



SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]

[Accredited by NAAC with 'A' Grade with CGPA of 3.27]

[Recognized 2(f) & 12(B) Status under UGC Act of 1956]

Katteri – 636 902, Uthangarai (Tk), Krishnagiri (Dt)

Tamil Nadu, India

Website: www.svmcugi.com

E-mail: svmcbotany2015@gmail.com



DEGREE OF MASTER OF SCIENCE IN BOTANY CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS FOR

M.Sc. BOTANY PROGRAMME

(SEMESTER PATTERN)

(For Students Admitted in the College from the
Academic Year 2021-2022 Onwards)



Programme Outcomes (POs)

PO1	Able to comprehend basic principles of Botany.
PO2	Explain concept and current applications of plant sciences and advances in the relevant subject areas including microbial, environmental, food, pharmaceutical and ethno medical sciences.
PO3	Describe structure and reproduction of different forms of plant life from lower to higher group and to compare life cycles of various groups of plants.
PO4	Explore quantitative parameters of plant community.
PO5	Provide importance to technical terms in all branches of botany and construct floral formula and floral diagram of a flower.
PO6	Acquire knowledge pertaining to analysis data and interpret biological results.
PO7	Demonstrate principles and practical experience of a wide range of biochemical techniques in plant science innovations.
PO8	Understand scope of Botany for further education, research and employment approaches and to manage projects in multidisciplinary.



Programme Specific Outcomes (PSOs)

PSO1	Students will gain in depth knowledge about lower forms, morphology, taxonomy, anatomy and embryology of plants towards their identification and classification to involve plants further in biochemical and pharmaceutical aspects.
PSO2	Students will be able to apply biostatistics & bioinformatics tools and biophysical principles for the analysis of relevant biological situations and develop intellectual skills on biological data and databases.
PSO3	Students will acquire knowledge to explicate ecological interlinking of life on earth by studying energy and nutrient flow through the environment. They will be able to correlate physical features of the environment with structure of populations, communities and ecosystem.
PSO4	Students will gain basic knowledge on local, rare, endangered, endemic, and exotic medicinal plants, their therapeutic values and cultivation practices for their effective conservation.
PSO5	Students will be able to inter-relate integral and ubiquitous role of microbes with their environment. Students will acquire knowledge to recognize plant diseases and their management in economically important crop plants.



SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Master of Science (B.Sc.) in Botany

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2021-2022 Onwards)

Sl. No.	Nature of the Course	Course Code	Name of the Course	Hours / Week	Credit	Marks		
						CIA	ESE	Total
SEMESTER I								
1	Core – I	21PBO1C01	Plant Diversity – I (Algae, Fungi, Lichens and Bryophytes)	6	5	25	75	100
2	Core – II	21PBO1C02	Plant Diversity – II (Pteridophytes, Gymnosperms and Paleobotany)	6	5	25	75	100
3	Core – III	21PBO1C03	Microbiology and Plant Pathology	5	4	25	75	100
4	Core Practical – I	21PBO1P01	Practical – I (Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms, Paleobotany, Microbiology and Plant Pathology)	9	4	40	60	100
5	Elective – I	21PBO1E01	Algal Biotechnology	4	4	25	75	100
Total				30	22	140	360	500
SEMESTER II								
6	Core – IV	21PBO2C04	Plant Systematics	5	4	25	75	100
7	Core – V	21PBO2C05	Anatomy of Angiosperms, Embryology of Angiosperms and Plant Microtechniques	5	5	25	75	100
8	Core – VI	21PBO2C06	Cell Biology, Genetics and Molecular Biology	5	5	25	75	100
9	EDC	---	Extra Disciplinary Course (EDC) (Other than Botany Major Subject)	4	4	25	75	100
10	Common Course	21P2HR01	Human Rights	2	2	25	75	100
11	Core Practical – II	21PBO2P02	Practical – II (Plant Systematics)	3	3	40	60	100
12	Core Practical – III	21PBO2P03	Practical – III (Anatomy of Angiosperms,	6	4	40	60	100



			Embryology of Angiosperms Plant Microtechniques, Cell Biology, Genetics and Molecular Biology)					
Total				30	27	205	495	700
SEMESTER III								
13	Core – VII	21PBO3C07	Ecology, Phytogeography and Remote Sensing	6	4	25	75	100
14	Core – VIII	21PBO3C08	Plant Biotechnology and Nanotechnology	6	4	25	75	100
15	Elective – II	21PBO3E02	Herbal Technology	6	4	25	75	100
16	Elective – III	21PBO3E03	Wood Technology	6	4	25	75	100
17	Core Practical– IV	21PBO3P04	Practical – IV (Ecology, Phytogeography, Remote Sensing, Plant Biotechnology and Nanotechnology)	6	4	40	60	100
18	Internship	21PBO3IN01	Internship	-	-	-	-	-
Total				30	20	140	360	500
SEMESTER IV								
19	Core – IX	21PBO4C09	Plant Physiology, Plant Biochemistry and Biophysics	6	4	25	75	100
20	Core – X	21PBO4C10	Research methodology, Bioinstrumentation, Biostatistics and Bioinformatics	6	4	25	75	100
21	Elective – IV	21PBO4E04	Horticulture and Forestry	6	4	25	75	100
22	Project	21PBO4PR01	Project Work	6	5	40	60	100
23	Core Practical – V	21PBO4P05	Practical – V (Plant Physiology, Plant Biochemistry, Biophysics, Bioinstrumentation, Biostatistics and Bioinformatics)	6	4	40	60	100
Total				30	21	155	345	500
Cumulative Total				120	90	640	1560	2200

*Core Practical Examinations will be conducted at the end of every semester.



Sl. No.	Extra Disciplinary Course (EDC) (Other than Botany major students)							
1	EDC	21PBO2EDC01	Horticulture	4	4	25	75	100
		21PBO2EDC02	Herbal Botany	4	4	25	75	100

Note:

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

SWAYAM – Study Webs of Active-Learning for Young Aspiring Minds

NPTEL – National Programme on Technology Enhanced Learning

Major Elective Courses

1. Algal Biotechnology
2. Herbal Technology
3. Wood Technology
4. Horticulture and Forestry

Common Course

1. Human rights

Extra Disciplinary Courses (EDC)

1. Horticulture
2. Herbal Botany



PROGRAMME SYLLABUS



Program: M.Sc. Botany				
Core – I		Course Code: 21PBO1C01		Course Title: Plant Diversity – I (Algae, Fungi, Lichens and Bryophytes)
Semester I	Hours/Week 6	Total Hours 90	Credits 5	Total Marks 100

Course Objectives

1. To enhance the knowledge on diverse assemblage of lower plant groups.
2. To gain insight about life cycles of various algae, fungi, lichen and bryophytes.
3. To analyze the importance of lower plant groups.
4. To evaluate economic importance of lower plant groups.

