

SHIVAJI UNIVERSITY, KOLHAPUR.



Accredited By NAAC with 'A' Grade

Revised Syllabus For

M.Sc. Part-I

Botany

CBCS PATTERN

Syllabus to be implemented from

June, 2019 onwards.

SHIVAJI UNIVERSITY, KOLHAPUR
DEPARTMENT OF BOTANY

M. Sc. BOTANY REVISED SYLLABUS (Choice Based Credit System)

1. The entire course of M. Sc. (Botany) will be of **four Semesters** spread over two years.
2. There shall be **four theory courses** and **four practical courses** in every semester.
3. Each theory course shall have four units and each practical course shall have two units (based on the theory).
4. Each unit in theory course shall comprise 15 lectures each of 60 minutes duration and there shall be four lectures per theory course per week. There shall be one practical (not less than three hours duration) for each theory course per week. Library/Reference-work/ Excursion/Field-work/Seminar/Group Discussion/Project work shall also be organized in every week.
5. Department of Botany shall offer **two elective papers** each of 100 marks for the students of other PG departments of the University. Elective paper shall consist of four units having 60 lectures and will be available to PG Part-II students during Semester III and Semester IV. **The decision regarding the admission to such other departmental students will be made by the Departmental Committee.**
6. There shall be at least a short (up to 3 days) and a long tour (not exceeding 15 days) per year for all M. Sc. Part-I and Part-II students. The long tour may be arranged to a region out of the state covering various Botanical Regions/Research Institutes/Centres etc. Tours are the part of curriculum and are obligatory to each student, failing which they will not be considered eligible to appear for the examination. Under unavoidable circumstances, if the student fails to attend the tour, he/she will be required to produce a justifiable evidence for not attending the tour. However, in lieu of tour the candidate will have to complete the work assigned by the Department.
7. Following documents/materials shall have to be produced by each student at the time of practical examination (at the end of each Semester)
 - i) Submission of a laboratory journal of practical records.
 - ii) Submission of a set of *micro preparations (semi-permanent/permanent) of plant materials illustrating the subject matter of the relevant paper.
 - iii) Submission of a *field record book (**in his/her own handwriting**) duly signed by the concerned teacher and at least 15 herbarium specimens (weeds and cultivated plants)/ preserved specimens collected by the candidate during the field work or excursion tour. Rare, endangered and threatened (RET) plant species should not be collected and used for submission.* wherever applicable.
8. The Department offers following specializations[#] at M. Sc. II (Semester III and IV).
 - Plant Physiology
 - Mycology and Plant Pathology
 - Cytogenetics and Plant Breeding

- Energy, Ecology and Environment
- Angiosperm Taxonomy
- Marine Botany
- Plant Biotechnology
- Plant Protection**
- Plant Diversity**
- Palaeobotany (Presently suspended)

based on the merit, willingness and availability of seats

**offered by the Department of Botany, Yashwantrao Chavan Institute of Science, Satara

9. Entire course of M. Sc. Botany will be of **2400**marks. Every Semester will be of 600 marks [400 marks for theory (four courses) and 200 marks for practical (four courses)].
10. Examination of each **theory course** shall be of **100 marks** [80 (university examination) + 20 (internal examination)]. University examination of 80 marks (03 hours duration) will be conducted at the end of each Semester. Internal examination of 20 marks (comprising 20 multiple choice questions) will be conducted before the semester examination during each semester.
11. Each practical course examination will be of based on the respective theory course and will be of **50 marks** [40 (university examination) + 10 (internal assessment)] Duration of university practical examination shall be of five hours.
12. The question paper of theory course (80 marks) will consist of seven questions, carrying 16 marks each, of which the student shall have to attempt **five** questions. The last question will be **compulsory** consisting of short answer type questions. The types of questions and their distribution will be as follows:
 - i) Descriptive or essay type questions (50 – 60 %)
 - ii) Short answer type questions (20 – 30 %)
13. Examination:

Theory : 1. Internal marks: 20 per theory paper

2. External marks: 80 per theory paper (examination at the end of semester)

Practical: A total of 200 marks' examination will be conducted for practical courses at the end of 1st 2nd and 3rd Semesters. At the end of 4th semester 150 marks examination will be conducted and for 50 marks project work will be evaluated.
14. Project work Evaluation: By Internal and External Examiner at the end of Fourth Semester.

CBCS TEMPLATE FOR M. Sc. I BOTANY - 48 CREDITS

Sr. No.	Courses	Credits
M. Sc. I, Sem I		24
Core Course Botany (CC)	Paper-I (CC-101): Biology and Diversity of Fungi, Algae and Bryophytes – (04) Paper-II (CC-102): Biology and Diversity of Pteridophytes, Gymnosperms and Palaeobotany (04) Paper-III (CC-103): Plant Ecology and Evolution (04) Paper-IV (CC-104): Tools and techniques (04)	
M. Sc. I, Sem I Practical		
Core Course Botany Practical (CCPR)	Practical-I (CCPR-105.1): Biology and Diversity of Fungi, Algae and Bryophytes (02) Practical II (CCPR-105.2): Biology and Diversity of Pteridophytes, Gymnosperms and Palaeobotany (02) Practical -III (CCPR-105.3): Plant Ecology and Evolution (02) -IV (C Practical CPR-105.4): Tools and techniques (02)	
Non CGPA	AEC-106 Ability Enhancement Course (02)	
M. Sc.I, Sem II		24
Core Course Botany (CC)	Paper-V (CC-201): Angiosperm Systematics(04) Paper-VI (CC-202): Plant Pathology(04) Paper-VII (CC-203): Plant Structure Development and Reproduction(04) Paper-VIII (CC-204): Cell and Molecular Biology(04)	
M. Sc.I, Sem II Practical		
Core Course Botany Practical (CCPR)	Practical -V (CCPR-205.1): Angiosperm Systematics(02) Practical -VI (CCPR-205.2): Plant Pathology(02) Practical -VII (CCPR-205.3): Plant Structure Development and Reproduction(02) Practical -VIII (CCPR-205.4): Cell and Molecular Biology(02)	
Non-CGPA	SEC- 206 Skill Enhancement Course (Credit 02)	

