HEMCHAND YADAV VISHWAVIDYALAYA, DURG (C.G.)

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SCHEME OF EXAMINATION
&
SYLLABUS
Of

M.Sc. (Botany) Semester Exam

UNDER

FACULTY OF SCIENCE

Session 2018-19

(Approved by Board of Studies)

Effective from July 2018

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SYLLABUS M.Sc. BOTANY

Semester	Paper	Title	External marks	Internal marks	Credit
First	I	Cytology	80	20	4
	II	Genetics	80	20	4
	III	Microbiology, Phycology and Mycology	80	20	4
	IV	Bryophyte, Pteridophyta and Gymnosperm	80	20	4
	LC - I	Lab Course-I (Based on paper I &III)	80	20	4
	LC - II	Lab Course-II (Based on paper II &IV)	80	20	4
Second	I	Taxonomy and diversity of plants	80	20	4
	II	Molecular Biology	80	20	4
	III	Plant physiology	80	20	4
	IV	Plant metabolism	80	20	4
	LC- I	Lab Course-I (Based on paper I &II)	80	20	4
	LC-II	Lab Course-II (Based on paper III &IV)	80	20	4
Third	I	Plant development and plant resources	80	20	4
	II	Plant Ecology– I **(E**cosystem and vegetation ecology)	80	20	4
	III	Biotechnology I (Genetic engineering of plants & microbes)	80	20	4
	IV	**Elective paper-1** Molecular plant pathology-I **OR** **Elective paper-II** Limnology-I **OR** **Elective paper-III** Ethno botany I	80	20	4
	LC-I	Lab Course-I (Based on paper I &II)	80	20	4
	LC-II	Lab Course-II (Based on paper III &IV)	80	20	4

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Fourth	I	Plant reproduction and plant resources utilization	80	20	4
	II	Plant Ecology II (Pollution and biodiversity conservation)	80	20	4
	III	Biotechnology II (Plant cell, tissue culture & organ culture)	80	20	4
	IV	**Elective paper-1** Molecular plant pathology-II **OR Elective paper-II** Limnology-II **OR Elective paper-III** Ethno botany II	80	20	4
	LC-I	Lab Course-I (Based on paper I &II)	80	20	4
	LC-II	Lab Course-II (Based on paper III &IV)	80	20	4

Choice Based Credit System: Semester II **Course Forestry seed Technology.**
Marks 100, Credit Points -03, Total Hours -50

Choice Based Credit System: Semester III **Course Environmental Science.**
Marks 100, Credit Points -03, Total Hours -50

- Each theory paper will have 5 questions of equal marks. First question will encompass all the five units without internal choice, whereas rest questions will be unit wise with internal choice.
- The respective teachers on each paper will ensure the internal evaluation by a class test and a seminar / poster presentation of 20 marks each and submit the foil and counter foil to the HOD by the end of the activity.



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SCHEME OF EXAMINATION, 2018-2019
M.Sc. I SEMESTER, BOTANY
THEORY

PAPER	TITLE	MAX. MARKS	Internal Assessment/ seminar	Total marks
I	CYTOLOGY	80	20	100
II	GENETICS	80	20	100
III	MICROBIOLOGY,PHYCOLOGY AND MYCOLOGY	80	20	100
IV	BRYOPHYTA,PTERIDOPHYTA AND GYMNOSPERM	80	20	100

PRACTICAL

LAB COURSE-I	BASED ON PAPER I&III	80	20	100
LAB COURSE-II	BASED ON PAPER II&IV	80	20	100
	TOTAL MARKS (Theory and Practical)			**600**

M.Sc. II SEMESTER, BOTANY

THEORY

PAPER	TITLE	MAX. MARKS	Internal Assessment /Seminar	Total marks
I	TAXONOMY AND DIVERSITY OF PLANTS	80	20	100
II	MOLECULAR BIOLOGY	80	20	100
III	PLANT PHYSIOLOGY	80	20	100
IV	PLANT METABOLISM	80	20	100

Choice Based Credit System: Semester II **Course Forestry seed Technology.**
Marks 100 , Credit Points -03, Total Hours -50

PRACTICAL

LAB COURSE-I	BASED ON PAPER I&II	80	20	100
LAB COURSE-II	BASED ON PAPER III&IV	80	20	100
	TOTAL MARKS (Theory and Practical)			**600**

TOTAL MARKS OF SEMESTER I&II- 1200

NOTE : Botanical excursion (within or outside Chhattisgarh) is compulsory for the Students of M.Sc.

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PRACTICAL SCHEME, LAB COURSE- I
M.Sc. I SEMESTER (BOTANY)

Time-5Hours **Maximum Marks80**

1.	Exercise based on Cytology	15 Marks
2.	Exercise based on Phycology + Microbiology	20 Marks
3	Exercise based on Mycology	15 Marks
4.	Spotting	20 Marks
5.	Viva-voce	10 Marks
6.	Sessional (Internal Assessment)	20 Marks

Total- 100 Marks

PRACTICAL SCHEME, LAB COURSE-II
M.Sc. I SEMESTER (BOTANY)

Time-5Hours **Maximum Marks80**

1.	Exercise based on Genetics	10Marks
2.	Exercise based on Bryophyta	10Marks
3.	Exercise based on Pteridophyta	15Marks
4.	Exercise based on Gymnosperm	15Marks
5.	Spotting	20Marks
6.	Viva-voce	10Marks
7.	Sessional(Internal Assessment)	20Marks