UNIT – I

Algae: Classification of algae by F.E. Fritsch (1935-45). General characteristic features of algae. Thallus organization in algae. General features of following classes: Chlorophyceae, Xanthophyceae, Chrysophyceae, Bacillariophyceae, Cryptophyceae, Dinophyceae, Chloromonadineae, Euglenophyceae, Phaeophyceae, Rhodophyceae and Cyanophyceae.

UNIT – II

Structure, reproduction and life history of the following genera: *Oscillatoria*, *Navicula*, *Ulva*, *Padina* and *Gracilaria*. Economic importance of algae.

UNIT – III

Fungi: Classification of Fungi by G. C. Ainsworth (1966). Heterothallism in fungi, sexuality in fungi, Parasexuality, sex hormones in fungi. Mycorrhizal fungi, Economic importance of fungi. Structure, reproduction and life cycle of the following genera: *Rhizopus*, *Taphrina*, *Polyporus* and *Fusarium*.

UNIT – IV

Lichens: Classification: Structure of the thallus, nutrition, asexual reproduction, sexual reproduction, structure of apothecium and economic importance of Lichens.

**UNIT – V**

Bryophytes: Classification of Bryophytes by E.V. Watson (1971). General characteristic features of Bryophytes: Hepaticopsida, Anthocerotopsida and Bryopsida. Economic importance of Bryophytes. Structure, reproduction and life cycle of the following genera: *Targionia*, *Porella* and *Polytrichum*.

Text Books

1. Alam, A. (2020). Contemporary Research on Bryophytes Book Series: Recent Advances in Botanical Science.
2. Aziz, F and Rasheed, R (2019). A Course Book of Algae. Publisher: University of Sulaimani, Iraq.
3. Bessey, E.A. (1950), Morphology and Taxonomy of Fungi. : London, Constable & Company, Limited; the Blakiston Company, Philadelphia.
4. Chopra, R.N. Kumar, P.K. (1988). Biology of Bryophytes. John Wiley, New York.
5. Dinabandhu, S and Kaushik. B.D. (2012). Algal Biotechnology and Environment. I.K. International, New Delhi.
6. Hale, M.E. (1961). A Hand Book of Lichens. University of California Press. London
7. John Webster and Roland W.S. Weber. (1985), Introduction to Fungi. Third Edition. Cambridge University Press. London
8. Mahendra Rai. (2009). Advances in Fungal Biotechnology. I.K. International Publishing, House, New Delhi.
9. Mihir Kumar, D. (2010). Algal Biotechnology. *Daya Publishing House*, New Delhi.
10. Parihar, N.S. (1987). An Introduction to Embryophyta Volume 1 Bryophyta, Central Book Depot, Allahabad.
11. Sahoo, D. (2000). Farming the Ocean: Seaweeds Cultivation and Utilization. Aravali International, New Delhi.
12. Sambamurthy, A.V.S.S. (2005). A Text of Alga. I.K. International Publishing House Pvt. Ltd. New Delhi.
13. Sharma, O.P. (1986) A Text Book of Algae. McGrawHill, New Delhi.
14. Sharma, O.P. (2011). Diversity of Microbes and Cryptogams/Algae. Tata Mc Graw Hill Education Private Ltd., New Delhi.



15. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
16. Vashishta, B.R., Sinha A.K and Singh V.P. (2008). Botany for Degree Students. Algae. S.Chand and Co, New Delhi.
17. Vashishta, P.C. (2014). Botany for Degree Students Bryophytes. Chand & Company Ltd., New Delhi.
18. Vashishta, P.C. (2014). S.Chand & Company Ltd., New Delhi.
19. Watson, E.V. (1971). The Structure and Life of Bryophytes. Hutchinson and Co. London.

Reference Books

1. Fritsch, F.E. (1935). Structure and Reproduction of algae. Vol I and Vol II, Cambridge University Press. Cambridge.
2. Graham, L.E. (1993). Origin of Land Plants, John Wiley and Sons Inc. New York.
3. Hojnacka, K., Wieczorek, P.P., Schroeder, G., Michalak, I. (Eds.) (2018). Algae Biomass: Characteristics and Applications. Developments in Applied Phycology.
4. Pelzer, M.J., Chan, E.C.S and Krieg, N.R. (1983). Microbiology, Tata MaGraw Hill Publishing House, New Delhi.
5. Puri, P. (1980). Bryophytes. Atma Ram and Sons, New Delhi.
6. Round, F.E. (1981). The Ecology of Algae. CUP, Cambridge.
7. South, G.R. and Whittick, A. (1987). Introduction to Phycology, Blackwell Scientific Publications. Oxford.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Identify and describe primitive plants such as algal, fungi and bryophytes.	K1
CO2	Summarize the classification of lower plant groups	K2
CO3	Illustrate the morphology and reproduction of selected algae, bryophytes and fungal forms.	K3
CO4	Find out the economic and ecological importance of lower group of plants.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core – II		Course Code: 21PBO1C02	Course Title: Plant Diversity – II (Pteridophytes, Gymnosperms and Paleobotany)	
Semester I	Hours/Week 6	Total Hours 90	Credits 5	Total Marks 100

Course Objectives

1. To learn the classification, structure and organization of lower vascular plants.
2. To outline the transition of lower vascular plants.
3. To understand their reproduction and life cycle pattern.
4. To study the primitive and advanced features of living and fossil forms.

UNIT – I

Pteridophytes: General characteristics and classification (Reimer, 1954). Apospory – Apogamy, Origin and evolution of stele and soral evolution. Homospory, Heterospory and seed habit. Telome theory and morphogenesis. Economic importance of Pteridophytes.

UNIT – II

Range of Morphology, Structure, Reproduction and Evolution of Gametophytes and Sporophytes of following genera: *Angiopteris*, *Polypodium*, *Osmunda*, *Salvinia* and *Isoetes*

UNIT – III

Gymnosperms: General characters – Structure – Anatomy - Reproduction, Phylogeny. Classification (K.R. Sporne, 1954). Economic importance of Gymnosperms.

UNIT – IV

Structure (Exomorphic and endomorphic) - reproduction and life history of the following genera: *Araucaria*, *Cupressus* and *Gnetum*.

UNIT – V

Paleobotany: Study of fossils – Importance of Fossils: Formation and types of fossils, techniques of study of fossils, geological time scale. Applied aspects of paleobotany; use in coal and petroleum exploration. Study of organ genera: *Lepidocarpon*, *Pentoxylon*, and *Cordaites*.