M.Sc. PART-I (SEMESTER I)

Paper-I (CCB1): Biology and Diversity of Fungi, Algae and Bryophytes

Total lectures: 60

Unit: I	[15]
Fungi	
General characters of Fungi.	[1]
Classification of Fungi by Hawksworth <i>et al.</i> (1995).	[1]
Biodiversity and Taxonomy of following phyla up to the level of order.	[13]
Phyla	Order
Chytridiomycota	Chytridiales
Zygomycota	Glomales
Ascomycota	Taphrinales, Xylariales, Pezizales
Basidiomycota	Aphyllorphorales, Uredinales, Ustilaginales Phallales, Nidulariales
Unit II:	[15]
Biodiversity and Taxonomy of following phyla up to the level of order	[15]
Oomycota	Saprolegniales, Peronosporales
Hypochytridiomycota	Hypochytriales
Labyrinthulomycota	Labyrinthulales
Plasmodiophoromycota	Plasmodiophoromycetales
Dictyostelliomycota	Dictyostelliales
Myxomycota	Stemonitales
Unit III:	[15]
Algae	
Classification of Algae by Robert Edward Lee (2008)	[2]
Culture, Cultivation and methods of preservation.	[2]
Role of Algae in human welfare	[1]
Structure, Reproduction, Phylogeny and interrelationship with reference to the classes mentioned Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae Phaeophyceae, Rhodophyceae, Chrysophyceae	[10]
Unit IV:	[15]
Bryophytes	
Classification of Bryophytes as per Vashishta <i>et al</i> (2011)	[2]
Origin of Bryophytes	[1]
Distribution, habit, morphology, reproduction, phylogeny, and inter relationship with reference to the orders mentioned	[10]
Sphaerocarpaceae, Takakiales, Jungermanniales, Metzgeriales, Anthocerotales, Sphagnales Andreaeales, Buxbaumiales, Funariales, Polytrichales	

- Economic importance of Bryophytes. [1]
 Bryophytes as indicators of pollution. [1]

Practical I (CCPR-105.1)

Unit I: [15]

Fungi

1. Isolation of fungi from soil, air, water and host, their inoculation on culture media.
 2-6. Detailed study of following types from each of the following orders.

Class	Order	Types
Chytridiomycetes	Chytridiales	Physoderma, Synchytrium
Zygomycetes	Glomales	Glomus
Hemiascomycetes	Taprinales	Taprina
Pyrenomycetes	Clavicipitales	Claviceps
	Xylariales	Xylaria
Discomycetes	Pezizales	Peziza
Teliomycetes	Uredinales	Melampsora, Uromyces
	Ustilaginales	Ustilago
Hymenomycetes	Agaricales	Agaricus.
	Aphyllorphorales	Polyporus
Gasteromycetes	Nidulariales	Cyathus
	Phallales	Phallus
Oomycetes	Saprolegniales	Saprolegnia
	Perenosporales	Plasmopara, Bremia, Albugo.
Plasmodiophoromycetes	Plasmodiophorales	Plasmodiophora (Slide)
Myxomycetes	Stemonitales	Stemonitis

Unit II: [15]

Algae

- 1-3. Study of Algae: classes mentioned in theory paper (available specimens / slides)
 Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae,
 Rhodophyceae, Chrysophyceae

Bryophytes

- 4-6. Morphological, anatomical and reproductive studies of the following orders
 (available specimens / slides)
 Sphaerocarpaceae, Takakiales, Jungermanniales, Metzgeriales, Anthocerotales, Sphagnales
 Andreaeales, Buxbaumiales, Funariales, Polytrichales

Reference Books:

Algae:

- Chapman, V.J. and D. J. Chapman (1965) The Algae
 Desikachary, T.V. (1972) Taxonomy and Biology of Blue -green algae
 Fritsch, F. E. (1965) Structure and Reproduction of Algae

Gangulee, H.C. and A. K. Kar (1992) College Botany Vol. III
Kumar, H.D. and H. N. Singh (1971) Textbook of Algae
Pandey, B. P. (1994) Textbook of Botany – Algae
Sharma, O.P. (1986) Textbook of Algae
Vashista, B. R. (1995) Botany for degree students-Algae
Venkataraman et al. (1974) Algae-Form and Function
Lee R.E. (2008) Phycology, Fourth Edition Cambridge University Press © R.E. Lee 2008

Journals:

Phykos.
Phycologia
Seaweed Research.
Mahasagar
Indian Journal of Marine Biology

Fungi:

