definition and elementary properties. Division Algorithm, G.C.D. and L.C.M. of two integers, Basic properties of G.C.D. , Euclidean Algorithm. Primes. Euclid's Theorem, Unique Factorization Theorem.

References

1. K.B. Datta, Matrix and Linear Algebra - Prentice Hall of India PVT ltd. New Delhi 2000
2. Chandrika Prasad, Text book on Algebra and theory of equations- Pothishala private ltd. Allahabad.
3. H.S. Hall and S.R. Knight, Higher Algebra- H.M. Publications 1994
4. S.L. Loney, plane trigonometry part- II Macmillan and company, London
5. Elementary number theory, David Burton- Tata Mc Graw Hill (Walter Rudin Series) Indian Edition
6. Prof. T.M. Karade and M.S. Bendre, Algebra and Trignometry Sonu Nilu.

SYLLABUS

B.SC. PART I SEMESTER I

PAPER II

MAT 102: DIFFERENTIAL AND INTEGRAL CALCULUS

TOTAL MARKS: 75 (60+15)

Unit I

Limit and continuity of a function $\epsilon - \delta$ definition of limit and continuity two sided continuity. Theorem on differentiation, Mean value theorem, Rolles theorem, Legranges mean value theorem Cauchy's generalised Mean value theorem. Marlaurin Series and Toylor's series expansion, curvature.

Unit II

Higher orders derivative calculation of n^{th} derivative some standard result. Determination of n^{th} Derivative of rational function, n^{th} Derivative of product of the power of Sines and Cosine. Leibnitz's theorem n^{th} Derivative of product of the two function.Indeterminant form.

Unit III

Integral of irrational and transcendental function. Integral based on

$\sqrt{x^2 + a^2}$, $\sqrt{x^2-a^2}$, $\sqrt{a^2-x^2}$

Reduction formula for $\int Sin^n x dx$ and $\int Cos^n x dx$

Reduction formula for $\int Sin^p x\ Cos^q x dx$

Reduction formula for $\int tan^n x dx$ and $\int Cot^n x dx$

Reduction formula for $\int Sec^n x dx$ and $\int Cosec^n x dx$

Reduction formula for

$$\int \frac{1}{(X^2+a^2)^n} dx$$

Reduction formula for $\int x^m\ (ax^2+b)^p\, dx$

Unit IV

Improper integral, Gamma function, Properties of Gamma function, Beta function, Properties of Beta function.

References

1) Gabriel klambaue, Mathematical Analysis, Marcel Dekkar, Inc, New York, 1975
2) N. Piskunovv, Distterntial and integral calculate peace publisher, Moscro.
3) Murray R. Spiegel, Theory, and problems of Advanced calculus, Schaum's outline series schaum publishing co New York.
4) Gorakh Prasad, Ditteroential calculus Pothishala private ltd. Allahabad.
5) Gorakh Prasad , Integral Calculus Pothishala Private Ltd. Allahabad.
6) P. K. Jain and S. K. Kaushik, An Introduction to Real Analysis S. Chand and Co. New Delhi 2002
7) Prof. T.M. Karade and M.S. Bendre,Calculas and Differential Equations Sonu,Nilu,Nagpur

SYLLABUS

B.SC. PART I SEMESTER – II

MTH:103 PAPER – III VECTOR CALCULUS,GEOMETRY & DIFFERENCE EQUATION

TOTAL MARKS: 75(60+15)

Unit I

Vector triple product. Product of Four Vectors. Vector differentiation. Gradient, divergence and curl. Solenoidal and irrotational vector field.

Unit II

Double integration. Properties of double integration. Iterated integral. Change of order of Integration. Transformation of double integral in polar form.

Unit III

Spheres , Plane section of a sphere. Intersection of two sphere. Sphere through a given circle cone. Equation of cone with Vertex at origin. Right circular cone. Right circular cylinder.

Unit IV

Formation of difference equation. Order of difference equation. Liner difference equation. Homogeneous linear equation with constant coefficient. Non homogeneous linear equation Particular integrals

Reference Books.

1) Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
2) Erwin Kregsrig, Advanced Engineering Mathematics John wiler and sons, 1999
3) N. Saran and S. N. Nigam, Introduction to Vector Analysis, Pothishala Pvt. Ltd.
4) Shanti Narayan, A text book of Vector Calculus S. Chand & co., New York.
5) S. L. Loney, The elements of coordinator Geometry, Macmillan and Company London.
6) R. J. T. Bell, Elementary treatise on coordinator Geometry of three dimensions Wiley Eastern Ltd. 1994
7) N. Sharan and R. S. Gupta, Analytical Geometry of three dimensions.
8) Gorakh Prasad and H. C. Gupta, Text Book on Coordinator Geometry, Pothishala Pvt. Ltd. Allahabad.
9) P. K. Jain and Khalil Ahmad. A text book of Analytical Geometry of three dimensions Wiles Eastern Ltd. 1994
10) Prof. T.M. Karade and M.S. Bendre, Vector Analysis and Geometry, Sonu Nilu,Nagpur

SYLLABUS
B.SC. I SEMESTER – II
PAPER –IV
MAT:104 DIFFERENTIAL EQUATION AND ANALYSIS

TOTAL MARKS: 75(60+15)

Unit – I

Exact Differential equations. Linear differential Equation. Equation reducible to linear form. First order and higher degree equations solvable for x,y,p. Clairaut's differential equations. Orthogonal trajectories

Unit – II

Linear differential equation with constant coefficient. Operator method to find the particular integral. Linear differential equation of second order. Wronskian. Method of Variation of parameter

Unit – III

Sequences. Theorem on limit of sequences. Bounded and Monotonic Sequences. Cauchy Sequences. Cauchy's convergence criterion

Unit – IV

Series of non-negative terms. Comparison test, Cauchy's integral test, Ratio test. Alternating Series, Leibnitz's theory, Absolute and conditional convergence. Series of arbitrary terms

Reference

1) D. A.Murry, Introductory Course in Differential Equations, orient Longman (India), 1967
2) G. F. Simmons, Differential Equations Tata Mc Graw Hill 1972
3) E. A. Codington, An Introduction to ordinary Differential Equations and their Application C. B. S. Publisher and Distributors, Delhi, 1985.
4) O. E. Stanaitis, An introduction to sequences, Series and inproper integral Holden-Dev Inc. San Francisco, California.
5) Eart D. Rain ville, Intinite series The Macmillan company, New York.
6) Prof. T.M. Karade and M.S. Bendre, Calculas and Differential Euations, Sonu Nilu.Nagpur

GONDWANA UNIVERSITY, GADCHIROLI.
STUDY COMMITTEE IN MATHEMATICS
B.SC. (MATHEMATICS)
SEMESTER WISE SYLLABUS
WITH EFFECT FROM
2012-13
Teaching Pattern

B.Sc. Part I

Semester I:

Paper I : MAT 101 ALGEBRA AND TRIGONOMETRY
TOTAL MARKS: 75 (60+15)

Paper II : MAT102 DIFFERENTIAL AND INTEGRAL CALCULUS
TOTAL MARKS: 75 (60+15)

Semester II :

Paper III : MAT 103 VECTOR CALCULUS,GEOMETRY & DIFFERENCE EQUATION
TOTAL MARKS: 75(60+15)

Paper IV : MAT 104 DIFFERENTIAL EQUATION AND ANALYSIS
TOTAL MARKS: 75(60+15)

Teaching Pattern:

1. Four Lectures per week per paper.
2. One tutorial per week per section per paper .

STUDY COMMITTEE IN MATHEMATICS

B.SC. (MATHEMATICS)

SEMESTERWISE DISTRIBUTION OF MARKS & CREDITS

Sr No.	Class	Semester	Theory Paper Marks		Internal Assessment Marks	Total Marks
			Paper I	Paper II		
1	B.Sc.Part I	I	60	60	15+15	150
2	B.Sc.Part I	II	60	60	15+15	150
3	B.Sc.Part II	III	60	60	15+15	150
4	B.Sc.Part II	IV	60	60	15+15	150
5	B.Sc.Part III	V	60	60	15+15	150
6	B.Sc.Part III	VI	60	60	15+15	150
			360	360	180	900

Semester	**Papers**	**University Exam Marks - Credits**	**Internal Assessment Marks - Credits**	**Total Marks - Credits**	**Grand Total Marks – Credits 900 - 60**
1	2 Compulsory	2x60 - 2x4	2x15 - 2x1	150 - 10	
2	2 Compulsory	2x60 2x4	2x15 - 2x1	150 - 10	
3	2 Compulsory	2x60 2x4	2x15 - 2x1	150 - 10	
4	2 Compulsory	2x60 2x4	2x15 - 2x1	150 - 10	
5	1 Compulsory 1 Elective	2x60 2x4	2x15 - 2x1	150 - 10	
6	1 Compulsory 1 Elective	2x60 2x4	2x15 - 2x1	150 - 10	

Paper Pattern and Evaluation Scheme

Theory- Two theory papers for every Semester each of 60 Marks and time duration is of three clock hours.

Internal Assessment- TOTAL Marks 30 Per Semester 15 on each paper
Considering Students Attendance, Class Performance,
Unit test, Home Assignments, Class seminar

Question Paper Pattern:

Time 3 Hours All questions are compulsory Total Marks: 60

Question I (12 Marks)

Unit I A) 6 Marks

B) 6 Marks

OR

Unit I C) 6 Marks

D) 6 Marks

Question II (12 Marks)

Unit II A) 6 Marks

B) 6 Marks

OR

Unit II C) 6 Marks

D) 6 Marks

Question III : (12 Marks)

Unit III A) 6 Marks

B) 6 Marks

OR

Unit III C) 6 Marks

D) 6 Marks

Question IV: (12 Marks)

Unit IV A) 6 Marks }

B) 6 Marks }

OR

Unit IV C) 6 Marks }

D) 6 Marks }

Question V : (12 Marks)

Unit V Eight Short Questions (Attempt any Six) two from each unit, with each of two marks

Evaluation Scheme

1. Theory and Internal Assessment will be separate heads of passing.
2. To pass the internal assessment, student must secure at least 6 marks out of 15 in each paper.
   In case a student fail in Internal assessment he/she will have to submit the same before the commencement of next examination.
3. In case a student fails in theory but passes in IA, the marks of these carried over in each paper.
4. Total marks must be 40 percent in aggregate for a student to be declared pass.

Proceedings of the meeting of the Subject committee in Mathematics held on April 24, 2012

As per the notification of Gondwana University Subject committee in Mathematics of the Gondwana University met at **11.30** am on Dated **April. 23, 2012** at University Administrative Hall, Dr. Lalsingh Khalsa Chairman Subject committee was in chair . Dr Lalsingh Khalsa placed the agenda itemwise before the committee for the consideration and approval of Committee.

Item No.I To consider and confirm the Semester wise Syllabus for B.Sc.I and Msc I (Mathematics)

Resolution No.I Dr Ladke L.S. placed the copies of Syllabus for observation and discussed in the meeting. All the members with some suggestions accepted the semesterwise syllabus for B.Sc. I and M.Sc. I for 2012-13. and it was unanimously confirmed.

Item No.II To discuss on teaching Pattern

Resolution No.2 Dr. Lalsingh Khalsa explained the teaching pattern of both papers in each semester for B,Sc I and M.Sc. I It was discussed among members and finally with some changes teaching plan was accepted unanimously.

Item-III :- To discuss on Paper pattern and evaluation scheme.

Resolution 2- Pattern of both papers for each semester was discussed thoroughly and decided to set the questions on each unit with intra unit choice based.

While discussing on evaluation scheme it was decided that Theory and Internal Assessment will be separate heads of passing and frame some rules of evaluation.

There was no other item for discussion

Dr. L.H. Khalsa Chairman Study Committee thanked all the members for their valuable participation and Co-operation.

⌘ Following members were present at the meeting. ⌘

Sr.No.	Name	Designation	Signature
1.	Dr Khalsa L.H.	Chairman	
2.	Dr.Thengane K.D.	Member	
3.	Dr. Singaru S.S.	Member	
4.	Dr Varhade D.N.	Member	
5.	Dr.Ladke L.S.	Member	

GONDWANA UNIVERSITY

GADCHIROLI

SEMESTER SYSTEM PATTERN SYLLABUS

for

B.Sc.

Mathematics

SEMESTER – V

(With effect from : 2014-15)

SYLLABUS

B. Sc. III (Semester – V)

Paper – I (Compulsory)

MAT 301 : Linear Algebra

Total Marks : 75 (60+15)

UNIT – I

Analytic function, Cauchy Riemann equation, Polar form of C – R equations, Harmonic function, Mobius transformation, Cross ratio.

UNIT – II

Vector space, Subspace, Linear span, Quotient space, Linear dependence and independence and their basic properties, Basis and dimension.

UNIT – III

Linear transformations : The algebra of linear transformation, Rank-Nullity theorem, Matrix and linear transformation, Rank and Nullity of a matrix, Isomorphism.

UNIT – IV

Inner product space: Inner product, Cauchy Schwartz inequality, Orthogonal vectors, Orthogonal complement, Orthonormal set. Bessel's inequality for finite dimensional space, Gram – Schmidth orthogonalisation process.

Reference Books :-

1. Prof. T. M. Karade, J. N. Salunke, K. S. Adhav and M. S. Bendre, Abstract Algebra, Sonu Nilu, Bandu Soni Layout, Gayatri road, Parsodi, Nagpur.
2. N. Herstein. Topics in Algebra, Wiley eastern, Ltd. New Delhi, 1975.
3. N. Jacobson, Basic Algebra, Vols. I & II. W. H. Freeman, 1980 (Also published by Hindustan company).
4. Shanti Narayan, A Text Book of Modern Abstract Algebra, S. Chand & Co., New Delhi
5. K. B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. New Delhi, 2000.
6. P. B. Battacharya, S. K. Jain and S. R. Nagpal, Basic Abstract Algebra (2^{nd} Edition) Cambridge University Press. Indian Edition. 1997.
7. K. Hoffman and R. Kunze. Linear Algebra, 2^{nd} Editions, Prentice-Hill. Englewood Cliffs (New Jersey), 1971.
8. S. K. Jain, A. Gunawardena and P. B. Battacharya, Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag) 2001.
9. S. Kumaresan, Linear Algebra, A Geometrical Approach. Prentice Hall of India. 2000.
10. Vivek Sahani and Vikas Bist. Albebra, Narosa Publishing House. New Delhi, 1997.
11. I. S. Luther and I. B. S. Passi, Algebra, Vol. I-Groups. Vol. II-Rings. Narosa Publishing House (Vol. 1-1996, Vol. II-1999), New Delhi.
12. D. S. Malik, J. N. Mordeson and M. K. Sen. Fundamentals of Abstract Algebra. McGraw-Hell International Edition, 1997.

SYLLABUS

B. Sc. III (Semester – V)

Paper – II (Optional)

MAT 302 : Special Relativity - I

Total Marks : 75 (60+15)

UNIT – I

Review of Newtonian mechanics, Inertial Systems, Galilean transformations, Newtonian relativity, Conservation laws in Newtonian mechanics, Maxwell's electromagnetic theory, Michelson-Morley experiment, Lorentz Fitzgerald contraction hypothesis, Relative character of space and time.

UNIT – II

Einstein's special theory of relativity, postulates of special relativity theory, Lorentz transformation, Geometrical interpretation of Lorentz transformation, Group properties of Lorentz transformation, Length contraction, Time dilation.

UNIT – III

Relativistic Kinematics – Composition of parallel velocities, Transformation equations for components of velocity, Relativistic addition law for velocities, transformation of Lorentz contraction factor $(1-v^2/c^2)^{1/2}$, The transformation equation for components of acceleration of a particle.

UNIT – IV

Geometrical representation of space time, Four dimensional Minkowskian space time of special relativity, Time like, Light-like and space-like intervals, Lorentz transformation in index form, proper time, world line of a particle, Four vectors and Four tensor in Minkowskian space-time.

Reference Books :-

1. Lectures on Special Relativity
   Prof. T. M. Karade, K. S. Adhav and Maya S. Bendre, Sonu Nilu.
2. C. Moller, The theory of Relativity, Oxford Clarendon Press, 1932.
3. P. G. Bergmann, Introduction to the theory of relativity, Prentice Hall of India, Pvt. Ltd. 1969.
4. I. I. Anderson, Principle of relativity Physics, Academic Press, 1967.
5. Murray R. Spiegel, Theory and Problems on vector Analysis SIJ Metrics and
   Introduction to Tensor Theory, Shaum's outline Series, Mc. Gra. Hill Book Company

SYLLABUS

B. Sc. III (Semester – V)

Paper – III (Optional)

MAT 303 : Linear Programming and Transportation Problem

Total Marks : 75 (60+15)

UNIT – I

Linear Programming Problem : Convex Set, Extreme points of a convex set, Convex combination, Fundamental theorem of linear programming, Definition, Formulation of linear programming problems (LPP), Graphical solution of linear programming problems, General formulation of LP problems, Standard form and matrix form of LP problems.

UNIT – II

Simplex Method : Introduction, Definitions and notations, Computational procedure of simplex algorithm, Simple way for simplex computations, Artificial variables, Two-phase method, Alternative method of two-phase simplex method.

UNIT – III

Transportation Problems

Mathematical formulation of Transportation problem, Tabular representation, Definitions, Special structure of the solution, North-west corner rule, Vogel's approximation method, Method of finding optimal solution, algorithm for solving transportation problem

UNIT – IV

Assignment Problems : Introduction, Mathematical formulation of Assignment problem, Reduction theorem, Hungarian Method for solving Assignment problem, Unbalanced Assignment problem

Prescribed text book Scope as in "Operations Research" by S.D. Sharma, Kedar Nath Ram Nath & Co, Meerut.

Reference text Book: "Operation Research" by Kanthi Swarup, R.K. Gupta and Manmohan, S. Chand publications, New Delhi.

GONDWANA UNIVERSITY, GADCHIROLI.

B.SC. II (MATHEMATICS)
SEMESTER WISE SYLLABUS
WITH EFFECT FROM
2013-14
Teaching Pattern

B.Sc. Part II

Semester III:

Paper I : **MAT 201 : Advanced Calculus and Group Theory**

Paper II : **MAT 202 : Differential Equations**

Semester IV :

Paper III : **MAT 203 : Abstract Algebra & Differential Equation**

Paper IV : **MAT 204 : Classical Mechanics & Statics**

Teaching Pattern:

1. Four Lectures per week per paper.

2 One tutorial per week per batch per paper. (The batches of tutorials to be formed as prescribed by the University).

SYLLABUS

B. Sc. II (Semester - IV)

Paper – III

MAT 203 : Abstract Algebra & Differential Equation

Total Marks : 75 (60+15)

UNIT – I

Group automorphism, Inner Automorphism, Automorphism Group & their computations. Cayley's theorem, Counting principle.

UNIT – II

Ring theory, Subrings, Integral domain ,Characteristic of rings, Ideals.

UNIT – III

Introduction of power series, Legendre's Equations, Legendre's polynomial, generating function of Pn(x). Recurrence formula for Pn (x), Orthogonality of Legendre's polynomials, Bessel's equation, Recurrence formula for Jn (x) .

UNIT – IV

Fourier series, Even and odd periodic function, orthogonal function, Dirichlet Condition, Half range Fourier sine & cosine series.

Reference Books :-

1. Prof. T. M. Karade, J. N. Salunke, K. S. Adhav and M. S. Bendre, Abstract Algebra, Sonu Nilu, Bandu Soni Layout, Gayatri road, Parsodi, Nagpur.
2. I. N. Herstein. Topics in Algebra, Wiley eastern, Ltd. New Delhi, 1975.
3. N. Jacobson, Basic Algebra, Vols. I & II. W. H. Freeman, 1980 (Also published by Hindustan company).
4. Shanti Narayan, A Text Book of Modern Abstract Algebra, S. Chand & Co., New Delhi
5. K. B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. New Delhi, 2000.
6. P. B. Battacharya, S. K. Jain and S. R. Nagpal, Basic Abstract Algebra (2^{nd} Edition) Cambridge University Press. Indian Edition. 1997.
7. K. Hoffman and R. Kunze. Linear Algebra, 2^{nd} Editions, Prentice-Hill. Englewood Cliffs (New Jersey), 1971.
8. S. K. Jain, A. Gunawardena and P. B. Battacharya, Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag) 2001.
9. S. Kumaresan, Linear Algebra, A Geometrical Approach. Prentice Hall of India. 2000.
10. Vivek Sahani and Vikas Bist. Albebra, Narosa Publishing House. New Delhi, 1997.
11. I. S. Luther and I. B. S. Passi, Algebra, Vol. I-Groups. Vol. II-Rings. Narosa Publishing House (Vol. 1-1996, Vol. II-1999), New Delhi.
12. D. S. Malik, J. N. Mordeson and M. K. Sen. Fundamentals of Abstract Algebra. McGraw-Hell International Edition, 1997.

SYLLABUS

B. Sc. II (Semester - IV)

Paper IV

MAT 204 : Classical Mechanics & Statics

Total Marks : 75 (60+15)

UNIT – I

Analytical condition of equilibrium of coplanar forces, Virtual work, Uniform catenary.

UNIT – II

Generalized co-ordinates, Constraints, D' Alembert's Principle & Lagrange's equations.

UNIT – III

Reduction to the equivalent one body problem, Central force field, Classification of central orbit, Differential equation of central orbit, Kepler's laws of motion, Virial theorem.

UNIT – IV

Hamilton's Principle, Extension of Hamilton's principle to non conservative holonomic system, Hamilton's equation. Principle of least action, Routhian, Routh's Procedure.

Reference Books :-

1. Prof. T. M. Karade, Classical Mechanics, Sonu Nilu, Bandu Soni Layout, Gayatri road. Parsodi, Nagpur.
2. Prof. T. M. Karade and M. S. Bendre, Mechanics, Sonu Nilu, Bandu Soni Layout, Gayatri road, Parsodi, Nagpur.
3. H. Goldstein, Classical Mechanics. (2^{nd} Edition) Narosa Publishing House, New Delhi.
4. S. L. Loney, Statics, Macmillian and Company, London.
5. R. S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad
6. S. L. Loney, An Elementary Treatise on the Dynamics of a Particle and of Rigid bodies, Cambridge University Press, 1956.

GONDWANA UNIVERSITY, GADCHIROLI.

B.SC. II (MATHEMATICS)
SEMESTER WISE SYLLABUS
WITH EFFECT FROM
2013-14
Teaching Pattern

B.Sc. Part II

Semester III:

Paper I : **MAT 201 : Advanced Calculus and Group Theory**

Paper II : **MAT 202 : Differential Equations**

Semester IV :

Paper III : **MAT 203 : Abstract Algebra & Differential Equation**

Paper IV : **MAT 204 : Classical Mechanics & Statics**

Teaching Pattern:

1. Four Lectures per week per paper.

2 One tutorial per week per batch per paper. (The batches of tutorials to be formed as prescribed by the University).

SYLLABUS

B. Sc. II (Semester – III)

Paper – I

MAT 201 : Advanced Calculus and Group Theory

Total Marks : 75 (60+15)

UNIT – I

Group : Definition of Group with example and Properties, Sub-group, cosets ,Normal Subgroup.

UNIT - II

Permutation groups, product of permutations, even and odd permutation. Cyclic group. Group homorphism and isomorphism. Fundamental theorem of homomorphism.

UNIT III

Limit and continuity of function of two variables Partial differentiation, chain rule, Differential.

UNIT – IV

Jacobins, Homogeneous function, and Euler's theorem, maxima & minima and saddle point of function of two variables, Lagrange's multiplier method.

Reference Books :-

1. Prof. T. M. Karade and M. S. Bendre, Advanced Calculus, Sonu Nilu, Bandu Soni Layout, Gayatri road, Parsodi, Nagpur.
2. George J. Klir and B.O. Yuana, Fuzzy set and Fuzzy Logic, Prentice Hall India Ltd. 2002.
3. Gabriel Klambauel, Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
4. T. M. Apostol, Matheematical Analysis, Narosa Publishing House. New Delhi, 1985.
5. R. R. Goldberg, Real Analysis. Oxford & I. B. H. Publishing Co., New Delhi 1970.
6. D. Soma Sundaran and B. Choudhary. A first course in Mathematical Analysis, Narosa Publishing House. New Delhi, 1977.

7. P. K. Jain and S. K. Kaushik, An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000.
8. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
9. Murray R. Speigel, Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York.
10. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
11. S. C. Malik, Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
12. I. N. Herstein, Topics in Algebra, Wiley eastern, Ltd. New Delhi, 1975.
13. P. B. Battacharya, S. K. Jain and S. R. Nagpaul, First Course in Linear Algebra, Wiley eastern, Ltd. New Delhi, 1983.
14. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.
15. Shanti Narayan, A Course of Mathematical Analysis S. Chand & Co., New Delhi.

SYLLABUS

B. Sc. II (Semester –III)

Paper – II

MAT 202 : Differential Equations

Total Marks : 75 (60+15)

UNIT I

Method of solution of dx/P = dy/Q = dz/R, Pfaffian differential equation, Formation of partial Differential equation, Lagrange's equations, Linear Partial Differential equation, Charpit's Method, Compatible Differential Equation.

UNIT – II

Linear partial Differential equation of second & higher order, Homogenous & non – homogeneous equation with constant coefficients, Equation reducible of linear PDEs with constant coefficients.

UNIT – III

Laplace transforms, Existence theorem for Laplace transforms, Linearity of Laplace transform, Shifting theorem, Inverse Laplace transform.

UNIT – IV

Convolution theorem, Laplace transform of derivatives & integrals, Differentiation & integration of transform, Solution of differential equation,Partial differential equation.

Reference Books :-

1. Prof. T. M. Karade, Differential Equations, Sonu Nilu, Bandu Soni Layout, Gayatri road, Parsodi, Nagpur.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons Inc. 1999.
3. D. A. Murray. Introductory Course on Differential Equations, Orient Longman. (India). 1967.
4. A. R. Forsyth. A Treatise on Differential Equations. Macmillan and Co. Ltd. London.
5. Francis B. Helderbrand, Advance Calculus for Applications, Prentice Hall of India Pvt. Ltd., New Delhi, 1977.
6. Jane Cronin. Differential Equations. Marcel Dekkar, Inc. New York, 1994.
7. Frank Ayres. Theory and Problems of Differential Equations. McGraw-Hill Book Company. 1998.
8. Richard Bronson. Theory and Problems of Differential Equations. McGraw-Hill. Inc. 1973.

Board of Studies in Physics

FACULTY OF SCIENCE

GONDWANA UNIVERSITY, GADCHIROLI

Syllabus of

B.Sc. First Year (Semester pattern) (Choice Based Credit System)

SUBJECT - PHYSICS

Semester I & Semester II

Semester I & Semester II

SUBJECT - PHYSICS

Teaching and Semester Examination Scheme for B.Sc(First Year) .

Class	Semester	Paper	Teaching Scheme Per Week (workload)			Examination Scheme			
			Theory	Total	Practical	Theory Marks		Practical Marks	Total Marks
						Paper	Internal Assessment		
B. Sc. I	I	USPHT 01	3	6 + 1T	6	50	10	30	150
		USPHT 02	3			50	10		
	II	USPHT 03	3	6 + 1T	6	50	10	30	150
		USPHT 04	3			50	10		

B.Sc.Semester CBCS Pattern Examination Scheme

1. There shall be total six semesters.
2. Each semester shall comprise of 90 teaching days.
3. Each Semester I to VI shall be of 150 marks.
4. Distribution of marks will be as follows

i.	Paper I Theory	----	50 marks
	Internal Assessment	----	10 marks
ii.	Paper II Theory	----	50 marks
	Internal Assessment	----	10 marks
iii.	Practical	----	30 marks
Total	(i+ii+iii)	----	150 marks

5. The marks on internal assessment of the student shall be compounded with the theory Paper. The passing marks will be **35%** marks .