Text Books

1. Bhatnagar and Moitra, (1996). Gymnosperms. New age International Publishers, New Delhi.
2. Bhatnagar, S.P and Moitra, A. (1996). Gymnosperms, New Age Int. Pvt. Ltd., New Delhi.
3. Biswas, C. and Johri, B.M. (2004). The Gymnosperms. Narosa Publishing House, New Delhi.
4. Johri, R.M. Snehlata and Sandhya Sharma, (2004). A Textbook of Pteridophyta. Vedams Books (P) Ltd., New Delhi.
5. Johri, RM, Lata S, Tyagi K (2005). A text book of Gymnosperms, Dominate Pub and Distributer, New Delhi.
6. Rasheed, A. (1999). An Introduction to Pteridophyta, Vikas Publishing Co., New Delhi.
7. Raup, D.M and Steven, M. Stanley. 2004. Principles of paleontology. San Francisco, London.
8. Sharma, O.P. (2006). Pteridophyta. Tata McGraw-Hill Education, New York.
9. Sharma, O.P. (2012). Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi.
10. Smith, G.M. (1955). Cryptogamic Botany Vol. II, Tata Mcgraw Hill Publishing Co. Ltd., New Delhi.
11. Sporne, K.R. (1991). The Morphology of Gymnosperm. B.I. Publications, New Delhi.
12. Stewart, W.N and Rathwell, G.W. (1993). Paleobotany and the Evolution of Plants. Cambridge University Press.
13. Vashishta, P.C., Sinha and Anilkumar (2010). Pteridophytes, S. Chand & Company Ltd, New Delhi.
14. Vashishta. P.C.(1990). Pteridophyta, S. Chand & Co. Ltd, New Delhi.
15. Vashista, P.C. (1976). Gymnosperms, S.Chand & Co. New Delhi.
16. Vashishta, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India. W.H. Freeman Edition, New York.

Reference Books

1. Arnold C.A. (1972). An introduction to Paleobotany, McGraw-Hill Publishers. New York.
2. Arora M.P. (1990). Evolutionary biology, Himalaya Publication House, New Delhi.
3. Atchlay W.R. and Woodnuff D.S. (1981). Evolution and Speciation, Cambridge University Press, Cambridge.
4. Bierhost, D.W. (1971). Morphology of Vascular plants. McMillan Company, New York.
5. Bower. F.O. (1939). The Ferns (Vol. I, II & III), Today & Tomorrow's Printers, New Delhi.



6. Chamberlain, C.J. (1934). *Gymnosperms: Structure and Evolution*. Chicago Reprinted (1950) New York.
7. Delveloryas, T. (1962). *Morphology and Evolution of Fossil Plants*. Holt, Rinehart and Winston, New York.
8. Doyle, W.T. (1970). *Non Vascular Plants: Form and Function*. Belmont, California.
9. Eames, A.J. (1936). *Morphology of Vascular Plants Lower groups*, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
10. Foster and Gifford, Jr., (1962). *Comparative Morphology of Vascular Plants*. Allied Pacific Pvt. Ltd., Bombay.
11. Sporne, K.R. (1970). *The morphology of Pteridophytes (The structure of Ferns and Allied Plants)* Hutchinson University, London.
12. Sporne, K.R. (1972). *The Morphology of Pteridophytes*, B.I. Publications, Madras.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Recognize various forms of pteridophytes and gymnosperms.	K1
CO2	Understand the characteristics features and classification of pteridophytes and gymnosperms.	K2
CO3	Illustrate the morphology and reproduction of selected pteridophytes and gymnosperms.	K3
CO4	Analyze the chronological events by studying the fossils.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core – III		Course Code: 21PBO1C03	Course Title: Microbiology and Plant Pathology	
Semester I	Hours/Week 5	Total Hours 75	Credits 4	Total Marks 100

Course Objectives

1. To understand growth and morphology of microbes.
2. To disseminate knowledge on cultural techniques of microorganisms.
3. To understand the economical importance of microorganisms.
4. To gain knowledge on plant disease management.
5. To establish an overview of the recent advances in the field of microbiology.

UNIT – I

Microbiology: History and Scope of Microbiology – Microbial diversity and Classification (Bergey and Holt, 1993) – Bacteria – types – Structure and Reproduction – Actinomycetes – Virus Classification – Viruses Structure and Reproduction – Bacteriophages – Mycoplasma – prions.

UNIT – II

Sterilization techniques – Types and Preparation of media – Industrially important microorganisms – Microbial metabolites – Fermentor (Bioreactor) design and operation – types of fermentation – Downstream processing.

UNIT – III

Microbiology of food – Dairy products – Cheese and Yoghurt – Food spoilage – Food preservation methods – Industrial production of Bioproducts (Alcohol, Lactic acid, Amylase, and Penicillin) – Immobilization techniques – Bioremediation and Biodegradation – Industrial wastes treatment – Xenobiotic compounds.

UNIT – IV

Plant Pathology: History of Plant pathology, Classification of Plant diseases, Koch's Postulates, Disease cycle, Dispersal of plant pathogens, Inoculum, Inoculum potential, Pre-penetration



structures produced by pathogens, Penetration, Infection, Defense mechanism in plants, Role of Enzymes and Toxins in Plant pathogenesis and disease forecasting. Methods of disease control – Plant quarantine.

UNIT – V

A Study of the disease symptoms, causal organism, and transmission and control Measures of the following plant diseases.

1. Damping off by *Pythium*
2. Little leaf of Brinjal (Mycoplasma)
3. Bacterial Blight of beans
4. Bunchy top of Banana (Virus)
5. Citrus canker (Bacteria)
6. Blight of potato (Early Late blight)
7. Tobacco mosaic disease (TMV)

Text Books

1. Bergey, D. H. and Holt, J. G. (1993). Bergey's manual of determinative bacteriology. 9th ed. Baltimore: Williams & Wilkins, New York.
2. Bilgrami, K.S. and Dube, H.C. (2010) A text book of Modern Plant Pathology – Vikas Publishing House (P) Ltd., New Delhi.
3. Dubey, R.C., and Maheswari, D.K. (2014). A text book of Microbiology, S.Chand & company, New Delhi.
4. Freifelder, D. (1990). Microbial genetics. Narosa Publishing House, New Delhi.
5. Luke, S.P. Moore, James C. Hatcher. (2019). Infectious Diseases, Microbiology and Virology A Q&A Approach for Specialist Medical Trainees. Cambridge University Press.
6. Powar, C.B. and Dagniwala, H.F. (2008). General Microbiology. Himalaya Publishing House, Bombay.
7. Sharma, P.D. (2012). Microbiology – Rastogi and Co, Meerut. New Delhi.

Reference Books

1. Agrawal, A.K., and Parihar, P. (2006). Industrial microbiology, Student Edition, Jodhpur.
2. Alexander, (1978). Introduction to soil Microbiology, Wiley Eastern Private Ltd., New Delhi.
3. Carpenter, P.L. (1977). Microbiology, W.B. Saunders Co., London.