Total- 100 Marks

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PRACTICAL SCHEME, LAB COURSE- I
M.Sc. II SEMESTER (BOTANY)

Time-5Hours **Maximum Marks 80**

1.	Exercise based on Molecular biology	15Marks
2.	Exercise based on plant description (2 plants)	35Marks
3.	Spotting	20Marks
4.	Viva-voce	10Marks

5.	Sessional(Internal Assessment)	20Marks

Total- 100 Marks

PRACTICAL SCHEME, LAB COURSE-II
M.Sc. II SEMESTER (BOTANY)

Time-5Hours **Maximum Marks80**

1.	Exercise based on Paper-III	25Marks
2.	Exercise based on Paper-IV	25Marks
3.	Spotting	20Marks
4.	Viva-voce	10Marks

5.	Sessional(Internal Assessment)	20Marks

Total- 100 Marks

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M.Sc. Botany
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M.Sc. SEMESTER - I

PAPER - I
CYTOLOGY

MAX.MARKS-80

UNIT-I

- The dynamic cells, Structural organization of the plant cell, specialized plant cell types, chemical foundation, biochemical energetics.
- Cell wall - Structure and functions, biogenesis and growth.
- Plasma membrane; structure, models and functions, site for ATPase, ion carriers' channels and pumps, receptors.

UNIT-II

- Chloroplast-structure, genome organization, gene expression, RNA editing.
- Mitochondria; structure, genome organization, biogenesis.
- Plant Vacuole - Tonoplast membrane, ATPases transporters as a storage organelle.

UNIT-III

- Nucleus: Structure, nuclear pore, Nucleosome organization.
- Ribosome- Structure and functional significance.
- Cell cycle and Apoptosis; Control mechanisms, role of cyclin dependent kinases.
- Amitosis, mitosis and meiosis, karyokinesis and cytokinesis and cell plate formation, mechanisms of programmed cell death (PCD).

UNIT-IV

- Other cell organelles: Structure and functions of microbodies, microtubules, microfilaments, Golgi apparatus, lysosome, endoplasmic reticulum.

- Techniques in cell biology: Immune techniques, in situ hybridization to locate transcripts in cell types

- Electron microscope, camera lucida, micrometry- stage and ocular micrometer

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LIST OF PRACTICALS

- Identification of different stages of mitosis from suitable plant material. (onion root tips, garlic root tips).
- Identification of meiosis from suitable plant material. (Onion floral buds).
- Microtomy of bud and root
- Isolation of cell organelles: Mitochondria, Chloroplast, Nucleus, Lysosomes and their assay by succinate dehydrogenase activity (Mitochondria), acid phosphatase activity (Lysosome), acetocarmine staining (Nucleus) and microscopic observation (Chloroplast).
- Study of mitotic index from suitable plant material.
- Study of cyclosis(rotation/circulation) in cells of suitable plant material.
- Preparation of stain and its uses: Acetocarmine, acetoorcein, safranine, iodine, cotton blue, fast green, lactophenol, xylol, egg albumen, euperol etc.

Suggested Reading:-

1. De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and MolecularBiology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. NewDelhi].
2. Sad ova David – 2004 (First Indian Edition). Cell Biology, NewDelhi.
3. Albert Etal 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science(Iaylar and Francis) New York Group(wt.)
4. Lodish Etal 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman andcompany, NewYork.
5. Giese Arthur 1979 (Fifth Edition). Cell Physiology, Toppan company Ltd., Tokyo,Japan.
6. Cooper G.M and Hausman R.E 2007 (Fourth Edition). The Cell molecularapproach Sinauer associate, Inc, Suderland(USA).
7. Powar C.B 2005 (Third Edition). Cell Biology, Himalaya Publishing,Mumbai.
8. Roy S.C and KKDe 2005 (Second Edition). Cell Biology, New central Book AgencyPrivate Ltd.,Kolkata.
9. Krishnamurthy, K.V 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
10. Buchanan B.B, Gruissm W. and Jones R.L 2000. Biochemistry and Molecular Biologyof Plant. American Society of Plant Physiologist, Maryland,USA.
11.. De D.N 2000. Plant Cell Vacuoles : An Introduction. CISRO Publication, Collingwood, Australia.
12. Kleinsmith L.J and Kish V.M 1995. Principles of Cell and Molecular Biology (Second Edition). Happer Collins College Publishers, New York,USA.
13. Lodish H., Berk A., Zipursky, S.L Matsudaira P., Baltimore D. and Darnell J. 2000. Molecular Cell Biology (Fourth Edition). W.H. Freeman and Company, NewUSA.
14. David Freifelder 1996. Essentials of Molecular Biology, Panima PublishingCompany
15. Gerald Karp 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and Scne Ine.,USA

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PAPER - II

GENETICS

MAX.MARKS-80

UNIT-I

- Chromatin Organization **:** Chromosome structure and packaging of DNA, molecular organization of centromere and telomere, nucleolus and ribosomal RNA genes, chromatin and heterochromatin, Karyotype and idiogram, banding pattern, specialized types of chromosomes; polytene, lamp brush, ß chromosomes and sex chromosomes.

UNIT-II

- Mapping of Bacteriophage genome, Phage phenotype, recombination in phage, genetic transformation and transduction in bacteria.

- Molecular basis of chromosome pairing, chromosomal aberration and polyploidy.