6. A student will have to perform at least Ten (**10**) experiments per semester. At the time of Practical examination every student has to perform two experiment, each of three hours duration.

7. The distribution of marks for practical examination is as follows.

Record Book	----	6
Viva-voce	----	6
Experiment	----	18
TOTAL	**----**	**30**

8. Evaluation of the student during the semester for internal assessment:-

i) For Theory internal

S.N.	Work Assigned	Marks	Marks Obtained
1	Assignment	**02**	
2	Class Test	**05**	
3	Active Participation/Seminar/Routine Activity etc.	**03**	

Signature of teacher in-charge Head of Department

9. The internal assessment shall be done by respective college and the marks shall be sent to the university one month prior to the final examination of each semester.

10. All theory papers shall be divided into four units. Each unit shall be cover in 15 periods of 48 minutes.

11. The theory question paper shall be of 3 hours duration and comprise of 5 questions with internal choice and with equal weightage to all units. The pattern of question paper shall be as follows.

Pattern of Question Paper

Subject – Physics

Time: 3 Hours **Maximum marks :50**

Question No.			**Marks Allotted**
Qu. 1	**EITHER**		
	A	(From Unit – I) (i, ii, iii, two or three bits including numerical)	**10**
	OR		
	B	(From Unit – I) [Four bits (a),(b), (c), (d) including numerical]	**4 x 2½**
Qu. 2	**EITHER**		
	A	(From Unit – II) (i, ii, iii, two or three bits including numerical)	**10**
	OR		
	B	(From Unit – II) [Four bits (a),(b), (c), (d) including numerical]	**4 x 2½**
Qu. 3	**EITHER**		
	A	(From Unit – III) (i, ii, iii, two or three bits including numerical)	**10**
	OR		
	B	(From Unit – III) [Four bits (a),(b), (c), (d) including numerical]	**4 x 2½**
Qu. 4	**EITHER**		
	A	(From Unit – IV) (i, ii, iii, two or three bits including numerical)	**10**
	OR		
	B	(From Unit – IV) [Four bits (a),(b), (c), (d) including numerical]	**4 x 2½**
Qu. 5 Attempt any TEN questions from the following.			
a) From Unit I			**1**
b) From Unit I			**1**
c) From Unit I			**1**
d) From Unit II			**1**
e) From Unit II			**1**
f) From Unit II			**1**
g) From Unit III			**1**
h) From Unit III			**1**
i) From Unit III			**1**
j) From Unit IV			**1**
k) From Unit IV			**1**
l) From Unit IV			**1**

The above pattern is for all two papers of each semester of B.Sc. I (CBCS pattern) & B.Sc. II (CBCS pattern) w.e.f. **2018-19** and B.Sc. III from next subsequent years

Proposed Syllabus for B.Sc. I CBCS (Semester Pattern)Subject – Physics

The syllabus of Physics as per semester system for the B.Sc. I will be implemented from the Academic year **2017-2018**.

Name of Programme	Duration	Semester	Subject :- Physics	Code	Title
B.Sc. I	Two semesters	I	Theory	USPHT01	Mechanics and Relativity
				USPHT02	Gravitation, Oscillation and Properties of Matter
			Practical	USPHP01	10 experiments
		II	Theory	USPHT03	Vector Analysis and Electrostatics
				USPHT04	Magnetostatics and Electromagnetic Waves
			Practical	USPHP02	10 experiments

USPHT01: MECHANICS AND RELATIVITY

Aim: To make the students understand the basic concepts of Mechanics and Relativity as core part of the subject.

Unit I:

Laws of Motion: Newton's laws of motion and its limitations, Components of velocity and Acceleration (radial and transverse), Frame of reference, inertial and non-inertial frame of reference, uniformly rotating frame, Centripetal force,

Centre of Mass: Centre of mass**,** Linear momentum about centre of mass, equation of motion of centre of mass.
Numericals.

Unit II:

Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets.(Single stage and multistage)

Collision: Perfectly elastic and inelastic collision in one dimension, velocities of particles in elastic collision, application of elastic collision,
Numericals

Unit III:

Dynamics of rigid body: Moment of inertia, radius of gyration, physical significance of Moment of inertia, Principle of perpendicular and parallel axis (no derivations), Moment of inertia of a ring, rod, solid sphere.
Numericals.

Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum. Isotropy and rotation invariance of space, angular impulse, homogeneity and isotropy of time. Conservation of energy (from homogeneity of time and Newton's laws of motion) Numericals.

Unit IV:

Special Theory of Relativity: Constancy of speed of light. Lorentz transformation and its inverse form. Postulates of Special Theory of Relativity. Length contraction. Time dilation, variation of mass with velocity. Relativistic addition of velocities. Mass energy equivalence.
Numericals.

USPHT02: Gravitation, Oscillation and Properties of Matter

Aim : Students should understand the concept related with Gravitation and Properties of Matter.

Unit I:

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Gravitational Field and Gravitational potential. Gravitational potential due to spherical shell.

Gravitation: Gravitational self-Energy of a body, Kepler's Laws (statement only). Geosynchronous satellite and orbits. Weightlessness. Basic idea of global positioning system (GPS).

Numericals.

Unit II:

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy.

Free, Damped and Forced harmonic Oscillations, Differential equation of a damped oscillator and its solutions, Energy equation of damped oscillations, Power dissipation, Power absorption, Resonance, Quality factor and band width.

Numericals.

Unit III:

Elasticity: Hooke's law , Stress-strain diagram , Elastic moduli-Relation between elastic constants Poisson's Ratio, Expression for Poisson's ratio in terms of elastic constants, Work done in stretching and in twisting a wire. Twisting couple on a cylinder , Torsional pendulum and determination of rigidity modulus.

Numericals.

Unit IV:

Viscosity: Streamline and Turbulent flow, Coefficient of viscosity, Reynold's number, equation of continuity, Bernoulli's theorem and its applications (Lift of an Aeroplane and Atomizer), Poiseulle's equation.

Surface tension: Surface tension and its molecular interpretation, Angle of contact, Excess of pressure inside a liquid drop, bubble in air and liquid, wetting and spreading,

Numericals.

USPHP01 : (Practical)

Every student will have to perform at least five (05) experiments from each group. This odd semester practical examination shall be conducted by **Internal Examiner.**

Group A

1. To determine height of building using Sexant.
2. Moment of inertia of flywheel.
3. Study of conservation of momenta in two dimensional collisions.
4. Study of compound pendulum.
5. To determine '**g**' by Kater's Pendulum.
6. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g
7. Study of oscillations of mass under different combinations of spring.
8. To determine '**g'** and velocity for a freely falling body using Digital Timing Technique.
9. Calculation of percentage error of diameter of orifice of capillary.

Group B

1. Young's modulus by Cantilever.
2. Modulus of rigidity by statistical method.
3. Coefficient of viscosity by Poiseulle's flow method.
4. Determination of surface tension by Quinke's method.
5. Determination of surface tension by capillary rise method.
6. Modulus of rigidity by Tortional Pendulum.
7. Young's modulus by bending of beam.
8. Young's modulus by Vibration method.
9. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.

Reference Books: Semester I

1. Fundamentals of Physics – Halliday and Resnick (6^{th} edition)
2. Concepts of Physics Vol. I and II - H.C. Verma
3. Properties of Matter – Brijlal
4. Waves and Oscillations – Chaudhari R.N.
5. Berkely Physics Course – Vol. I
6. Physics for degree students B.Sc. First Year – C.L. Arora, Dr P.S. Hemne
7. Mechanics – D.S. Mathur , Dr. P.S. Hemne
8. B.Sc. Practical Physics – Dr. P.S. Hemne, Harnam Singh
9. University Physics- FW Sears, MW Zemansky and HD Young
10. Engineering Mechanics- Basudeb Bhattacharya
11. University Physics- Ronald Lane Reese

USPHT03 : Vector Analysis and Electrostatics

Aim : To make the students understand the basic concepts vectors and vector analysis and its applications in electostatics as core part of the subject.

Unit I: Vector Analysis:

Scalar and Vector, Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).
Numericals.

Unit II: Electrostatics- I

Definitions of electric field, electric field intensity, electric potential, electric dipole, electric dipole moment, electric quadrupole. Electric field intensity due to electric dipole, electric field as a negative gradient of potential, conservative nature of electric field, torque on a dipole in a uniform electric field. Potential energy of an electric dipole, electrostatics field energy.
Numericals

Unit III: Electrostatics- II

Gauss's theorem of electrostatics(no derivation), applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere.
Electric potential due to a point charge, electric dipole (along axial line and equatorial line), uniformly charged spherical shell and solid sphere.
Numericals,

Unit IV: Electric field in dielectric:

Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation of dielectric, Displacement vector. Parallel plate capacitor completely filled and partially filled with dielectric.
Numericals.

USPHT04: Magnetostatics and Electromagnetic Waves

Aim : To make the students understand the basic concepts of Magnetostatics and Elecrtomagnetic Waves as core part of the subject.

Unit I: Magnetostatics

Biot-Savart's law & its applications- straight conductor, circular coil, Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. **Magnetic properties of materials:** Magnetic intensity, magnetic field, permeability, magnetic susceptibility. Brief introduction of diamagnetic, paramagnetic, and ferromagnetic materials.
Numericals.

Unit II: Electromagnetic Induction:

Faraday's laws of electromagnetic induction, Lenz's law, self (L) and mutual inductance(M), L of single coil, M of two coils. Energy stored in magnetic field.
Transformer – Construction and working, Energy losses, parameters and application .
Numericals

Unit III: Maxwell`s equations and Electromagnetic Wave Propagation:

Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector and Poynting theorem, energy density in electromagnetic field, electromagnetic wave propagation through vacuum, transverse nature of EM waves.
Numericals

Unit IV: Steady Electric current:

Kirchoff's laws and its applications (Wheatstone bridge and Carry-foster bridge), Rise and decay of current in LR, CR circuits, time Constants.

Alternating electric current: AC circuits, Complex numbers, j-operator and applications to LR and CR circuits.
Numericals

USPHP02 :(Practical)

Every student will have to perform at least five (05) experiments from each group. This even semester practical examination shall be conducted by**Internal and External Examiners** both.

Group A

1. Use of vibration magnetometers to study a field.
2. To compare capacitance using De'Sauty's bridge .
3. Measurement of inductance using impedance at different frequencies.
4. Measurement of capacitance using impedance at different frequencies.
5. Study of decay of currents in LR circuits.
6. Response curve of LCR circuit, resonance frequency and quality factor.
7. Study of Transformer.
8. Characteristic of Choke.
9. Determination of high resistance by Leakage method.

Group B

1. To determine a Low Resistance by Carey -Foster's Bridge.
2. To verify the Thevenin's theorem.
3. To verify the Norton'sTheorem.
4. To verify the Superposition electrical network.
5. To verify the Maximum Power Transfer Theorem.
6. To verify the Milliman's Theorem.
7. Calibration of ammeter by Potentiometer.
8. Determination of resistance of Galvanometer by half deflection method.
9. Low resistance by Potentiometer.

Reference Books: Semester II

1. Electricity and Magnetism -- Edward M. Purcell
2. Electricity and Magnetism -- J.H. Fewkes & J. Yarwood
3. B.Sc. Practical Physics -- Dr P.S. Hemne, Harnam Singh
4. Electricity and Magnetism--D C Tayal
5. Physics for degree students B.Sc. First Year – C.L. Arora, Dr P.S. Hemne
6. Electromagnetic waves and radiating systems – E.C. Jordan
7. Electricity and Magnetism – S.S. Atwood
8. Electricity and Magnetism – A.S. Mahajan and A.A. Rangwala
9. Electricity and Magnetism - Brijlal and Subramanyam
10. Electricity and Magnetism – D.N. Wasudeva
11. Electrodynamics – S.L. Gupta and R. Singh
12. Mechanics and Electrodynamics – Brijlal and Subramanyam
13. Introduction to electrodynamics - D.J. Griffiths
14. Fundamentals of Physics – Halliday and Resnick

Board of Studies in Physics

FACULTY OF SCIENCE

GONDWANA UNIVERSITY, GADCHIROLI

Syllabus of

B. Sc. Second Year (Semester pattern)

(Choice Based Credit System)

SUBJECT - PHYSICS

Semester III & Semester IV

Semester III & Semester IV
SUBJECT - PHYSICS

Teaching and Semester Examination Scheme for B.Sc(Second Year) .

Class	Semester	Paper	Teaching Scheme Per Week (Workload)			Examination Scheme			
			Theory	Total	Practical	Theory Marks		Practical Marks	Total Marks
						Paper	Internal Assesment		
B. Sc. II	III	USPHT05	3	6 + 2T	6	50	10	30	150
		USPHT06	3			50	10		
	IV	USPHT07	3	6 + 2T	6	50	10	30	150
		USPHT08	3			50	10		

B. Sc. Semester CBCS Pattern Examination Scheme :

1. There shall be total six semesters.
2. Each semester shall comprise of 90 teaching days.
3. Each Semester I to VI shall be of 150 marks.
4. Distribution of marks will be as follows

i.	Paper I	Theory	50 Marks
		Internal Assessment	10 Marks
ii.	Paper II	Theory	50 Marks
		Internal Assessment	10 Marks
iii.	Practical (section A and B)		30 Marks
Total	(i + ii + iii)		**150 Marks**

5. The marks on internal assessment of the student shall be compounded with the theory Paper. The passing marks will be **40 %** marks.

6. A student will have to perform at least five experiments from each section (Total **10** experiments) per semester. At the time of Practical examination every student has to perform two experiments (one from each section), each of three hours duration.

7. The distribution of marks for practical examination is as follows.

Record Book	----	6
Viva-voce	----	6
Experiment (A + B)	----	18
TOTAL	**----**	**30**

8. Evaluation of the student during the semester for internal assessment:-

For Theory internal:

Sr. No.	Work Assigned	Marks	Marks Obtained
1.	Assignment	02	
2.	Class Test	05	
3.	Active Participation Seminar/Routine Activity etc.	03	
Total		**10**	

Signature of teacher in-charge Head of Department

9. The internal assessment shall be done by respective college and the marks shall be sent to the university one month prior to the final examination of each semester.
10. All theory papers shall be divided into four units. Each unit shall be cover in 15 periods of 48 minutes.
11. The theory question paper shall be of 3 hours duration and comprise of 5 questions with internal choice and with equal weightage to all units. The pattern of question paper shall be as follows.

Pattern of Question Paper
Subject – Physics

Time: 3 Hours **Maximum marks :50**

Question No.		**Marks Allotted**
Qu. 1 EITHER		
A (From Unit – I)	(i, ii, iii, two or three bits including numerical)	**10**
OR		
B (From Unit – I)	[Four bits (a),(b), (c), (d) including numerical]	**4 x 2½**
Qu. 2 EITHER		
A (From Unit – II)	(i, ii, iii, two or three bits including numerical)	**10**
OR		
B (From Unit – II)	[Four bits (a),(b), (c), (d) including numerical]	**4 x 2½**
Qu. 3 EITHER		
A (From Unit – III)	(i, ii, iii, two or three bits including numerical)	**10**
OR		
B (From Unit – III)	[Four bits (a),(b), (c), (d) including numerical]	**4 x 2½**
Qu. 4 EITHER		
A (From Unit – IV)	(i, ii, iii, two or three bits including numerical)	**10**
OR		
B (From Unit – IV)	[Four bits (a),(b), (c), (d) including numerical]	**4 x 2½**

Qu. 5 Attempt any TEN questions from the following.

a) From Unit I	**1**
b) From Unit I	**1**
c) From Unit I	**1**
d) From Unit II	**1**
e) From Unit II	**1**
f) From Unit II	**1**
g) From Unit III	**1**
h) From Unit III	**1**
i) From Unit III	**1**
j) From Unit IV	**1**
k) From Unit IV	**1**
l) From Unit IV	**1**

The above pattern is for all two papers of each semester of B.Sc. I (CBCS pattern) & B.Sc. II (CBCS pattern) w.e.f. **2018-19** and B.Sc. III from next subsequent years.

Proposed Syllabus for B.Sc. II CBCS (Semester Pattern)Subject – Physics

The syllabus of Physics as per semester system for the B.Sc. II will be implemented from the Academic year **2018-2019**.

Name of programme	**Duration**	**Semester**	**Subject: Physics**	**Code**	**Title**
B. Sc. II	**Two Semester**	**Sem- III**	**Theory**	USPHT05	**Thermal Physics**
				USPHT06	**Radiation & Statistical Physics**
			Practical	USPHP03	10 experiments
		Sem- IV	**Theory**	USPHT07	**Waves, Acoustic & Laser**
				USPHT08	**Optical Physics**
			Practical	USPHP04	10 experiments

Syllabus of B. Sc. Second year (Semester pattern)
(Choice Based Credit System) Subject- PHYSICS (Sem-III and Sem-IV)

Sem-III Paper-I (Thermal Physics)
USPHT05: THERMAL PHYSICS (Paper I)

Aim: To make the students to understand the basic concepts of Thermal physics as core part of the subject.

Unit- I (Kinetic Theory of Gases & Transport Phenomena):

Assumptions of Kinetic theory of gases, Pressure exerted by gas (no derivation), Derivation of Maxwell's law of distribution of velocities and its experimental verification, Degree of Freedom (Mono, Di and Polyatomic gases), Law of equipartition of energy, Mean free path, Expression for mean free path and its dependency on temperature and pressure.

Transport of momentum & viscosity of gas(η), Transport of energy & thermal conductivity (K), interrelationship between η & K, dependency η & K on temperature and pressure, Transport of mass (diffusion). *Numericals.*

Unit- II (Concept of Thermodynamics):

Thermodynamic system, Thermodynamic variables (Intensive and Extensive), Thermodynamic equilibrium, Thermodynamic process (Isothermal, Adiabatic, Isobaric, Isochoric), Zeroth law of thermodynamics and its importance.

Concept of Internal Energy, First law of Thermodynamics and its applications and limitations, Derivation of Work done during isothermal and adiabatic process, Adiabatic relations between P, V and T, Specific heat (Definition), General relation between C_P and C_V, Thermal expansion and Compressibility. *Numericals.*

Unit- III (Second and Third laws of Thermodynamics):

Reversible and irreversible process, Second law of Thermodynamics (Statements), Heat Engine and its efficiency, Carnot's Ideal heat engine, Carnot's cycle, Carnot's Theorem (Only statement).

Concept of entropy, Second law of Thermodynamics in terms of entropy, Entropy changes in reversible and irreversible process, T-S diagram and derivation of Work done and efficiency, Third law of Thermodynamics. *Numericals*.

Unit- IV (Thermodynamics Functions):

Internal energy function, Enthalpy function, Gibb's function, Helmholtz function, Derivations of Maxwell's thermodynamics relations, First and second Tds equations.

Latent heat (definition), First latent heat equation (Clausius-Clapeyron equation), Second latent heat equation (Clausius equation), Joule – Thomson effect, Porus-Plug experiment and its application (To show enthalpy constant). *Numericals*.

Sem-III Paper-II (Radiation and Statistical Physics)

USPHT06: RADIATION AND STATISTICAL PHYSICS

Aim: To make the students to understand the Thermal radiation laws and basic concepts of statistical analysis and as core part of the subject.

Unit- I (Theory of Radiation):

Black body radiation, Spectral distribution, Concept of energy density, Derivation of Planck's law, Wien's distribution law, Rayleigh-Jeans law, Stefan's Boltzmann law and Wien's displacement law from Planck's law. *Numericals*.

Unit- II (Statistical basis of thermodynamics):

Probability and thermodynamic probability, Principle of equal priori probabilities, Mu- space, Phase space, macrostate and microstate, Constraint, Accessible and inaccessible states, Entropy and thermodynamic probability, Equilibrium between two system in thermal contact. *Numericals.*

Unit- III (M-B Statistics):

Fundamental postulates of statistical mechanics, M-B statistics applicable to ideal gas, Maxwell- Boltzmann energy distribution law, Most probable speed, Average speed and root mean square speed, Maxwell- Boltzmann law of distribution of velocity. *Numericals*.

Unit- IV (B-E and F-D Statistics):

Fundamental postulates of B-E statistics, Bose- Einstein's energy distribution law, Photon gas, Planck's radiation law.

Postulates of Fermi- Dirac statistics, F-D energy distribution law, Fermi energy, Expression for Fermi energy of electrons in metal, Fermi energy for electron at absolute zero (E_{F_0}), Comparison between M-B, B-E and F-D statistics. *Numericals*.

Reference Books:

1. Fundamentals of Physics – Halliday and Resnick (6th edition).
2. Concepts of Physics Vol. I and II - H.C. Verma.
3. Properties of Matter – Brijlal.
4. Waves and Oscillations – Chaudhari R.N.
5. Berkely Physics Course – Vol. I.
6. Physics for degree students B.Sc. First Year – C.L. Arora, Dr P.S. Hemne.
7. Physics for degree students B.Sc. Second Year – C.L. Arora, Dr P.S. Hemne.
8. Mechanics – D.S. Mathur , Dr. P.S. Hemne.
9. A Text Book of First year Physics, M. K. Bagde, S. Chand Publication.
10. University Physics- FW Sears, MW Zemansky and HD Young.
11. Engineering Mechanics- Basudeb Bhattacharya.
12. University Physics- Ronald Lane Reese.

USPHP03 : (Practical)

Every student will have to perform at least five (05) experiments from each group. This odd semester practical examination shall be conducted by **Internal Examiner.**

Group A:

1. To determine the coefficient of thermal conductivity of copper. (by Searle's Apparatus or other method).
2. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
3. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
4. To study the variation of thermo-emf across two junctions of a thermocouple with temperature.
5. To determine heating efficiency of electrical kettle using voltages.
6. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.
7. To determine Mechanical Equivalent of Heat (J). (by Callender and Barne's constant flow method or other method).
8. To determine Mechanical Equivalent of Heat (J) by Joule's Calorimeter.

Group B:

1. Measurement of Planck's constant using black body radiation.
2. To determine Stefan's Constant.
3. To verify the Stefan's law of variation by using an incandenscent lamp
4. To verify the laws of probability distribution throwing one coin, tow coin and ten coins.
5. To show the deviation of probability from theoretical value decrease with increase in the number of event.
6. Study of statistical distribution from the given data and to find most probable, average and rms value.
7. Study of random decay of nuclear disintegration and determination of decay constant using dices.
8. To record and analyze the cooling temperature of an hot object as a function of time.(cooling law)

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.
5. B.Sc. Practical Physics – Dr. P.S. Hemne, Harnam Singh, S. Chand Publication.

Sem-IV Paper-I (Waves, Acoustics & Laser)

USPHT07: WAVES, ACOUSTICS & LASER (Paper I)

Aim: To make the students to understand the basic concepts Sound Waves, Acoustics and Laser as core part of the subject.

Unit- I (Superposition of two Harmonic Oscillations):

Super position of two SHMs having slightly different frequencies along same line (Beats), Lissajous's Figures, Super position of two Perpendicular Harmonic Oscillations-Graphical and Analytical Methods with equal (1:1) frequencies and unequal (1:2) frequencies, Formation of Lissajous's Figures by CRO and optical method. Application of Lissajous's Figures. *Numericals*.

Unit- II (Wave Motion and Fourier's Theorem):

Transverse waves on a string, Progressive and standing waves on a string, Normal Modes of a vibration of string, Group velocity, Phase velocity and their relations, Wave intensity.

Fourier's Theorem-statement, evaluation of Fourier coefficients, Its application to saw tooth wave and square wave, Limitations. *Numericals*.

Unit- III (Ultrasonic and Acoustics):

Ultrasonic waves and its properties, Production by piezoelectric effect, detection, applications (depth of sea, signalling & medical uses).

Noise and music, characteristics of musical sound, Intensity and loudness of sound, Bel and Decibels, musical notes, musical scale, Echo, Reverberation and time of reverberation, Absorption coefficient, Sabine's formula, Requirements of good auditorium. *Numericals*.

Unit- IV (Laser):

Coherence, spatial and temporal coherence, Einstein's coefficients (absorption, spontaneous and stimulated emission), population inversion, optical pumping, characteristics of laser beam, Ruby laser, Semiconductor laser, He-Ne Laser, applications of lasers. *Numericals.*

Sem-IV Paper-II (Optical Physics)

USPHT08: OPTICAL PHYSICS (Paper II)

Aim: To make the students to understand the basic concepts of Light Waves and properties of light waves as core part of the subject.

Unit I (Interference of Light):

Definition and Properties of wave front, Huygens Principle of propagation of wave front, Principle of superposition and interference of light, Division of amplitude and division of wave front, Fresnel's Biprism, Phase change on Reflection- Stokes' treatment, Interference in Thin Films: due to reflected and transmitted light in parallel film, Fringes of equal inclination (Haidinger Fringes), Interference in wedge-shaped film, Fringes of equal thickness(Fizeau Fringes). *Numericals*.

Unit II (Newton's Rings & Michelson's Interferometer):

Newton's Rings: Experimental setup & theory, application of Newton's ring for measurement of wavelength and refractive index.

Michelson's Interferometer- construction and working, types of fringes (circular and localised), Determination of wavelength and Wavelength difference, Refractive index and Visibility of fringes. *Numericals*.

Unit III (Diffraction):

Basic concept of diffraction, types of diffraction, Fresnel's Diffraction: Definition, Half-period zones, Zone plate, Diffraction due to straight edge and narrow slit. Fraunhofer's diffraction: Definition, Single slit, Double Slit, Diffraction Grating-construction, theory, its application to determine wavelength. *Numericals*.

Unit IV (Polarization):

Concept of polarisation, Plane polarized light(PPL), production of PPL by reflection, double refraction, Brewster's law, Uniaxial and biaxial crystal, positive and negative crystal, Nicol's prism- construction and working, Nicol as a polariser and analyser, Circular and elliptical polarization, phase retardation (quarter and half wave plate). *Numericals*.

Reference Books:

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill.
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
3. Fundamentals of Optics, H. R. Gulati and D.R. Khanna, 1991, R. Chand Publication.
4. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986. Addison-Wesley.
5. A Text Book of Optics, N. Subramanyam and Brijlal, S. Chand Publication.
6. A Text Book of First year Physics, M. K. Bagde and S. P. Singh, S. Chand Publication.
7. Optics and spectroscopy, R. Murugeshan, S. Chand Publication.
8. Physics for degree students, B. Sc. Second Year, C. L. Arora and Dr. P. S. Hemne, S. Chand Publications

USPHP04 : (Practicals)

Every student will have to perform at least five (05) experiments from each group. This even semester practical examination shall be conducted by **Internal and external examiner both.**

Group A:

1. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law.
2. To study Lissajous Figures by using CRO.
3. To determine the frequency of a tuning fork using sonometer.
4. To determine the velocity of transverse wave on stretched string using sonometer.
5. To determine the velocity of sound by using resonance tube.
6. To determine the unknown frequency by using Helmholtz resonator.
7. To determine velocity of ultrasonic waves in a given liquid.
8. To determine the wavelength of Laser beam.
9. To study the divergence of Laser beam.
10. To study the mono-chromaticity of Laser beam.
11. To study the characteristics of loudspeaker.