4. Darglos, J. (1975). Bacteriophages. Chapman & Hall Ltd., London.
5. Gardner E.J, Simmons M.J, Snustad D.P. (2010) Principle of Genetics (VIII Edition), WSE India Pvt. Ltd., New Delhi.
6. William, D. Stansfield, Raul Cano and Jaime Colome (1996). Schaun's outline of theory and problems of Molecular and Cell biology. McGraw Hill, New York.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Enumerate the characteristics features of microorganisms.	K1
CO2	Describe various isolation and cultural techniques of the microorganisms.	K2
CO3	Explain the economical importance of microbes.	K2
CO4	Implement the disease management techniques in the fields.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core Practical – I		Course Code: 21PBO1P01	Course Title: Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms, Paleobotany, Microbiology and Plant Pathology	
Semester I	Hours/Week 9	Total Hours 135	Credits 4	Total Marks 100

Course Objectives

Algae: Micro preparation and detailed microscopic analysis of vegetative and reproductive parts of the following genera – *Oscillatoria*, *Navicula* (Diatoms), *Ulva*, *Padina*, and *Gracilaria*. Economic importance of Algae (Agar agar, Caragennean, SCP and Diatoms)

Fungi: Micro preparation and detailed microscopic analysis of vegetative and reproductive parts of the following genera – *Rhizopus*; *Taphrina*; *Polyporus* and *Fusarium*. Lichens.

Bryophytes: Micro preparation and detailed microscopic analysis of vegetative and reproductive parts the following Bryophytes – *Targionia*, *Porella* and *Polytrichum*.

Pteridophytes: Study of the Habit, T.S of leaf and Stem, Morphology of Reproductive structures of following genera. *Angiopteris*, *Polypodium*, *Osmunda*, *Salvinia* and *Isoetes*.

Gymnosperms: Study of the Habit, TS of leaf and stem, Morphology of Reproductive structures of following genera *Araucaria*, *Cupressus* and *Gnetum*.

Paleobotany: Study the following fossil members, *Lepidocarpon*, *Pentoxylon*, and *Cordaites* through permanent slides.

Microbiology Experiments

1. Isolation and identification of bacteria and fungi from soil sample and spoiled food.
2. Inoculation of bacteria in the Peptone broth and bacterial streaking in the petriplate.
3. Preparation of culture media (Bacteria).
4. Gram's staining of bacteria found in milk, curd and root nodules.
5. Testing quality of milk by Methylene blue reduction test (MBRT)

**Demonstration**

1. Media preparation and culturing of Cyanobacteria.
2. Preparation of spawn for cultivation of edible mushroom (oyster).
3. Mass cultivation of *Rhizobium*, *Azotobacter*.
4. Microbiological test for soil fertility (Phosphate solubilizing Bacteria).
5. Production of citric acid using *Aspergillus niger*.
6. Fermentation - Solid state, submerged.

Note: Visit to nearby leading laboratories / industries.

Plant Pathology: Study of the disease symptoms, causal organism, transmission and control measures of the following plant diseases:

1. Damping off by *Pythium*.
2. Little leaf of Brinjal (Mycoplasma).
3. Bacterial Blight of beans.
4. Bunchy top of Banana (Virus).
5. Citrus canker (Bacteria).
6. Blight of potato (Early Late blight).

*Bonafide record of practical work done should be submitted for the practical examination.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Compare and classify the lower forms and advanced Thallophytes.	K4
CO2	Distinguish the internal organization of Cryptogams and Phanerogams.	K4
CO3	Analyze the fossil plant through permanent slides.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S

S – Strong

H – High

M – Medium

L – Low



**SRI VIDYA MANDIR ARTS AND SCIENCE COLLEGE (Autonomous)
KATTERI – 636 902**

PG MODEL PRACTICAL QUESTION PAPER

End semester Examination Question Paper Pattern

(For the candidates admitted from the academic year 2021-22 onwards)

**Core Practical – I Algae, Fungi, Lichens Bryophytes, Pteridophytes, Gymnosperms,
Paleobotany, Microbiology and Plant Pathology**

Time: 4 Hours

Max. Marks: 60 Marks

Practical : 50 Marks

Record : 5 Marks

Viva –Voce : 5 Marks

BREAK UP OF MARKS

1. Make suitable micro preparations of A, B and C. Draw labeled sketches. Identity giving reasons. Leave the slides for valuations. (3 × 4 = 12)
2. With suitable micro preparations of D and E. Draw labeled sketches. Identity giving reasons. Leave the slides for valuations. (2 × 4 = 8)
3. Draw diagrams and write notes of interest of F, G, H and I. (4 × 2 = 8)
4. Name the Genus and group of the macroscopic specimens of J, K and L. (3 × 3 = 9)
5. Determine whether the given sample M is contaminated with bacteria or not. Leave the slide for evaluation. (5 Marks)
6. Name the causative organism, disease symptoms and control measures of the pathological specimen N. (8 marks)

**KEY**

A, B and C = Algae, Fungi and Bryophytes

Preparation – 1, Identification -1, Diagram -1, Reason -1 = 4 (3 x 4 = 12)

D and E = Pteridophytes / Gymnosperms (2 x 4 = 8)

Preparation – 1, Identification -1, Diagram -1, Reason -1 = 4

F, G, H and I = Micro slides (Algae/Fungi/Bryophytes/Pteridophytes/Gymnosperms)

Slides, spotters, Specimen, Photo cards. (4 x 2 = 8)

J, K and L = Macroscopic specimens (Algae/Fungi/Bryophytes/Pteridophytes/Gymnosperms)

Genus (1), Group (1) and Morphology (1) (3 x 3 = 9)

M = Microbiology - Material/Sample to be given 5 Marks

N = Pathological specimen 8 marks



Program: M.Sc. Botany				
Elective – I		Course Code: 21PBO1E01	Course Title: Algal Biotechnology	
Semester	Hours/Week	Total Hours	Credits	Total Marks
I	4	60	4	100

Course Objectives

1. To understand concepts of resource potential of algae.
2. To know the commercial importance of algae.
3. To learn the therapeutic properties of algae.
4. To provide an overview of the role of algae in the environment.

UNIT – I

Objectives of algal biotechnology, resource potential of algae, commercial utility of algae, Algal production systems; indoor cultivation methods and large-scale cultivation of algae, Harvesting of algae.

UNIT – II

Industrial application of algal fuel, algal lipids – transesterification to ester fuel – substitutes for petroleum derived fuel, production of fine chemicals, biofertilizers and hormones, application of seaweed liquid fertilizers. Algae as food for fish, poultry and animals.

UNIT – III

Therapeutic uses – Remedial compounds, antioxidants, antithrombotic, anticoagulants, wound healing, skin diseases, antiulcerogenic, antifungal, antibiotics and anti-tumour, antiviral compounds. Production of pigments and utilization. Role of algae in agriculture and aquaculture – Symbiotic algae.

