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SCHEME OF EXAMINATION
&
SYLLABUS
of
M.Sc. (Botany) Semester Exam
UNDER
FACULTY OF LIFE SCIENCE
Session 2021-23

(Approved by Board of Studies)
Effective from July 2021

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 **(**Ecosystem 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

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.

SCHEME OF EXAMINATION
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**

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 Mark

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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 microme

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.

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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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 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 Welwistschiale

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.

    Vashista B.R & A.K Sinha 2005. Botany for degree students – Bryophta,S.Chands Publication
16. Sporne. Morphology of Bryophytes, Oxford PublishingHouse
17. Rashid A (1998). An introduction to Bryophyta. First edition, Vikas Publishing House Pvt. Ltd, NewDelhi