Group B:

1. Familiarization with Schuster`s focussing; determination of angle of prism.
2. Determination of angle of minimum deviation of prism using different colour.
3. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
4. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
5. To determine the value of Cauchy Constants of a material of a prism.
6. To determine the Resolving Power of a Prism.
7. To determine wavelength of sodium light using Fresnel Biprism.
8. To determine wavelength of sodium light using Newton's Rings.
9. To determine the wavelength of Laser light using Diffraction of Single Slit.
10. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating.
11. To determine the Resolving Power of a Plane Diffraction Grating.
12. To determine the Resolving power of telescope.
13. To determine focal length of long focus convex lens using short focus convex lens.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. B.Sc. Practical Physics – Dr. P.S. Hemne, Harnam Singh, S. Chand Publication.

Board of Studies in Physics

FACULTY OF SCIENCE

GONDWANA UNIVERSITY, GADCHIROLI

Syllabus of

B.Sc. Third Year (Semester Pattern)

SUBJECT - PHYSICS

Semester V Semester

GONDWANA UNIVERSITY, GADCHIROLI

SUBJECT - PHYSICS

(A) Teaching workload and Semester Examination Scheme for B.Sc.

Class	Semester	paper	Teaching workload per week			Examination Scheme								Total marks	Total Credits
						Theory Paper			Internal assessment			Practical			
			Theory	Total	Practical	marks		Credits	marks		Credits	marks	credits		
B.Sc.I	I	I	3	6+ 1T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
	II	I	3	6+ 1T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
B.Sc.II	III	I	3	6+ 2T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
	IV	I	3	6+ 2T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
B.Sc.III	V	I	3	6+ 2T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
	VI	I	3	6+ 2T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	**3**			50			10						
B.Sc.	**Total marks : 900**								**Total Credits : 120**						

T* Periods for Tutorials per batch.

(B) B.Sc.Semester Pattern Examination Scheme

1. There shall be total **six** semesters.
2. Each semester shall comprise of **90** (Ninety) actual teaching days.
3. Each Semester I to VI shall be of **150** marks.

4. Every subject in each semester will comprise of two theory papers of **50** marks each. Practical/ laboratory work will be of **30** marks and Internal assessment of **10** marks for each theory paper.

i.	Paper I Theory	----	50 marks
	Internal Assessment	----	10 marks
ii.	Paper II Theory	----	50 marks
	Internal Assessment	----	10 marks
iii.	Practical	----	30 marks
Total marks		**----**	**150 marks**

5. All theory papers shall be divided into four units. Each unit shall be cover in 15 periods of 45 minutes.

6. The scope and limitations of the subject of all semester opted by the students shall be indicated in the syllabi from time to time. The medium of instruction and examination shall be English.

7. The theory question paper will be **intraunit** choice and equal weightage to all questions. Duration of each theory paper shall be **three** hours. There will be five questions each of **10** marks. All questions are compulsory. Fifth question will be on all four units with three sub-questions from each unit.

8. **Pattern of question paper: Subject - Physics**

Time: 3 Hours **Maximum marks :50**

Question No.		**Marks Allotted**
Qu. 1 Either		
(A)From Unit - I		10
Or		
(B)From Unit – II / III / IV		10
Qu. 2		
If **Qu. 1 (B)** From Unit – II	Then	
Either (A) From Unit – III **Or**	(B)From Unit - IV	10
If **Qu. 1 (B)** From Unit – III	Then	
Either (A) From Unit – II **Or**	(B)From Unit - IV	10
If **Qu. 1 (B)** From Unit – IV	Then	
Either (A) From Unit – II **Or**	(B)From Unit - III	10
Qu. 3 Either		
a) From Unit - I		2.5
b) From Unit - II		2.5
c) From Unit - III		2.5
d) From Unit - IV		2.5
Or		
e) From Unit - I		2.5
f) From Unit - II		2.5
g) From Unit - III		2.5
h) From Unit - IV		2.5
Qu. 4 Either		
a) From Unit - I	2.5	
b) From Unit - II	2.5	
c) From Unit - III	2.5	
d) From Unit - IV	2.5	
Or		
e) From Unit - I	2.5	
f) From Unit - II	2.5	
g) From Unit - III	2.5	
h) From Unit - IV	2.5	
Qu. 5 Attempt any 10 questions from the following.		
(a) Unit - I	1	
(b) Unit - I	1	
(c) Unit - I	1	

(d)	Unit - II	1
(e)	Unit - II	1
(f)	Unit – II	1
(g)	Unit – III	1
(h)	Unit – III	1
(i)	Unit – III	1
(j)	Unit – IV	1
(k)	Unit – IV	1
(l)	Unit – IV	1

8. A student will have to perform at least five (**05**) experiments from each group.

9. Practical examination for all semesters shall be conducted **twice** in a year, at the end of each semester. Practical examination in odd semesters shall be conducted by **Internal examiner**, whereas practical examination in even semester shall be conducted by **Internal as well as external examiner**. Duration of practical examinations shall be of **6** hours. At the time of Practical examination every student has to perform **two** experiments **one** experiment from each group.

10. The distribution of marks for practical examination is as follows.

Record Book	----	6 marks
Viva-voce	----	6 marks
Each Experiment	(9 marks) ----	18 marks
TOTAL	----	**30 MARKS**

11. Evaluation of the student during the semester for internal assessment:

The University approved teacher will have to conduct a test on each unit. The test is to be carried out with the interest to make the student aware of the basics of the theory and the experiments as well. This will enhance the viva-voce competence and subject interest of the student. The record of these tests is to be maintained in the department duly signed by the teacher in-charge and head of the department. The record is to be maintained in the following format. Each unit test should be of **10** marks. Find the average and assign it to the student.

Record of marks scored in the unit tests during the semester.

Date										Average marks obtained
S.No.	Name of the Student	Paper I				Paper II				
		Test1	Test 2	Test 3	Test 4	Test1	Test 2	Test 3	Test 4	
1	ABC									
2	DEF									
3	GHI									
4	JKL									
5	MNO									
6	PQR									
7	STU									
8	VWX									
9	YZ									

Signature of teacher in-charge Head of Department

12. The internal assessment shall be done by respective college and the marks shall be

sent to the university one month prior to the final examination of each semester.

13. Minimum marks for passing will be **35%** of the total marks. A candidate has to pass individuality in theory / internal assessment / practical separately. The minimum passing marks for theory **35** marks, for internal assessment **7** marks and that for practical **11** marks.

C) Grade Point Average (GPA) and Course Grade Point Average (CGPA)

In the Credit and Grade Point System, the assessment of individual Courses in the concerned examinations will be on the basis of marks only, but the marks shall later be converted into Grades wherein the overall performance of the Learners can be reflected after considering the Credit Point. The overall evaluation shall be designated in terms of Grade.

(Table No.1): Performance Grading Scale

Marks Obtained %	Grade	Grade Points
75 & above	O	6
65 to 74.99	A	5
55 to 64.99	B	4
50 to 54.99	C	3
45 to 49.99	D	2
40 to 44.99	E	1
00 to 39.99	F	0

(Table No. 2): Final Grade Points

Final Grade Points	Final grade
5.0 to 6.0	O
4.50 to 4.99	A
3.50 to 4.49	B
2.50 to 3.49	C
1.50 to 2.49	D
0.50 to 1.49	E
0.00 to 0.49	F

O: Outstanding, **A**: Very Good, **B**: Good, **C**: Average, **D**: Satisfactory, **E**: Pass, **F**: Fail

Semester Grade point average (SGPA)

SGPA: Semester Grade Point Average shall be calculated for individual semesters. It is also designated as GPA.

$$SGPA = \frac{\sum CG}{\sum C}$$

Where, $\sum CG$: Sum of Product of Credits & Grade points and $\sum C$: Sum of Credit points.

Cumulative Grade Point Average (CGPA)

CGPA: Cumulative Grade Point Average shall be calculated for the entire Program by considering all the semesters taken together. The CGPA of a student will be Average of the SGPA's of that student. A student will be allotted a cumulative Grade Point Average (**CGPA**) after clearing all the four semesters. The CGPA of a student will be Average of the four SGPA's of that student.

After calculating the SGPA for an individual semester and the CGPA for entire program, the value can be matched with the grade in the Final Grade Point table No. 2 as per the Seven (07) Points Grading System and expressed as a single designated GRADE such as O, A, B, C, D,

Syllabus for B.Sc. III Subject – Physics

The syllabus of Physics as per semester system for the B.Sc. III will be implemented from the Academic year **2014-2015**.

Name of Programme : **B.Sc. III**
Duration: **Two semesters**

Semester V: Paper I (5S-PHY 501): Statistical Physics and Relativity
Paper II (5S-PHY 502): X-rays and Solid State Physics,
Practical (5S- PHY 503)

Semester VI: Paper I (6S-PHY 601): Nuclear Physics, Nanotechnology and Biophysics
Paper II (6S-PHY 602): Fibre Optics, Communication and Digital Electronics
Practical (6S- PHY 603)

Paper I: 5S-PHY 501: (Statistical Physics and Relativity)

Unit I

***S*tatistical Basis of Thermodynamics:** Probability and thermodynamic probability, principle of equal a *priori* probabilities, mu space, Macro-states and Microstates, Constraints, accessible

and inaccessible states, Equilibrium between two systems in thermal contact, Bridge with macroscopic physics. *Numericals.*

Unit II

M-B Statistics: Fundamental postulates of statistical mechanics, M-B statistics applicable to ideal gas, Maxwell-Boltzmann energy distribution law, Maxwellian distribution of speeds in an ideal gas, distinction between mean, r.m.s. and most probable speed values. *Numericals.*

Unit-III

***Quantum* Statistics:** Bose-Einstein statistics, 'h' as a natural constant and its implications, B-E energy distribution law, Fermi-Dirac statistics, F-D energy distribution law, Distribution of energy among electrons, Fermi level and Fermi energy, Comparison of M-B, B-E, and F-D statistics. *Numericals.*

Unit-IV:

Theory of Relativity: Reference systems, inertial frames, Postulates for the special theory of relativity, Lorentz transformations, Length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-energy equivalence. *Numericals.*

References and Text books –

1. Physics for degree students B.Sc. Second Year – C.L. Arora, Dr P.S. Hemne
   Publisher: S. Chand & Publication, New Delhi.
2. Statistical Mechanics, by- Kamal Singh
3. Quantum Mechanics ,Statistical Mechanics and Solid state physics, by- Chattopadhyay and P. C. Rakshit
4. Heat, thermodynamics and statistical physics, by- Brijlal, Subramayam and Dr. P.S. Hemne, Publisher: S. Chand & Company Ltd. New Delhi.
5. Introduction to special theory of Relativity, by- Shrivastava
6. Elements of special theory of Relativity, by- S. P. Singh and M. K. Bagde.
7. Introduction to theory of Relativity, by- P. G. Bergmann

Paper II: 5S-PHY 502: X-Rays and Solid State Physics

Unit I

X-rays-Introduction, discrete and continuous X-ray spectra, Main feature of continuous X-ray spectra, Characteristics X-ray spectra, Duane-Hunt law, X- ray emission spectra, Moseley law its importance and applications, Auger effect, X-ray absorption spectra, applications of X-rays in various fields.

Numericals.

Unit II

Crystal Structure: Crystal structure, periodicity, lattices and bases, fundamental translation vectors, unit cell, Wigner-Seitz allowed rotations, lattice types, lattice planes, common crystal structures, Bragg's law, Laue patterns.

Numericals.

Unit III

Bonding: Potential between a pair of atoms, Lennard-Jones potential, concept of cohesive energy, ionic solids, covalent solids, metallic solids, Van der Walls bond and molecular crystals, Hydrogen bond.

Magnetic Properties: Atomic magnetic moment, magnetic susceptibility, Langevin's theory of Dimagnetism.

Numericals.

Unit IV

Free Electron Theory: Drude-Lorentz model, Wiedemann Franz law (Derivation), Density of states.

Band Theory of Solids: Bloch theorem (statement only), Kroning Penny model, Concept of hole, Hall effect (without proof), distinction between metal, semiconductor and insulator.

Numericals.

References and Text books –

1. Physics for degree students B.Sc. Third Year – C.L. Arora, Dr P.S. Hemne
   Publisher: S. Chand & Publication, New Delhi.
2. Solid State Physics, by- S. U. Pillai.
3. Solid State Physics, by- Gupta Kumar.
4. Introduction to Solid State Physics, by- C. Kettel.
5. Modern Physics, by- R. Mugadesham
6. Modern Physics, by- J. B. Rajam
7. Modern Physics, by- Kumar , Krishane, Nandeem
8. A Text Book of Modern Physics, by- K. C. Lal, S. T. Ahmad.
9. Modern Physics, by- Aurther Biser.

5S-PHY 503 :(Practical)

1. Every student will have to perform at least **Five (05)** experiments from each group.
2. Every student will have to perform **two** experiments one from each group in 6 hours during university practical examination.
3. The distribution of practical/laboratory work of 30 marks is-

Two experiments (9 Marks each)	- 18 Marks
Record book	- 06 Marks
Viva Voce	- 06 Marks

Total	30 Marks

List of the experiments-

Group A

1. To show that deviation of probability from theoretical value decrease with increase in number of events.
2. Study of statistical distribution from the given data and to find most probable, average and rms values.
3. Plotting of distribution curve from the given data and calculation of (a) Most probable (b) Average and
   (c) RMS values.
4. Study of probability dependence on number of events (With one coin)
5. Comparison of experimental and theoretical values of probability with two and three coins.
6. To verify the maximum power transfer theorem.
7. To determine the capacitance of a capacitor by Scherring bridge.
8. Study of Owen's bridge.
9. To determine the capacitance or to compare two capacitances by Wien's bridge.
10. Study of dielectric constant.

Group B

1. Determination of activation energy of material of the thermistor.
2. To determine the lattice parameter 'a' of the unit cell of a cubic crystal using X ray diffraction film.
3. To determine the energy band gap of a semiconductor using a junction diode (Si/Ge).
4. Identification of unknown element from a line emission spectra.
5. To determine the energy band gap of a semiconductor (Germanium) using four probe method.
6. To determine Hall coefficient and mobility of charge carriers in a semiconductor.
7. To study the characteristics of a Silicon Controlled Rectifier (SCR).
8. To verify the Stefan's law of radiation by using an incandescent lamp.

9. Study of OPAMP as inverting and non-inverting amplifier.
10. Study of OPAMP as adder and subtractor.

References books -

1. B.Sc. Practical Physics - – Dr P.S. Hemne, Harnam Singh,
   Publisher: S. Chand & Company Ltd. New Delhi.
2. Practical Physics For B. Sc. II –Kale, Soman, Gawande & Gokhale
   Publisher: Kitab Mahal, Nagpur
3. Practical Physics For B. Sc. III –Kale, Bahekar & Gokhale
   Publisher: Kitab Mahal, Nagpur

Board of Studies in Physics

FACULTY OF SCIENCE

GONDWANA UNIVERSITY, GADCHIROLI

Syllabus of

B.Sc. Third Year (Semester Pattern)

SUBJECT - PHYSICS

Semester VI

GONDWANA UNIVERSITY, GADCHIROLI

SUBJECT - PHYSICS

(A) Teaching workload and Semester Examination Scheme for B.Sc.

Class	Semester	paper	Teaching workload per week			Examination Scheme								Total marks	Total Credits
						Theory Paper			Internal assessment			Practical			
			Theory	Total	Practical	marks		Credits	marks		Credits	marks	credits		
B.Sc.I	I	I	3	6+ 1T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
	II	I	3	6+ 1T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
B.Sc.II	III	I	3	6+ 2T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
	IV	I	3	6+ 2T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
B.Sc.III	V	I	3	6+ 2T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	3			50			10						
	VI	I	3	6+ 2T*	6	50	100	**12**	10	20	**2**	30	**6**	150	**20**
		II	**3**			50			10						
B.Sc.	**Total marks : 900**								**Total Credits : 120**						

T* Periods for Tutorials per batch.

(B) B.Sc.Semester Pattern Examination Scheme

1. There shall be total **six** semesters.
2. Each semester shall comprise of **90** (Ninety) actual teaching days.
3. Each Semester I to VI shall be of **150** marks.

4. Every subject in each semester will comprise of two theory papers of **50** marks each. Practical/ laboratory work will be of **30** marks and Internal assessment of **10** marks for each theory paper.

i.	Paper I Theory	----	50 marks
	Internal Assessment	----	10 marks
ii.	Paper II Theory	----	50 marks
	Internal Assessment	----	10 marks
iii.	Practical	----	30 marks
Total marks		**----**	**150 marks**

5. All theory papers shall be divided into four units. Each unit shall be cover in 15 periods of 45 minutes.

6. The scope and limitations of the subject of all semester opted by the students shall be indicated in the syllabi from time to time. The medium of instruction and examination shall be English.

7. The theory question paper will be **intraunit** choice and equal weightage to all questions. Duration of each theory paper shall be **three** hours. There will be five questions each of **10** marks. All questions are compulsory. Fifth question will be on all four units with three sub-questions from each unit.

8. **Pattern of question paper: Subject - Physics**

Time: 3 Hours **Maximum marks :50**

Question No.		**Marks Allotted**
Qu. 1 Either		
(A)From Unit - I		10
Or		
(B)From Unit – II / III / IV		10
Qu. 2		
If **Qu. 1 (B)** From Unit – II	Then	
Either (A) From Unit – III **Or**	(B)From Unit - IV	10
If **Qu. 1 (B)** From Unit – III	Then	
Either (A) From Unit – II **Or**	(B)From Unit - IV	10
If **Qu. 1 (B)** From Unit – IV	Then	
Either (A) From Unit – II **Or**	(B)From Unit - III	10
Qu. 3 Either		
a) From Unit - I		2.5
b) From Unit - II		2.5
c) From Unit - III		2.5
d) From Unit - IV		2.5
Or		
e) From Unit - I		2.5
f) From Unit - II		2.5
g) From Unit - III		2.5
h) From Unit - IV		2.5

Qu. 4 Either

a)	From Unit - I	2.5
b)	From Unit - II	2.5
c)	From Unit - III	2.5
d)	From Unit - IV	2.5
	Or	
e)	From Unit - I	2.5
f)	From Unit - II	2.5
g)	From Unit - III	2.5
h)	From Unit - IV	2.5

Qu. 5 Attempt any 10 questions from the following.

(a)	Unit - I	1
(b)	Unit - I	1
(c)	Unit - I	1
(d)	Unit - II	1
(e)	Unit - II	1
(f)	Unit – II	1
(g)	Unit – III	1
(h)	Unit – III	1
(i)	Unit – III	1
(j)	Unit – IV	1
(k)	Unit – IV	1
(l)	Unit – IV	1

8. A student will have to perform at least five (**05**) experiments from each group.

9. Practical examination for all semesters shall be conducted **twice** in a year, at the end of each semester. Practical examination in odd semesters shall be conducted by **Internal examiner**, whereas practical examination in even semester shall be conducted by **Internal as well as external examiner**. Duration of practical examinations shall be of **6** hours. At the time of Practical examination every student has to perform **two** experiments **one** experiment from each group.

10. The distribution of marks for practical examination is as follows.

Record Book	----	6 marks
Viva-voce	----	6 marks
Each Experiment	(9 marks) ----	18 marks
TOTAL	**----**	**30 MARKS**

11. Evaluation of the student during the semester for internal assessment:

The University approved teacher will have to conduct a test on each unit. The test is to be carried out with the interest to make the student aware of the basics of the theory and the experiments as well. This will enhance the viva-voce competence and subject interest of the student. The record of these tests is to be maintained in the department duly signed by the teacher in-charge and head of the department. The record is to be maintained in the following format. Each unit test should be of **10** marks. Find the average and assign it to the student.

Record of marks scored in the unit tests during the semester.

Date										Average marks obtained
S.No.	Name of the Student	Paper I				Paper II				
		Test1	Test 2	Test 3	Test 4	Test1	Test 2	Test 3	Test 4	
1	ABC									
2	DEF									
3	GHI									
4	JKL									
5	MNO									
6	PQR									
7	STU									
8	VWX									
9	YZ									

Signature of teacher in-charge Head of Department

12. The internal assessment shall be done by respective college and the marks shall be sent to the university one month prior to the final examination of each semester.

13. Minimum marks for passing will be **35%** of the total marks. A candidate has to pass individuality in theory / internal assessment / practical separately. The minimum passing marks for theory **35** marks, for internal assessment **7** marks and that for practical **11** marks.

C) Grade Point Average (GPA) and Course Grade Point Average (CGPA)

In the Credit and Grade Point System, the assessment of individual Courses in the concerned examinations will be on the basis of marks only, but the marks shall later be converted into Grades wherein the overall performance of the Learners can be reflected after considering the Credit Point. The overall evaluation shall be designated in terms of Grade.

(Table No.1): Performance Grading Scale

Marks Obtained %	Grade	Grade Points
75 & above	O	6
65 to 74.99	A	5
55 to 64.99	B	4
50 to 54.99	C	3
45 to 49.99	D	2
40 to 44.99	E	1
00 to 39.99	F	0

(Table No. 2): Final Grade Points

Final Grade Points	Final grade
5.0 to 6.0	O
4.50 to 4.99	A
3.50 to 4.49	B
2.50 to 3.49	C
1.50 to 2.49	D
0.50 to 1.49	E
0.00 to 0.49	F

O: Outstanding, **A**: Very Good, **B**: Good, **C**: Average, **D**: Satisfactory, **E**: Pass, **F**: Fail

Semester Grade point average (SGPA)

SGPA: Semester Grade Point Average shall be calculated for individual semesters. It is also designated as GPA.

$$SGPA = \frac{\sum CG}{\sum C}$$

Where, ∑CG: Sum of Product of Credits & Grade points and ∑C: Sum of Credit points.

Cumulative Grade Point Average (CGPA)

CGPA: Cumulative Grade Point Average shall be calculated for the entire Program by considering all the semesters taken together. The CGPA of a student will be Average of the SGPA's of that student. A student will be allotted a cumulative Grade Point Average (**CGPA**) after clearing all the four semesters. The CGPA of a student will be Average of the four SGPA's of that student.

After calculating the SGPA for an individual semester and the CGPA for entire program, the value can be matched with the grade in the Final Grade Point table No. 2 as per the Seven (07) Points Grading System and expressed as a single designated GRADE such as O, A, B, C, D,

Syllabus for B.Sc. III Subject – Physics

The syllabus of Physics as per semester system for the B.Sc. III will be implemented from the Academic year **2014-2015**.

Name of Programme : **B.Sc. III**
Duration: **Two semesters**

Semester V: Paper I (5S-PHY 501): Statistical Physics and Relativity
Paper II (5S-PHY 502): X-rays and Solid State Physics,
Practical (5S- PHY 503)

Semester VI: Paper I (6S-PHY 601): Nuclear Physics, Nanotechnology and Biophysics
Paper II (6S-PHY 602): Fibre Optics, Communication and Digital Electronics
Practical (6S- PHY 603)

Paper I: 6S-PHY 601: Nuclear Physics, Nanotechnology and Biophysics

Unit I

Nuclear physics- Interaction of charged particles and neutrons with matter, G. M. counter, Proportional counter and scintillation counter. Nuclear reactions, Packing fraction, Mass defect and binding energy, Nuclear fission.

Numericals.

Unit II

Structure of nuclei: Liquid drop model, Chain reaction, Nuclear fusion, Cosmic ray, Elementary particles, Shell model of the nucleus. Alpha decay, Range of α particle, Geiger Nuttal law, Tunneling, Gamow's theory of α decay.

Numericals.

Unit III

Nanomaterials- Size and properties of nanomaterials, Difference between nanomaterials and bulk materials, Nano cluster, quantum dots.

Nanotechnology- Different methods of synthesis of nanomaterials (Wet chemical, Sol-gel and HCR Technique), Basic principle of characterization technique of SEM and TEM.

Unit IV

Applications of Nanotechnology: Applications in nano-medicine, nano-electronics, nano-sensing, nano-magnetics (only basic idea).

Bio-physics- Bio Potential- compound action Potentials of the human body, Electrocardiogram for heart (ECG), Electroencephalogram for brain (EEG)(Only working mechanism).

References and Text books –

1. Nuclear Physics, by- S. N. Ghoshal.
2. Atomic and Nuclear physics, by- N. Subramanyam, Brijlal.
3. Introduction to Nuclear physics, by-H. A. Enge.

4. Atomic and Nuclear physics, by- T. A. Littlefield, N. Thorley.
5. Nano Technology, by- Er. Rakesh Rathi. Publisher: S. Chand & Publication, New Delhi.
6. Introduction to Nano Technology, by- C. P. Poole, Jr. F. J. Owens.
7. Nano Technology, by- T. J. Daming.
8. Nano Structure and Nano Materials, by- M. Balkrishanarao, K. Krishana Reddy.
9. Introduction to Bio Physics, by- P. Narayanan, New Age Publications.
10. Medical Instrumentation, by- Khandpur TMH.
11. Text Book of Bio Physics, by- R. N. Roy
12. Laboratory manuals of Bio Physics Instruments, by- P. B. Vidyasagar.
13. Bio physics, by- Vatsala Piramal, Dominant Publications and Distributions, New Delhi.

Paper II: 6S-PHY 602: Fibre Optics, Communication and Digital Electronics

Unit I

Fiber optics- Importance of optical fiber, Propagation of light waves in optical fiber, Basic structure, Stepped index monomode fiber, Graded index fiber, Acceptance angle and acceptance cone, Numerical aperture, Fiber losses and their units (basic concept), Electrical and optical band width, bandwidth length product.

Numericals.

Unit II

Communication- Introduction to A.M. F.M. and P.M.

Amplitude modulation (A.M.): Frequency spectrum, Modulation factor, Percentage modulation, Expression for Power dissipation in AM wave, disadvantages.

Frequency modulation - Frequency deviation, Carrier swing, Modulation index, Deviation ratio, Expression for FM wave, Frequency spectrum, significant side band terms, FM band width, Merits and demerits.

.*Numericals*.

Unit III

Number Systems- Binary, decimal, hexadecimal and their inter-conversions, Binary coded decimal (BCD), Addition and subtraction of binary numbers, 1'S, 2'S and 9'S,10'S compliment,

Logic gates- AND,OR,NOT, NOR, NAND, Ex-OR, Ex-NOR and their truth table, Boolean equations, De Morgan's theorem and its verification. Half adder, Full adder, Half subtractor and full subtractor, Boolean equations, De Morgan's theorem and its verification.

Numericals.

Unit IV

Astable, monostable and bistable multivibrators , RS flip-flop, clock RS FF, DFF, JKFF, and JKMSFF 4-bit serial binary counter shift register (SISO and SIPO), Ring counter,

References and Text books -

1. Optical Fibres and Fibre Optic communication System, by- Subir Kumar Sarkar, S. Chand & Company,
2. An introduction to fiber optics, by-R. Allen Shotwell.
3. Optical fiber communication, by-John M. Senior.
4. Laser and Optical fiber communication, by- P.Sarah.
5. Digital and Analog Technique 1st Edition, by- Navneet, Gokhale, Kale, Kitab Mahal Nagpur.
6. Basic Electronics (Solid State), by- B. C. Therja.
7. Optoelectronics and fiber optics communication, by- C. K. Sarkar, D.C. Sarkar.
8. Communication Electronics, by- A. Kumar
9. Digital Electronics, by- V. K. Jain
10. Digital Principle and Application, by- Malvino and Leach
11. Digital Electronics and It's Application, by- R. P. Jain
12. Digital computer Electronics, II nd Edition, by- Malvino, TMH Edition.