UNIT-III

- Genetic recombination & genetic mapping; Mechanism of crossing over, molecular mechanism of recombination, role of enzymes in recombination, site specific recombination, linkage, linkage group, genetic marker.
- Tetrad analysis in *Neurospora crassa*

UNIT-IV

- Plant breeding technique: Introduction, selection (pure line, mass, bulk),emasculation, bagging, tagging, hybridization (self / cross), mutation, resistant and susceptible, heterosis, inbreeding depression, chimera
- Alien gene transfer through chromosome manipulation; Transfer of whole genome examples from Wheat, *Arachis* & *Brassica*. Transfer of individual chromosomes & chromosome segment, methods for detecting alien chromatin production.

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LIST OF PRACTICALS-

- Staining of salivary gland chromosomes of Chironomas larva or Drosophila.
- Isolation of DNA and its quantification by UV- spectrophotometric method.
- Isolation of RNA and its quantification by UV- spectrophotometric method.
- Detection of DNA by Agarose gel electrophoresis.
- Transformation in Bacteria
- Transduction in Bacteria.
- Biometry : mean, median, mode, chi square test, t test
- Mendelian ratios and gene interaction- monohybrid, dihybrid, complete dominance and incomplete dominance, qualitative and quantitative gene interaction, lethal gene, multiple allelism (ratios 9:3:3:1, 12:3:1, 15:1, 9:3:4,9:7, 9:6:1,13:3, 1:4:6:4:1 etc.)
- Reciprocal translocation in *Tradescantia* and *Rhaeo*

Suggested Readings:

1. Albert B. Bray, D Lewis, J Raff, M. Robert, K. and Walter 1989, Molecular Biology of the Cell (Second Edition) Garland Publishing Inc, NewYork.
2. Atherly, A.G., Girton, J.R. and McDonald, J.F 1999. The Science ofGenetics Saunders College Publishing, Frot Worth,USA.
3. Burnham, C.R 1962. Discussions in Cytogenetics. Burgess Publishing Co. Minnesota.
4. Busch, H. and Rothblum. L 1982. Volume X. The Cell Nucleus rDNA partA. AcademicPress.
5. Hartk D.L and Jones, E.W 1998 Genetics: Principles and Analysis (Fourth Edition). Jones and Bartlett Publishers, Massachusetts,USA.
6. Khush, G.S 1973. Cytogenetics of Aneuploids. Academic Press, NewYork, London.
7. Karp, G. 1999. Cell and Molecular Biology : Concept and Experiments. John Wiley and Sons, Inc.,USA.
8. Lewin, B. 2000. Gene VII. Oxford University Press, New York,USA.
9. Lewis, R. 1997. Human Genetics : Concepts and Application (SecondEdition). WCB McGraw Hill,USA.
10. Malacinski, G.M and Freifelder, D. 1998 : Essentials of Molecular Biology (Third Edition). Jones and B. Artlet Publisher, Inc.,London.
11. Russel, P.J. 1998. Genetics (Fifth Edition). The Benjamin/Cummings Publishing Company IND.,USA.
12. Snustad, D.P and Simmons, M.J 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc.,USA.
13. Gardner and Simmons Snustad 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons,Singapore.
14. Sariu C 2004 (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd., NewDelhi.

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15. Ahluwalia K.B 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, NewDelhi.
16. Burus and Bottino 1989. (Sixth Edition). The Science of Genetics. Macmillan Publishing Company, New York(USA).
17. Pawar C.B 2003 (First Edition). Genetics Vol. I and II. HimalayaPublishing House,Mumbai.
18. Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt.Ltd., NewDelhi.
19. Verma and Agarwal, Genetics, S. Chand Co, NewDelhi..
20. Singh B.D 2004. Genetics. Kalyani Publication,Ludhiana.
21. Gupta P.K Genetics and Cytogenetics, Rastogi Publications.

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M.Sc. Botany
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PAPER – III

MICROBIOLOGY, PHYCOLOGY AND MYCOLOGY

MAX.MARKS-80

UNIT-I

- **Archaebacteria and Eubacteria** : General account, ultra structure, nutrition and reproduction, biology and economic importance.

- **Cyanobacteria:** Salient feature and biological importance.

UNIT-II

- **Viruses:** Characteristics and ultra-structure of virions, isolation and purification of viruses, chemical nature, replication, transmission of viruses, economic importance,Prions, viroids (PSTV), virusoids.

- **Phytoplasma and Mycoplasma:** General characteristic and role in causing plant diseases.

UNIT-III

- **Phycology :** Algae in diversified habitats (terrestrial, freshwater, marine, parasite, symbiotic, epiphytic,endophytic, endozoic), thallus organization, cell ultra-structure, reproduction (vegetative, asexual,sexual).
- Criteria for classification of Chlorophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta.
- Economic importance of algae.
- Pigmentation in algae
- Perennation in algae
- Evolution and development of sex in algae

UNIT-IV

- **Mycology :** General characters of fungi, substrate relationship in fungi, cell structure unicellular and multicellular organization, cell wall composition, nutrition (saprobic biotrophic, symbiotic) reproduction, (vegetative, asexual, sexual) heterothallism, heterokaryosis, Para sexuality, recent account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina, fungi as biocontrol agent, economic importance of fungi.
- **Mycorrhiza:** VAM fungus

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LIST OF PRACTICALS

ALGAE: -

a. Cyanophyta: - Range of thallus organization and reproductive structures, types showing unicellular, colonial , trichome, filamentous, branched (pseudo and true branched).