UNIT – IV

Immobilization of algae: Natural compounds of immobilization, methods of immobilization, recombinant DNA technology in algae. Isolation, fusion and regeneration of protoplasts in macro algae.



UNIT – V

Role of algae in environmental health; Phycoremediation. Sewage disposal and waste treatment of Industrial effluent, algae as indicators in assessing water quality and pollution. Role of algae in nanobiotechnology.

Text Books

1. Aziz, Farhad and Rasheed, Rezan (2019). A Course Book of Algae. Publisher: University of Sulaimani.
2. Bold, H.C. and Wynne, M.J. (1978). Introduction to the Algae. Structure and Function. Prantice Hall of India New Delhi.
3. Kumar, H.D. and Singh, H.N. (1982). A text Book on Algae. Affiliated East-West Press Pvt. Ltd. New Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
5. Sambamurty, A.V.S.S. (2015). A Textbook of Algae. S Chand publications, New Delhi.
6. Trivedi, P.C. (2001). Algal Biotechnology. Point publisher, Jaipur, India.

Reference Books

1. Alexopoulous, C.J. and Bold, H.C. (1978) Algae and Fungi. The Macmillan Co. London.
2. Baddiley, S. Carey, N.H. Higgins, I.J. and Potter, W.G. (1994). Microalgae: Biotechnology and Microbiology, Cambridge University Press. Cambridge.
3. Becker, E.W. (1994). Micro algae Biotechnology and Microbiology. Cambridge University Press.
4. Borowitzka, M.A. and Borowitzka, L.J. (1988) Microalgal Biotechnology, Cambridge University Press, Cambridge.
5. Chapman, V.J. (1962). The Algae. Macmillan and Co. Ltd. New York.
6. Dixon, P.S. (1973). Biology of Rhodophyta. Hafner Press. New York.
7. Fogg, G.E. (1953). The metabolism of Algae. Methuen & Co. London.
8. Fritsch, F.E. (1935). The structure and reproduction of algae, Vol. I. University Press, Cambridge.
9. Fritsch, F.E. (1945). The structure and reproduction of algae, Vol. II. University Press, Cambridge.



10. Hojnacka, K., Wieczorek, P.P., Schroeder, G., Michalak, I. (Eds.) (2018). Algae Biomass: Characteristics and Applications. Developments in Applied Phycology.
11. Ignacimuthu, S. (1996). Basic Biotechnology. Tata Mc Graw Hill Publishing Ltd. New Delhi.
12. Morris, I. (1968). An Introduction to the Algae, Hutchinson University Library, London.
13. Prescott, G.W. (1969). The Algae: A Review, Thomson Nelson & Sons. London.
14. Round, F.E. (1973). The Biology of Algae. Edward Arnold. London smith, G.M. 1955. Cryptogamic Botany Vol. I Mc Graw-Hill Co. New York.
15. Smith, G.M. (1955). Cryptogamic Botany Vol. I Mc Graw – Hill Co. New York.
16. Smith, S and Reed, D.J. (1997). Mycorrhizal symbiosis. Academic Press. The University of Adelaide, Adelaide, Australia
17. Trehan, K. (1990). Biotechnology. Narosa Pub. House. London.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Gain knowledge on commercial utility of algae.	K1
CO2	Explain the industrial applications of algae.	K2
CO3	Summarize the medicinal uses of algae.	K2
CO4	Demonstrate the role of algae as indicator in environmental health.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core – IV		Course Code: 21PBO2C04	Course Title: Plant Systematics	
Semester II	Hours/Week 5	Total Hours 75	Credits 4	Total Marks 100

Course Objectives

1. To study about the classification and nomenclature of Angiosperms.
2. To understand the theory and practices involved in plant systematics.
3. To learn the striking affinities of different plant families.
4. To acquire the fundamental values of plant systematics.
5. To establish a suitable method for correct identification and adequate characterization of plants.
6. To be aware of the importance of taxonomic relationships in plant systematic studies.

UNIT – I

Historical account of the classification of angiosperms up to the present day. Systems of classification – Detailed study of Bentham and Hooker, Bessey, Takhtajan, Cronquist and APG IV – merits and demerits. ICN – history, principles, typification, principles of priority and their limitations, effective and valid publication, author citation, retention, choice and rejection of names, names of hybrids.

UNIT – II

Computer aided taxonomy (TROPICOS, IPNI, The Plant List). Taxonomic tools – flora, monograph, icons and journals. Keys – dichotomous keys and their uses. Botanical gardens. Sources of taxonomic information – embryology, cytology, chemotaxonomy. RET species –India, Tamil Nadu and IUCN criteria, 2012.

UNIT – III

Biosystematics – Aim and scope. Tureson's work. Modern trends in Taxonomy – Computerized Systematics – collecting data, converting and documenting characters of plants in computers – Molecular taxonomy – DNA Fingerprinting and Barcoding of plants.

**UNIT – IV**

Study of the diagnostic characters, economic importance, systematics and phylogeny of Menispermaceae, Polygalaceae, Oxalidaceae, Rhamnaceae, Meliaceae, Vitaceae, Sapindaceae, Rosaceae, Combretaceae, Onagraceae, Lythraceae, and Aizoaceae.

UNIT – V

Study of the diagnostic characters, economic importance, systematics and phylogeny of Oleaceae, Gentianaceae, Convolvulaceae, Boraginaceae, Bignoniaceae, Pedaliaceae, Nyctaginaceae, Aristolochiaceae, Orchidaceae, Commelinaceae, Loranthaceae and Cyperaceae.

Text Books

1. Bennet, S.S.R. (1989). An Introduction to Plant Nomenclature. International Book Distribution, India.
2. Heslop, J and Herrison, (1970). New Concepts in Flowering Plants - Taxonomy. Heinemann Educational Books, India, Revised Edition.
3. Heywood, V.H. (1967). Plant Taxonomy, Edward Arnold, London.
4. Jeffery, C. (1982). An introduction to Plant Taxonomy, J& A Churchill Ltd., London
5. Lawrence, G.H.M. (1995). The Taxonomy of Vascular Plants (Vol I-IV), Central Book, Dept., Allahabad.
6. Mathew, K.M. (1983). The Flora of Tamil Nadu Carnatic, The Rapinat Herbarium, Tiruchirappalli.
7. Pandey, B.P. (1997). Taxonomy of Angiosperms, S. Chand & Co., New Delhi.
8. Pandey, S.N. and Misra, S.P. (2008). Taxonomy of Angiosperms, Ane Books India, New Delhi.
9. Rendle, A.R. (1979). A Classification of Flowering Plants. Cambridge University Press.
10. Sambamurty, A.V.S.S. (2005). Taxonomy of Angiosperms, I.K. International Pvt. Ltd., New Delhi.
11. Saxena NB. and Shamindra Saxena (2001). Plant Taxonomy, K.K. Mittal for Pragati Prakasham, Meerut, New Delhi.
12. Sharma, O.P. (2009). Plant Taxonomy. Tata McGraw-Hill Education Private Limited, New Delhi.
13. Sharma, O.P. (2017) Plant Taxonomy (II Edition). The McGraw Hill Companies, New York, United States.