6S-PHY 603 :(Practical)

1. Every student will have to perform at least **Five (05)** experiments from each group.

2.Every student will have to perform **two** experiments one from each group at the time of university practical examination in 6 hours.

3.The distribution of practical/laboratory work of 30 marks is-

Two experiments (9 Marks each)	- 18 Marks
Record book	- 06 Marks
Viva Voce	- 06 Marks
Total	30 Marks

List of the experiments-

Group A

1. Study of random decay of nuclear disintegration and determination of decay constant using dices.
2. To study low-pass, high-pass and band-pass filters.
3. To determine the electric charge (e) of an electron by Millikan's oil drop method.
4. To determine the value of specific charge (e/m) of an electron by Thomson method.
5. Study of RS flip-flop
6. Study of JK flip-Flop
7. Study of 4-bit binary counter.
8. o study the working of an Astable multivibrator.
9. To study the working of a Mono-stable multivibrator.
10. To study the working of a bi-stable multivibrator.

Group B

1. To determine modulation index and percentage modulation of AM modulator.
2. To study Master Oscillator Power Amplifier (MOPA)
3. To study transistor as a switch - calculation of ON and OFF state resistance.
4. Study of Characteristics of LED.
5. Study of basic gates: AND, OR and NOT gates.
6. Study of NAND gate and its use as a Universal gate.
7. Study of NOR gate and its use as a Universal gate.
8. Verification of De Morgan's theorem.
9. Simplification of logic circuits using laws and theorems of Boolean algebra.
10. Study of half adder and full adder.

References books -

1. B.Sc. Practical Physics - – Dr P.S. Hemne, Harnam Singh,
   Publisher: S. Chand & Company Ltd. New Delhi.
2. Practical Physics For B. Sc. II –Kale, Soman, Gawande & Gokhale
   Publisher: Kitab Mahal, Nagpur
3. Practical Physics For B. Sc. III –Kale, Bahekar & Gokhale
   Publisher: Kitab Mahal, Nagpur

Board of Studies in Physics

FACULTY OF SCIENCE

GONDWANA UNIVERSITY, GADCHIROLI

Credit Based Proposed Syllabus of

B.Sc. Second Year (Semester Pattern)

SUBJECT - PHYSICS

Semester III & Semester IV

Proposed Syllabus for B.Sc. II Subject – Physics

The syllabus of Physics as per semester system for the B.Sc. II will be implemented from the Academic year **2013-2014**.

Name of Programme : **B.Sc. II**
Duration: **Two semesters**
Semester III: Paper I (3S-PHY 301): Thermodynamics and Acoustics
Paper II (3S-PHY 302): Optics and Laser
Practical (3S- PHY 303): To perform 10 experiments (05 from each group)
Semester IV: Paper I (4S-PHY 401): Quantum Mechanics and Molecular Physics
Paper II (4S-PHY 402): Atomic physics and Solid State Electronics
Practical (4S- PHY 403): To perform 10 experiments (05 from each group)

Paper I: 3S-PHY 301: (Thermodynamics and Acoustics)

Unit I

Laws of Thermodynamics*:* Thermodynamic variables: extensive and intensive, Zeroth Law, Isochoric, Isobaric and Adiabatic Processes, Reversible and Irreversible Process, P-V diagrams, First Law of thermodynamics, Internal energy as a state function, Cyclic Process, Carnot's Cycle and its efficiency, Carnot's Theorem.
Numericals.

Unit-II

Entropy: Concept of entropy, Principle of increase of entropy, Second Law of thermodynamics, T-S diagram, Thermodynamic Scale of Temperature, Perfect gas scale, Third law of thermodynamics. Heat death of universe.
Thermodynamic Relationships: Maxwell's thermodynamical relations, Clausius – Clapeyron's Equation,
Numericals.

Unit-III

Blackbody Radiation: Black Body in Practice, Black Body Radiation and its Temperature Dependence, Wien's Displacement Law, Rayleigh – Jean's Law, Ultraviolet Catastrophe, Planck's quantum postulates, Planck's law, Complete fit with experiment.
Numericals.

Unit-IV

Acoustics. Noise and music, Intensity and loudness, bel and decibel, the music scale, Transducers and their characteristics (crystal microphone, moving coil loud-speaker), Recording and Reproduction of sound (magnetic tape, compact disc), Acoustics of a hall, reverberation and reverberation period, Sabine's formula. Requirement for a good acoustics.
Numericals.

References and Text books -

1. Heat, thermodynamics and statistical physics, by- Brijlal, Subramayam and Hemne,
2. Publisher: S. Chand & Company Ltd. New Delhi.
3. Physics for degree students B.Sc. Second Year – C.L. Arora, Dr P.S. Hemne,
4. Publisher: S. Chand & Company Ltd. New Delhi.
5. Heat, Thermodynamics and Statistical Physics, by- Pragati Prakashan , Singhal, Agrawal.
6. A Text Book of Heat, by- J. B. Rajam.
7. Treatise on heat, by- Shah, Srivastava.
8. Waves and Oscillations, by-Stephenson.
9. A Text Book of Oscillations, waves and Acoustic, by- Dr. M. Ghosh, Dr. D. Bhattacharya, Publisher: S. Chand & Company Ltd. New Delhi.
10. Oscillation, waves and sound, by- Sharma and Saxena.
11. Waves and oscillation, by- N. Subrahmanuam and Brijlal, Publisher: S. Chand & Company
12. The Physics of waves and oscillation, by- N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd.

Paper II: 3S-PHY 302: Optics and Laser

Unit I

Interference of light: The principle of super-positions, two-slit interference, Localised fringes, Thin films, Interference fringes at wedge-shaped films, Newton's rings (in reflected and transmitted light) and refractive index measurement.

Numericals.

Unit II

Michelson interferometer, its application for determination of wavelength, Febry-Perot interferometer.

Diffraction: Fresnel's diffraction- Half period zones, Zone plates, Diffraction due to straight edge and due to narrow slit.

Fraunhoffer diffraction- Fraunhoffer diffraction at a single slit, Plane diffraction grating and its applications, Resolving power of grating, Rayleigh's criterion for resolution.

Numericals.

Unit III

Polarization. Concept of polarization, Brewster's law, positive and negative crystal, Nicol prism, its application as an analyzer and polarizer, Double refraction in uniaxial crystal, phase retardation plate (Half and Quarter wave).

Numericals.

Unit IV

LASER- Spatial and temporal coherence, absorption, spontaneous and stimulated emission, Population inversion, Optical pumping, characteristics of laser beam, Ruby laser, Semiconductor laser, Application of lasers.

Numericals.

References and Text books -

1. Physics for Degree students for B. Sc. Second year, by- C. L. Arora, Dr. P. S. Hemne. Publisher: S. Chand & Company Ltd. New Delhi.
2. Optics and Spectroscopy, by- R. Murugeshan , Kiruthign Sivaprakash.
3. Optics, by- Brijlal and Subramayam. Publisher: S. Chand & Company Ltd. New Delhi.
4. Optics, by- Ajay Agatak.
5. A text book of optics, by- Dr. Subrahmanyam, Brijlal and M. N. Avadhanulu. Publisher: S. Chand & Company Ltd. New Delhi.
6. Optics, by- J. K. Sharma, K. K. Sarkar.
7. Fundamentals of optics, by-Jenkins and white.
8. Optics, by- D. P. Khandelwal.
9. Lasers and Non linear optics. By- B. B. Laud
10. LASERS- Theory and Applications, by- Thyagarajan and A. K. Ghatak
11. Optics and LASER, by- V. K. Sewane
12. Introduction to Lasers, by- Dr. Avadhanulu, Dr. P. S. Hemne. Publisher: S. Chand & Company Ltd. New Delhi.

3S-PHY 303 :(Practical)

1. Every student will have to perform at least **Five (05)** experiments per semester.
2. Every student will have to perform **two** experiments one from each group at the time of university practical examination in 6 hours.
3. The distribution of practical/laboratory work of 30 marks is-

Two experiments (9 Marks each)	- 18 Marks
Record book	- 06 Marks
Viva Voce	- 06 Marks

Total	30 Marks

List of the experiments-

Group A

1. Study of resistance thermometary using thermistor.
2. Study of conduction of heat through poor conductor in circular form (Lee's disc method).
3. Study of conduction of heat through poor conductor in cylindrical form (Using Rubber tube).
4. Thermal conductivity of a rubber in the form of a tube.
5. Specific heat of solid by method of mixture and radiation correction.
6. Specific heat capacity of graphite and its variation with temperature.
7. Determination of specific heat of a liquid (turpentine oil) by method of cooling.
8. To study the adiabatic expansion of a gas and determination of ratio of two sp. heats of a gas by Clement and Desorme's method.
9. Mechanical Equivalent of Heat (J) by Calendar - Barne's constant flow method
10. Determination of specific heat capacity of a liquid by Calendar - Barne's constant flow method
11. Mechanical Equivalent of Heat (J) by Joule's calorimeter.
12. Determination of temperature coefficient of resistance of Platinum using Platinum Resistance Thermometer.
13. Determination of the coefficient of linear expansion of a rod by optical lever method.
14. To determine velocity of the transverse waves on stretched string using sonometer.
15. Study of the characteristics of loudspeaker (woofer, squawker and tweeter)
16. Study of the characteristics of a microphone
17. Study of directional characteristics of a microphone.
18. Study of interference with two coherent sources of sound and determination of velocity of sound in air.

Group B

1. Determination of focal length of a concave lens using a short focus covex lens
2. Determination of focal length of long focus convex lens using an auxiliary short focus convex lens.
3. Refractive index μ of glass prism by plotting I- δ curve using spectrometer (Schuster's method).
4. Refractive index μ of flint glass prism for sodium light using spectrometer.
5. Dispersion power (ω) of a glass prism using hydrogen discharge tube.
6. Dispersion power (ω) of a glass prism using mercury lamp.
7. Resolving power of a prism
8. Determination of refractive indices of different colours and plotting the graph of refractive index vs. wavelength.
9. Determination of angular magnifying power of a telescope.
10. Determination of linear magnifying power of a telescope.
11. To determine the wavelength (λ) of monochromatic light source by Newtons rings.

12. To determine the radius of curvature of plano-convex lens by Newton's rings apparatus.
13. To determine wavelength of monochromatic light source (λ) by Fresnel's biprism.
14. To determine the wavelength of sodium light using a plane transmission grating.
15. To determine the wavelength of mono-chromatic light using a plane transmission grating in minimum deviation position.
16. To determine the wavelength (λ) of prominent lines of mercury by a plane transmission grating.
17. To determine the resolving power of a telescope.
18. To determine the refractive index of the material using Brewster's law.
19. To study the divergence of a laser beam.
20. To determine wavelength of a LASER beam using plane diffraction grating.

References books -

1. B.Sc. Practical Physics - – Dr P.S. Hemne, Harnam Singh
   Publisher: S. Chand & Company Ltd. New Delhi.
2. Practical Physics For B. Sc. II –Kale, Soman, Gawande & Gokhale
   Publisher: Kitab Mahal, Nagpur
3. Practical Physics For B. Sc. III –Kale, Bahekar & Gokhale
   Publisher: Kitab Mahal, Nagpur
4. University Practical Physics – D.C. Tayal, Ila Agrawal
   Publisher: Himalaya Publishing House
5. B.Sc. Practical Physics - C. L. Arora
   Publisher: S. Chand & Company Ltd. New Delhi.
6. A Text Book on Practical Physics – K. G. Muzumdar, B. Ghosh
   Publisher: Shreedhar Publishers, Kolkata

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
B.Sc. Part II
Subject- Zoology
Semester III – Paper I
Life and Diversity of Animals
(Chordates)

Unit- I	Periods
Pisces–Salient features of Chondrychthyes and Osteichthyes.	2
Labeo rohita : External morphology, Digestive, Circulatory and Respiratory systems. Economic importance of fishes. Fish Migration and Accessory Respiratory organs.	10
Unit-II	
Amphibia – Classification, Parental care and Neotony.	4
Reptilia- Classification based on temporal vacuities.	3
Snake venom, Poision apparatus & Biting mechanism	5
Unit-III	
Birds – Origin of birds	3
Types of feathers	1
Flight adaptations (Morphological, Anatomical and Physiological)	4
Migration and its significance	3
Ratitae and Carinitae	1
Unit-IV	
Mammals – General characters of Prototheria, Metatheria and Eutheria	6
Comparative account of Aortic arches and Heart.	6

Semester - III

DEVELOPMENTAL BIOLOGY

Paper-II

Unit-I	**Periods**
Types of eggs- classified on the basis of amount and distribution of yolk.	5
Chemical composition of yolk.	
Mechanism and significance of Fertilization.	
Parthenogenesis- Definition, types and its significance.	3
Cleavage- Types of cleavages	2
Blastulation- Definition and types of blastulation.	2
Unit-II	
Morphogenetic movements in the early development of frog (Invagination, Epiboly, Emboly, Involution, Ingression and Delamination).	6
Development of chick up to the formation of Primitive streak	3
Development of Extra embryonic membranes in chick and their Significance.	3
Unit-III (Mammalian development)	
Gametogenesis- (Oogenesis and Spermatogenesis).	4
Structure of Sperm and Ovum.	2
Implantation- Definition and types.	2
Placentation- Definition, Types (Based on the Morphological and histological structures). Functions of placenta.	4
Unit –IV	
Stem Cells- Totipotancy, Sources, Types and their use in human welfare.	4
In Vitro Fertilization (Test tube Baby)- Technique advantages and disadvantages.	4
Semen Bank, Artificial Inseminations and Contraceptives	4

PRACTICALS

B.Sc.II (Zoology), Semester-III

Laboratory practical course and examination pattern is given below:

1. Identification, Classification : distinguishing characters and adaptive features of

a) Fishes *: Pristis, Torpedo, Notopterus, Exocoetus, Clarius, Ophiocephalus, Catla, Rohu, Mrigal*.

b) Amphibia : *Bufo, Salamaner, Ichthyophis*
c) Reptilia : *Chameleon, Varanus, Pharynosoma, Draco, Tortoise*, Cobra, k rait, Russill's viper, *Echis*, Sea snak e.
d) Birds: Owl, Woodpeck er, Kingfisher, Kite, Duck , Parrot.
e) Mammals: Squirrel, Mongoose, Bat, Loris, Rabbit.

2. Anatomical Observations
Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc. (Any fish)

i. Digestive system
ii. Reproductive system
iii. Brain and Cranial Nerves

3. Study of skeleton of Rabbit/ Fowl
(Loose bones of skull not to be studied)

4. Developmental Biology –
Study of the following slides-
1. Study of permanent slide of Frog embryology, Chick embryology
(18 hrs, 24 hrs, 30 hrs, 36 hrs, 72 hrs)

5. Study of permanent slides-
V.S. skin of Frog and Mammal

6. Study of permanent Preparation of the following with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc.

Fish scales – placoid, cycloid, ctenoid
Hyaline cartilage and striated muscle

7. Collection, study tour and submission of report

Distribution of Marks –

1. Anatomical observations	10
2. Spotting- (4 specimens, 4 slides, 2 bones).	10
3. Permanent stained micro preparation	4
4. Class record,	3
5. Submission of slides and study tour report	3

====

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
B.Sc. Part II
Subject- Zoology
Semester IV – Paper II
Animal Behavior and Evolution
(Paper -I)

Unit- I	**Periods**
Definition, Types and Adaptive nature of Behavior	05
Innate Behavior-Reflexes, taxes and instinctive behavior	05
Hypothalamus and behavior	02
Unit-II	
Imprinting, Pavlovian and Trial and Error conditioning	03
Social behavior: Aggregation, Migration and navigation,	03
Courtship (Appeasement, intentional & display movement)	03
Reproductive fighting, Dominance hierarchy	03
Unit-III	
Oparin's concept of Miller's experiments	01
Biochemical origin of life	02
Adaptive radiation in mammals	02
Parallel, Convergent and Divergent evolution	02
Recapitulation theory	02
Natural selection- Stabilizing, Directional and Disrupting	03
Unit-IV	
Populations, gene pool, gene frequency, genotype frequency	02
Hardy-Weinberg law, migration and random genetic drift	03
Mechanism of isolation	04
Mechanism and pattern of speciation	03

Semester - IV

Genetics and Genetic Engineering

(Paper -II)

Unit- I	**Periods**
Structure of DNA and RNA. Types of RNA Concept of gene as cistron, muton and recon.	3
Gene regulation in Prokaryotes (Lac operon in E. coli)	2
Salient feature of genetic code.	2
Protein synthesis- Transcription and Translation.	3
Unit- II	
Genic balance mechanism of sex determination in Drosophila.	3
Cytoplasmic inheritance: Kappa particles in *Paramecium*, Milk factor in Mice.	3
Gene mutation and Mutagenic agents – (physical and chemical).	4
Unit-III	
Definition and Types of Eugenics. Eutelogenesis.	1
Basic concept in recombinant DNA technology	1
Isolation of gene- DNA manipulation enzyme: Nucleases, ligase, Polymerases, Alkaline phosphatase and topoisomerases	3
Gene isolation methods- shotgun Method, hybridization and reverse transcription.	3
Cloning vectors: Plasmid, Bacteriophage, Lamda, Cosmids YAC's (Yeast artificial chromosome)	2
Unit IV	
Splicing technique - Insertion of DNA and ligation using blunt ends, Cohesive ends.	2
Introduction of recombinant DNA in to host cell by Genetic transformation, Transfection, Transduction and Transgenesis.	4
Application of genetic engineering- Production of insulin, Vitamins and monoclonal Antibodies.	4

PRACTICALS

B.Sc.II (Zoology), Semester-IV

1. Study of chemotaxis and phototaxis in animals.
2. Identification of wild and mutant type Drosophila.
3. Demonstration of monohybrid by beads.
4. Demonstration of Dihybrid by beads.
5. Study of sickle cell anemia.
6. Study of Thalassemia.
7. Study of ABO and Rh blood groups in human society.
8. Study of Drum stick in the human blood.
9. Study of Barr body in vaginal smear or buccal epithelium.
10. Study of human genetic trait by using Hardy-Weinberg equations- Rolling of tongue, baldness, widow peak, length of index and ring finger, attached and free ear lobe.
11. Study of pictures of human chromosome abnormalities.
12. Study of pictures of Adaptive radiations in Reptilia and Mammals.
13. Study of pictures of Parallel, Convergent and Divergent evolution.
14. Study of picture of Stabilizing, Directional and Disruptional evolution.
15. Preparation of models on genetics.

Distribution of marks for Practical at the end of Semester-IV

1. Study of monohybrid/dihybrid cross by beads.	05
2. Identification of pictures (2 marks each).	08
3. Study of any human trait by using H-W equation.	06
4. Study any one of experiment (From 6 to 10).	04
5. Submission of any genetic model .	02
6. Viva-voce	02
7. Class Record	03
Total …… .30	

Books Recommended –

Paper –I : Chordate and Developmental biology

1. T. B. of Zoology vol II – Parker & Haswell
2. T. B. of Vertebrate zoology _ S. N. Orasad
3. Vertebrate zoology –E. L. Jorden
4. Vertebrate zoology – Vishwanath
5. Zoology of chordates – Nigam H. C.
6. Phylum Chordata –n Newman H.H.
7. Biology of vertebrates –Walter & Sayles
8. The vertebrate body – Romer A. S.
9. Comparative anatomy of the vertebrates – Kingslay J. D.
10. The Biology of Amphibia – Noble G. K.
11. Snakes of India – Gharpura K. G.
12. Life of Mammals – Young J.Z.
13. Vertebrates – Kotpal R. L.
14. Introduction to Chordates – Majupuria T.C.
15. Vertebrate Zoology – Dhami & Dhami
16. T. B. Vertebrate Zoology – Agrawal
17. Protochordates – Chatterjee & Pandey
18. Protochordates – Bhatia
19. T. B. of Chordates – Bhamrah and Juneja
20. Chordate anatomy – Arora M.P.
21. The Chordates – Alexander.
22. T. B. of animal embryology – Puranik
23. T. B. of Chordate embryology – Dalella & Verma
24. T. B. of embryology – Sandhu
25. S.Y B. Sc Zoology Sem-III- Dhamani,Bakare,Harney & Bhute

26. S.Y B. Sc Zoology Sem-IV- Dhamani,Bakare,Harney & Bhute

(Paper-III) Animal Behavior and Evolution

1. Animal Behavior- M.P. Arora, Himalaya Publication New Delhi.
2. Animal Behavior- Vinod Kumar, Himalaya Publication, New Delhi.
3. Animal Behavior- N.Arumugam, Saras Publication, Nagercoil.
4. Text Book of Animal Behavior- H.S. Singh, Anmol Publications Pvt. Limited, Edition, 1999.
5. Animal Behavior- H.S. Gundevia and H.G.Singh, S.Chand Publication, New Delhi.
6. Cell Biology, Genetics, Evolution and Ecology-P.S.Verma and V.K.Agarwal, S. Chand and Company, New Delhi, edition, 1986.
7. Organic Evolution- M.P. Arora, 2010, Himalaya Publication New Delhi.
8. Organic Evolution- N.Arumugam, Saras Publication, Nagercoil.
9. Organic Evolution- Veer Bala Rastogi, Rastogi Publication, Meerut.
10. Organic Evolution- Richard Swann Lull, The Mac- Millan Company: New York, Revised edit., 1948.

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
B.Sc. Part I
Subject- Zoology
Semester I – Paper I
Life and Diversity of Animals
(Protozoa to Annelida)

Unit – I

1. Introduction of Non-chordates – Animal sub-kingdom. **1**
2. Protozoa - General characters and classification. **1**
3. Plasmodium – Structure and life cycle. **3**
4. Parasitic protozoans of Man, mode of infection and diseases Caused by Entamoeba, Trypanosoma. **4**
5. Paramoecium – Structure and Reproduction. **2**

Unit II

1. Porifera – General characters and classification. **2**
2. Sycon – Different cells types, Canal System in sponges. **3**
3. Coelenterata – General characters and classification. **1**
4. Obelia - Structure and life cycle. **3**
5. Polymorphism in Coelenterata. **2**

Unit – III

1. Platyhelminthes – General characters and classification 2
2. Taenia solium – Structure and Life cycle 3
3. Aschelminthes – General characters and classification **1**
4. Ascaris – External morphology, Reproductive system and Life cycle. **3**
5. Diseases caused by parasitic nematodes, causes and control measures – Ancylostoma, Wuchereria. 3

Unit – IV

1. Annelida – General characters and classification. **1**
2. Leech – External morphology, Digestive system, Excretary system, Reproductive system, Copulation Fertilization, **6**
3. Trochophor Larva and its Significance **2**
4. Vermi culture and its importance. **2**

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
B.Sc. Part I
Subject- Zoology
Semester I – Paper II
Environmental biology

Unit I

- ● Ecosystem - definition and type **2**
- Detailed study of pond ecosystem. **2**
- Producers, consumer and decomposer. **2**
- ● Energy flow in ecosystem, food chain, food web and pyramids **5**

Unit II

- Biodiversity and its conservation. **2**
- Genetic diversity, species diversity. **2**
- Causes of reduction, methods of conservation. **4**
- Present status of biodiversity in India, Conservation project, Project
- Tiger, National park and sanctuaries (Nagzira, Tadoba, Kaziranga). **3**

Unit III

- Basic components of the Environment
- Atmosphere: Major zones and importance, composition of air. **3**
- Hydrosphere: Global distribution of water, physicochemical
- characteristic of water. **3**
- Lithosphere: Types of rocks, formation of soil. **3**
- Renewable and non- renewable energy sources. **2**

Unit IV

- Environmental pollution
- Sources, effects of air pollution with special reference to Acid rain,
- Global warming and Greenhouse effect, Control measures. **5**
- Sources, effects and control measures of water pollution 3
- Sources, effects and control measures of Noise pollution **2**
- Sources, effects and control measures of Heavy metal pollution (lead, mercury and cadmium). **2**

B.Sc. I Zoology
Semester I

References :

Paper I – Life and Diversity of Animals

1. Barnes **– Invertebrate zoology (Halt-Saunders international)** Philadelphia, USA
2. Barradaile L.A. & Potts F.A. – **The invertebrate**
3. Nigam **– Biology of non chordates**
4. Kotpal, Agrawal & Khetrapal **– Modern text book of zoology invertebrates,** Rastogi Publication, Meerut.
5. Jordan E.L. & P.S. Verma**– Invertebrate zoology,** S. Chand & Co. Ltd. New Delhi.
6. Puranik P.G. & Thakur R.S. **– Invertebrate zoology**
7. Majupuria T.C. **– Invertebrate zoology**
8. Dhami & Dhami **– Invertebrate zoology**
9. Parker & Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers & Distributors, New Delhi.
10. Dr. S.S. Lal **Practical Zoology Invertebrates 9th edition,** Rastogi Publication Meerut.
11. EJW Barrington– **Invertebrate Structure and Function** ELBS III Edition
12. R.L. Kotpal **– Phylum Protozoa to Echinodermata (series),** Rastogi and Publication, Meerut.

Paper II- Environmental Biology

1. Ashthana D.K. **– Environmental Problem & Solution**
2. Agrawal K.C. **– Environmental Biology**
3. Agrawal K.C. **- Biodiversity**
4. Mukharjee **– Environmental Biology**
5. S. Arora **– Fundamentals of Environmental Biology**
6. Sharma **– Ecology & Environmental Biology**
7. Verma P.S. & Agrawal V.K. **– Environmental Biology, S. Chand.**
8. Trivedi & Rao **– Air Pollution**
9. Chapman & Reiss – **Ecology-Principles and Applications**, Cambridge.
10. Chatterjee B – **Environmental Laws-Implementation and Problems.**
11. . Sharma P.D. – **Environmental Biology**, Rastogi Publication, Meerut.
12. Trivedi R.K. – **Hand Book of Environmental Laws, Rules, Guidelines, Compliances and Standards, Enviromedia.**
13. . Odum E.P. and Barret – **Fundamentals of Ecology**, Thomson.
14. . Smith R.L. – **Ecology and Field Biology**, Harper Collins.
15. D.N. Saksena &D.M. Gaidhane **– Environmental Biology**, Studium Press (India)

B.Sc. I - Zoology
Semester I – Practical I

I.Classification of Specimen (class/order)

Protozoa – *Enamoeba, Euglena, Paramoecium*
Porifera – *Leucosolenia, Euplectella, Spongilla*
Coelenterata - *Aurelia, Tubipora, Adamsia.*
Platyhelminthes - *Planeria, Fasciola, Taenia*.
Aschelminthes- *Ascaris, Ancylostoma, Wucheria*
Annelida – *Aphrodite, Neries, Pheretima, Pontobdella*

II. Study of Slides:

Entamoeba, *Plasmodium*, Sponge gemule, L.S. *Sycon*, *Obelia* medusa, Miracidium, Cercaria larva of *Fasciola*, T.S. *Ascaris* (male or female) , T.S. of Leech through crop.