Ainsworth, G. G. and A.S. Sussman : The Fungi Vols. I, II, III, IV- A and IV-B
Alexopoulos, C.J. and C. W. Mims (1979) : Introductory Mycology
Bessey, E. A. (1967) : Morphology and Taxonomy of Fungi
Dayal (1995) : Aquatic Fungi of India
Gangulee, H.S. and A. K. Kar (1992) : College Botany Vol. I
Mundkur B.B. and M.J.Trimukchar (1952) :Ustihlaginales of India
Sharma, O.O. (1989) : Textbook of Fungi
Sparrdo F.K. (1960) : Aquatic phycomycetes
Subramanan, C. V. (1971) :Hyphomycetes
Thind K. S. (1977) : The Myxomycetes of India
Alexopoulos C.J., Mims C.W., Blackwell M. (2007) Introductory Mycology (Fourth Edition) Wiley India Pvt. Ltd

Bryophytes:

Cavers, R. (1964) : Inter-relationship of Bryophytes
Chopra, R. N. and P. K. Kumra (1988) : Biology of Bryophytes.
Kashyap, S. R. (1929) : Liverworts of Western Himalayas and the Punjab Plains Part I and II
Parihar, N. S. (1959) : An introduction to Embryophyta. Bol. I –Bryophyta
Ram Udar (1976) : Bryology in India
Smith, G. M. (1955) :Cryptogamic Botany Bol. II
Vashishta, B.R. (1996) : Botany for degree students –Brtophyta
Vashishta B.R., Sinha A.K. and Adarsh Kumar (2011,2016) Botany for Degree Students-Part III
Bryophyta , Revised Edition 2011, Reprint 2016, S, Chand Publishing
Watson, E.V, (1963) : British Mosses and Liverworts
Watson, E.V, (1964) : The Structure and life of Bryopytes

M.Sc. PART-I (SEMESTER I)

Paper-II (CC-102): Biology and Diversity of Pteridophytes, Gymnosperms and Palaeobotany

Total Lectures: 60

Unit I:	[15]
Brief outline of Classification of Pteridophytes (Extant)	(2)
Morphology, anatomy, reproduction, phylogeny and interrelationship of following orders.(Extant)	
Lycopodiales- <i>Lycopodium</i> ,	
Selaginales - <i>Selaginella</i> ,	
Isoetales- <i>Isoetes</i> ,	
Filicales- <i>Microsorium</i> , <i>Pteris</i> ,	
Marattiales- <i>Angiopteris</i> ,	
Salviniales- <i>Salvinia</i> .	(12)
Current trends of research in Pteridophytes : Overview	(1)
Unit II:	[15]
Classification of Gymnosperms (Latest system)	(2)
Study of morphology, anatomy, reproductive organs and affinities of extant members of following orders. Coniferales, Ginkgoales, Taxales, Ephedrales, Welwitschiales	(10)
Applied aspects of Gymnosperms.	(3)
Unit III:	[15]
Morphology anatomy and evolutionary trends in Lepidodendrales and Sphenophylales, Psilophytales, Marattiales, Filicales	(12)
Evolution in reproductive characters of Cycadales	(3)
Unit IV:	[15]
Study of geological time scale.	(2)
Morphology, anatomy and evolutionary trends of following extinct groups.	
Pteridospermales, Bennettitales, Cordaitales, Cycadales,	(10)
Techniques used in the study of different fossil types.	(3)

Practical II (CCPR-105.2)

Unit I:

1-6. Morphological, anatomy and reproductive studies of the following members (available specimens / slides) (Extant) [15]

Lycopodiales	:	<i>Lycopodium</i> ,
Selaginales	:	<i>Selaginella</i>
Isoetales	:	<i>Isoetes</i>
Filicales	:	<i>Microsorium</i> , <i>Pteris</i>
Marattiales	:	<i>Angiopteris</i>
Salviniales	:	<i>Salvinia</i>

Unit II: [15]

- 1-6. Study of the morphology and anatomy of the vegetative and reproductive parts of *Araucaria*, *Cupressus*, *Podocarpus*, and *Ephedra* from available specimens / slides.

Study of following specimens :

- Sigillariales : *Sigillaria* Stem
- Sphenophyllales : *Sphenophyllum* Stem
- Medullosales : *Pachytesta* Seed
- Coniferales : *Elatocladus*,
- Angiosperms : *Sahanianthus* flower

Palaeobotanical Techniques: Peel technique, Palaeopalynological techniques.

Reference :

- Arnold, C.A. 1972. An introduction to paleobotany
Bierhorst, D.W. 1971. Morphology of Vascular plants
Bower, F. O. 1963. The Ferns
Darroh, W.C. 1968. Principles of paleobotany
Eames, A. J. and E. M. Giffard. 1950. Comparative morphology of vascular plants
Jermy, A. G. 1973. The Phylogeny and Classification of ferns.
Parihar, N.S. 1959. An Introduction to Pteridophyta
Rashid, A. 1978. An introduction of Pteridophytes
Spome, K.R. 1966. Morphology of Pteridophytes
Surange, K.R. 1968. Indian Fossil Pteridophytes
Trivedi, A. N. 2002. Advances in Pteridology
Vashishta, B.R. 1996. Botany for degree students – Pteridophytes
Andrews, H.N. 1961. Studies in Paleobotany
Bhatnagar, S.P. and Moitra Alok 1996. The Gymnosperms.
Bhatnagar, S.P. and Moitra Alok. 1975. The Gymnosperms
Bierhorst, D.W. 1971. Morphology of vascular plants
Chamberlein, C.J. 1966. Gymnosperms, Structure and Evolution
Coulter and Chamberlein, J. M. Morphology of Gymnosperms
Darroh, W.C. 1960. Principles of Paleobotany
Foster, A. S. and Gifford, E. M. 1959. Comparative morphology of vascular plants
Ramanujan, C.G.K. 1979. Indian Gymnosperms in Time and Space
Shukla, A.C. and Mishra, S.D. 1975. Essentials of Paleobotany
Spome, K.R. 1967. Morphology of Gymnosperms
Stewart, W. N. 1983. Paleobotany and the evolution of plants, Cambridge U.S.
Vashishta, P.C. 1976. The Gymnosperms

Journals: American Fern Journal

International Journal of plant sciences.