b. Chlorophyta: - *Chlamydomonas, Pandorina, Eudorina, Volvox, Chlorella, Pediastrum, Hydrodictyon, Scenedesmus, Ulothrix, Cladophora, Draparnaldia, Draparnaldiopsis, Fristschiella, Chara, Nitella, Coleochaete, Ulva,, Caulerpa, Oedogonium, Zygnema, Spirogyra,.*

c. Phaeophyta: -*Ectocarpus, , Dictyota, Laminaria, Fucus, Sargassum.*

d. Rhodophyta: -*Porphyra, Batrachospermum, Gelidium, Gracillaria,Champia,Polysiphonia.*

FUNGI: -

Thallus organization, Spore producing organs, Tissue differentiation and accessory structures of following –

a. Mastigomycotina: - *Synchytrium ,Saprolegnia, Achlya, Peronospora, Plasmopora,Albugo, Sclerospora.*

b. Zygomycotina: -*Mucor, Rhizopus,Pilobolus.*

c. Ascomycotina: - *Yeast, Penicillium, Claviceps, Xylaria, Trichoderma, Taphrina, Protomyces, Eurotium, Erysiphe, Phyllactinia, Uncinula.*

d. Basidiomycotina: -*Uromyces, Ravenelia, Monosporidium,Puccinia, Melampsora,Ustilago, Agaricus, Pleurotus, Ganoderma,Polyporus, Cyathus, Lycoperdon, Geaster.*

e. Deuteromycotina: - *Aspergillus, Fusarium, Cercospora, Colletotrichum, Alternaria, Curvularia, Cladosporium*

Suggested Readings : -

1. Alexopoulus C.J , Mims C.W. and Blackwel M.I 1996. Introductory Mycology. John Wiley and SonsInc.
2. Kumar H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., NewDelhi.
3. Mehrotra R.S and Aneja R.S 1998. An introduction to Mycology. New Age Intermediate Press.
4. Rangaswamy G. and Mahadevan A. 1999. Diseases of crop plants in India(Fourth Edition) Prentice Hall of India Pvt. Ltd. NewDelhi.
5. Webster J. 1985. Introduction to Fungi. Cambridge UniversityPress.
6. Hawker L.E. 1967. An Introduction to FungiCambridge.
7. Kamat M.N 1959. Hand Book of Mycology, PrakashPublication.
8. Vashista B.R & A.K Sinha 2005. Botany for degree students – Fungi,S.Chands

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Publication.
9. Vashista B.R & A.K Sinha 2005. Botany for degree students – Bryophta, S.Chands Publication.
10. Ainsnorth G.C 1973. The Fungi Vol IV A, IV B AcademicPress.
11. Bessey 1950. Morphology and Taxonomy of fungi. The BlakistanCo.
12. Burnett J.H. 1968. Fundamentals of Mycology. Edwards ArnoldPublication.
13. Morries I 1986. An Introduction to the Algae. Cambridge University Press,U.K.
14. Round F.E. 1986. The Biology of Algae. Cambridge University Press,Cambridge
15. Vashista B.R & A.K Sinha 2005. Botany for degree students – Algae, S.Chands Publication
15. Vijayraghavan M.R and Bela Bhatia (1997), Red Algae : Structure, ultrastructure and Reproduction, APH publishing Corporations, NewDelhi.
16. Vijayraghavan M.R and Bela Bhatia (1997), Brown Algae : Structure, ultrastructure and Reproduction, APH publishing Corporations, NewDelhi.
17. Fritsch F.E (1945). The structure and reproduction of the algae Volume I andII, Cambridge UniversityPress.
18. Chapman V.J and Chapman D.J (1973). Thje Algae Macmillon and company, NewYork.
19. Bold H.C and Wynne M.J (1975). Introduction to the Algae structure andreproduction prentice hall Biological ScienceSeries.
20. Pandey S.N. A Text-book of Botany Volume I, Vikas Publications.

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PAPER - IV

BRYOPHYTA, PTERIDOPHYTA AND GYMNOSPERM

MAX.MARKS-80

UNIT-I

- **Bryophyta :** morphology, structure, reproduction, life history, distribution, classification.
- General account of Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Economic and ecological importance.
- Progressive sterilization of sporogenous tissue in bryophytes
- Spore dispersal mechanism in bryophytes
- Thallus organization of bryophytes
- Progressive and reduction theory of origin and development in bryophytes

UNIT-II

- **Pteridophyta:** morphology, anatomy and reproduction, classification,evolution of stele. Telome theory, concept of first vascular plants
- Homospory, Heterospory and origin of seed habit,
- General account of fossil pteridophyta.
- Prothallus organization
- Introduction to Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

UNIT-III

- Gymnosperm: General characters of gymnosperm mentioning diversity.
- Classification of gymnosperm.
- Resemblances and difference amongst gymnosperm, pteridophyta and angiosperm.
- Gymnosperm distribution in India.
- Gymnosperm Biotechnology.
- Economic importance of gymnosperm.
- Structure and theories regarding origin of Paleozoic ovule.

UNIT-IV

- Extinct gymnosperm : general account of pteridospermales, Glossopteridales, Caytoniales,Pentoxylales.
- Extant gymnosperm : Cycadales, Ginkgoales, Coniferales, Ephidedrales Gnetales, and Welwistschial.