III. Anatomical Observations

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc.

a. Leech – Digestive – Excretory and reproductive system
b. Earthworm – Nervous system, Reproductive system

IV. Study of permanent Preparation of the following with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc. (Any three)

Obelia colony, sponge gemmules, sponge spicules, *Nereis* parapodia, Jaws of Leech, Nerve ring of earthworm

V. Practicals in Environmental Biology

Estimation of dissolved oxygen of water
Estimation of free CO_2 of water
Estimation of pH and turbidity of water
Estimation of Hardness of water
Study of aquatic macrophytes in pond ecosystem
(floating/submerged/emergent/marginal)
Study of aquatic insects
Visit to a pond and submission of report on zooplankton.
Study of Biodiversity of invertebrates in our area.

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
B.Sc. Part I
Subject- Zoology

GONDWANA UNIVERSITY,
GADCHIROLI SEMESTER SYSTEM
SYLLABUS
FO
R
B.Sc.
ZOOLOGY
B.Sc. Part I
SEMESTER – I
PRACTICALS

Distribution of marks for Practical at the end of Semester. I

i) Anatomical Observations 05

ii) Identification of Spots, 2 Specimens, 2 Slides, 1 Spot from Environmental Biology 10

iii) Practical from Environmental Biology (DO or CO_2 or Alkalinity or Hardness)……07

iv) Permanent stained micropreparation (From Animal waste)…… 03

vi) Class Record…… 02

v) Biodiversity study tour & Submission of tour diary……. 03

Total…… **30**

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
B.Sc. Part I
Subject- Zoology

Semester II – Paper I
Life and Diversity of Animals
(Arthropoda to Protochordata)

Unit I –

1. Arthropoda – General characters and classification. **1**
2. Cock roach – External morphology, Digestive system, Reproductive system, mouth parts, sense organs. **6**
3. Insects as Vectors – Mosquito, Housefly, shadfly, Tse-Tse fly. **2**
4. Bioluminescence in Invertebrates. **2**

Unit II

1. Mollusca – General characters and classification. **1**
2. Pila – External morphology, Digestive system, Nervous system, Respiratory system, Reproductive system. **6**
3. Shell and pearl formation in Mollusca. **2**
4. Torsion in Mollusca. **2**

Unit III

1. Echinodermata – General characters and classification. **1**
2. Regeneration & autonomy in Echinodermata. **2**
3. Asterias – External morphology, water vascular system and locomotion, Bipinnaria larva. **3**
4. Hemichordata – General characters and classification **2**
5. Balanoglossus – External morphology, Affinities, Tarnaria larva. **3**

Unit IV

1. Protochordata – General characters & classification. **1**
2. Amphioxus – Structure, Digestive system, Excretory system, sense organs. **4**
3. Herdmania – Structure, Digestive system, Ascidian tadpole, Retrogressive Metamorphosis. **4**
4. Agnatha – General characters of cyclostomata, (Petromyzon and Myxine) **2**

GONDWANA UNIVERSITY GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
B.Sc. Part I
Subject- Zoology
Semester II – Paper II
Cell Biology

Unit I

- Intr oduction, History and scope of cell biology, cell th eory and its modern concept. **2**
- Prokaryotic and eu karyotic cell (Plant and Animal cell), mycoplasma. **2**
- Biological membrane: Sandwitch model and fluid mosaic model osmosis, endocytosis (pinocytosis and phagocytosis), passive and active tr ansport (Na^+ K^+ ion pump). **7**

Unit II

- Nucleus – Str ucture of nuclear membrane, pore complex (franke), Nucleocytoplasmic exchange. **5**
- Str ucture and general functions of Nucleolus. **2**
- Chromosome – str ucture and types, Nucleosome. **2**
- Giant Chromosome: Lampbru sh and polytene chromosome. **2**

Unit III

- Ultr astr ucture of mitochondria, electr on tr ansport mechanism and oxidative phosphorylation. **5**
- Endoplasmic Reticulum – str ucture and types; function. **3**
- Golgi complex – str ucture and functions. **3**

Unit IV

- Lysosome: Str ucture, enzymes and polymorphism in lysosome. **3**
- Ribosome: Str ucture (lake's model), function, polyribosome. **3**
- Cell division: Mitosis, meiosis, synaptonemal complex, significance. **5**

B.Sc. I Zoology
Semester II

References:

Paper I- Life and Diversity of Animals

1. Barnes **– Invertebrate zoology (Halt-Saunders international),** Philadelphia, USA
2. Barradaile L.A. & Potts F.A. – **The invertebrate**
3. Nigam **– Biology of non chordates**
4. Kotpal, Agrawal & Khetrapal **– Modern text book of zoology invertebrates,** Rastogi Publication, Meerut.
5. Jordan E.L. & P.S. Verma**– Invertebrate zoology,** S. Chand & Co. Ltd. New Delhi.
6. Puranik P.G. & Thakur R.S. **– Invertebrate zoology**
7. Majupuria T.C. **– Invertebrate zoology**
8. Dhami & Dhami **– Invertebrate zoology**
9. Parker & Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers & Distributors, New Delhi.
10. Dr. S.S. Lal **Practical Zoology Invertebrates 9th edition,** Rastogi Publication Meerut.
11. EJW Barrington, ELBS – **Invertebrate Structure and Function III Edition**
12. R.L. Kotpal **– Phylum Protozoa to Echinodermata (series),** Rastogi and Publication, Meerut.
13. . Parker J. and Haswell W. – **Text Book of Zoology**, ELBS Edition
14. Vidyarthi – **Text Book of Zoology**, Agrasia Publishers, Agra.
15. . Jordan E.L. and Verma P.S. – **Chordate Zoology**, S. Chand and Co., New Delhi

Paper II- Cell Biology

1. C.B. Powar, **Cell Biology** – Himalaya Publication, New Delhi.
2. C.B. Power, **Fundamental of Cell Biology** – Himalaya Publication, New Delhi.
3. Cooper – **Cell Biology**
4. Dr. S.P. Singh, Dr. B.S. Tomar – **Cell Biology** 9th revised edition, Rastogi Publication, Meerut.
5. Gupta P.K. – **Cell and Molecular Biology**, Rastogi Publication, Meerut.
6. Veer Bala Rastogi – **Introduction to Cell Biology**, Rastogi Publication, Meerut
7. De-Robertis – **Cell and Molecular Biology**, Holt Saunders
8. Gupta – **Cell and Molecular Biology**, Rastogi Publications
9. Alberts B. *et.al* – **Molecular Biology of the cell** (Sinauer)
10. . Lodish H. *et.al* – **Molecular Cell Biology**.
11. Gerald Karp – **Cell and Molecular Biology-Concepts and Experiments**, John Wiley, 2007.

B.Sc. I - Zoology

Semester II – Practical II

I. Observation, classification upto (class/order) and sketching of the following animals (specimen/model)

Phylum Arthropoda – Prawn, Limulus, Scolopendra, Julus, moth

Phylum Mollusca – Chiton, Pila, Dentalium, Unio, octopus

Phylum Echinodermata – Antedon, Holothuria, Echinus, Sea star, Brittle star

Phylum Hemichordata – Balanoglossus

Phylum Protochordata – Herdmania, Salpa, Doliolum, Amphioxus

II. Study of slides

Nauplius, Zoea, Megalopa,Glochidium, T.S. of arm of starfish, Bipinniria, Auricularia, Tornaria, T.S. of Balanoglossus through proboscis and collar, T.S. of Balanoglossus through pharynx, gonads, intestine and caudal region.

III. Anatomical Observations

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc.

a) Digestive and Nervous system of Cockroach.

b) Nervous system of Pila.

IV. Mounting - Study of permanent Preparation of the following with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc. (Any five)
Mouth parts of cockroach, mosquito, Honey bee, Salivary gland and trachea of Cockroach, Redula of Pila, and Pedicillariae of starfish.

V. Practicals in cell Biology

- Study of compound and dissecting microscope
- Ultramicroscopic structure of Prokaryotic cell, Animal cell, Plant cell. (pictures)
- Study of Osmosis in Eukaryotic cell.(Human RBCs)
- Demonstration of mitotic cell division in onion root tip by squash method
- Demonstration of polytene chromosome in dipteran larvae with the help of already available permanent slides/ ICT tools/ models/ charts/ photographs etc.
- Demonstration of mitochondria in buccal epithelium by Janus Green- B method.
- Use of ocular micrometer and measurement of micro objects.

GONDWANA UNIVERSITY, GADCHIROLI
SEMESTER SYSTEM SYLLABUS
FOR
B.Sc. ZOOLOGY
B.Sc. Part I
SEMESTER – II
PRACTICALS

Distribution of marks for Practical at the end of Semester. II

i) Anatomical Observations ……. 07

ii) Identification & Comments on spots (3 Specimen, 2 Slide)….. 10

iii) Practical form Cell Biology …….. 05

iv) Permanent stained micropreparation …….. 03

v) Viva & Submission of slides……. 03

vi) Class Record……. 02

Total …… 30

GONDWANA UNIVERSITY
GADCHIROLI CREDIT GRADE
SEMESTER SYSTEM B.Sc. I - Zoology
Question Paper pattern I
(Sem. I & II)

Note :- All questions are compulsory All questions carry equal marks
Draw diagrams wherever necessary.

Time: 03 Hrs. **Total marks : 50**

Question 1. Describe or write essay on : **02 x 05 = 10**
OR 01 x 10 = 10

Unit I **OR** **A) Unit II**
B) Unit II

Question 2. Describe or write essay on : **02 x 05 = 10**
OR 01 x 10 = 10

Unit III **OR** **C) Unit IV**
D) Unit IV

Question 3. Write notes on: **04 x 2 ½ = 10**

A) Unit I **OR** **E) Unit I**
B) Unit II **F) Unit II**
C) Unit III **G) Unit III**
D) Unit IV **H) Unit IV**

Question 4. Write notes on: **04 x 2 ½ = 10**
A) Unit I **OR** **E) Unit I**
B) Unit II **F) Unit II**
C) Unit III **G) Unit III**
D) Unit IV **H) Unit IV**

Question 5. Write in one or two lines only (Diagram NOT necessary) 01 x 10 = 10
(Solve any ten questions)
A) Unit I **G)**
Unit III B) Unit II
H) Unit IV C) Unit III
I) Unit I
D) Unit IV **J)**
Unit II E) Unit I
K) Unit III
F) Unit II **L) Unit IV**

GONDWANA UNIVERSITY GADCHIROLI

SEMESTER SYSTEM SYLLABUS

FOR

B.Sc. Part III

Subject- Zoology

Semester – V

Paper - I: General Mammalian Physiology –I

Unit – I : Enzymes

1. Enzymes –Distribution and chemical nature of enzymes
2. General properties of enzymes
3. Classification of enzymes
4. Factors affecting enzyme activity

Unit-II : Nutrition and Digestion

1. Structure and functions of digestive glands - (Salivary, Gastric, Intestinal, Liver and Pancreas)
2. Gastrointestinal hormones
3. Digestion and absorption of proteins, carbohydrates and lipids.
4. Vitamins- Fat soluble and water soluble vitamins; Sources, deficiency and diseases

Unit-III : Respiration

1. Respiratory pigments - Types, distribution and properties
2. Mechanism of Respiration
3. Transport of O2 and CO2
4. Respiratory disorders and effects of smoking

Unit-IV : Circulation

1. Composition and functions of blood
2. Blood clotting – Intrinsic and extrinsic factors, blood groups and *Rh* factor
3. Cardiac cycle
4. E.C.G. and Blood pressure

Semester – V

Paper –II : Applied Zoology-I

(Aquaculture and Economic Entomology)

Unit –I: Aquaculture

1. Site selection and construction ,Pre-stocking and post stocking manangement of nursery, rearing and stocking ponds
2. Breeding of fishes by bund and Chinese hatcheries. Induced breeding by hypophysetion. New generation drugs in induced breeding
3. Brief study of freshwater aquaculture system – Polyculture, cage culture, sewage fed fish culture, integrated fish farming
4. Fish products and byproducts, Fish preservation

Unit-II

1. Prawn culture and Pearl culture
2. Fabrication and setting up of aquarium and its maintenance
3. Breeding of aquarium fishes – Live bearers and egg layers
4. Diseases caused by fungi, bacteria, protozoa and helminthes

Unit-III : Economic Entomology (Methods of pest control)

1. Chemical control : Insecticides - Pyrethroids, carbomate and HCN – mode of action,merits and demerits
2. Biological control – Biological agents – predators and parasites; merits and demerits
3. Crop pest: Life cycle, damage and control of

I. Cotton spotted boll worm -*Eariasvitella*

II. Stored grain pest- Rice Weevil,*Sitophilusoryzae*

4. Animal pest:Life cycle, damage and control of –

I. House fly – *Muscanebulo*

II. Stable fly – *Stomoxyscalcitrans*

Unit-IV : Economic Entomology (Industrial entomology) **(9 Periods)**

1. Sericulture - Types of Silkworm. Life cycle and rearing of mulberry silkworm,*Bombyxmori*
2. Life cycle and rearing ofnon mulberry silkworm (Tasar), *Antheraeamylitta* ; Brief idea of cocoon processing for silk fabric - cocoon boiling, reeling, rereeling, winding, doubling, twisting and weaving
3. Apiculture – Types of honey bees. Life cycle, culture, movable frame hive, bee product and its economic importance
4. Lac culture – Lac insect,*Lacciferlacca* - Life cycle, Lac processing, Lac products and Economic Importance

Semester – V

PRACTICAL – V (Based on Paper I and II)

Section A: General Mammalian Physiology - I and

Section B: Applied Zoology–I (Aquaculture and Economic Entomology)

Section A: General Mammalian Physiology – I

1. Detection of action of salivary amylase on starch

2. Detection of carbohydrates, proteins and Lipids

3. Detection of Vitamin A and Vitamin C

4. Measurement of lung capacity

5. Preparation Haemin crystal

6. Total count of WBC and RBC

7. Determination of Hb percentage

8. Study of histological slides of Mammal – T.S. salivary gland, T.S. stomach, T.S. intestine, T.S. pancreas, T.S. liver and T.S. lung

Section B: Applied Zoology–I (Aquaculture and Economic Entomology)

Aquaculture:

1. **Collection and identification of fishes**

a. Freshwater edible fishes – catla, rohu, mrigal, grass carp, silver carp, *Cyprinouscarpio ,Ophiocephalous, Clariaus, Heteropneustes, Wallago, Mystus,*

b. Aquarium fishes – Gold fish, Molly, Sword tail, Kissing *Gourami*

2. **Anatomical Observations**

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc.

: a. Digestive system, reproductive system and brain with pituitary of cultural fishes.

b. Gonosomatic index.

3. **Fabrication and setting up of aquarium**

4. **Mounting**: Scales of fishes, zooplankton

Economic Entomology:

1. **Study of Insect Pest**

a. Agriculture pest – Grasshopper, Red Cotton bug, Gram pod borer, Cotton pink bollworm, Cotton spotted bollworm

b. Medical pest – House fly, Mosquito, *Pediculushumanus*

c. Veterinary pest – Stable fly, Dog tick, Bird lice

d. Stored grain pest – Stored grain weevil, Flour moth

e. Useful Insects – Honeybee, Silk moth, Lac insect, Dragon fly, Lady bird beetle

2. **Mounting** : Study of permanent Preparation of the following with the help of already available permanent slides ICT tools/ models/ charts/ photographs etc. (Any five)
Mouth parts, Legs, wings of any insects and sting of Honeybee

3. **Visit** to – Fish farm, Apiculture, Sericulture, Agricultural educational centre, Sea shore and Lake.

Distribution of Marks Total Marks 30

1 Physiology experiment	05
2. Identification and comment on spots	08
(2 from Mammalian histology,3 from Aquaculture and 3 from Economic Entomology)	
3. Anatomical Observations	05
4. Permanent stained preparation.....	03
5. Submission ,collection and study tour report.....	03
5. Submission of practical record.....	03
6. Viva voce.....	03

Total 30

GONDWANA UNIVERSITY GADCHIROLI

SEMESTER SYSTEM SYLLABUS

FOR

B.Sc. Part III

Subject- Zoology

Semester – VI

Paper - I: General Mammalian Physiology –II

Unit –I : Nerve and Muscle Physiology

1. Types of neurons, E.M. structure of neuron
2. Conduction of nerve impulse
3. Ultrastructure of striated muscle, Sliding filament theory of muscle contraction
4. Properties of muscles (Twitch, Tetanus, Tonus, Summation, All or None Principle, Muscle fatigue)

Unit-II : Excretion

1. Structure of uriniferous tubule
2. Mechanism of urine formation
3. Counter – current mechanism
4. Normal and abnormal constituents of urine; Elementary idea of dialysis

Unit-III : Endocrinology

1. Structure and functions of pituitary gland
2. Structure and functions of thyroid and parathyroid gland
3. Structure and functions of adrenal gland
4. Structure and functions of pineal gland

Unit-IV : Reproduction

1. Oestrous and menstrual cycle
2. Male and female sex hormones
3. Causes of infertility in male and female
4. Contraceptives– Mechanical and hormonal ;*In-vitro* fertilization

Semester - VI

Paper - II :Applied Zoology –II

(Biotechniques, Microtechnique, Immunology, Bioinformatics and Biostatistics)

Unit –I :Biotechniques

1. **Concepts of sterilization**: Filtration, autoclaving, dry heat sterilization,wet sterilization and radiation
2. **Separation of biomolecules**: Centrifugation (Sedimentation, density gradient); Chromatography (Elementary idea ofthin layer, gel filtration and ion exchange-Principles and applications)
3. **Electrophoresis**: Agarose gel electrophoresis, SDS-PAGE
4. Principles of colorimeter and spectrophotometers

Unit-II :Microtechnique

1. Fixation, dehydration, clearing, embedding & section cutting
2. Difficulties encountered during section cutting (causes and remedies)
3. Double staining with Haematoxylin and Eosin
4. Histochemical staining techniques for carbohydrates (Periodic acid schiff), proteins (Mercury-bromophenol blue) and lipids (Sudan black-B)

Unit – III: Immunology

1 .**Concepts of immunity –** Innate and acquired immunity, organs of the immune system
2. **Antigen and Antibody -**Structure, types and functions , Antigen-antibody interaction – Precipitation and agglutination
3. **Types of immune response**: B cell response (antibody mediated), T cell response (cell mediated)
4. **Autoimmunity and immunodeficiencies**- Autoimmune diseases and their treatment, AIDS and other immunodeficiencies

Unit-IV : Bioinformatics and Biostatistics

1. Bioinformatics: Definition, Basic concepts in bioinformatics, importance and role of bioinformatics in life sciences
2. Bioinformatics databases- introduction, types of databases
3. Nucleotide sequence databases, Elementary idea of protein databases
4. Biostatistics – Tabulation of data, presentation of data, sampling errors, mean, mode, median, probability, standard error and standard deviation

Semester – VI

PRACTICAL –VI (Based on Paper XI and XII)

(Section A: General Mammalian Physiology – II and Section B: Applied Zoology – II ,Biotechniques, Microtechnique, Immunology, Bioinformatics and Biostatistics)

Section A : General Mammalian Physiology – II

1. Detection of urea, albumin, sugar and creatin in urine

2. Sperm count from any domestic animal (Source of semen: Government artificial insemination centre).

3. Anatomical Observations - Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc.

Endocrine glands of Culturable fishes

4. Study of histological slides of Mammal– T.S.Kidney, Pituitary, Thyroid, Adrenal, testis, ovary, uterus, placenta, medulated and non medulated nerve fibre, smooth and striated muscle

Section B : Applied Zoology – II

(Biotechniques, Microtechnique, Immunology,Bioinformatics and Biostatistics)

1. Separation of amino acids by paper chromatography

2. Separationof proteins by electrophoresis technique

3. Block preparation and section cutting

4. Double staining method (H-E)

(Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)

5. Demonstration of carbohydrates, proteins and lipids by histochemical methods

(Source of tissue: Animal wastes from local recognized slaughter houses/ poultry farms/ fish markets etc.)

6. Determination of mean, mode, median from a given biostatistical data and/or graphical representation of the data using computers

7. Use of internet for survey of literature using protein and nucleotide databases(NCBI)

8. Use of softwares like Microsoft offices

9.Immunological diagnosis of pregnancy

10. Antigen –Antibody Reaction

Distribution of Marks **Total Marks 30**

I. Physiology experiment..... 05

II. Identification and comments on spots

(Mammalian histology 3 spots) 03

III. Microtechnique - Section cutting, spreading and 03

H-E staining of given slide

IV. Anatomical observation 05

V. Analysis of given biostatistical data 02

VI. Retrieval of specific literature from given information..... 02

VII. Submission of slides and study tour report..... . 02

VIII. Submission of certified practical record..... 03

IX. Viva voce..... 05

List of Recommended Books: (For Semester V and VI)

Physiology

1. Human Physiology – Chatterjee A. G. vol. I & II
2. Medical Physiology – Gyton
3. T. B. of Animal Physiology – Berry
4. Introduction to Animal Physiology and Related Biotechnology – H. R. Singh
5. Animal Physilogy – Arora M.P.
6. General and Comparative Physiology – Hoar W. S.
7. T. B. of Animal Physiology – Hurkat and Mathur
8. Animal Physiology – Nahbhushan and kodarkar
9. T. B. of Animal Physiology & General Biology – Thakur &Puranik
10. General Endrocrinology – Turner Bagnaro
11. Reproduction and Human welfare – Greep and koblinsky
12. Animal Physiology – Shastri & Goel
13. Animal Physiology – Verma&Tyagi
14. Human Physiology - Vander and sheman
15. Applied Physiology – Keels, Neils and Joels
16. Animal Physiology – Rastogi S. C.
17. Animal Physiology – Veerbala Rastogi
18. Comparative Vertebrate Endocrinology – Beutley
19. T.Y B. Sc Zoology Sem-V- Dhamani,Bakare,Harney & Bhute

20. T.Y B. Sc Zoology Sem-VI- Dhamani,Bakare,Harney & Bhute

Aquaculture

1. Wealth of India, Raw Material, Vol. IV – ICAR
2. Fishes of India vol I & II- Day
3. Fish & Fisheries of India – Jhingran
4. Hatchery Manual for Common Indian & Chinese carps – Jhivgan&Pallin
5. Fish Pathology – Roberts
6. Introduction of Fishes – Khanna
7. Fishery Science & Indian Fishes – Khanna
8. Fishery Science & Indian Fisheries – Shrivastava
9. A Manual of F. W. Aquaculture – Santhanam
10. An Aid to Identification of Commercial Fishes of India & Pakistan- Mishra
11. Standard Methods for Examination of Water & Waste Water - APHA
12. Hand Book of Breeding of Major Carps by Pituitary Hormones – S. L. Chonder

Entomology

1. T. B. of Applied Entomology – K. P. Shrivastava
2. T. B. of Agricultural Entomology - II S Pruthi
3. Modern Entomology – D. B. Tembhare (2nd Edition)
4. A Hand Book of Practical Sericulture – Ullar S. R. &Narsimhanna M.N.
5. Destructive and Useful Insects – Metcalf C.L. & Flint W.P.
6. General Text Book of Entomology – Richards O. W. & Davis R. G.
7. Agricultural Pests of India & South East Asia – Atawal A.S.
8. Hand Book of Economic Entomology for South Asia – Ayyar& Ram Krishna.
9. Medical Entomology – Hati A. K.
10. Bee-Keeping in India – Singh S
11.Indian Odonatological Bibliography ANDREW, R. J. & MITRA, T. R.
12. A handbook of Common Odonates of Central India, ANDREW, R. J., SUBRAMANIAN, K. A. & TIPLE A.D.

Biotechnique and Microtechnique

1. Animal Tissue Technique – Humason
2. Histological Technique – Devaenport
3. Microtechnique – Jiwaji&Patki
4. Microtechnique – Wankhede
5. Biophysical Chemistry – Upadhyay, Upadhyay and Nath
6. Techniques in Life Sciences – D. B. Tembhare

Immunology

1. Immunology – R. C. Kuby et al.
2. Immunology - Tizzard
3. Immunology - Roitt, Brostoff and D. Male
4. Immunology – Abbas

Bioinformatics and Biostatistics

1. Mount W. 2004. Bioinformatics and Sequence Genome Analysis 2nd Editon CBS Pub. New Delhi.
2. Bergman, N. H. Comparative Genomics. Humana Press Inc. Part of Springer Science+BusinessMedia, 2007.
3. Baxevanis, A. D. Ouellate, B. F. F. 2009. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins.John-Wiley and Sons Publications, New York.
4. Campbell A. M. and Heyer, L. J. 2007. Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings.
5. Des Higgins and Willie Taylor 2000. Bioinformatics: Sequence, Structure and Databanks.Oxford University Press.
6. Rashidi H. H. and Buehler 2002. Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London.
7. Gibas Cynthia and Jambeck P. 2001. Developing Bioinformatics Computer Skills: ShroffPublishersand Distributors Pvt. Ltd. (O'Reilly), Mumbai

Gondwana University, Gadchiroli

B. SC. SEMESTER I

Compulsory English

Unit 1: The following texts from the prescribed textbook

1. All about a Dog
2. The Story of Mobile Phones
3. Ranjit Sinhji
4. Computers and Commonsense
5. Sir Isaac Newton

Unit 2: The following poems from the prescribed textbook

1. The Railway Clerk
2. Leave this Chanting
3. A Poison Tree
4. The Road Not Taken – Robert Frost

Unit 3: The following items in grammar, vocabulary and composition

1. Synthesis (compound and complex sentences)
2. Use of tenses
3. Synonyms
4. Antonyms
5. Formal letters

Unit 4: The following items in language and study skills

1. Note-making
2. Changing verbal information into non-verbal and vice-versa
3. Comprehension of unseen passage

Format of Assessment

	Term-end Written Exam				**Internal Assessment**		
UNIT	**LAQ**	**SAQ**	**VSAQ**	**TOTAL**	Class work, Home Assignments, Project work	Oral Test	**Total**
Unit 1	10	10	05	25			
Unit 2	05	10	05	20			
Unit 3	--	04	16	20			
Unit 4	--	10	05	15			
Total	15	34	31	80	10	10	20

Question paper (Term end – Written)

QUE. 1: UNIT 1

(A) Two out of three questions to be answered in about 100 words each	2X5 = 10
(B) Four out of six questions to be answered in about 50 words each	4X 2.5 = 10
(C) Five VSAQs to be answered in one sentence each	5X1 = 05

QUE. 2: UNIT 2

(A) One out of two questions to be answered in about 100 words each	1X5 = 05
(B) Four out of six questions to be answered in about 50 words each	4X 2.5 = 10
(C) Five VSAQs to be answered in one sentence each	5X1 = 05

QUE. 3: UNIT 3

(A) VSAQs on two grammar items	2X4 = 08
(B) VSAQs on two vocabulary items	2X4 = 08
(C) One out of two formal letter writing tasks	1X4 = 04

QUE. 4: UNIT 4

(A) One question on note-making	1X5 = 05
(B) One question on verbal to non-verbal OR non-verbal to verbal information	1X5 = 05
(C) Comprehension of unseen passage (5 VSAQs on the passage)	5X1 = 05

Pattern for Internal Evaluation

1. Classwork, home assignments, project work	10
2. Oral test – self-introduction, general conversation, loud reading	10

Gondwana University, Gadchiroli

B. SC. SEMESTER II

Compulsory English

Unit 1: The following texts from the prescribed textbook

1. Hari
2. Uncommon Stories of Common Things
3. Mary Kom
4. The Dying Sun
5. Dr. A. P. J. Abdul Kalam

Unit 2: The following poems from the prescribed textbook

1. Success is Counted Sweetest
2. If
3. All That's Past
4. Talking in Their Sleep

Unit 3: The following items from grammar, vocabulary and composition

1. Change of voice
2. Using degrees of comparison
3. One word substitution
4. Common idioms
5. Job applications, resume

Unit 4: The following items from language and study skills

1. Summarising/ précis writing
2. Describing charts, diagrams, etc
3. Comprehension of unseen passage

Format of Assessment

	Term-end Written Exam				**Internal Assessment**		
UNIT	**LAQ**	**SAQ**	**VSAQ**	**TOTAL**	Class work, Home Assignments, Project work	Oral Test	**Total**
Unit 1	10	10	05	25			
Unit 2	05	10	05	20			
Unit 3	--	04	16	20			
Unit 4	--	10	05	15			
Total	15	34	31	80	10	10	20

Question paper (Term end – Written)

QUE. 1: UNIT 1

(A) Two out of three questions to be answered in about 100 words each	2X5 = 10
(B) Four out of six questions to be answered in about 50 words each	4X 2.5 = 10
(C) Five VSAQs to be answered in one sentence each	5X1 = 05

QUE. 2: UNIT 2

(A) One out of two questions to be answered in about 100 words each	1X5 = 05
(B) Four out of six questions to be answered in about 50 words each	4X 2.5 = 10
(C) Five VSAQs to be answered in one sentence each	5X1 = 05

QUE. 3: UNIT 3

(A) VSAQs on two grammar items	2X4 = 08
(B) VSAQs on two vocabulary items	2X4 = 08
(C) One out of two application/ resume writing tasks	1X4 = 04

QUE. 4: UNIT 4

(A) One question on note-making	1X5 = 05
(B) One question on verbal to non-verbal OR non-verbal to verbal information	1X5 = 05
(C) Comprehension of unseen passage (5 VSAQs on the passage)	5X1 = 05

Pattern for Internal Evaluation

1. Class work, home assignments, project work	10
2. Oral test – general conversation, short presentation and discussion on it	10

Prescribed Textbook for Units 1 and 2: "**Facets of English**" by Gondwana University/ ??? Publishers

Recommended books for Units 3 and 4:

1. Dwivedi & Kumar: **Macmillan Foundation English**, Macmillan India, 2002.
2. Narayanswami: **Strengthen Your Writing**, Orient Longman, 2000.
3. Krishnaswamy: **A Guide to Modern English**, Macmillan India, 2001
4. Thomson & Martinet: **A Practical English Grammar**, Oxford University Press, 1995
5. Wallace: **Collins Dictionary of English Idioms**, Harper Collins India, 1996
6. Wallace: **Study Skills in English**, Cambridge University Press, 2001.
7. Taylor: **English Conversation Practice**, Tata MacGraw Hill, 1997.