M.Sc. PART-I (SEMESTER I)
Paper-III (CC-103): Plant Ecology and Evolution

Lectures: 60

Unit-I:

(15)

1. Major Ecosystems – types of biomes
2. Terrestrial biomes- grassland , tropical rainforest, temperate deciduous forest.
3. Aquatic biomes – 1. Fresh water ecosystem – Lotic and Lentic
2. Marine ecosystem – ocean, sea, estuary
4. Species interaction: concept of allelopathy, parasitism, mutualism, commensalism, competition and predation

Unit-II: Population and Community Ecology

(15)

1. **Population Ecology:** Characteristics of a population; population growth curves; population regulation, life history strategies (r and K selection); concept of metapopulation - demes and dispersal, interdemec extinctions, age structured populations.
2. **Community Ecology:** Nature of communities; community structure and attributes; level of species diversity and its measurement, edges and ecotones.

Unit- III:

(15)

1. **Ecological Succession:** Types; mechanisms; changes involved in succession, concept of climax.
2. **Emergence of evolutionary thoughts:** Lamarck; Darwin-concepts of variation, adaptation struggle, fitness and natural selection; Spontaneity of mutations; the evolutionary synthesis.

Unit- IV:

(15)

1. **Origin of cells and unicellular evolution :** Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparane and Haldane; Experiment of Miller (1953); The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes.
2. Phytogeographical regions of India, Environmental educational programmes (UNESCO, MAB, Biosphere reserve, UNEP, WWF)

Practical III (CCPR-105.3) Plant Ecology and Evolution

Unit 1:

1. Study of Phytoplankton
2. Evaluation of Abiotic components of Aquatic ecosystem (pH, temperature, Transparency).
3. Determination of Phytomass.
4. Study of species diversity index.
5. Study of Population dynamics
6. Determination of field capacity of Soil

Unit 2:

1. Determination of residual chlorine from water sample.
2. Determination of frequency, Density, Abundance, Dominance and IVI of the plant community.
3. Estimation of DO and free CO₂
4. Study of morphological and anatomical characteristics of plants under pollution stages.
5. Allelopathic analysis of the plants.
6. Preparation of Ecological report.

REFERENCES

1. Patterns of primary production in the biosphere. H.F.W. Lieth (1978).
2. Fundamentals of Ecology. Agarwal S. K. (1992).
3. The Biosphere. Bradbury I. K. (1990)
4. Handbook of Limnology and water pollution with practical methodology Das S. M. (1989).
5. Environment and Plant Ecology. Etherington J. R. (1975).
6. Deterministic mathematical models in population ecology. Freedman H. I.(1980).
7. Quantitative Plant Ecology. Greig Smith P. (1983).
8. Comparative Plant Ecology. Grisms J. P. et .al (1988).
9. Quantitative and dynamic ecology. Kershaw K. S. (1964).
10. Concept of ecology. Kormondy E. J. (1966).
11. Ecology. Krebs C. J. (1978).
12. Manual of plant Ecology. Misra K. C. (1989).
13. Proceedings of the school of plant ecology. Misra R. and Das R. R. (1971).
14. Ecology. Odum E. P. (1971).
15. Fundamentals of Ecology. Odum E. P. (3rd ed. 1996).
16. Fundamentals of Ecology. Odum E. P. and Gary W. Barrett (6th ed. 2010).
17. Principles of Environment Sciences. Pandeya S. C. eta .l (1963).
18. on the Origin of Species. London: John Murray (always seek out the first edition, facsimile version, and avoid later editions). Darwin, C. 1859
19. Genetics and the Origin of Species. New York: Columbia Univ. Press (there are several later editions, and the title changed in the last). Dobzhansky, T. 1937.
20. The Genetical Theory of Natural Selection. Oxford: Oxford Univ. Press (there is a later edition). Fisher, R. A. 1930.
21. Phylogenetic Systematics. Urbana: Univ. Illinois Press (an English translation of a book published earlier in German). Hennig, W. 1966.

M.Sc. PART-I (SEMESTER I)
Paper-IV (CC-104): Tools and techniques

Total Lectures: 60

Unit: I **[15]**

Laboratory discipline: safety and care, experimental report.