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LIST OF PRACTICALS

Bryophyta: -

a. Hepaticopsida: - *Ricciocarpus, Riccia, Marchantia, Targionia, Astrella, Porella, Cyathodium, Plagiochasma,*
b. Anthocerotopsida: -*Anthoceros,Notothyllus*.
c. Bryopsida: -*Sphagnum, Funaria,Polytrichum,*
d. Pteridophyta:-

1. Study of the following members to observe arrangement of Sori on a receptacle :- *Isoetes, Osmunda, Angiopteris, Ceratopteris, Achrostichum,Gleichinia*
2. Morphology, Anatomy and reproductive structures of :- *Psilotum, Selaginella, Lycopodium, Equisetum, Ophioglossum, Lygodium, Pteris, Pteridium, Adiantum, Marsilea, Salvinia, Azolla.*

e. Gymnosperms: -

Morphology, Anatomy and reproductive structures of –*Cycas, Zamia, Ginkgo, Pinus, Cryptomeria, Juniperous, Araucaria, Taxus, Cedrus Thuja, Podocarpus, Gnetum, Ephedra.*

monographic study of the members of bryophytes, pteridophytes and gymnosperms
Hand /microtome Double stained permanent slides (DSPS) **preparation of atleast 20 slides** from above genera should be submitted.

Suggested readings:

1. Sporne K.R. 1991. The Morphology of Pteridophytes. B.I Publishing Pvt. Ltd.Bombay.
2. Stewart W.N. and Rathwell G.W. 1993. Paleobotany and the Evolution of plants. Cambridge UniversityPress.
3. Bhatnagar S.P and Moitra Alok 1996. Gymnosperms. New Age International Pvt. Ltd. Publishers, New Delhi, 470pp.
4. Biswas C and Johari B.M 2004. The Gymnosperms Narosa Publishing House, NewDelhi. 497 pp.
5. Sporne K.R 1965. The Morphology of Gymnosperms London, pp.216.
6. Bierhorst D.W. 1971. Morphology of Vascular Plants. New York and London.
7. Chamberlain C.J 1934. Gymnosperms-Structure and Evolution, Chicago.(Page19)
8. Coulter J.M. and Chamberlain C.J. 1917. Morphology of Gymnosperms,Chicago.
9. Foster A.S and Gifford E.M 1959. Comparative Morphology of Vascular Plants.San Francisco.
10. Maheshwari P. and Vasil, Vimla 1961. Gnetum,Delhi.
11. Vashishta P.C., A.R. Sinha, Anil Kumar. 2006. Gymnosperms. S.Chand.Publication
12. Vashishta P.C. 2006. Pteridophytes. S.Chand.
13. Parihar N.S. 1996. Biology and Morphology of Pteridophytes. Central BookDepot, Allahabad
14. Parihar N.S. 1991. Bryophyta. Central Book Depot,Allahabad.
15. Puri P. 1980. Bryophytes. Atma Ram and Sons,Delhi.
16. Vashista B.R & A.K Sinha 2005. Botany for degree students – Bryophta,S.Chands

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Publication
17. Sporne. Morphology of Bryophytes, Oxford PublishingHouse
18. Rashid A (1998). An introduction to Bryophyta. First edition, Vikas Publishing House Pvt. Ltd, NewDelhi.

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SEMESETR II

PAPER - I

TAXONOMY AND DIVERSITY OF PLANTS

MAX.MARKS-80

UNIT-I

- Plant nomenclature : Historical background of nomenclature, Binomial Nomenclature, International code of Botanical nomenclature.
- Plant identification : Herbaria, Botanical gardens, Taxonomic literature, Taxonomic-keys.
- Taxonomic hierarchy - Major categories, minor categories ,species concept.
- Taxonomic evidences - Morphology, Anatomy, Palynology, Embryology, Cytology, Phytochemistry, Genome analysis and Nucleic acid hybridization.

UNIT-II

- Pre Darwinian Classification Based on form relationship (Benthem and Hooker)
- Post Darwinian classification Engler and Prantl, Bessey's, Hutchinson, Takhtajan and Cronquist.
- Recent modifications : Dahlgren's system of classification.
- Fossil angiosperm.

UNIT-III

- Study of following families with particular reference to systematic position, phylogeny, evolutionary trends and economic importance.
- Polypetalae: Ranunculaceae, Magnoliaceae, Nymphacaceae, Brassicaceae, Sterculiaceae Meliaceae, Moringaceae, Fabaceae, Myritaceae, Cucurbitaceae, Apiaceae (Umbelliferae),
- Gamopetalae:Rubiaceae, Asteraceae, Sapotaceae. Oleaceae, Asclepiadaceae, Solanaceae, Bignoniaceae, Verbenaceae, Lamiaceae (Labiatae),

UNIT-IV

- Study of following families with particular reference to systematic position, phylogeny, Evolutionary trends and economic importance,
- **Monochlamydae-** Nyctaginaceae, Amaranthaceae, Polygonaceae,Euphorbiaceae, Moraceae, Casuarinaceae
- **Monocot families-** Orchidaceae, Iridaceae, Amaryllidaceae, Sciteminae (Musaceae) Zingiberaceae, Cannaceae, Liliaceae, Commelinaceae, Palmae (Aracaceae), Araceae, Cyperaceae, Poaceae (Graminae) study of local available familiar plants.