Date 27/04/2012

1) Dr. Vivek V. Joshi
2) Dr. Amol Padwad

गोंडवाना विश्वविद्यालय,गडचिरोली

हिंदी (अनिवार्य)

जून:२०१२ **बी. एस. सी. प्रथम (प्रथम सत्र)** कुल अंक : ८०+२०

पाठ्यपुस्तक: साहित्य कलश-

घट्कीकरण,प्रश्नपत्र का प्रारूप एवं अंक विभाजन

इकाई: एक –

पाठ्यपुस्तक के निर्धारित गद्य खंड में से चार –चार लघुत्तरी प्रश्नों के दो समूह होंगे,जिनमें से किसी एक ही समूह के सभी प्रश्नों के उत्तर देने होंगे.प्रत्येक प्रश्न ५ अंक के होंगे. **कुल अंक होंगे (२०)**

इकाई: दो –

पाठ्यपुस्तक के निर्धारित कविता खंड में से दो-दो लाघुत्तरी प्रश्नों के दो समूह होंगे,जिनमें से किसी एक ही समूह के सभी प्रश्नों के उत्तर देने होंगे.प्रत्येक प्रश्न १०अंक के होंगे. **कुल अंक होंगे (२०)**

इकाई: तीन –

व्यावहारिक हिंदी ज्ञान के अंतर्गत कार्यालयीन पत्र से दो प्रश्न १० अंक के होंगे,जिनमें से किसी एक प्रश्न का उत्तर देना अनिवार्य होगा. . **कुल अंक होंगे (१०)**

इकाई: चार –

व्यावहारिक हिंदी ज्ञान के अंतर्गत देवनागरी लिपि एवं पदनाम से पांच प्रश्न होंगे,प्रत्येक प्रश्न दो अंक के होंगे.
कुल अंक होंगे(१०)

इकाई: पांच –

पाठ्यपुस्तक में निर्धारित सम्पुर्ण पाठ्यक्रम से दस अति-लघुत्तरी प्रश्न होंगे,सभी प्रश्नों का उत्तर अनिवार्य होगा.प्रत्येक प्रश्न 2 अंक के होंगे. **कुल अंक होंगे (2०)**

सूचना :

१. इकाई एक और दो के अंतर्गत पूछे जाने वाले सभी प्रश्न लघुत्तरीय होंगे.प्रश्नों के उत्तर लगभग २५ पंक्तियों में अपेक्षित है.

२. इकाई एक और दो में पूछे गये सभी प्रश्न विकल्प के साथ होंगे.

३. इकाई तीन के अंतर्गत पूछे गए प्रश्नों के उत्तर कम से कम १५० शब्दों के होने चाहिए.

४. इकाई चार में पूछे गए सभी प्रश्न लघुत्तरीय होंगे.

५. इकाई पांच के अंतर्गत पूछे गए सभी प्रश्न अति लघुत्तरी होंगे.जिनके उत्तर ४ से ५ पंक्तियों में देने होंगे.

६. **अंतर्गत मूल्यांकन** **२० अंक**

- गृहपाठ **१० अंक**

- परिसंवाद/परिचर्चा **१० अंक**

---------- पाठ्यक्रम ---------- **गद्य बिभाग**

:- १.परदा –यशपाल (कहानी) २.शरणागत-वृन्दावनलाल वर्मा **३.**गुंडा –जयशंकर प्रसाद (कहानी)**4.**पूस की रात-प्रेमचंद **5.**सुसंस्कृत समाज की पृष्ठभूमि सुयोग्य नारी-भगवती शर्मा.

पद्य विभाग :-१.कबीर के साखी(१०) २.रहीम के दोहे(१०) ३. .पुष्प की अभिलाषा-माखनलाल चतुर्वेदी

४.आ! धरती कितना देती है-सुमित्रानंदन पन्त ५.एकता-मैथिलीशरण गुप्त

व्यावहारिक हिंदी ज्ञान :-

अ) कार्यालयीन पत्र:नौकरी के लिए आवेदन पत्र,बैंक और ग्राहक के बीच पत्राचार.बीमा अधिकारी,एजेंट आदि को पत्र

ब) देवनागरी लिपि का सामान्य परिचय,पदनाम.

---------- **सन्दर्भ ग्रन्थ: १.**प्रयोजनमूलक हिंदी संरचना एवं अनुप्रयोग- डॉ.रामप्रकाश गुप्त,राधाकृष्ण प्रकाशन,दिल्ली

२ .मानक हिंदी व्याकरण-डॉ.अशोक कुमार उपाध्याय-धनपत रॉय & कं. दिल्ली ३.राजभाषा शब्दकोष –डॉ.हरदेव बाहरी-लोकभारती प्रकाशन,इलाहबाद ४.व्यावहारिक हिंदी ज्ञान –डॉ.शैलेन्द्र कुमार शुक्ल ५.सामान्य हिंदी –पृथ्वी नाथ पाण्डेय- नालंदा पब्लिशिंग हाउस,इलाहाबाद ६.सम्प्रेषण मूलक व्यावसायिक हिंदी-डॉ.माधव सोनटक्के ,ओरिएन्ट ब्लैकस्वान प्राइवेट लिमिटेड,हैदराबाद.७.साहित्य कलश-राघव पब्लिशर्ष&डिस्ट्रीब्यूटर.

हिंदी (अनिवार्य)

बी. एस. सी. प्रथम (द्वितीय सत्र) **जनवरी:**

कुल अंक:८०+2०

पाठ्यपुस्तक: अ) साहित्य कलश **ब)व्यावहारिक हिंदी ज्ञान**

घट्कीकरण,प्रश्नपत्र का प्रारूप एवं अंक विभाजन

इकाई: एक –

पाठ्यपुस्तक के निर्धारित गद्य खंड में से चार –चार लघुत्तरी प्रश्नों के दो समूह होंगे,जिनमें से किसी एक ही समूह के सभी प्रश्नों के उत्तर देने होंगे.प्रत्येक प्रश्न ५ अंक के होंगे. **कुल अंक होंगे (२०)**

इकाई: दो –

पाठ्यपुस्तक के निर्धारित कविता खंड में से दो-दो लघुत्तरी प्रश्नों के दो समूह होंगे,जिनमें से किसी एक ही समूह के सभी प्रश्नों के उत्तर देने होंगे.प्रत्येक प्रश्न १०अंक के होंगे. **कुल अंक होंगे (२०)**

इकाई: तीन –

व्यावहारिक हिंदी ज्ञान के अंतर्गत व्यावसायिक पत्र से दो प्रश्न १० अंक के होंगे,जिनमें से किसी एक प्रश्न का उत्तर देना अनिवार्य होगा. **कुल अंक होंगे (१०)**

इकाई: चार –

व्यावहारिक हिंदी ज्ञान के अंतर्गत प्रशासनिक शब्दावली और कंप्यूटर से पांच प्रश्न होंगे,प्रत्येक प्रश्न दो अंक के होंगे.
कुल अंक होंगे (१०)

इकाई: पांच –

पाठ्यपुस्तक में निर्धारित सम्पुर्ण पाठ्यक्रम से दस अति-लघुत्तरी प्रश्न होंगे,सभी प्रश्नों का उत्तर अनिवार्य होगा.प्रत्येक प्रश्न २ अंक के होंगे. **कुल अंक होंगे (२०)**

सूचना :

१. इकाई एक और दो के अंतर्गत पूछे जाने वाले सभी प्रश्न लघुत्तरीय होंगे.प्रश्नों के उत्तर लगभग २५ पंक्तियों में अपेक्षित है.

२. इकाई एक और दो में पूछे गये सभी प्रश्न विकल्प के साथ होंगे.

३. इकाई तीन के अंतर्गत पूछे गए प्रश्नों के उत्तर कम से कम १५० शब्दों के होने चाहिए.

४. इकाई चार में प्रशासनिक शब्दावली के हिंदी से अंग्रेजी (५)और अंग्रेजी से हिंदी के (५) कुल दस अनिवार्य शब्द दिए जायेंगे.

५. इकाई पांच के अंतर्गत पूछे गए सभी प्रश्न अति-लघुत्तरी होंगे.जिनके उत्तर लगभग ४ से ५ पंक्तियों में अपेक्षित है.

६. **अंतर्गत मूल्यांकन** **२० अंक**

- गृहपाठ **१० अंक**

- परिसंवाद/परिचर्चा **१० अंक**

---------- **पाठ्यक्रम** ----------

गद्य विभाग :- १.सदाचार का ताबीज-हरिशंकर परशाई (व्यंग्य) २.ममता- जयशंकरप्रसाद(कहानी) ३.ईदगाह-प्रेमचंद ४.दान-डॉ.भदंत आनंद कौशल्यायन ५.पर्यावरण;प्रकृति और प्रदूषण-श्रीराम शर्मा

पद्य विभाग :- १.धर्म है-गोपालदास सक्सेना २.मधुशाला-हरिवंशराय बच्चन ३.वीरों का कैसा हो वसंत-सुभद्राकुमारी चौहान ४.नदी के द्वीप-सचिदानन्द हीरानंद वातस्यायन अज्ञेय ५.क्या पूजा क्या अर्चन रे -महादेवी वर्मा

व्यावहारिक हिंदी ज्ञान :-

अ)व्यावसायिक पत्र: वित्तिय एवं शासकीय संस्थाओं से पत्राचार,आदेश एवं मॉल प्राप्ति की स्वीकृत. शिकायत,दावा एवं समझौता.

ब)प्रशासनिक शब्दावली और कंप्यूटर: अंग्रेजी से हिंदी और हिंदी से अंग्रेजी प्रसाशनिक शब्दावली ,कंप्यूटर का सामान्य परिचय,प्रकार और उपयोग.

---------- **सन्दर्भ ग्रन्थ:**१.प्रयोजनमूलक हिंदी संरचना एवं अनुप्रयोग- डॉ.रामप्रकाश गुप्त,राधाकृष्ण प्रकाशन,दिल्ली २.व्यावहारिक हिंदी ज्ञान –डॉ.शैलेन्द्र कुमार शुक्ल ३.सामान्य हिंदी –पृथ्वी नाथ पाण्डेय- नालंदा पब्लिशिंग हाउस,इलाहाबाद ४.मानक हिंदी व्याकरण-डॉ.अशोक कुमार उपाध्याय-धनपत रॉय & कं. दिल्ली ५.राजभाषा शब्दकोष –डॉ.हरदेव बाहरी-लोकभारती प्रकाशन,इलाहबाद ६.सम्प्रेषण मूलक व्यावसायिक हिंदी-डॉ.माधव सोनटक्के ,ओरिएन्ट ब्लैकस्वान प्राइवेट लिमिटेड,हैदराबाद. साहित्य कलश-राघव पब्लिशर्ष&डिस्ट्रीब्यूटर.

New
18/5/2012
Sub matter

गोंडवाना विद्यापीठ, गडचिरोली
बी. कॉम, भाग १/बी.एस.सी.भाग १
मराठी (आवश्यक)

जून : २०१२ एकूण गुण ८० + २०

पाठ्यपुस्तक- साहित्यशिल्प संपादक- डॉ. श्याम मोहरकर प्रकाशक.....

घटकीकरण - प्रश्नपत्रिकेचे स्वरुप आणि गुणविभागणी

घटक	गद्य (गुण)		पद्य गुण	अंतर्गत मूल्यांकन
घटक १ + २. दीर्घोत्तरी प्रश्न	१६	+	१६	२०
घटक ३ + ४. लघुत्तरी प्रश्न	१६	+	१६	
घटक १,२,३ ४. लघुत्तरी प्रश्न	०८	+	०८	
एकूण :-	४०	+	४० +	२० = १००

प्रथम सत्र :- अभ्यासक्रम

गद्य -	लेखक	संदर्भ ग्रंथ
१. भाषाभिवृध्दीची सामाजिक दृष्टी	- श्री. म. माटे	'साहित्यधारा' - श्री. म. माटे, पुणे.
२.एक राष्ट्र एक जनता	- डॉ. वि भि. कोलते	नागपूर आकाशवाणीवरील भाषण - साहित्यसुधा भाग ३
३. श्री गाडगेबाबा	- प्रा. मधुकर केचे	'विदर्भाचे शैलीकार'- साहित्यप्रसार केन्द्र, नागपूर
४. जीवनाच्या सुगंधी मिठीसाठी	- बाबा आमटे	'उज्ज्वल उद्यासाठी', गुजर युवक अकादमी, पुणे.
५. विनोदबुध्दी	- डॉ. अ.वा. वर्टी	'विनोद - एक व्याख्यान', परिमल प्रकाशन, औरंगाबाद.
६. वैज्ञानिक दृश्टीकोण म्हणजे काय ?	डॉ. जयंत नारळीकर	विज्ञान आणि वैज्ञानिक

पद्य -	कवी	संदर्भ
१ पसायदान	- ज्ञानेश्वर	'ज्ञानेश्वरी'
२ फटका	- अनंत फंदी	
३ नवा शिपाई	- केशवसुत	'हरपले श्रेय' कॉन्टि. प्रका. पुणे
४ पृथ्वीचे प्रेमगीत	- कुसुमाग्रज	'विशाखा' कॉन्टि. प्रका. पुणे
५ तेथे कर माझे जुळती	- बा. भ. बोरकर	'बोरकरांची कविता', मौज प्रका. मुंबई.
६ वसुंधरेचा जन्मसोहळा	- सुधाकर गायधनी	'मोकाट ग्रहांचा फकीर', दास गणू प्रका. नागपूर.

उपयोजित मराठी-
१ मराठी व्याकरण
२ प्रसार माध्यमासाठी लेखन
३ वक्तृत्व कला

प्रश्न पत्रिकेचे स्वरुप द्वितीय सत्र

प्र १ क. ,७, ८, ९, १० या गद्यपाठांवर दीर्घोत्तरी प्रश्न (दोन पैकी एक)	१६ गुण
प्र २ क. ७, ८, ९, १० या पद्यावर दीर्घोत्तरी प्रश्न (दोन पैकी एक)	१६ गुण
प्र ३ क. ७, ८,९,१०, ११,१२ या गद्यपाठांवर लघुत्तरी ४ प्रश्नांचा एक गट (दोन गटांपैकी एक)	१६ गुण
प्र ४ क. ६ ,७, ८, ९, १०, ११, १२ या पद्यांवर लघुत्तरी ४ प्रश्नांचा एक गट (दोन गटांपैकी एक)	१६ गुण
प्र ५ वरील ४ घटकांवर ४ प्रश्न अनिवार्य	१६ गुण
	एकूण ८० गुण

अंतर्गत मूल्यांकन-	
व्याकरण- रस व अलंकार	५ गुण
परिसंवादाचे आयोजन	५ गुण
पत्रलेखन (व्यक्तिगत व कार्यालयीन)	५ गुण
नोकरीसाठी अर्ज	५ गुण
	एकूण २० गुण

द्वितीय सत्र:- अभ्यासक्रम

गद्य:-	लेखक	संदर्भ ग्रंथ
७. जागतिकीकरण आणि मराठी साहित्य	- निशिकांत मिरजकर	'भाषादर्पण', बी. कॉम १ रा.तु.म. नागपुर विद्यापीठ
८. मराठी माणूस उद्योगधंद्यात मागे का ?	- बी. जी. शिर्के	' उद्योगपर्व', राजहंस प्रका. पुणे
९. निरक्षरांची अक्षारलेणी	- डॉ. मधुकर वाकोडे	'विदर्भाचि शैलीकार'- साहित्यप्रसार केन्द्र, नागपूर
१०. डॉ. आंबेडकर आणि सामाजिक आर्थिक लोकशाही	- डॉ. नरेंद जाधव	
११. झाडीपट्टीची दंडार : दशा आणि दिशा	- डॉ. हरिश्चंद्र बोरकर	'झाडीपट्टीची दंडार', दास्ताने प्रका. पुणे
१२.'वाघ आणि मी'	- अतुल धामनकर	'वाघ', श्रीविद्या प्रका. पुणे

पद्य :-	कवी	संदर्भ ग्रंथ
७. तयास मानव म्हणावे का ?	- सावित्रीबाई फुले	'काव्य फुले'
८. दे वरचि असा दे	- राष्ट्रसंत तुकडोजी	'राष्ट्रीय भजनावली' श्री गुरूदेव प्रका, गुरूकुंज आश्रम, मोझरी
९ उष:काल होता होता	- सुरेश भट	रंग माझा वेगळा,साहित्यप्रसार केंन्द्र, नागपूर
१० प-हाटी	- विठ्ठल वाघ	काया मातीत मातीत
११. माय	- वामन निंबाळकर	गावकुसाबाहेरील कविता', प्रबोधन प्रका. नागपूर
१२. बाताल मावा देस ?	- उषाकिरण आत्राम	'लेखणीच्या तलवारी', हरीवंश प्रका. चंद्रपूर

उपयोजित मराठी -
मराठी व्याकरण
पत्रलेखन, परिसंवाद

प्रश्न पत्रिकेचे स्वरुप द्वितीय सत्र

प्र १ क. ,७, ८, ९, १० या गद्यपाठांवर दीर्घोत्तरी प्रश्न (दोन पैकी एक)	१६ गुण
प्र २ क. ७, ८, ९, १० या पद्यावर दीर्घोत्तरी प्रश्न (दोन पैकी एक)	१६ गुण
प्र ३ क. ७, ८,९,१०, ११,१२ या गद्यपाठांवर लघुत्तरी ४ प्रश्नांचा एक गट (दोन गटांपैकी एक)	१६ गुण
प्र ४ क. ६ ,७, ८, ९, १०, ११, १२ या पद्यांवर लघुत्तरी ४ प्रश्नांचा एक गट (दोन गटांपैकी एक)	१६ गुण
प्र ५ वरील ४ घटकांवर ४ प्रश्न अनिवार्य	१६ गुण
	एकूण ८० गुण

अंतर्गत मूल्यांकन-	
व्याकरण- रस व अलंकार	५ गुण
परिसंवादाचे आयोजन	५ गुण
पत्रलेखन (व्यक्तिगत व कार्यालयीन)	५ गुण
नोकरीसाठी अर्ज	५ गुण
	एकूण २० गुण

प्रा.डॉ.सौ. सुधा मालधुरे
अध्यक्ष
भाषा अभ्यास समिती (विज्ञान विभाग)
गोंडवाना विद्यापीठ, गडचिरोली

प्रा.डॉ. श्याम मोहरकर
संपादक
'साहित्य शिल्प' (वाणिज्य विभाग)
गोंडवाना विद्यापीठ, गडचिरोली

Syllabus of

B.Sc. (Computer Science)

Part II (Semester-III)

COMPUTER SCIENCE BOARD

Prepared by Dr. S.B. Kishor

Chairman, Computer Science Board

GONDWANA UNIVERSITY,

GADCHIROLI

SESSION 2013-2014

B.Sc. II (Computer Science) SEMESTER- III

Paper-1 : DATA BASE MANAGEMENT SYSTEM & MS-ACCESS

Paper-2 : OBJECT ORIENTED PROGRAMMING WITH C++

B.Sc. – II (Computer Science)
SEMESTER - III
Paper-I: Data Base Management System & MS-Access

(Marks-50)

UNIT–I: Database Environment

Basic Terminology, Data Processing, Traditional and DBMS Environment, Components of DBMS, Database Approach -Objectives, Benefits, Characteristics, Advantages of DBMS. Three Tier Architecture, Data Abstraction. **Database Administration:** Role, Functions, Responsibility

UNIT–II: Data Model and Design

Data Models, Record Based Logical Model, Relational Database Structure, Normalization, Normal forms, Functional Dependency, 1NF (First Normal Form), 2NF (Second Normal Form), 3NF (Third Normal Form), Relational Algebra, Codd's Rules

UNIT–III: Working With Ms-Access

Elements of an Access database - Tables, Queries, Forms, Reports, Macros. Introduction to Ms-Access, Designing Database, Crating Database using Wizard, Working with Table. **Field types** – Auto number, Date/Time, Number, Text, Yes/No, Hyperlink. Creating Tables using Design View and Using wizard, Editing Table, Editing Records

UNIT–IV: Query and Form Designing

Query: Filtering Data, Studying different types of Queries, Specifying Criteria in Queries, Filter using multiple criteria. **Forms, Report and Macro:** Procedure to create a form, Reports and Macros

Books:

1) R. Panneerselvam," Database Management System ",PHI, 2006, ISBN : 81-203-2028-X
2) Dr.MadhulikaJain,VinitaPillai, Shashi Singh and Satish Jain, "Introduction to Database Management", BPB, 2002, ISBN: 81-7656-638-1
3) Bioin C. Desai, " An Introduction to Database Management", GP Publication, 2006
4) Caleste Robinson, " Access 97", BPP, 1998, ISBN : 81-7029-928-4

References:

1) Abraham Silberschatz, Henry F. Korth, S. Sudarshan, " Database System Concept ", McGraw Hill, 2002, ISBN : 0-07-228363-7.
2) C.J. Date, A. Kannan, S. Swamynathan," An Introduction to Database system", Pearson, 2008, ISBN : 978-81-7758-556-8
3) S.B. Kishor, DBMS and Oracle, Das Ganu, ISBN : 978-93-81660-08-9
4) Sanjay Saxena, "MS Office 2007 in a Nutshell", Vikas Publication, 2011, ISBN-978-81-259-5036-3
5) Rutkosky, Seguin, Audrey, "Microsoft office 2007", BPB, ISBN-10:81-8333-228-5/13:978-81-8333-228-6

B.Sc. – II (Computer Science)
SEMESTER - III
Paper-II: Object Oriented Programming with C++

(Marks-50)

UNIT -I: Elements of Programming and Function

Introduction: Basic Elements of Programming, Console I/O Operations**,**

Function: Function Prototyping, Call and Return By Reference, Inline Function, Default and Const Arguments, Function Overloading, Arrays, Manipulators and Enumeration.

UNIT -II: Classes and Object

Object Oriented Methodology: Basic Concepts/Characteristics of OOP. Advantages and Application of Oops, Procedural Programming Vs OOP.

Classes and Objects: Specifying a Class, Creating Objects, Private & Public Data Members and Member Functions, Defining Inline Member Functions, Static Data Members and Member Functions. Arrays within Class, Arrays of Objects, Objects as Function Arguments, Returning Objects.

UNIT -III: Constructors, Destructors, Operators Overloading and Inheritance.

Constructors and Destructors: Introduction, Parameterized Constructors, Multiple Constructors in A Class, Constructors With Default Arguments, Dynamic Initialization of Objects, Copy Constructors, Dynamic Constructors, Const Objects, Destructors

Operators Overloading: Definition, Unary and Binary Overloading, Rules for Operator Overloading.

Inheritance: Defining Derived Classes, Types of Inheritance, Constructors and Destructors In Derived Classes.

UNIT -IV: Pointers Virtual & Friend functions and file handling

Pointers: Pointer to Objects, This Pointer, 'New' and 'Delete' Operators, Virtual Function, Friend Functions. Opening, Closing A File, File Modes, File Pointers and Their Manipulation, **Sequential Input and Output Operations:** Updating A File, Random Access, and Error Handling During File Operations, Command Line Arguments.

Books:

1) K.R.Venugopal, Rajkumar, T. Ravishankar, "Mastering C++", TMH ,ISBN:0-07-463454-2.
2) Farrel,"Object-Oriented Programming using C++",Cenage Pub, ISBN: 9788131505175

References:

3) Parimala N.," Object Orientation through C++", Macmillan India Ltd. Publication, ISBN:-0333 93202-1
4) E Balagurusamy, "Object Oriented Programming with C++ ", Tata McGraw Hill Publishing Company Limited, New Delhi, ISBN:- 13- 978-07-066907-9

B.Sc. – II (Computer Science)
SEMESTER - III
Practical - I: Data Base Management System & MS-Access

A] Create table Student (Student no, Student name, and Course) in MS-ACCESS with the following details and perform following operations.

Student_no	Student_name	Course
101	Sunil	Vb
102	Anshu	Vb.Net
103	Sonam	Tally
104	Shital	Vb.Net

1. Use Column width as best fit.
2. Set Student no as a Primary Key.
3. Insert at least 10 students' records.
4. Display all the students whose name begin with letter 'S'.
5. Display the query view and take out the print out.
6. Add new fields such as Fees, Date_adm ,Date_of_birth, .Address)
7. Add data to above newly fields.
8. Select Student name, Course and Fees from student table.
9. Delete all the students who were admitted on specific date.
10. Update fees to increase it by thrice.
11. Select all the students of VB.NET paying course fees of 4000.
12. Update table by replacing the course name to TALLY wherever the course fees is 3500.
13. Delete the record where Student name is SONAM.
14. Display the student name, student no who was born on '14/6/1996'
15. Replace the Address of student say, ANSHU to PUNE.
16. Remove all the records where number of students is less than 2 for particular course.