SI units, Structure and properties of water: Biological significance. Ionization of water, pH and Buffers. Computers in biology, Internet and Bioinformatics **[05]**

Microscopy: Introduction, The light microscope, Fluorescence microscope, TEM, SEM, Phase contrast, Confocal microscope: Principles and working **[05]**

Biostatistics: Measures of Dispersion and Variability. The variance and coefficient of variation, Correlation and regression, Chi square test for goodness of fit and independence **[05]**

Unit: II **[15]**

Separation Techniques: Centrifugation: Basic principles of centrifugation, types, care and safety aspects of centrifuges, preparative and analytical centrifugation **[04]**

Chromatographic Techniques: Principles, Paper, TLC, Column, HPTLC, HPLC, GC, Affinities **[06]**

Electrophoretic Techniques: General principles, support media, electrophoresis of proteins and nucleic acids, capillary, microchip electrophoresis **[05]**

Unit: III **[15]**

Spectroscopic Techniques: Introduction, principles and applications in UV-Vis, fluorescence and AAS. Infrared and Raman, MALDI-TOF **[09]**

Radioisotope Techniques: Introduction, half-life, units of radio activity, Detection and measurement of radioactivity, autoradiography, counters, safety aspects. **[06]**

Unit: IV **[15]**

Culture Technique: Principles, types (bacterial, fungal, algal, plant) media preparation, sterilization, inoculation, Laminar air flow, autoclaves, thermo bath, and incubators **[06]**

Collection and Preservation of plant material, cryopreservation **[03]**

Immunological techniques: Immune response, Antibody and their specificity, Antigen, antibody interaction, Immuno diffusion, Immuno assay, Western Blotting, **[6]**

Practical IV (CCPR 105.4)

Unit I: [15]

1. Laboratory discipline, safety and care
- 2-3. Preparation of standard solutions, %, M, N, ppm and pH – measurement and preparation of buffers.
4. ANOVA use of computer.
5. Determination of Correlation coefficient.
6. Separation of pigment by chromatographic techniques (TLC/ Column)

Units II: [15]

1. Verification of Beer and Lambert's law
 - 2-3. Separation of proteins by gel electrophoresis
 4. Study of instruments/equipments:- Flame photometer, Any type of Centrifuge, NMR, GC, HPLC, AAS, SEM, TEM.
 5. Density gradient centrifugation – A separation technique
 6. Micrometry
-

REFERENCE:

- Practical cytology, applied genetics and Bio-statistics- Goswami H. K. and R. Goswami. Himalayan Publ. House, Bombay (1993)
- Methods in plant molecular biology – M. A. Schwer and Zeclinskin publ. Academic Press New York (1989)
- Photosynthesis and production in a changing environment. A field and laboratory manual- Hall, Scurlik, Bolhar Nordenkampt, Leagood and Long Chapman and Hall Publ. (1993)
- Experimental plant physiology – J. Arditti and Dunn, Publ. Academic Press (1970).
- Techniques in Bioproductivity and photosynthesis by – Coombs, Hall, Long and Sourlock, Pergamon press Oxford (1985)
- Methods in enzymology- Colowick and Kaplan Academic Press.
- A Handbook of field and herbarium techniques- S. K. Jain and R. R. Rao (1977), New Delhi : Today and Tomorrow's Printers and Publishers, c1977
- Practical Biochemistry: Principles and Techniques. Ed. E. Wilson and J. Walker (2000) Cambridge Publ.
- Modern Experimental Biochemistry-Boyer, R.(2005). Pearsa, Education, Singapore.
- Methods in Experimental Biology.-Ralph, R. (1975).Blakie, London
- An Introduction to Biometry- Mungikar, A. M. (1997), Saraswati Printing Press Aurangabad.
- Research Methodology For Biological Sciences (01 Edition, 2013)- Gurumani, N. (2013), MJP Publishers
- Botanical histochemistry: principles and practice- William A. Jensen (1962), W. H. Freeman, 1962 the University of Michigan
- Flow Cytometry : First Principles (Second Edition)- Givan A.L. (2001), Wiley-Liss, Inc.
- Flow Cytometry Protocols (2nd edition), Methods in Molecular Biology (Volume 263)- Editors Hawley T.S. and Hawley R.G. (2004), Totowa, NJ: Humana Press
- Handbook of Histopathological and Histochemical Techniques (Including Museum Techniques) (Third Edition)- Culling C.F.A. (1974), Elsevier Ltd.

Non CGPA Ability Enhancement Course (AEC-106) – Credit 02

M.Sc. PART- I (SEMESTER II)

Paper-V (CC-201): Angiosperm Systematics

Total lectures: 60

Unit I:

[15]

TAXONOMY: Introduction, aims, principles and importance of taxonomy in charting, documentation, Bioprospecting, CBD implementation, conservation and sustainable use of plants. (5)

TAXONOMIC TOOLS: Herbarium, Botanical Gardens and their role in teaching, research and conservation; important herbaria and botanical gardens of the world and India, Important websites for taxonomic literature. (5)

INTERNATIONAL CODE OF NOMENCLATURE OF ALGAE FUNGI AND PLANTS (ICN): Brief history, Principles, Scientific names, Principle of priority, typification, valid and effective publication, nominaconservanda, nominarejicienda. (5)

Unit-II.

[15]

EVOLUTIONARY CONCEPTS: Key concepts in evolution- origin of intra-population variations, population and environment, general biological principle, transference of function, adaptive radiations, punctuated equilibrium.(5)

PLANT SPECIATION: Morphological and biological species concept; allopatric, abrupt, sympatric, hybrid and apomictic speciation. (5)

REPRODUCTIVE ISOLATING MECHANISMS: Premating- temporal, habitat, floral, reproductive mode; post mating, prezygotic- incompatibility; post mating, postzygotic- incompatibility, hybrid inviability, hybrid floral isolation, hybrid sterility, hybrid breakdown. (5)

Unit III:

[15]

TAXOMETRICS: Principles, Numerical taxonomy, methodology, merits and demerits (4)

CLADISTICS: Principles, cladistic approach in plant classification, methodology, merits and demerits (4)

SYSTEMS OF ANGIOSPERM CLASSIFICATION: brief historical account of systems of classification, phylogenetic systems of angiosperm classification- Cronquist's systems of classification (up to subclass level), Angiosperm Phylogeny group, APG IV (2016) classification (7)