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LIST OF PRACTICALS:-

1. Methods of non-destructive field collection and documentation.
2. Techniques of herbaria preparation.
3. Morphological characterization of selected families of dicots and monocots and identification up to families.
4. Preparation of artificial key based on appropriate character combination.
5. Identification of genus and species from Monocots and Dicots.
6. Identification of given plant up to species with the help of modern flora keys.
7. Every student should submit duly prepared atleast 40 herbarium sheets.

Suggested readings: -

1. Blatter E and W.S Millard. 1929. Some Beautiful Indian Trees J.Bom. Nat Hist Soc.33:624-635.
2. Bor N.L 1943. Manual of Indian Forest Botany.London.
3. Cliford H.T and W. Stephenson. 1975. An Introduction to NumericalTaxonomy. Academic Press,N.Y.
4. Cole A.J (Ed.) 1969. Numerical Taxonomy. AcademicPress,N.Y.
5. Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nel and Sons, Ltd.London.
6. Davis P.H and V.H Heywood 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd London.
7. Heywood V.H 1967. Plant Taxonomy,London.
8. Lawrence, G.H.M 1951. Taxonomy of Vascular Plants.N.Y.
9. Lawrence G.H.M 1955. An Introduction to Plant TaxonomyN.Y.
10. Rendle A.B. 1925. The Classification of flowering plants. 2 Vols.London.
11. Santapau H. 1953. The Flora of Khandala on the Western Ghats ofIndia.
12. Singh V. and D.K Jain, 1981 Taxonomy of Angiosperms. Rastogi Publication,Meerut.
13. Swingle D.B. 1946. A Text book of Systematic Botany. Mc Graw Hill Book Co. NewYork.
14. Pande B.P 1997. Taxonomy of Angiosperms. S.Chand Publication.
15. Takhtajan A. 1969. Flowering Plants; Origin and Disposal.



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PAPER – II

MOLECULAR BIOLOGY

MAX.MARKS-80

UNIT-I

- RNA and DNA Structure. A, B, C and Z Forms of DNA, HnRNA, mRNA, tRNA, rRNA, exon, intron, split gene, junk DNA
- DNA replication , damage and repair

UNIT-II

- Transcription, translation in prokaryotes and eukaryotes
- Molecular Cytogenetics **:** Nuclear DNA content, C-value paradox, Cot curve and its Significance,
- Restriction mapping - concept and techniques,
- Multigene families and their evolution,

UNIT-III

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

- Protein sorting: Targeting of proteins to organelles.

UNIT-IV

- Mutation: Spontaneous and induced mutation, physical and chemical mutagens molecular basis of gene, transposable elements in prokaryotes and eukaryotes mutation induced by transposones, site directed mutagenesis Inherited human diseases and defects in DNA repair, translocation, intersect Robertsonian translocation, B-Atranslocation.

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PRACTICALS:

1. Study of structure different types of DNA and RNA
2. Formation and significance of chromosomal bridge, micronuclei, legard, acentric and dicentric due to Chromosomal aberrations
3. Physical and chemical mutagens and its role
4. Symptoms and inheritance pattern of genetic human diseases- sickle cell anaemia , thallasemia, alkaptunuria, phenylketonuria etc.

Suggested Readings:

1. Albert B. Bray, D Lewis, J Raff, M. Robert, K. and Walter 1989, Molecular Biology of the Cell (Second Edition) Garland Publishing Inc, NewYork.
2. Atherly, A.G., Girton, J.R. and McDonald, J.F 1999. The Science of Genetics Saunders College Publishing, Frot Worth,USA.
3. Burnham, C.R 1962. Discussions in Cytogenetics. Burgess Publishing Co. Minnesota.
4. Busch, H. and Rothblum. L 1982. Volume X. The Cell Nucleus rDNA partA. AcademicPress.
5. Hartk D.L and Jones, E.W 1998 Genetics: Principles and Analysis (Fourth Edition). Jones and Bartlett Publishers, Massachusetts,USA.
6. Khush, G.S 1973. Cytogenetics of Aneuploids. Academic Press, NewYork, London.
7 . Karp, G. 1999. Cell and Molecular Biology : Concept and Experiments. John Wiley and Sons, Inc., USA.
8. Lewin, B. 2000. Gene VII. Oxford University Press, New York,USA.
9. Lewis, R. 1997. Human Genetics : Concepts and Application (SecondEdition). WCB McGraw Hill,USA.
10 . Malacinski, G.M and Freifelder, D. 1998 : Essentials of Molecular Biology (Third Edition). Jones and B. Artlet Publisher, Inc., London.
11. Russel, P.J. 1998. Genetics (Fifth Edition). The Benjamin/Cummings Publishing Company IND.,USA.
12. Snustad, D.P and Simmons, M.J 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc.,USA.
13. Gardner and Simmons Snustad 2005 (Eighth Edition). Principles ofGenetics, John Wiley and Sons,Singapore.
14. Sariu C 2004 (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd., NewDelhi.
15. Ahluwalia K.B 2005 (First Edition). Genetics. New Age InternationalPrivate Ltd. Publishers, New Delhi.*(Page12)*
16. Burus and Bottino 1989. (Sixth Edition). The Science of Genetics. Macmillan Publishing Company, New York(USA).
17. Pawar C.B 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House,Mumbai.
18. Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., NewDelhi.
19. Verma and Agarwal, Genetics, S. Chand Co, NewDelhi..
20. Singh B.D 2004. Genetics. Kalyani Publication,Ludhiana.
21. Gupta P.K Genetics and Cytogenetics, Rastogi Publications.