B] Create the Tables in which
Stud_per_Detail(Stud_no, Stud_name, Sex, date_of_birth, Address, Ph_no) and
Stud_off_detail(Stud_no,Course,Fees,date_Adm).

1. Select Stud_Name, Address from Stud_Per_Detail and Stud_no, Course, Fees from Stud_off_datail.
2. Create a report view for above query.
3. Append the records of above tables Stud_Per_Detail to Stud_History where Student Date_of_Birth i s 14/06/1996.
4. Print the table design view and datasheet view.

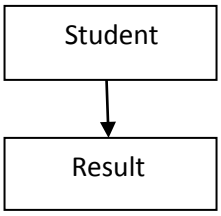
C] Create a table Donar(Donar_no, Donar_name, BG, Sex) by using following instruction.

1. Use Columnar Layout.
2. Use Blueprint style.
3. Give the title for Form as Donar Details Form.
4. Enter 5 records.
5. Print the Form view.

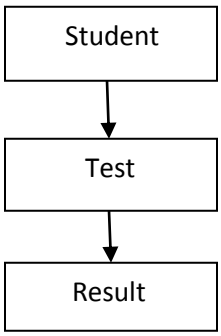
B.Sc. – II (Computer Science)
SEMESTER - III
Practical -II: Object Oriented Programming with C++

1. Write a cpp program to find roots of quadratic equations.
2. Write a cpp program that will ask for a temperature in Fahrenheit and display in Celsius.
3. Write a cpp program which accepts marks of three subjects. Calculate total & average marks and also check student is pass or fail. (if average above or equal to 50 the 'Pass') .
4. Design a menu driven program using switch case which accepts two integer values and program will display menus for addition, subtraction, multiplication, division and ask user to select appropriate choice.
5. Design inline functions for add and multiply of two integer numbers.
6. Write a cpp program to overload "sum()" function for add two integers, to add three real and add three integers.
7. Write a cpp program for following series.
   Sin X= $X - X^3/3! + X^5/5! - X^7/7! + \ldots\ldots\ldots$
8. Write a cpp program for following.
   Cos X= $1 - X^2/2! + X^4/4! - X^6/6! + \ldots\ldots\ldots$
9. Design a class "Complex" with real and imaginary members also design appropriate member function to get and print complex numbers.
10. Design a class " Time" with hours and minutes as data members and to get and print data of Time class also design a sum() with object as arguments to add two objects of Time class.
11. Design a class "Employee" with appropriate members. Demonstrate array of objects.
12. Create a class " Complex" with real and imaginary members and to initialize them write overloaded constructor for i) Default constructor ii) Constructor with one parameter iii) Constructor with two parameters.
13. Create a constructor for "Integer "class with M and N as data members and constructor for initialize data members.
14. Design a class "String" with name and length as data members. Create a dynamic constructor to initialize object of any length can be created.
15. Create a class "Employee" with empno, ename, salary as data members and create Copy constructor to create objects from already created objects.
16. Write a cpp program to overload unary '++' and '- -"operator for "Sample" class with X,Y, Z of integer type.
17. Write a cpp program to overload binary '+' operator for Complex Class. (Complex class is already design).

18. Write a program to Single inheritance for following structure.
    Student Class (rollno, sub1, sub2) and Result class (total,avg)



19. Write a class for Multilevel Inheritance for following structure
    Student class (rollno),Test Class(sub1,sub2), Result Class(total, avg)



20. Write a program in show () and display () function are overridden. Demonstrate use of virtual function for runtime polymorphism.
21. Write a program which demonstrates the pure virtual function.
22. Write a cpp program in which use pointer to Sample class objects are used. Demonstrate it.
23. Write a cpp program which read contents from file and counts no. vowels and consonants in a file.
24. Write a cpp program which counts no. command line arguments on command line.
25. Write a cpp program which read a file and write contents of a file without white spaces into another file.
26. Write a cpp program which reads contents from a file and the even nos. are copied to "even.txt" and odd nos. is copied to "odd.txt" file.
27. Write a cpp program which demonstrates use of this pointer.

Syllabus of

B.Sc. (Computer Science)

Part II (Semester-IV)

COMPUTER SCIENCE BOARD

Prepared by Dr. S.B. Kishor

Chairman, Computer Science Board

GONDWANA UNIVERSITY,

GADCHIROLI

SESSION 2013-2014

B.Sc. II (Computer Science) SEMESTER- IV

Paper-1 : DATA STRUCTURES

Paper-2 : EVENT DRIVEN PROGRAMMING WITH VISUAL BASIC

B.Sc. II (Computer Science)
SEMESTER-IV
Paper-I: Data Structures

(Marks-50)

UNIT I: Introduction to Data Structures

Data Structure and Algorithms- Introduction, Data Structures, Fundamentals of DS, Operations on Data Structure

Arrays – Introduction, Memory/Storage Representation of One and Two Dimensional Array,

Sorting- Definition of Sorting, Comparison of Sorting Method, Bubble Sort, Insertion Sort, Selection Sort, Merging.

Searching- Definition**,** Type of Searching (Binary Search, Linear Search.)

UNIT II: Stacks and Queue

Stacks- Introduction & Definition, Application of Stack, Various Representation of Stack, Operation on stack (Push and Pop) Hierarchy of Operation, Representation of Arithmetic Expression (Infix, Postfix, Prefix) Multiple Stack. Evaluation of postfix expressions and their conversions

Queues- Introduction, Applications of Queue, Various Representations of Queue, Operation on queue.Concept of Deque, Priority Queues, Circular Queue.

UNIT III: Recursion and Link List

Recursion- Introduction, Recursion Properties, Applications of Recursion (Factorial, Addition of Two Number, Power of A Number, Fibonacci Series, Multiplication of Two Number, Tower of Hanoi.) Advantages and Disadvantages of Recursion.

Linked List- Introduction, Application of Linked List, and Representation of Linked List, Operation on Linked List (Inserting, Removing, Reversing, Searching, Sorting). Concept of Double Linked List.

UNIT IV: Tree and Graphs

Trees- Introduction**,** Definition of Trees, Binary Tree, Type of Binary Tree, Operation on Binary Tree, Traversal of Binary Tree, Binary Search Tree (BST), Expression Trees, Memory Representation of Binary Tree

Graphs: - Definition of Graph, Various Terminology Used in Graph, Sequential Representation of Graph, Path Matrix, Spanning Tree, and Minimum Spanning Tree (Kruskal Algorithm, PRIM'S Algorithm), Traversing a Graph.

Books:

1) LipschutzSchaum's "Data Structure" Outline Series [TMH].ISBN-0-07-060168-2
2) D. Samanta, "Classical Data Structure", Prentice Hall India, ISBN: 8120318749
3) Dr. S.B. Kishor, "Data Structures", Das Ganu ,4th Edition, 2011, ISBN-978-81-921757-4- 4

References:

1) Tenenbaum," Data Structures Using C and C++", Second Edition, Prentice Hall India, New Delhi. ISBN-81317-0328-2

2) Deshpande and Kakade, "C and Data Structure", Dramatic Pub..ISBN-81-7722424-7

B.Sc. II (Computer Science)
SEMESTER - IV
Paper II:Event Driven Programming with Visual Basic

(Marks-50)

UNIT-I: Introduction to Visual Basic

Integrated Development Environment (IDE) – Features, Event driven programming,
Programming Constructs: Data Types, Variable, Constant, Operator, System defined Function, Dialog Box and Creating User Interface
Control flow statement: if-then, select-case, for-next, while wend, do-loop statement. With..End, Type of Event.

UNIT-II: VB Control and Procedure

Visual Basic Control: Form, Label, Textbox, Frame, Checkbox, Option Button, ListBox, ComboBox, Timer, Scrollbar, Picture, Image, File Controls, Artwork control
ActiveX Control: Tab Strip, Status Bar, Slider, Month View, DTPicker, Rich Text Box, Common Dialog
Procedure: Types of Procedure, Subroutine, Function, Module

UNIT-III: Menu, Interface and Array

Menu: Menu Editor, Creating Menus, Utility features provided by menu editor, modifying menu at run time, pop-up menu, Creating Toolbar using Image List
Interface: SDI, MDI,
Array: One Dimensional Array, Built-in Array function, For..Each Loop, Arrays Types

UNIT-IV: ActiveX Data Object

Data & ADODC Control, Connecting ADODC to Bound Control, Use of ADO Object, ADO Architecture, ADO Object Methods for Editing, Updating and Searching
Data Environment, Data Report,
Debugging and Error Handling: Types of Error, Debugging, Handling Run Time Error.

Books:

1) Steve Brown,"Visual Basic 6.0 Complete", Complete Idiot's Books, ISBN 978-0789718129
2) Dr. S.B. Kishor,"Front End Development using Visual Basic", Das GanuPrakashan, ISBN 978-93-81660-0-5
3) EvangelosPetroutsos ,"Mastering Visual Basic 6 ", BPB, 2005 ISBN-81-7635-269-1.
4) MoelJerke,"Complete Reference Visual Basic 6",TMH, 2004, ISBN -0-07-463666-9.

References:

1) Peter Norton's ,"Visual Basic 6.0" ,SAMS tec-Media,2006,ISBN-81-7635-150-4
2) Michael Halvorson, " Learn Visual Basic 6.0 Now",PHI, ISBN 0-7356-0729-X
3) Michael Vine ,"Visual Basic Programming – For Absolute Beginner", PHI, ISBN: 0761535535
4) Paul Sheriff ,"Teaches Visual Basic 6",PHI,978-8120315624

B.Sc. II (Computer Science)
SEMESTER-IV
Practical -I: Data Structures

1) To delete an element from K^{th}position of Array.
2) To insert an element ITEM at K^{th} position of Array.
3) To insert an element Item in Sorted Array.
4) To implement the operation of Push, Pop and to know the status of stack.
5) An algorithm to check the status of stack.
6) To find factorial of a number using Recursion.
7) To find multiplication of two number using Recursion.
8) To simulation the game of Tower of Hanoi using recursion.
9) To implement the operation of insertion and deletion on Queue.
10) A menu driven program to implement the operation of addition, deletion, searching, traversing, reversion, sorting, counting number of nodes and at the end erasing the link list.
11) Implementation of stack using linked list.
12) Implementation of Queue using linked list.
13) To create binary search tree, traverse it and find number of leaves and total nodes in the Tree.
14) To arrange the list of number in a Sorted order using Merge Sort.
15) To arrange the list of number in the Sorted order using Quick sort.
16) To check all the element of list is in sorted order or not.
17) To search an element using sequential or linear search .At the end display time required to search an element including number of comparison.
18) To search an item position in sorted list (Binary search).

B.Sc. II (Computer Science)
SEMESTER - IV
Paper II: Event Driven Programming with Visual Basic

1) Design a form to accept First, Middle and Last Name and display the full name (Concatenate three text box) on Label when user click on Command Button.
2) Design an application that gives five choices of colors. Design an application to choose any one color using option button and change the Fore Color of Textbox.
3) Write an application to add and remove the name of city from combo box
4) Design a VB screen, to display current time in digital format continuously after every one second and change the background color of form.
5) Build the application, which marquee the caption of Form
6) Build the application, to convert the Fahrenheit temperature selected through scrollbar value into corresponding temperature is Celsius.
7) Build a application that collects marks for five different subjects. Calculate total, If total is >= 500 display message" You are allowed" otherwise display "You are not allowed."
8) A book stall gives discount on the books as per the following conditions,

No. of Books Purchased	Discount
<=5	Nil
>5 and <=10	10%
>10 and <=15	12%
> 15	20%

Create a form as follows to calculate the Discount

9) Build the VB application that converts a number entered into the Textbox to Octal, Hexadecimal and Decimal.
10) Build the application; to accept the password within time limit say 8 second otherwise display a message time elapsed.
11) Build the application using timer for personal appointment remainder while working with computer system.
12) Evaluate following sin(x) series

    Sin(x) = x – x"3/3! + x"5/5! – x"7/7! + x"9/9! - .....

13) Build the application, to change the color of Frame using RGB function from the values that are set by 3 Scroll bars.
14) Build a Calculator application to perform basic arithmetic operation
15) Build the application, to accept the temperature of Number of days passed in the current month and determines the highest and average temperature.
16) Demonstrate the working of data bound controls
17) Create a data bound control application to perform various data operation using DAO Control. Assume Database Name and Table Name is Donor having 4 fields Donor_Number, Donor_Name, Date_of_Birth, Donor_Blood and Sex.
18) Create a data bound control application to perform various data operation using ADO Control. Assume Database Name and Table Name is Donor having 4 fields Donor_Number, Donor_Name, Date_of_Birth, Donor_Blood and Sex.
19) Write an application to divide the number by another and it must be able to handle any error that may arise during run time.

Syllabus of
B.Sc. (Computer Science)
Optional Paper

Part III (Semester- V)

COMPUTER SCIENCE BOARD

Prepared by Dr. S.B. Kishor
Chairman, Computer Science Board

GONDWANA UNIVERSITY,
GADCHIROLI

SESSION 2014-2015

B.Sc. – III (Computer Science)

Semester V	**Paper 1:**	**SYSTEM ANALYSIS AND PROJECT MANAGEMENT**	**Theory : 50 Marks** **Internal : 10 Marks**	**Practical : 30 Marks**
	Paper 2:	**DATABASE PROGRAMMING WITH ORACLE**	**Theory : 50 Marks** **Internal : 10 Marks**	
Semester VI	**Paper 1:**	**E-COMMERCE AND HTML**	**Theory : 50 Marks** **Internal : 10 Marks**	**Practical : 30 Marks**
	Paper 2: **Elective** **1** **2** **3**	**VB.NET** **Data Communication With Cloud Computing Basics** **JAVA**	**Theory : 50 Marks** **Internal : 10 Marks**	

B.Sc. – III (Computer Science) SEMESTER – V

Paper – I : System Analysis and Project Management

Paper – II : Database Programming With Oracle

B.Sc. – III (Computer Science)
SEMESTER –V
PAPER-I: SYSTEM ANALYSIS AND PROJECT MANAGEMENT[Marks: 50

UNIT – I: System Concepts

Systems Concepts: Systems approach, characteristics, Types of Systems; Elements – Input, Output, Environment, Boundary Interface, Feedback & Control; MIS, Types of MIS: TPS, OAS DSS. KWS, Data and Information, Value of Information, Information Life Cycle, Data Vs Information,

UNIT – II: System Analysis

System Analysis: System Development Life Cycle (SDLC), Information Gathering (Sources, Methods, Interviews, Questionnaires, Observation, Document Analysis etc.), Feasibility study, Analysis (PARIS model), Design, Implementation, Planning and Control for System success. Tools of Structure Analysis (Data Flow Diagram, Data Dictionary, Decision Tree, Decision Table, CASE tools)

UNIT – III: System Design & Implementation

System Design: System Design Principle, Input Design, Output Design, Form Design

Implementation: Testing, Level of Testing, Nature of Test Data, Conversion, User Training, Hardware and Software Selection

Documentation, Types of Documentations, Quality Assurance, Privacy, Disaster Recovery Plan, Maintenance Review

UNIT – IV: Project Management

Introduction, Management Spectrum, Project Manager, Project Estimation, Project Scheduling

Quality Management: Quality Concept, Software Quality, Software Reliability, ISO 9000 Quality standards

Books:

1) S. Sadagopan, "Management Information System", PHI, *ISBN*, 8120311809
2) Goyal, "Management Information System", ISBN 0333 933885
3) Jawdejar, " Management Information System", MH, ISBN 0-07-044575-3
4) Elias Award, "System Analysis & Design", Golgotha Publication, 2nd Edition, ISBN: 81751568-X

References:

1) RogernPressman, "Software Engineering Practition Approach", ISBN 007-124083-7
2) Rajib Mall, "Fundamental of Software Engineering", PHI, 2nd Edition, ISBN-978-81-203-2445-9

B.Sc. – III (Computer Science)
SEMESTER –V
PAPER-II: Database Programming With Oracle [Marks: 50

UNIT – I: Introduction
RDBMS Concept, Introduction to Oracle, SQL Tools, Oracle as multi-User System, SQL, SQL *Plus, Getting Started with SQL, Writing SQL Commands, Components of SQL, Data Types, Database Users, Database Objects, Elements of SQL

UNIT – II: SQL Languages
Data Definition Language : Creation of Table, Viewing table Structure, Data Integrity through Constraints, Altering Table, Dropping Table, Truncating Table
Data Retrieval: Select Command, SQL Operators, Text Search, Group Queries, Order By Clause
DML Operation: Insert, Update and Delete
Transaction Control Language: Commit, Rollback, SavePoint
Data Control Language: Grant, Revoke

UNIT - III: SQL Function and Database Objects
Sql *functions: Character Function, Case Manipulation, Numeric Functions, Date Function, Conversion Function, Conditional Functions, Nested Functions, Group Functions
Database Objects: Views, Sequence, Synonym
Join, Set Operator and Sub query

UNIT - IV: Pl/SQL
Basic Elements of Programming, Select. Into Statement, Exception Handling: Predefined Exception, When Other Exception, Cursor: Explicit Cursor, Explicit Cursor Attributes, Subprogram and Packages, Trigger

Books:

1) Dr. S.B. Kishor, ”Oracle (PL/SQL) Programming”, Das GanuPrakashan, ISBN 978-81-921757-5-1
2) Kevin Loney, Marlene Theriault, “Oracle 9i: DBA Handbook”, TMH, ISBN: 78-0-07-048674-4.
3) Ivan Bayross,“ Oracle Developer 2000”, BPB, 2006, ISBN : 8/7029-899-7

References:

1) Paul Hipsley, “Developing Client / Server Applications with oracle Developer/2000 TM”, Techmedia, 1997, ISBN – 81-87150-02-X
2) Ivan Bayross,“ Commercial Application Development using Oracle Developer 2000 Forms 6i”, BPB, 2003, ISBN : 81-7656-742-6

Syllabus of
B.Sc. (Computer Science)
Optional Paper

Part III (Semester- VI)

COMPUTER SCIENCE BOARD

Prepared by Dr. S.B. Kishor
Chairman, Computer Science Board

GONDWANA UNIVERSITY,
GADCHIROLI

SESSION 2014-2015

B.Sc. – III (Computer Science)

Semester V	**Paper 1:**	**SYSTEM ANALYSIS AND PROJECT MANAGEMENT**	**Theory : 50 Marks** **Internal : 10 Marks**	**Practical : 30 Marks**
	Paper 2:	**DATABASE PROGRAMMING WITH ORACLE**	**Theory : 50 Marks** **Internal : 10 Marks**	
Semester VI	**Paper 1:**	**E-COMMERCE AND HTML**	**Theory : 50 Marks** **Internal : 10 Marks**	**Practical : 30 Marks**
	Paper 2: **Elective** **1** **2** **3**	**VB.NET** **Data Communication With Cloud Computing Basics** **JAVA**	**Theory : 50 Marks** **Internal : 10 Marks**	

B.Sc. – III (Computer Science) SEMESTER – VI

Paper – I : **E-COMMERCE AND HTML**

Paper – II : **Electives I:VB.Net**

Electives II: Data Communication with Cloud Computing Basics

Electives III: JAVA

B.Sc. – III (Computer Science)
SEMESTER –VI
PAPER-I: E-COMMERCE AND HTML [Marks: 50

UNIT-I: E-Commerce and Introduction to Internet

E-Commerce- Introduction, Application, Definition, Benefits of E-Commerce, Impediments of E-Commerce, Difference between Traditional and Electronic Commerce, E-Commerce Service,

Electronic Data Interchange (EDI): Introduction, Benefits, Value Added Services (VAS), On-line Payment Services, Trade Cycle.

Introduction- Internet, Basic Internet Terms**,** Internet Addressing, Protocols, Internet Protocols,Services of Internet,Search Engine**.**

UNIT-II: Basic of HTML and Tag

Introduction to HTML - Introduction, Features of HTML, Advantages & Disadvantages of HTML, HTML Editors, Step to Create and View HTML Document, Basic Structure of HTML Program

Tags & Attributes-Nesting of Tags, Classification of HTML Tags, Block Formatting Tags.

UNIT-III: Working with HTML

List - Introduction to Lists, Unordered List, Ordered List, Definition List, Nested List, Difference Between Ordered and Unordered List.

Linking - Introduction, Type of Hyperlink Creation, Working with Links, Pathname and Types, Types of Linking or Anchors.

Graphics in Web Page - Image Tag, Align Images, Embedding Inline Images and External Images,

Unit-IVAdvanced HTML

Tables - Basic table tags and their related attribute

Frames- Frames, <Frame> and <Frameset> tags and related attributes

Form designs, Form Controls, Text controls, password fields, radio buttons, and check boxes. Reset and submit buttons, form control selection, option processing and text area.

Books:

1) Greenstein and Feinman," Electronic Commerce", TMH, 2000, TMH, ISBN-0-07-042141-2,
2) Bhushan Dewan, "E-Commerce", S.Chand,2001, First Edition, ISBN - 81-219-2083-3,
3) S.B. Kishor, "E-Commerce and Web Design", Das Ganu, ISBN 978-93-81660-52-2

References:

1. Complete HTML, BPB, 2010, ISBN-13:978-0-07-070194-6.
   C.Xavier, "Web Technology and Design",TMH,2010, ISBN-13:978-81-224-1450-9

B.Sc. – III (Computer Science)
SEMESTER –VI

PAPER-II: Electives I: VB.NET [Marks: 50

UNIT –I: Introduction to .NET

Introduction to .NET Framework, Basic Functionality of CLR, MSIL, About Platform Independency, Language Interoperability, CTS and CLS, .NET Languages, Assemblies, Garbage Collection, Architecture of GC and Application Domain.

UNIT- II: Visual Studio.NET

WPF Designer and Windows Form Integration, Multi-Framework Targeting, Better Intelligent Support, Refactoring and Enhancements, Visual Studio Split View, Debugging the .NET Source Code

VB.NET Language: Features of VB.Net, Writing Programs in VB.Net, Compiling and Execution from Command Prompt

Data Types, Expressions and Operators: Option Statements, Basic Element of Programming (Data types, Variable, Constant, Control Flow Statement), Type Casting, Boxing and Unboxing, Built-in Functions in VB.Net, Sub Programs and Working with Arrays

UNIT- III: Object Oriented Programming with VB.Net

Principles of OOP, Data Encapsulation, Data Abstraction, Properties, Method Overloading, Constructors, Inheritance, Overloading and Overriding, Shadowing, Abstract Classes and Sealed Class, Polymorphism, Delegate - Unicast and Multicast, Events, Collections, Directories, Strings, String Builders, Attributes, Namespaces and Generics

Windows Applications: Introduction to System.Windows.Forms.DLL, Basic Controls and Event Driven Programming, Programming with Advanced Controls. **Windows Control Library**

Error Handling: Structured Error Handling, Error Categories, Debug and Trace Classes, Code Optimization, Testing Phases and Strategies

UNIT- IV: Data Access with ADO.NET

Introduction to Access Libraries ADO, Limitation of ADO, ADO.Net Objects and Usage, ADO.Net Managed Providers, Data Reader, Data Adapter and Dataset, Data Relation and Dataset, Data Binding, Connected and Disconnected Environments, Connection Pooling, ADO.Net Exceptions, Using Stored Procedures, N-Tier Database Application, Crystal Reports

Books:

1) David I. Schneider, "An Introduction to Programming Using Visual Basic .Net", PHI, ISBN 81-203-2159-6
2) ShirishChavan, "Visual Basic .NET", Pearson, ISBN 81-317-1391-1
3) Mastering Crystal Report - BPB Publication, ISBN 13 9788176567091

References:

1) Jeffrey R. Shapiro, "The Complete Reference -Visual Basic .NET", TMH, ISBN-0-07-049511-4
2) Anne Prince and Doug Lowe, "Murach's VB.NET database programming with ADO.NET".
3) Crystal Report – The Complete Reference, TMH

B.Sc. – III (Computer Science)
SEMESTER –VI
Paper-II: Electives II: Data Communication With Cloud Computing Basics
[Marks: 50

UNIT I: Data Communication

Data Transmission- Concept and Terminology, Analog and Digital Data Transmission, Transmission Impairment, Transmission Media. Data Encoding – Digital Data, Analog Data, Digital Signal, Analog Signal. Digital Data Communication- Asynchronous and Synchronous Transmission, Error Detection Technique, Interfacing. Data Link Controls – Line Configuration, Flow Control, Error Controls, Data Link Control Protocols. Multiplexing – Frequency Division Multiplexes, Synchronous Time Division Multiplexing.

UNIT II: Data Communication Network

Circuit Switching- Communication Network, Circuit Switching, Single Node Network, Digital Network Concept, Concept Signaling. Packet Switching- Packet Switching Principal, Virtual Circuit and Datagram, Routing, Traffic Controls, X.25.LAN and MAN – LAN, MAN Technology, Bus/Tress Star Topologies, Optical Fiber Bus, Ring Topology, and Medium Access Control Protocols, LAN/MAN Standards.

UNIT III: Communication Architecture

Protocols and Architecture- Protocol, The Layered Approach, OSI Model, TCP/IP Protocol Suite, System Network Architecture. Internetworking – Principles of Internetworking, The Bridge, Routing With Bridge, Connectionless Internetworking, Connectionless Internetworking Work Protocol, Router-Level Protocol, Connection Oriented Internetworking.

UNIT IV: Cloud Computing Basics

Cloud Computing : Overview , History, Characteristics/Capabilities of Clouds, Cloud Components, First stake holders of Cloud market, Virtualization, Cloud Computing Architecture. Cloud Computing Services : SaaS, PaaS, IaaS, Cloud Computing Deployment Models – Public, Private, Hybrid and others. Cloud Benefits and Limitations, Security concerns & benefits. Cloud Environment Roles, cloud vs. Distributed Computing, Regulatory issues with cloud.

Books:

1) Willam Stalling “Data and Computer Communication”, PHI, ISBN-81-7808-442-2
2) Forouzan,”Data Communication and Network”, TMH, ISBN-0-07-049935-7
3) Toby Velte, Anthony Velte, “Cloud Computing A Practical Approach”, McGraw-hill ,ISBN : 0071626948.

Reference:

1) Tim Mather, SubraKumarsamy," Cloud Security and Privacy", ISBN:0596802765
2) Rajkumar Buyya, " Mastering cloud computing", TMH

B.Sc. – III (Computer Science)
SEMESTER –VI

Paper-II: Electives III: JAVA [Marks: 50

UNIT – I: Introduction to Java

History of Java, Features of Java, JDK Environment, Java Virtual Machine, Garbage Collection

Programming Concepts of Basic Java: Identifiers and Keywords, Data Types in Java, Java coding Conventions, Expressions in Java, Control structures, decision making statements, Arrays and its methods

UNIT – II: Objects and Classes

Object Fundamentals, Pass by value, 'this' reference, Data Hiding and Encapsulation, Overloading, Overriding Constructors, Finalization, Subclasses (Inheritance), Relationship between super class object and subclass object, implicit subclass object to super class object Conversion, Dynamic method dispatch.

Language Features: Scope rules, Static data, Static methods, Static blocks, Modifiers of Class, Method, Data Members and Variable, Abstract Classes, Interfaces, Packages, Importing Packages and Classes, User define packages.