Unit IV:

[15]

FAMILIES OF ANGIOSPERMS: characteristic features, interrelationships, economic importance and classification as per APG-IV of the following groups and families:

ANITA grade: Amborellaceae, Nymphaeaceae, Hydatellaceae;

MAGNOLIIDS: Magnoliaceae,

MONOCOTS: Araceae,

COMMELINOIDS: Arecaceae,

EUDICOTS: Papaveraceae,

CORE EUDICOTS: Amaranthaceae,

EUROSIDS-I: Malpighiaceae,

EUROSID-II: Malvaceae,

ASTERIDS: Sapotaceae,

EUASTERIDS-I: Gentianaceae, Acanthaceae,
EUASTERID-II: Apiaceae, Asteraceae.

[15]

Practical V (CCPR-205.1)

Unit I:

1-5: Study of general characteristic features, diagnostic characters, floral diagram, floral formula and classification of flowering plant families: Amborellaceae, Nymphaeaceae, Hydatellaceae, Magnoliaceae, Araceae, Arecaceae, Poaceae, Papaveraceae, Amaranthaceae and Malpighiaceae as per APG-IV.

Unit II:

6-8: Study of general characteristic features, diagnostic characters, floral diagram, floral formula and classification of flowering plant families: Malvaceae, Sapotaceae, Gentianaceae, Acanthaceae, Apiaceae and Asteraceae as per APG-IV.

9: Identification of genus and species of locally available wild plants using regional and state floras. (At least 10 plants species belonging to locally available families of flowering plants)

10: Preparation of dichotomous keys (indented and bracketed) for identification of taxa.

11: Field trips within and around the University campus, compilation of field notes and preparation of herbarium sheets of weeds.

Reference Books:

Briggs David 2009. *Plant microevolution and Conservation in Human-influenced Ecosystems.* Cambridge University Press.

Cronquist, A. 1981. *An Integrated System of Classification of Flowering Plants* Columbia University Press, New York.

Cronquist, A. 1988. *The Evolution and Classification of Flowering Plants* (2nded.) Allen Press, U.S.A.

Davis, P. H. and V. H. Heywood 1991. *Principles of Angiosperm Taxonomy.* Today and Tomorrow Publications, New Delhi.

Hutchinson, J. 1959. *Families of Flowering plants.*

Judd W. S., Campbell, C. S., Kellogg, E. A., Stevens P. F. and M. J. Donoghue 2008. *Plant Systematics: A phylogenetic Approach.* Sunderland, Massachusetts, USA.

Lawrence George H. M. 1951. *Taxonomy of Vascular Plants.* Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi.

Leadlay E. and S. Jury (ed.) 2006. *Taxonomy and Plant conservation.* Cambridge University Press.

Manilal, K. S. and M. S. Muktesh Kumar [ed.] 1998. *A Handbook of Taxonomic Training.* DST, New Delhi.

Naik, V. N. 1984. *Taxonomy of Angiosperms.* Tata McGraw-Hill Publication Com. Ltd. New Delhi

Quicke, Donald, L. J. 1993. *Principles and Techniques of Contemporary Taxonomy.* Blakie Academic & Professional, London

Simpson M. G. 2006. *Plant systematics* (Second Edition) Elsevier.

Takhtajan, A. 1962. *Flowering plants- Origin and Dispersal.*

Taylor, D. V. and L. J. Hickey 1997. *Flowering Plants: Origin, Evolution and Phylogeny.* CBS Publishers & Distributers, New Delhi.

M.Sc. PART -I (SEMESTER II)
Paper-VI (CC-202): Plant Pathology

Total Lectures: 60

UNIT: I

[15]

1. History of plant diseases, beginning of modern plant pathology, Contributions of Prevost, Anton De Bary, Kuhn, Woronin, S. D. Garrett, J. G. Horsefall, K.C. Mehta, T. S. Sadavasivan, M. J. Trimulachari and A. Mahadevan.
2. Symptomology and Epidemiology: Disease identification based on symptoms, (external and internal). Epidemiology: epiphytotic (Slow and rapid), disease forecasting.
3. Methods of Studying plant diseases and their diagnosis: Field observation, collection of samples, laboratory studies, culturing of pathogenic organisms (fungi, bacteria and mycoplasma), Koch's postulates.
4. Stages of disease development: Pre penetration, Penetration, post penetration and colonization. Role of environmental factors in disease development. Defence mechanism in host: Structural, physiological, genetical and chemical.

UNIT: II

[15]

1. Introductory Virology: History of virology, Nomenclature and classification of plant viruses, ultrastructure of TMV, TYMV and Bacteriophages. Chemistry of plant viruses, isolation and purification of plant viruses. Economic importance of viruses.
2. MLO: Classification, morphology and characteristics of MLO's Identification techniques of MLO's
3. History, symptomology, causal organism, etiology and management of Viral and MLO diseases: Banana, Brinjal, Chilly, Tomato, Bhendi, Sugarcane, Beans, Papaya and Tobacco

UNIT: III

[15]

History, symptomology, causal organism, etiology and management of fungal and bacterial diseases: Rice, Jowar, Wheat, Bajra, Sugarcane, Pigeonpea, Rajmah, Tomato, Cabbage, Bhendi, Brinjal, Cucurbits, Chilli, Onion, Ginger and Turmeric.