14. Singh, V. and Jain, K.K. (1989). Taxonomy of Angiosperms – Rastogi, Meerut, India.
15. Sivaraajan, V.V. (1989). Introduction to Principles of Plant Taxonomy, Oxford and IBH, New Delhi.
16. Sokal, S.R. and Sneath, P.H. (1977). Numerical Taxonomy: The principle and practice of Numerical Classification. San Francisco: Freeman.
17. Solbig, (1985). Principles and Methods of Plant Biosystematics, The MacMillan Company, New Delhi.
18. Stace Clive, A. (1989). Plant Taxonomy and Biosystematics, Edward Arnold, London, Second Edition.
19. Vashista, P.C. (1990). Taxonomy of Angiosperms, S. Chand & Co., New Delhi.

Reference Books

1. Davis, P.H and Heywood, V.M. (1965). Principles of Angiosperm Taxonomy, Published by Van Nostrand.
2. Gamble, J.S, Fisher, L.E.F. (1967). The Flora of The Presidency of Madras. BSI, Calcutta.
3. Hutchinson, J. (1973). The Families of Flowering plants, Oxford University press, London.
4. Kress J.W, Wurdack, K.J., E.A C., Zimmer, L.A. Weigt and Janzen D.H. (2005). Use of DNA bar codes to identify flowering plants. Proc. Natl. Acad. Sci. USA 102, 8369-8374.
5. Simpson M.G. (2006). Plant systematics, Elsevier Academic Press, USA.
6. Stoeckle, M. (2003). Taxonomy, DNA and the barcode of life .Bioscience 53: 796-797.
7. Takhtajan A.L. (2009). Evolutionary trends in flowering plants, Bishen Singh Mahendra Pal Singh, Dehra Dun.
8. Takhtajan, A.L. (2009). Flowering Plants – Origin and dispersal – Oliver & Boyd. Publisher: Edinburgh.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Acquire knowledge both on ICN and APG classifications.	K1
CO2	Differentiate various systems of classifications based on their natural and phylogenetic characters of flowering plants.	K2
CO3	Apply the proficiency skills on identification of any unknown plant species using the manual of floras.	K3
CO4	Classify the plants based on their phylogeny.	K4

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core – V		Course Code: 21PBO2C05	Course Title: Anatomy of Angiosperms, Embryology of Angiosperms and Plant Microtechniques	
Semester II	Hours/Week 5	Total Hours 75	Credits 5	Total Marks 100

Course Objectives

1. To understand the histochemical techniques involved in permanent micro slides.
2. To acquire knowledge about complex vascular tissues.
3. To inherit knowledge on mega and micro sporangial development and their functions.
4. To attain knowledge about various aspects of anatomical features of plants.
5. To understand the key aspects of embryology of angiosperms.

UNIT – I

Tissues – Definition and Classification. Meristems – types – theories of apical meristems. Vascular cambium and cork cambium – types, origin and development of periderm, polyderm, rhytidome, lenticels. Phylogenetical trends of specialization of xylem and phloem. Dendrochronology – sap wood and heart wood – arrangement of vessels in secondary xylem.

UNIT – II

General characters of anomalous secondary thickening in dicot and monocot stem. *Aristolochia*, *Boerhaavia*, *Achyranthes*, and *Dracaena*. Secondary structure and vascular differentiation of root, shoot and root transition – Ontogeny of Dorsiventral and Isobilateral leaf. Nodal anatomy-uni, tri and multilacunar nodes.

UNIT – III

Embryology – Structure and development of anther. Microsporogenesis; Ultrastructure of pollen wall; Pollen–stigma incompatibility, methods to overcome incompatibility, structure, development and types of ovules, megasporogenesis and female gametophyte. Embryosac types *Polygonum* type of embryosac development.

**UNIT – IV**

Fertilization and its control, Endosperm – Nuclear, cellular and helobial and Ruminant types. Development of embryo – dicot and monocot. Apomixis, Polyembryony and Parthenocarpy.

UNIT – V

Microtechnique: A broad outline on steps involved in microtome sectioning (Fixation, dehydration, clearing, infiltration, embedding and block making), staining techniques, Types of Microtome, Camera lucida- Principle and their uses, Micrometry and Photomicrography.

Text Books

1. Bhojwani, S.S. and Bhatnagar, S.P. (1981). The Embryology of Angiosperms. Vikas, Publishing House Pvt. Ltd., New Delhi.
2. Crang, R., Lyons-Sobaski, S and Wise, R. (2018) Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants. Springer International Publishing.
3. Eames, A.J. and Mc Daniels, L.H. (1979). An Introduction to Plant anatomy. Tata McGraw-Hill Publishing Co., (P) Ltd., Bombay, New Delhi.
4. Maheswari, P. (1976). An introduction to the Embryology of Angiosperms. TATA McGraw Hill Publishing Co., Ltd., New Delhi.
5. Marimuthu R. (2011). Microscopy and Microtechnique. MJP publishers Chennai.
6. Pandey, B.P. (1978). Plant Anatomy, S. Chand & Co., New Delhi.
7. Patki L.R, Bhalchandra B.L, and Jeevaji I.H. (1987). An introduction to Microtechnique, S.Chand and company (Pvt) Ltd, New Delhi.
8. Pijushroy, (2010). Plant Anatomy, New central Book Agency, Pvt Lit, New Delhi.
9. Singh, V. Pande, P.C. and Jain D.K. (1987) – Anatomy of seed plants – Rastogi Publications, Meerut.

Reference Books

1. Austin, (1968). Fertilization. Prentice Hall of India, New Delhi.
2. Cutter, E.G. (1970). Plant Anatomy: Experimental and Interpretation. Edward Arnold Pub. Ltd., London.