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PAPER - III

PLANT PHYSIOLOGY

MAX.MARKS-80

UNIT-I

- **Membrane transport and translocation of water and solutes:** Plant-water relation,physical and chemical properties of water, imbibition, osmosis, diffusion, DPD, OP,TP,WP, plasmolysis (Incipient, evident and limited), deplasmolysis, mechanism of water transport through Xylem, root microbe interaction in facilitating nutrient uptake. Comparison of xylem and phloem transport, phloem loading and unloading, passive and active solute transport, membrane transport system.

UNIT-II

- **Signal Transduction :**Overview, receptors and G proteins, Phospholipids signaling, role of C-AMP, calcium-calmodulin cascade, diversity in protein kinases and phosphatases, specific signaling mechanism- two component sensor regulatory system in bacteria.

UNIT-III

- **Stress physiology :mineral nutrition in plants (excess and deficiency),**Plant responses to biotic and abiotic stress, mechanism of biotic and abiotic stress tolerance, HR Fundamental and SAR, water deficit and drought resistance, salinity stress, metal toxicity, freezing and heat stress, oxidative stress.

UNIT-IV

- Sensory photobiology, History of discovery of phytochromes and cryptochromes and their photo chemical and biochemical properties, photophysiology of light under responses,cellular localization, and molecular mechanism of action of enzyme.

- The flowering process:- Photoperiodism and its significance, endogeneous clock and its regulation, floral induction and development, Genetic, molecular analysis, role of vernalization.

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LIST OF PRACTICALS (Based on Paper III and IV)

1. Determination of osmotic pressure of cell sap by plasmolytic method.
2. Determination of Diffusion pressure deficit in potato tuber.
3. Determination of imbibition pressure of seeds of different catagories (protein, lipid, carbohydrate containing seeds).
4. To compare the rate of imbibitions of fatty and starchy seeds.
5. Determination of osmotic pressure of cell sap by plasmolytic method.
6. Determination of effect of temperature on the permeability of plasma membrane of beet root.
7. Determination of effect of different organic solvents (alcohol, formaline, benzene) on the permeability of plasma membrane of beet root.
8. Determination of effect of different concentration of organic solvents (alcohol, formaline, benzene) on the permeability of plasma membrane of beet root.
9. Determination of effect of different Phytohormones on the germination of seeds.
10. Determination of effect of different concentration of auxins on the germination of seeds.
11. Determination of the rate of respiration by Ganong's Respirometer.
12. Determination of the rate of respiration by Pipette manometer.
13. Determination of R.Q. of carbohydrates by Ganong's Respirometer.
14. Determination of R.Q. of lipids by Ganong's Respirometer.
15. Determination of R.Q. of proteins by Ganong's Respirometer.
16. Separation of chlorophyll pigments by paper chromatography.
17. Separation of chlorophyll pigments by circular paper chromatography.
18. Qualitative analysis of Organic acids by paper chromatography.
19. Qualitative analysis of amino acids by paper chromatography.

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20. Qualitative analysis of sugars by paper chromatography.
21. Separation of A.A by thin layer chromatography method.
22. Separation of chlorophyll by thin layer chromatography.
23. Determination of the effect of CO_2 concentration on the rate of photosynthesis by inverted funnel method.
24. Determination of the effect of CO_2 concentration on the rate of photosynthesis by Wilmot's bubbler.
25. Determination of the effect of intensity of light on the rate of photosynthesis by Wilmot's bubbler.
26. Determination of the effect of intensity of light on the rate of photosynthesis by inverted funnel method.
27. Determination of the effect of quality of light on the rate of photosynthesis by inverted funnel method.
28. Determination of the effect of quality of light on the rate of photosynthesis by Wilmot's bubbler.

MINOR EXPERIMENTS

1 Preparation of molar and molal solutions.
2 Preparation of percentagesolution.
3 Preparation of normal solution ofsolute.
4 Preparation of normal solution of acid andbase.
5 Demonstration of Brownian movement in the latex ofCalotropis.
6 Demonstration of tyndalleffect.
7 Demonstration of plasmolysis and deplasmolysis in plantcell.
8 Demonstration of exosmosis and endosmosis in grapes andresins.
9 Demonstration of the rate of respiration of flower buds by pipettemano-meter.
10 Demonstration of evolution of O_2 during photosynthesis by inverted funnel method.
11 Demonstration of the rate of photosynthesis by inverted funnel method.
12 Demonstration of the rate of photosynthesis by Wilmot's bubbler.

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13 Determination of the effect of temperature on the rate of photosynthesis by inverted funnel method.

14 Demonstration of the rise of temperature during seed germination.

15 Demonstration of evolution of CO_2 during respiration.

16 Demonstration of fermentation by Kuhns tube.

17 Demonstration of Determination of R.Q. of organic acids by Ganong's Respirometer.

18 Effect of phytohormones on the growth of seedling.

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Suggested Reading :-

1. Moore T.C. 1989. Biochemistry and Physiology of Plant Hormones Springer–Verlag, New York,USA.
2. Nobel P.S 1999. Physiochemical and Environmental Plant Physiology(Second Edition) Academic Press, San Diego,USA.
3. Salibury F.B and Ross C.W 1992. Plant physiology (Fourth Edition)Wadsworth Publishing Company,California,USA.
4. Singhal G.S., Renger G., Sopory, S.K. Irrgang K.D and Govindjee1999. Concept in Photobiology; Photosynthesis and Photomorphogenesis.Narosa Publishing House, New Delhi.
5. Taiz L. and Zeiger E. 1998. Plant Physiology (Second Edition). Sinauer Associates, Inc. Publishes, Massachusetts,USA.
6. Thomas B. and Vince-Prue D. 1997. Photoperiodism in Plants (Second Edition) Academic Press, San Diego,USA.
7. Verma S.K. and Verma Mohit 2007. A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.
8. Lehninger A.C 1987. Principles of Biochmistry, CBS Publishers and Distributers (Indian Reprint)