UNIT: IV

[15]

History, symptomology, causal organism, etiology and management of fungal and bacterial diseases: Maize, Cotton, Sunflower, Groundnut, Soybean, Sesamum, Banana, Grapes, Mango, Coconut, Coffee, Teak, Dalbergia, Pomegranate, Bamboo, Gerbera and Rose.

Practical VI : (CCPR-205.2)

UNIT: I

1-6 Fungal Diseases:

Club root, Damping off, White rust, Early and late Blight, Downy mildew, Powdery mildew, Smut, Rust, Bunt, Blast, leaf spot, Tikka, Anthracnose, Die back, Rot and Wilt.

UNIT: II

7. Bacterial Diseases: Bacterial Blight of Pomegranate and Leaf Spot. Mycoplasma Diseases : Grassy shoot disease and Little leaf

8. Viral Disease: TMV, PMV and YVMV. Phanerogamic plant Diseases: Total and Partial root and stem parasites

9. Nematode Disease: Root knot

10-12 Estimation of chlorophylls, sugars and polyphenols from healthy and infected leaves.

Reference Books:

Agrios, G. N. 2006: Plant Pathology, 5th Edition

Aneja, K. R. 1993. : Experiments in Microbiology, plant pathology and Tissue culture.

Cooke, A. A. 1981. Diseases of Tropical and Subtropical field, Fiber and oil plants

Gangopadhyay, S. 2004: Clinical Plant Pathology

Kuijit, J. 1969: The Biology of parasitic flowering plants.

Mahadevan, A. and R. Shridhar, 1982. Methods in physiological plant pathology **Agarwal**

A. and Mehrotra, R. S. 2012: Plant Pathology

Nyvall, R. F. 1979 : Field Crop Diseases Handbook

Paul Khurama, S. M. 1998: Pathological Problems of Economic crop plants and their management

Planke, J. E. and, 1968: Disease Resistance in plants.

Planke, J. E. Vander. 1963: Plant Diseases Epidemics and control.

Rangaswami, G. 1979: Diseases of crop plants in India.

Singh R. S. 2009: Plant Diseases, 9th Edition.

Current and back – Volumes of following periodicals:

1. Journal of phytopathology
2. Indian journal of phytopathology
3. Journal of Mycology and plant pathology
4. Annual review of plant pathology

M. Sc PART-I (SEMESTER II)

PAPER-VII (CC-203): PLANT STRUCTURE DEVELOPMENT AND REPRODUCTION

Lectures 60

Unit I:

[15]

Gametophyte in Angiosperms: outline of development of male and female gametophyte.

Pollen: Structure of stigma and style, chemotropism, pollen wall proteins, stigma surface proteins, post fertilization events.

Apomixis: Types and significance

Unit II:

[15]

Gametogenesis, fertilization and early development: Production of gametes, embryo sac development and double fertilization in plants; zygote formation, embryogenesis, establishment of symmetry in plants; seed formation and germination.

Polyembryony: Classification and importance

Unit III :

[15]

Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristems; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in *Arabidopsis* and *Antirrhinum*.

Unit IV:

[15]

Palynology: Scope and branches with special suggested readings

Palynotaxonomy: Pollen morphology and plant taxonomy with suggested readings to Gymnosperms and Angiosperms.

Paleopalynology: Principles, microfossil recovery theory and techniques, microfossil groups and oil exploration.

Aeropalynology: Principles, techniques, pollen analysis, pollen and spore allergy, allergic properties of pollen, pollen calendar and importance.

Melittopalynology: Bee colony, foraging behaviour of bees, unifloral and multifloral honey, application in crop productivity.

Agropalynology: Pollen viability, pollen germination, pollen storage and their significance.

Practical VII (CCPR-205.3)

PLANT STRUCTURE DEVELOPMENT AND REPRODUCTION (Credits -02)

Unit 1

1. Study of living shoot apices by dissection using aquatic plants (*Ceratophyllum* and *Hydrilla*)
2. Study of different types of stomata
3. Study of different types of trichomes.
4. Study of ultrastructure of male gametophyte with the help of slides and microphotographs.
5. Study of ultrastructure of female gametophyte with the help of slides and microphotographs.
6. Study of few apomicts with the help of any suitable material.

Unit 2

1. Study of polyembryonic seeds. (Mango, Citrus)
 2. Study of pollen morphotypes (by at least 6 examples)
 3. Study of aerospores by Gravity slide method and preparation of pollen calendar.
 4. Study of allergic plants and their pollen.
 5. Study of fertility by TTC (or Acetocarmine method)
 6. Study of Pollen germination.
-

Reference Books:-

Embryology:

1. Maheshwari, P. 1950 :An introduction to the embryology of Angiosperm.
2. Maheshwari, P.1963 : Recent advances on the embryology of Angiosperm.
3. Johari, B M. 1963 : Experimental embryology of vascular plants.
4. Stanley, R G and F.L. Linkens 1974: Pollen biology, Biochemistry management
5. Shivanna, K. R. and B M Johari 1989: The Angiosperm pollen, structure

Anatomy:

1. Barnova, M A. 1987: Historical developments of the present classification of morphological types of stomata. Bot.Res.53:53-79.
2. Cutter, E G 1971 Plant Anatomy
3. Dilcher, D D 1974: Approaches to the identification of angiosperms leaf remains. Bot.Rev. 40:2- 157
4. Emmes, E J. and M C Daniels, 1947: An introduction to plant anatomy.
5. Easau, K. 1962: Plant anatomy –anatomy of seed plants.
6. Fahn, A.1969: Secretory Tissue system
7. Foster, A S 1942: Practical plant anatomy
8. Haberland, G.1965: Physiological
9. Masueth, J D. 1936 : Plant anatomy
10. Metcalfe, C R and L Chalk, 1950: Anatomy of the dicotyledons
11. Solender, H. 1908 : Systematics anatomy of the dicots
12. Tomlinson, P S 1961: Anatomy of the monocotyledons.