3. Cutter, E.G. (1971). Plant Anatomy, Edward Arnold Pub. Ltd., London.
4. Cutter, E.G. (1978). Plant Anatomy, Experimental and Interpretation. Edward Arnold Pub. Ltd., London
5. Davis, G.L. (1966). Systematic Embryology of the Angiosperms. John Wiley. New York.
6. Dwivedi, J.N. (1988). Embryology of Angiosperms. Rastogi & Co., Meerut. New Delhi.
7. Esau, K. (1960). Plant Anatomy, Wiley Eastern Private Ltd., New Delhi.
8. Esau, K. (1977). Anatomy of seed plants. Wiley Eastern Publication, New Delhi.
9. Fahn, A. (1989). Plant Anatomy. Macmillan Publication (P) Ltd, Singapore.
10. Johansen, D.A. (1940). Plant Microtechnique, TATA McGraw Hill Book Co., Ins., New Delhi.
11. Johri, B.M. (1984). Experimental Embryology of Vascular plants. An International Journal for Botany and Mycology. 4:3, 364-370.
12. Kenneth R. Sporne (1972). The Evolution of Pollen Types in Dicotyledons. New Phytologist.71:1; 181-185.
13. Peter Gray. (1964). Hand book of Basic Microtechnique. McGraw Hill Publication, New York.
14. Rahavan, V. (1976). Experimental Embryogenesis in Vascular Plants, Academic Press, London.
15. Shivanna, K.R. and B.M. Johri. (1985). The Angiosperm Pollen Structure and Functions. Wiley- Eastern Ltd.
16. Sporne, K.R. (1972). The Evolution of Pollen Types in Dicotyledons. New Phytol.71: 181-185.
17. Steven Ruzi. (2005). Plant Microtechnique and Microscopy. Oxford University Press, London.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Knowledge on plant tissue and cellular organelles	K1
CO2	Explain the anomalous growth in plants.	K2
CO3	Illustrate the fertilization and development of embryo.	K3
CO4	Differentiate tissues using various microtechnique.	K4

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core – VI		Course Code: 21PBO2C06	Course Title: Cell Biology, Genetics and Molecular Biology	
Semester II	Hours/Week 5	Total Hours 75	Credits 5	Total Marks 100

Course Objectives

1. To provide an overview of the cellular and molecular aspects of the plant cell.
2. To describe normal chromosome number, structure, and behavior in plant cells.
3. To get the insight on the principles of inheritance as formulated by Mendel.
4. To understand the molecular biology of prokaryotes and Eukaryotes.

UNIT – I

Cell biology: Cell structure, organization of prokaryotic and eukaryotic cell. Detailed study of cell wall, nucleus, Chloroplast, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes and vacuoles. Cytoskeleton: structure, function and its role in motility.

UNIT – II

Nucleosome organization, chromosome structure in prokaryotes and eukaryotes, Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, electrical properties of membranes. Cell cycle: Mitosis and Meiosis, their regulation, regulation and control.

UNIT – III

Genetics: Mendelian principles - Dominance, Segregation and independent assortment, Genetic interaction - Complementary genes, Epistasis, Lethal genes, Multiple factor hypothesis. Linkage and crossing over – kinds of linkage, significance of linkage. Types of crossing over mechanism, models for homologous recombination. Construction of genetic map. Two point test cross, three point test cross.

UNIT – IV

Sex Determination and differentiation – Types, mechanism and significance. Sex linked inheritance. Mutation – types, spontaneous, induced mutation. Numerical changes in chromosomes



– Euploidy, polyploidy. Structural changes in chromosomes – deletion, Duplication, Inversion and Translation.

UNIT – V

Molecular Biology: The central dogma and structure of DNA and RNA; DNA Replication mechanism, models of replication. Transcription: in Prokaryotes and Eukaryotes, post transcriptional modification, genetic code, Translation – synthesis and processing of protein. Post translational modification. Organization of gene – regulation of gene, Operon concept, regulation of gene expression in prokaryotes – Lactose, Tryptophan, gene expression in eukaryotes.

Text Books

1. Ajoy Paul, (2009). Text Book of Cell and Molecular Biology, Books and Allied (P) Ltd Kolkata.
2. Baluska, F. and Vaidurya Pratap Sahi (2018) Concepts in Cell Biology – History and Evolution. Botanical Institute, Karlsruhe Institute of Technology, Karlsruhe, Germany.
3. David Freifelder, (1985). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
4. Freifelder, D. (1995). Microbial Genetics. Narosa Publication, New Delhi.
5. Gupta, P.K. (2009). Genetics, Rastogi publications, Meerut, New Delhi.
6. Janet Iwasa, Gerald Karp, Wallace F. Marshall (2018) Karp's Cell Biology, Global Edition.
7. Kumar, H.D. (1999). Molecular Biology. Vikas Publishing House Pvt. Ltd. New Delhi.
8. Satyesh Chandra Roy and Kalyan Kumar De. (1999). Cell Biology. New Central Book Agency (P) Ltd. Calcutta.
9. Verma P.S and Agarwal V.K. (2007). Cell Biology, Genetics, Molecular Biology and Evolution, S. Chand and Company Ltd., New Delhi.
10. Verma P.S. and Agarwal V.K. (2010) Genetics, S. Chand and Company Ltd., New Delhi.

Reference Books

1. De Robertis and De Robertis, (1998). Cell and Molecular Biology. B.I. Waverly Pvt. Ltd. New Delhi.
2. Geoffrey M. Cooper. (1997). The Cell – A Molecular approach. ASM Press, Washington.
3. Grierson, D. and Covey, S.N. (1984). Plant Molecular Biology. Blackie and sons, London.



4. Griffiths, A.J.F., Miller, J.H. and Suzuki, D.T. (2000). An Introduction to Genetic Analysis. 7th edition. New York.
5. Karp.G. (2008) Cell and Molecular Biology. 5th Edn. John Wiley & sons, London.
6. Lewin (2007). Gene IX. Jones and Barlett Pub. Sudbury, Massachusetts.
7. Strickberger, M.W. (2010). Genetics (3rd edition) PHI Learning Pvt. Ltd. New Delhi.
8. Walker J.M and Rapley, R. (2006). Molecular Biology and Biotechnology (4th Edn) Panima Publishing Corporation, New Delhi.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Gain insight in fundamentals of cell morphology with functions.	K1
CO2	Understand the biosynthesis of nucleic acids and cell division.	K2
CO3	Solve the relationship between phenotype and genotype.	K3
CO4	Distinguish the molecular aspects in prokaryotes and Eukaryotes and its gene expression.	K4

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core Practical – II		Course Code: 21PBO2P02	Course Title: Plant Systematics (Practical - II)	
Semester II	Hours/Week 3	Total Hours 45	Credits 3	Total Marks 100

Course Objectives

1. To identify selected taxa using taxonomic keys.
2. To understand the theory and practices involved in plant systematics.
3. To learn the striking affinities of different plant families.
4. To study the economically important plants in traditional methods.

Taxonomy and Biosystematics

Identification of Specimen at family, generic and specific level belonging to the following families.

1. Menispermaceae
2. Polygalaceae
3. Oxalidaceae
4. Meliaceae
5. Vitaceae
6. Sapindaceae
7. Rosaceae
8. Combretaceae
9. Onagraceae
10. Lythraceae
11. Aizoaceae
12. Oleaceae
13. Gentianaceae
14. Convolvulaceae
15. Boraginaceae
16. Bignoniaceae



17. Pedaliaceae
18. Nyctaginaceae
19. Aristolochiaceae
20. Orchidaceae
21. Commelinaceae
22. Cyperaceae
23. Loranthaceae
24. Rhamnaceae

- Economic importance of families mentioned above.
- Familiarity with the use of Flora.
- Preparation of Dichotomous artificial key using locally available plants.
- A field trip of not less than four days to a place of luxuriant vegetation to study. The flora and to study the different types of vegetation.
- Submission of a tour report and 20 herbarium sheets (Specimens collected from Tour collection/locally available plants during the internal practical examination.