UNIT – III: Exception Handling & Multithreading

Types of Exceptions try, catch, finally, throws keywords, creating your own exception, exceptions and Inheritance

Multithreading: Multithreading Concept, Thread Life Cycle, Creating multithreading Application, Thread Priorities, Thread synchronization.

UNIT – IV: Abstract Window Toolkit & Applets

Abstract Window Toolkit: Components and Graphics, Containers, Frames and Panels, Layout Managers-Border Layout, Flow Layout, Grid Layout, Card Layout, AWT all Components, Event Delegation Model, Event Source and Handlers, Event Categories, Listeners, Applets-Applet Life Cycle, Applet Context, Inter applet communication.

Books:

1) Cay S Horstmann Gary Cornell, "Core JAVA 2 Vol -1, 2", The Sun Micro Systems Press, New Delhi, *ISBN*-13: 978-0470105559
2) Peter Van der Liden, "Just Java", The Sun Micro Systems Press, New Delhi, *ISBN*, 0130897930
3) E. Balaguruswamy, "Programming with Java - A Primer", The Sun Micro Systems Press, New Delhi, *ISBN* 81-265-0931-7

References:

1) Deitel and Deitel, "Java How to Program", Prentice Hall Upper Saddle River, New Jersey 07458 (US). ISBN 0-13-034151-7
2) Jerry R Jackson Alan L, "Java by Example 1.2", McClellan Publication

Syllabus
of

Bachelor of Science

(Computer Science)
Optional Subject

(Three Years Degree Course)

B.Sc. I (Computer Science)

Semester I

PAPER I: INFORMATION AND COMMUNICATION TECHNOLOGY

UNIT-I: Introduction to IT and Computers

Block Diagram of Computer, Functioning of Computer, Generations of Computer, Classification of Computers, Characteristics, Advantages & Limitations of Computer. Computer Memory: Primary & Secondary, Types of Primary Memory

Number System: Decimal, Binary, Octal, Hexadecimal number systems, features andconversions, ASCII & EBCDIC codes.

UNIT-II: I/O and Storage Device

Input devices: Keyboard **Locator Device:** Mouse, Joy Stick Digitizing Tablet **Pick Device:** Light Pen, Touch Screen Track ball **Voice Recognition:** Microphone, Scanning: MICR, OCR, OMR, Barcode Reader, **Vision Capturing:** Webcam, Digital Camera, Touch Pad **Output devices:** VDU, Dot Matrix, Laser and Inkjet Printers, Plotters.

Storage Devices:Hard Disk, Optical Disk, Blue Ray Disc and Pen Drive

UNIT-III: Windows

Operating System, Classification of Operating System on the basic of task (Single User Single Task, Single User Multiple Task, Multi-User Multiple Task), Features of Windows, GUI, Operating with Windows, Desktop, Taskbar, Windows Explorer, Control Panel, My Computer, My Documents, Recycle Bin

Windows Accessories: Calculator, Notepad, Paint, System Information, Disk Management,Disk Defragmentation, Disk Cleanup

UNIT–IV: Network & Internet

Computer Communication, Need for Networks, Communication Device, Types of Network-LAN, WAN, MAN, Concept of Network Topology, Types of Topologies and its Advantages and Limitations. OSI Model.

Internet: Basic Internet terms, Internet Addressing, Services provided by Internet, Detailabout E-mail, Search Engine, Basic of Intranet. Social and Ethical Issue

Open Source Terminologies: Open Source Software, Freeware, Shareware, ProprietarySoftware

Books:

1) Peter Nortorn's, " Introduction to Computer", TMH, 2004, ISBN-0-07-05-3142-0
2) Pradeep K. Sinha and Priti Sinha " Computer Fundamentals", BPB, 2007, ISBN-10:81-7656-752-3/13:978-81-7656-752-7
3) Chetan Shrivastava " Fundamentals of Information Technology", Kalyani publishers, 2002, ISBN-81-7663-576-6
4) Dr Madhulika Jain,"Information Technology Concept", BPB,2006,ISBN – 81-7656-276-9
5) Verma,"Computer, Internet & Multimedia – Dictionary", Universities Press

References:

1) Sanjay Saxena and Prabhpreet Chopra, " IT Tools and Applications",2008
2) Akshay Kumar, " Information Technology and Info Guide", Authors press,2000, ISBN-81-7273-040-3

B.Sc. I (Computer Science)
Semester I
PAPER II: PROGRAMMING LOGIC AND TECHNIQUES

UNIT-I: Language Evolution

Machine Language, Assembly Language, High Level Language. Translators: Compiler, Interpreter and Assembler. The Compilation Process, Linker, Loader, Study of Programming Languages (Function Oriented, Object Based, Event Base), Study of HLL, Characteristics of Good Language, Generation of Languages,

UNIT-II: Programming Construction Tools

Problem Analysis, Process Analysis, Conceptual Development of Solution. Development Tools: Algorithm: Types of Algorithm, Algorithm of Analysis, Advantage and Disadvantage of Algorithm, Complexity of Algorithm, Big-O Notation Flowcharts: Types of Flowcharts, Adva**ntag**e and Disadvantage of Flowchart. Pseudo Code: Definition and Its Characteristics.

UNIT-III: Control Statements

Basics of Programming Language: Usage of Character Set, Meaning of Keywords andIdentifiers, Role of Data Types, Constants and Variables. Importance of Casting, Different Types of Operators and their Precedence, Expressions, Conditional Statements (One-Way, Two-Way and Multi-Way Conditional), Looping Statements (For, While, do-while), Usage of Exit, Continue, Break and Goto Statement.

UNIT-IV: Arrays

Arrays: Arrays, One dimensional array, Various Operation on Array (Inserting of Element, Deleting of Element, Rotating List, Sorting, Searching, Merging Etc) and Two dimensional arrays (Matrix Addition, Transpose of Matrix, Matrix Multiplication), Modular programming and its features.

Books:

1) Anil V. Chouduri, “The Art of Programming through Flowchart and Algorithms”, Laxmi Pub. ISBN-8170087791
2) Maureen Sprankle, “Problem Solving Programming Concepts”, Pearson, 7th Edition, 2009 ISBN 81-317-0711-1
3) Behrouz Forouzan, “Basic of Computer Science”,Cengage Leaning, ISBN 81-315-1118-9

References:

1) Donald Knuth,”The Art of Computer Programming Vol-I,II III”, Pearson.
2) Horowitz, Sahani, “Fundamental of Computer Algorithm”, Orient Longman, ISBN 9788173716126

B.Sc. – I (Computer Science)
SEMESTER - I
Practical

Practical based on IT, Office Automation

A) Information Technology

1. Study of various input devices with troubleshooting.
    a. To study and installation of keyboard.
    b. To study and installation of mouse.
2. Study of various output devices.
    a. To study the installation of printer.
3. To study the installation of multimedia.
4. Study of different operating system.
5. Study of booting process.
6. To study assembling and deassembling the PC.
7. To study and installation of antivirus software
8. Procedure to cleanup Disk, Disk fragmentation
9. Things to know while purchasing the computer.

B) Ms-Word

1. a) Type the Content Heading and then set the Index option using Tab setting. Finally take a print out.

CONTENTS

Chapter **Page No.**

[Chapter names at 1" with left alignment while Page number at 4.5" with right alignment and with leader …..]

b) Draw a Block diagram of computer system using auto-shapes, and name them using textbox and join each parts using line-style. At the end give the page border to it. Finally take a print out.

c) Type the following set of equation. Finally take a printout.

1. $B^2 - 4AC = 0$
2. H_2SO_4
3. If ($A^2 \geq 0$)
4. $f(x) = \sum_{i=1}^{i=5} 5 * X^i$
5. $k^2 - 4 = 0$, if $b_0 \neq 0$
6. $e^{i\theta} + e^{-i\theta} = 2\cos\theta$

Tip: Use Superscript, Subscript, Insert Symbol and Math equation (Insert → Object → Microsoft Equation)

2. Type the following letter and take printout

ABC
SAI Nagar
Mumbai
☎ 020-1111111

Dear Sir,

Kindly provide the **rate** of following set of peripherals,

- Computer with following configuration
  - Intel© Pentium© Processor T4400 (2.2 Ghz, 1MB L2 Cache, 800 MHz FSB)
  - 250 GB HDD, DVD RW, 35.56cms (14) CSV LED Backlit, 1GB DDR3 RAM
- Floppy disk of 1.44 MB of 12 Box
  - Sony
  - Verbatin
- 3-Button mouse of following 5 each
  a) i-ball
  b) Logitech

Thanking you,

Date : < Insert System Date > Your
XYZ

Tip: Use Bullet and Insert symbol option (Wingdings Font), System Date should be inserted throughInsert Date and Time Option.

3. Type the following

Ms-Office

1. Word
2. Excel
3. Power Point
4. Access

a) **Ms-Word:** MS-Word is the application software and one of the most powerful wordprocessor in Windows operating system. It is used for formatting of letters or the text. In simple meaning it is a word processor having various functions for text you may insert different objects like pictures, sound and video or calendar in word file.

b) **Ms-Excel:** Ms-Excel is a powerful spreadsheet or worksheet application that can use formanaging, analyzing and presenting data in tabular format. It also helps to display data in graphical format using charts.

c) **Ms-Power Point**: Ms-Powerpoint is a powerful tool to create professional lookingpresentation and slide shows.

d) **Ms-Access**: Ms-Access is a powerful program to create and manage database.

Perform the following operation,

i. When user presses on Access it should jump to Access Paragraph within page.
ii. Similarly create a hyperlink for other option within a page.
iii. Print it.

Tip: First of all create a book mark for word Ms-Access and then use hyperlink to word Access to linkwithin page for Ms-Access bookmark.

4. Define and write the characteristic of computer and perform following operation,
   a. Divide the text in two columns
   b. Insert the picture of computer in the background in each column.
   c. Insert header with your name
   d. In footer write name of your college
   e. Give proper heading for phrase.
   f. Use Drop Cap for 1st letter of each paragraph
   g. Define line spacing 1.5 with left margin 1.25” and right margin 0.75”
   h. Font : Courier New, Font size for heading 14 and for normal text 11
   i. Finally take a print out.

5. Type the following letter exactly as given below, Before start of typing, set up page in the following format

1) Page Size : A4 with Landscape Orientation
2) Left Margin: 2” Right Margin: 1” Top Margin: 0.5”

Computer Stream after 12th

COMPUTER

- **Science Stream**
  - **B.Sc (Computer Science)**
  - **B.Sc (IT)**
  - **BCA**
  - **B.E. (Computer Science)**
  - **B.E. (Information Technology)**
- **Commerce Stream**
  - **BCCA**
  - **B.Com (Information Technology)**

[If Computer Picture is not loaded on your computer then simply select one of the pictures loaded in clip-art]

Tip: For writing a text in direction, In Text box write COMPUTER and then select Text Directionoption from Format menu. And For background, select textbox and use fill color.

6. Write a letter to publisher for supplying the list of books along with book details. For ex.

To,
Publisher,
Das Ganu Prakasan,
Nagpur.

R/Sir,
Supply following title of books at the earliest.

Sr.No.	Title	Author	No. of

			Copies
1	Information System	S.Kishor	10
2	Information Technology	S. Kishor	15
3	Principle of Business Management	S. Kishor	12
4	Financial Accounting	Dr. Kishor Mohrir	13

Thanking you,

Date: < Insert System Date >

Yours

Principal
(Dr. WWW)

Perform Following option

1) Take a printout

2) Assume Liberian forget to enter one of the entry of book so, kindly add it between number 3 and 4 say,

4 Business Economics Gurbir Kaur Khalsa 10

3) Replace author name S. Kishor by S.B. Kishor at once.

4) Finally print the copy of this document with following settings,

- Left Margin = 1.75"
- Right Margin = 1"
- Top Margin = 1.5"
- Bottom Margin = 1"

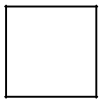
[**Tip**: Formatting option and Table]

7. Using Mail-Merge write a letter to all selected candidate for their final admission on specific date say (30-June) at XYZ Institute, with necessary documents at 10 AM.

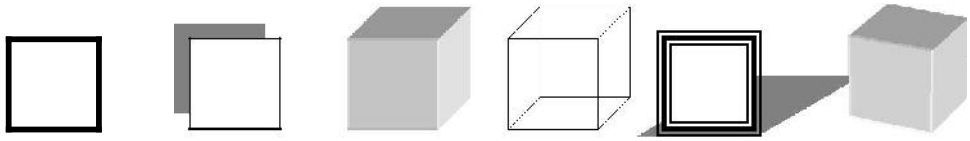
   Name should be highlighted while course and date of commencing class should be underlined
   Tip: Assume at least 5 recipient students details (Name, Address, Course for Enroll) are entered in database.

8. Create a document and while saving give a security to open the saved document. Take a screen shot while opening it.
   Tip : While Saving, select Security option from Tools Menu option.

9. Draw the following shape using rectangle option found in Drawing Toolbar



And generate following types of box by copying and formatting above box



Tip : Use shadow-style and 3-D style found in Drawing Toolbar

C) MS-Excel

1) Prepare following table in a worksheet using MS-Excel.

Name	Basic	DA	HRA	Gross Pay	PF	Net Pay
Rahul	10000					
Sachin	20000					
Nilesh	15000					
Bharti	25000					

Perform following operations:-

1. Complete the table using formulas
   - DA = Basic * 27 %
   - Hra = Basic * 10 %
   - PF = Basic * 12.5 %
   - Gross Pay = Basic + DA + HRA
   - Net Pay = Gross Pay–PF
2. Give the Proper Heading.
3. Take the printout in landscape orientation

2) Enter following data in MS-Excel worksheet.

Name	**Date of joining**	**Salary**	**Designation**
Rahul	Jan-05	10000	Peon
Sachin	Oct-10	20000	Accountant
Nilesh	Jan-05	15000	Clerk
Bharti	Dec-09	25000	Manager

Perform following operations:-

1. Copy the above data and place in sheet2 and sort the table in the ascending order or date of joining and give proper heading.
2. Copy the above data and place in sheet3 and sort the table in the ascending order or date of joining followed by order of name and give proper heading.
3. Copy all the above data to sheet4 and take printout

3) Prepare following using MS-Excel.

Players	**Match 1**	**Match 2**	**Match 3**	**Average**	**Highest Score**	**Sum**
Sehwag	78	43	91			
Sachin	45	77	62			
Yuvraj	65	80	37			
Dhoni	34	15	46			
Raina	23	75	55			

Perform following:-

a. Calculate Average and High score of each player using AVERAGE & MAX function
b. Calculate total score of each match using SUM function.
c. Sort above records in descending order on the basis of average.
d. Take the printout in landscape orientation

4) Prepare the Mark sheet of IT subject on the basic of 3 Unit test. Each of 30 Marks and perform following,
   1. Calculate total marks, Average and Grade

2. Auto format to the above table.
3. Take the printout

5) Prepare the multiplication using
1) Relative cell reference
2) Absolute cell reference.

Multiplicand	Multiplier	Product using Relative	Product using Absolute
13	1		
	2		
	3		
	:		
	:		
	10		

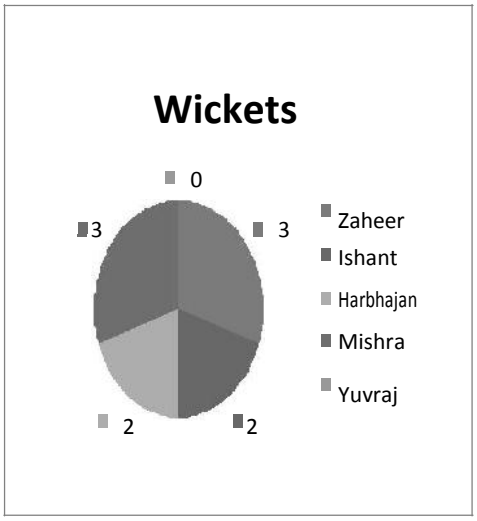
6) Create profit and prepare a column chart in MS-EXCEL using the data.

Month	Net Sales	Actual Cost	Profit
Jan. 10	22000	18000	
Feb. 10	245005	9555	
Mar. 10	32450	24850	

Perform following operations:-
a. Find the profit
b. Give a chart title "Profit Report"
c. Take the printout.

7) Draw Pie chart of following excel sheet.

Bowler	Over	Maiden	Runs	Wickets
Zaheer	10	2	22	3
Ishant	10	1	36	2
Harbhajan	10	0	48	2
Mishra	10	0	37	3
Yuvraj	10	0	43	0



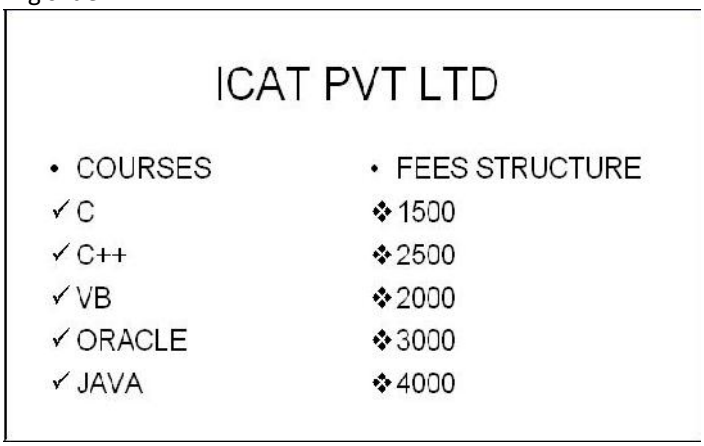
D) Ms-Powerpoint

1. Prepare the following slides with the information given below:

- Select the slide of your choice and write about yourself.
- Write about your family members name with relation. **Tip**: By using Title and 2 column text
- Using Title Content and text slide insert the picture of your favorite hero with the list of their movies.
- Finally run the slide continuously until ESC key is not pressed.

At last, write the steps that you have perform.

2. Create the following slide.



1. Change the bullet style in the first and the second level.
2. Change the case of the first level text to upper case and second level text to lower case.(By using Change Case option)
3. Change the attribute of the text to: Font : Arial, Font Style : Italics, Size:20
4. Justify the text.

3. Select the 10 slides of your choice. Apply the following settings and write the steps you have perform in each options.

- Insert page number in each slide
- Timer should be displayed during execution.
- Change the background color of each slide.
- Set the interval time for each slide to be displayed.
- Use Flash bulb animation in your presentation.
- Select a Color Schemes of your choice.
- Insert Chart in one of your slide.
- Insert a table in your presentation

B.Sc. - I (Computer Science)

SEMESTER- II

PAPER –I: OPERATING SYSTEM

UNIT -I: Introduction to Operating System

Operating System: Introduction, Purpose, Function And Role Of Operating System.

Types of OS: Concepts of Batch, Multi Programmed, Time Sharing, Parallel, Real Time AndDistributed.

Computer System Structure: Computer System Operation, I/O Structure, I/O Interrupt,DMA Structure, Storage Structure And Storage Hierarchy.

Hardware Protection: Dual Mode Operation, I/O Memory And CPU Protection, GeneralSystem Architecture.

UNIT -II: Operating System Structure

System Components: Process ,Main Memory, File I/O System, Secondary StorageManagement, Networking, Protection System, Command Interpreter System, Operating System Services, System Call.

Process And Job Control: Process And Types Of Process, Process State, Operation OnProcess, File Manipulation Device Management, Information Maintenance, And Communication.

System Structure: Simple Layered Approach, System Administrator.

UNIT - III: Linux

Structure of Linux Operating System, Exploring the directory structure, Naming files and directories

Shell: Bourne, Korn and C-Shells

File System Commands: ls, mkdir, rmdir, cd, cat, mv, cp, rm, ln, pwd, moreText editing with vi editor

UNIT IV: Shell Scripts

Pipe and Filters: sort, grep, egrep **Permission modes:** chmod, chown, chgrp **Process:** ps,kill Communication, **Shell Scripts:** Variables, Arithmetic in Shell Script, Control flow statements, Shell Parameters

Books:

1) Andrew S.Tanenbaum, “Modern Operating Systems” ,Second Edition, PHI.
2) Jack Tackett, Jr. and Steven Burnett, “Using Linux”, PHI (5th Ed)
3) Brian Proffitt, ”Install Configure and Customize (Red Hat Linux 7)”, PHI
4) Grant Taylor, “Linux Complete” , BPB pub., ISBN : 81-7656-170-3

References:

1) Brain Proffitt, “Red Hat Linux 7”,PHI.
2) Abraham Silbeschatz, “Operating System Concepts”, Bell Labs Peter Baergalvin Replika Press Pvt. Ltd.Delhi,
3) “Teach Linux in 24 hours”,SAMS Techmedia,ISBN:81-7635-499-6.

B.Sc. – I (Computer Science)
SEMESTER - II
Paper-II: STRUCTURED PROGRAMMING WITH 'C'

UNIT–I: Programming Logic and Basic Elements of 'C' Programming

Programming Logic: Problem Analysis, Process Analysis, Conceptual Development ofsolution. **Development Tools:** Algorithm, Flowchart

Translator: Interpreter, Compiler

Introduction to C: C-Character Set and Keyboards, Constants and Variables, Data types,Type Casting, Type Modification,

Operators and Expressions – Arithmetic, Relational, Logical Assignment, Bitwise and Increment and Decrement Operator

Input and Output statements in C.

UNIT–II: Storage Class and Control Statement

Storage Class: auto, static, extern, static

Conditional Statement: if-else, nested if, else-if ladder, switch, Ternary Operator

Looping Statement: for loop, while and do- while loop, Comma Operator and Use of break,continue and goto statements

UNIT–III: Arrays, Structure, Functions

Arrays: Definition, Types of Arrays, Initialization of Single and Two dimension array,Writing and Reading data from an array, Bounce Checking, Searching. Sorting and Merging of two array,

String: String Manipulation using string library functions.

Structure: Need of Structure, period operator, Initializing Structure, sizeof(), Arrays ofStructure, Nested Structures.

Unions: Concept and applications, enum

UNIT–IV: Function, Pointer and File Concept

Function: Arithmetic and String Library Function, User defined functions, use of void,Recursion.

Pointer: Declaring and Initializing pointer variable, Pointer Operator, Call by value and Callby Reference

Dynamic Memory Management Functions: malloc ( ), calloc(), realloc(), feee()

Files: Basic Concept of file, Operation on Files, Defining, Opening and closing files, Modesof Files

Books:

1) E. Balguruswami, "Programming in ANSI C", TMH, 2009, ISBN-978-0-07-064822-7/0-07-064822-0
2) Dr. S.B. Kishor, Dr. V. Godki, S. Madhavi,"Gateway to C Programming",Lambert Pub. Germany, ISBN 9783845414744

References:

1) RAJARAMAN, "COMPUTER PROGRAMMING IN C" ,PHI, 2002, ISBN-81-203-0859-X
2) K.R. Venugopal and S.R. Prasad, "Mastering C", TMH, 2008, ISBN-13:978-0-07-061667-7 / 10: 0-07-06-1667-1.

B.Sc. – I (Computer Science)
SEMESTER - II
Practical

OS & LINUX PRACTICAL LIST

PRACTICAL BASAED ON OPERATING SYSTEM USING C

1) A PROGRAM TO FIND THE TOTAL BASE MEMORY
2) A PROGRAM TO FIND THE TOTAL FREE SPACE MEMORY
3) A PROGRAM TO FIND TO KNOW BOOT DRIVE DISK
4) A PROGRAM TO FIND NO. OF DRIVE ATTACH TO SYSTEM
5) A PRGRAM TOKNOW THE VARIOUS INFORMATION OF DISK
6) A PROGRAM TO KNOW THE VARIOUS STATUS OF EQUIPMENT LIKE NUMBER OF PRALLEL PORT, SERIAL AND GAME PORT IS PRESENT OR NOT, TYPE OF VIDEO MODE
7) A PROGRAM TO CHECK MATH-COPROCESSOR IS INSTALLED OR NOT
8) A PROGRAM TO PRINT SYSTEM DATE, TIME AND TO CHECK WHEHTER MOUSE IS INSTALLED OR NOT.
9) A PROGRAM TO KNOW THE STATUS OF IMPORTANT KEY ON KEYBORD

PRACTICAL BASAED ON LINUX

1) **Perform the following Directory Commands**

   a) pwd b) ls c) mkdir d) cd e) rmdir

2) **Perform the following File management Commands**

   a. Cat b) cp c) ln d) rm e)more f) mv

3) A Shell Script to perform various arithematic operations.

4) A Shell Script that takes two numbers from keybord and display their average as an output.

5) A Shell Script to display current date, users who have logged in , process status and calendar of the month.

C PRACTICAL

1) A program to find simple and compound interest for the rate of interest.

2) A program to find corresponding temperature in Fahrenheit from a given temperature in Celsius.

3) A Program to accept decimal number and display equivalent number in Octal and Hexadecimal.

4) A program to swap the contents of two variables.

5) Program to accept the distance between two cities in Kilometer and print the distance in meter, feet, inches and centimeter.

6) Program to accept the two sides and angle included by these two sides to find area and third side of a Triangle.

7) To check a number is even or odd.

8) A program for testing leap year.

9) A program to find largest among any five number with minimum condition.

10) A program to find roots of Quadratic equation ax2+bx+c.

11) Consider the example where we want to print all the prime number between 10 to 100.

12) Program to print multiplication Table of a number.

13) A program to print number, square and cube of the first 10 natural number.

14) A program to find the factorial of a integer number.

15) A program to generate and print Fibonacci sequences.

16) A program to print first 5 lines of the following pyramid.

1

1 2

1 2 3

1 2 3 4

1 2 3 4 5

18) A program to print first n lines of the following Pyramid.

```
                1
            2       2
        3       3       3
    4       4       4       4
5       5       5       5       5
```

19) A program to find the GCD of two Positive integers by successive division.

20) A Program to find the number of Armstrong number between 123 to 425.

21) A program to print truth table from X* Y+Z.

22) A Program to generate a menu driven program using switch statement.

1) Add

2) Edit.

3) Delete.

4) Exit.

23) A Program to find sum of two matrices having size m*n and p*q.

24) A Program to Transport the matrix of size M*N.

25) A Program to delete an element from list of N number.

26) A Program to find sum of each row and column of matrix and also find largest and smallest element in the given matrix.

27) A program to count number of characters including uppercase and lowercase letter, digits, punctuations, space and words that are entered in a given string.

28) A Program to enter the marks of 5 subjects of 3 students and also find the total marks of each student using structure with array.

29) A Program to accept the containing 10 number and pass it to function to print it.

30) A program to evaluation following series.

$$e^x = 1 + x + x^2/2! + x^3/3! + x^4/4! + \text{----------} + x^n/n!$$

31) A program to define and accept the element of structure

1) Empno.

2) Name

3) Basic pay and display the same structure along with DA, CCAand gross salary.

DA and CCA are calculated as follows.

DA= 91% of basic salary

CCA= RS 100/- consolidation.

32) A program to Sort the string using Pointer.

33) A function length () which count the length (number of character in the given string.)

34) A function copystr () which will copy the contents of string into another.

35) A function concat () with will concatenation the string t to the end of string s.

36) A program to simulate DOS TYPE command.

37) A program to count number of characters include uppercase and lowercase latter, digits, punctuations, space, words and number of lines in given file.

38) A program to create data file “Student.dat” having fields, Rollno, Name and Address

39) A program to read and display the contents of data file “Student.dat”