Palynology

1. Cunningham, D D 1873 : Microscopic examination of air.
2. Fageri, K and J Inversen, 1964: Text book of pollen analysis.
3. Nair, P K K 1964 : Advances in Palynology.
4. Nair, P K K 1966 : Essentials of Palynology.
5. Heslop-Harrison, Y. 1971: Pollen development and physiology.
6. Gregory, P H, 1973: Microbiology of atmosphere.
7. Erdtman, G.1988 : Pollen morphology and plant taxonomy.
8. Tilak, S T. 1989 : Airborne pollen and fungal spores.
9. Shivanna K R and N S Rangaswami 1992 : Pollen Biology, A Laboratory manual.
10. Bhattacharya, K. , M R Majumdar and S G Bhattacharya 2006: A Text book of Palynology.

11. Shivanna K R and B M Johari,1985: The Angiosperm Pollen, structure and function.
12. Pandey and Chadha, 1992: Plant Anatomy and Embryology .

Journals:

1. Journal of Plant Sciences,
2. Experimental Biology
3. Developmental Biology
4. Phytomorphology
5. Currents sciences
6. Plant Biology
7. Int. Journal of Plant Sciences
8. Pollen Biology and Fertilization
9. Pollen Morphology
10. Journal of Palaeontology

M.Sc. PART-I (SEMESTER II)
Paper-VIII (CC-204): Cell and Molecular Biology

Total Lectures: 60

Unit I:

[15]

Dynamic cell: General account of plant cell structure and its organization, cell organelles- their structure and functions.

Plasma membrane : Structure, models and functions, sites for ATP ion carriers, channels and pumps, receptors, transport

Plasmodesmata : structure, role in movement of molecules.

Unit II:

[15]

Cell shape and motility: The cytoskeleton, organization and role of microtubules and microfilaments, motor movements.

Cell division: Mitosis and meiosis

Cell cycle: Cell cycle control system, cell cycle check points, Cyclin dependent kinases and cyclines.

Concept of gene, DNA replication in Prokaryotes and Eukaryotes, Reverse transcription, DNA modification and repair.

Unit III:

[15]

Cell signaling :

Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors.

Signal transduction pathways, secondary Messengers.

Regulation of signaling pathways,

Two component systems of signalling : Bacterial and plant

Light signaling in plants.

Unit IV:

[15]

Cellular communication:

General principles of cell communication, Cell adhesion and role of different adhesion molecules, Gap junctions, Extracellular matrix and integrins.

Cell apoptosis: Intrinsic and Extrinsic pathways.

Practical VIII (CCPR-205.4)

Unit I:

1-2. DNA isolation.

3. DNA separation by Gel electrophoresis

4. DNA estimation.

5. Preparation of feulgen stained chromosomes in root tip cells.

6. Demonstration of SEM

Unit II:

1. Demonstration of PCR
 2. Isolation and estimation of protein from seeds.
 - 3-4. Separation of proteins – by Electrophoresis.
 - 5-6. Study of enzyme activity: ATPase, Peroxidase, Catalase
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Reference Books :

- Johnson Lewys – 2004 : Cell Biology ; sarup and sons, New Delhi
- E.J. Dupraw – 1970 : Cell and Molecular Biology; Academic Press, London
- De Robertis and De Robertis – 1997 : Cell and Molecular Biology (VIII); B.I. Waverly Pvt. Ltd., New Delhi
- C. P. Swanson, T. Merz, and W.J. Young – 1982 :Cytogenetics ; Prentice – Hall of India Pvt. Ltd., New Delhi
- P.C.L. John (Ed.) – 1981 : The cell cycle; Cambridge University press
- Benjamin Lewin : Genes – VI, VII and VIII ; Oxford Press.
- R. A. Chapoldi 1977 : Membrane proteins and their interactions with lipids; Marcel Dekker, inc. N. York
- A. N. Mortonosi (Ed.) – 1985 : The enzymes of Biological Membranes Vol. I, II and III; Plenum press, New York
- Watson and others – 2004 : Molecular Biology of the gene (V); pearseEducations, Inc India
- P.C. Turner and others – 2002 : Molecular Biology (II); Viva Books, Pvt. Ltd., New Delhi.
- W. Ream and K. G. Field – 1999 : Molecular Biology Techniques ; Academic Press, London.
- Brace Albertsetal – 1983 : Molecular Biology of the cell ; Garland Publ. Inc., New York.
- Charlothe J. Avers – 1986 : Molecular cell Biology ; Addison. Wesley Publ. Company
- SandhyaMitra – 1988 : Elements of Molecular Biology ; McMillan India Ltd., N. Delhi
- C. B. Powar – 1992 : Cell Biology; Himalaya Publishing House.

Journals:

- Annual review of plant Biology
- Cell
- Cytologia
- Journal of Genetics
- The Journal of cytology and Genetics
- Journal of Experimental Biology
- The journal of Biochemistry
- Indian journal of Biochemistry and Biophysics.
- Trends in Biotechnology

Non CGPA SEC-206 Compulsory Skill Enhancement course (Credit 02)