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PAPER - IV

PLANT METABOLISM

MAX.MARKS-80

UNIT-I

- **Photosynthesis :** General concepts and historical background, evolution of photosynthetic apparatus, photosynthetic pigments and light harvesting complexes, photo oxidation of water, mechanism of electron and proton transport, Carbon assimilation ,the Calvin cycle, photorespiration and its significance, the C_4 cycle, the CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.

UNIT-II

- **Respiration and lipid metabolism :** Overview of plant respiration, aerobic and anaerobic, glycolysis, Fermentation, Krebs' cycle (TCA cycle), electron transport and ATP synthesis, Pentose phosphate pathway, alternative oxidative system, structure and function of lipids, fatty acid biosynthesis, synthesis of membrane lipids ,structural lipids and storage lipids and their catabolism, Glyoxylate cycle.

UNIT-III

- **Nitrogen and Sulphur metabolism: Overview**, biological nitrogen fixation, nodule formation and nod factors, nif gene, nitrogense, leghaemoglobin, mechanism of nitrate uptake and reduction, ammonium assimilation, sulphur uptake, transport and assimilation.nitrogen cycle, sulphur cycle.

UNIT-IV

- **Plant growth regulators and elicitors :** Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylenes, abscisic acid, brassinosteroid, polymines ,jasmonic acid and salicylic acid, hormone receptors.
- **Movements** in plants-types and its measurement.
- **Fundamentals of enzymology :** Structure and nature of enzymes, inhibitions, General aspects of allosteric mechanism, regulatory & active sites, isozymes, kinetics of enzymatic catalysis, Michaelis-Menton equation and its significance.

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LIST OF PRACTICALS:- (Paper III and IV)

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17. Separation of chlorophyll pigments by circular paper chromatography.
18. Qualitative analysis of Organic acids by paper chromatography.
19. Qualitative analysis of amino acids by paper chromatography.
20. Qualitative analysis of sugars by paper chromatography.
21. Separation of A.A by thin layer chromatography method.
22. Separation of chlorophyll by thin layer chromatography.
23. Determination of the effect of CO_2 concentration on the rate of photosynthesis by inverted funnel method.

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Determination of the effect of CO_2 concentration on the rate of photosynthesis by Wilmot's bubbler.

24. Determination of the effect of intensity of light on the rate of photosynthesis by Wilmot's bubbler.
25. Determination of the effect of intensity of light on the rate of photosynthesis by inverted funnel method.
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MINOR EXPERIMENTS

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2. Preparation of percentage solution.
3. Preparation of normal solution of solute.
4. Preparation of normal solution of acid and base.
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6. Demonstration of tyndall effect.
7. Demonstration of plasmolysis and deplasmolysis in plant cell.
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BIOCHEMISTRY PRACTICALS

i. Qualitative estimation of amylase enzyme activity in the germinating seeds of wheat.
ii. Qualitative estimation of amylase enzyme activity in potatotuber.
iii. Qualitative estimation of catalase enzyme activity in the germinating seeds of wheat.
iv. Qualitative estimation of catalase enzyme activity in potato tuber.
v. Effect of enzyme concentration on the rate of catalase enzyme activity in potato tuber.
vi. Effect of enzyme concentration on the rate of catalase enzyme activity in the germinating seeds of wheat.
vii. Effect of enzyme concentration on the rate of amylase enzyme activity in of potato tuber.
viii. Effect of enzyme concentration on the rate of amylase enzyme activity in the germinating seeds of wheat.
ix. Effect of substrate concentration on the rate of catalase enzyme activity in the germinating seeds of wheat.
x. Effect of substrate concentration on the rate of catalase enzyme activity potato tuber.
xi. Effect of substrate concentration on the rate of amylase enzyme activity in the germinating seeds of wheat.

Sussested readings

1. Moore T.C. 1989. Biochemistry and Physiology of Plant Hormones Springer–Verlag, New York,USA.
2. Nobel P.S 1999. Physiochemical and Environmental Plant Physiology(Second Edition) Academic Press, San Diego,USA.
3. Salisbury F.B and Ross C.W 1992. Plant physiology (Fourth Edition)Wadsworth



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4. Singhal G.S., Renger G., Sopory, S.K. Irrgang K.D and Govindjee1999. Concept in Photobiology; Photosynthesis and Photomorphogenesis.Narosa Publishing House, New Delhi.
5. Taiz L. and Zeiger E. 1998. Plant Physiology (Second Edition). Sinauer Associates, Inc. Publishes, Massachusetts,USA.
6. Thomas B. and Vince-Prue D. 1997. Photoperiodism in Plants (Second Edition) Academic Press, San Diego,USA.
7. Verma S.K. and Verma Mohit 2007. AText Book of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.
8. Leninger A.C 1987. Principles of Biochmistry, CBS Publishers and Distributers (Indian Reprint)

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