*Bonafide record of practical work done should be submitted for the practical examination.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Construct keys to identify unknown plants.	K3
CO2	Classify the plants into species, genus and family.	K4
CO3	Summarize the economic uses of plants.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S

S – Strong

H – High

M – Medium

L – Low



**SRI VIDYA MANDIR ARTS AND SCIENCE COLLEGE (Autonomous)
KATTERI – 636 902**

PG MODEL QUESTION PAPER (PRACTICALS)

End semester Examination Question Paper Pattern

(For the candidates admitted from the academic year 2020-21 onwards)

Core Practical – II (Plant Systematics)

Time: 4 Hours

Max. Marks: 60 Marks

Practical : 50 Marks

Record : 5 Marks

Viva –Voce : 5 Marks

BREAK UP OF MARKS

1. Find out the binomials of given specimen of A, B and C. (3 × 3 = 9 marks)
2. Refer specimens D, E and F to their respective families, give the reasons at each level of Hierarchy. (3 × 4 = 12 marks)
3. Construct a key using G, H, I, J, and K (5 × 2 = 10 marks)
4. Mention the family, genus and species of L, M and N (3 × 3 = 9 marks)
5. Write economic importance of O, P, Q, R and S. (2 × 5 = 10 marks)

Key

A, B and C Families prescribed in the syllabus

D, E and F Flowering plants from families prescribed in the syllabus

G, H, I, J and K Flowering twigs

L, M and N Plants given in practical syllabus

O, P, Q, R and S Economic importance of families



Program: M.Sc. Botany				
Core Practical – III		Course Code: 21PBO2P03		Course Title: Anatomy of Angiosperms, Embryology of Angiosperms, Plant Microtechniques, Cell Biology, Genetics and Molecular Biology
Semester II	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To know the variations in the internal structural organization of plants.
2. To gain knowledge on chromosomes.
3. To understand the basic concept and modern techniques of microtome.
4. To study about the principles of Mendelian and non-Mendelian inheritances.

Anatomy of Angiosperms, Embryology of Angiosperms and Plant Microtechniques

Preparation of hand sections, maceration and clearing

1. Temporary and permanent mounting of whole specimens and Sections using different types of mountants.
2. Calibration of microscope through micrometry.
3. Microtomy and microtome sectioning
4. Maceration of wood elements by various chemical methods and micrometry.
5. Examining of different cell and tissue types with help of suitable techniques.
6. Structure of (primary and or secondary) leaf, root, stem and floral parts (including fruits).
7. Examining of vascular cambium and study of its activity.
8. Examining of anomalous secondary thickening mentioned in syllabus.
9. Examining of structural and identification of wood of some common Indian Timbers such as *Prunus*, *Mangifera indica*, *Terminalia*, *Tectona grandis*, *Swietenia mahagoni*, *Azadirachta indica*, *Lagerstroemia* and *Pterocarpus*.

Embryology of Angiosperms



1. Organization of anther and pollen, pollen wall patterns, pollen germination and pollen tube growth.
2. Study on ovary, ovules and their modification.
3. Isolation of plant embryos and embryonic tissues.

Note:

1. A minimum of 10 double stained permanent sections to be submitted.
2. Record and observation note book.
3. Wax blocks and slides mounted with wax ribbons.
4. Group report on ontogenetic change in a selected plant.

Cell Biology

1. Squash and smear techniques –Onion root tip (mitosis) *Rheo* flower bud (Meiosis).
2. View of plant cell inclusions – Cystolith and Raphides, Chloroplast (*Hydrilla* leaf).
3. Isolation of plant organelles by centrifugation techniques (Demonstration).
4. Separation of giant chromosome (*Chironomus* larvae).

Genetics

1. Evaluation of Genetic concept by solving problem of Mendelian hypothesis.
2. Genetic Interaction (Mendelian modified ratios) complementary, supplementary, duplicate factor, Multiple alleles.
3. Population genetics- Hardy Weinberg law.
4. Three point test cross – chromosome map.
5. Isolation of auxotrophs by UV mutagenesis (Demonstration).
6. Isolation of spontaneous mutations in bacteria by gradient plate technique (Demonstration).

Molecular Biology

1. Colorimetric estimation of DNA and RNA.
2. Regulation of gene expression (With the help of models /Charts /Book diagram).
3. Protein biosynthesis with the help of models /chart/ Book diagram.

* Bonafide record of practical work done should be submitted for the practical examination.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Prepare a transverse section of given plant material.	K3
CO2	Construct a chromosome map.	K3
CO3	Observe the sequential changes in the internal structure of plants by sectioning through microtechniques.	K4
CO4	Explain the sex linked disease among the population.	K4

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	M	H	S	S

S – Strong

H – High

M – Medium

L – Low



SRI VIDYA MANDIR ARTS AND SCIENCE COLLEGE (Autonomous)

KATTERI – 636 902

PG MODEL PRACTICAL QUESTION PAPER

End semester Examination Question Paper Pattern

(For the candidates admitted from the academic year 2021-22 onwards)

Core Practical: III Anatomy of Angiosperms, Embryology of Angiosperms, Plant Microtechniques, Cell Biology, Genetics and Molecular Biology

Time: 4 Hours

Practical: 50 Marks

Max. Marks: 60 Marks

Record : 5 Marks

Viva-Voce : 5 Marks

BREAK UP OF MARKS

1. Prepare a transverse section of A. Identify the anomaly by giving reasons. Draw diagrams and submit the slides for valuation. (6 marks)
2. Macerate and identify the elements of the specimen B. Measure the length and breadth using Micrometer. (6 marks)
3. From the given material C dissect and mount any two stage of embryo. Draw diagrams. Submit the slides for valuation. (6 marks)
4. With the flower bud given in D, identify any 2 developmental stages of microsporogenesis. Draw diagrams. Submit the slides for valuation. (6 marks)
5. Prepare a squash of E. Display any 2 stages of cell divisions. Draw labelled sketches. (4 marks)
6. Construct a chromosome map; calculate interference and coefficient of variation from a three point test cross data given in F. (8 marks)
7. Solve the genetic problem G and H. (2 × 3 = 6 marks)
8. Write notes of interest on I, J, K and L. (4 × 2 = 8 marks)

Key

A, B, C & D Material given in the practical class.

E - Material given in the practical class

F - Construct a chromosome map/Three point test cross data.

G & H- Genetic problem given in the practical (Mono & Dihybrid ratio).

I, J, K, L -Spotters from Anatomy, Micro technique & Embryology (Slide/ Chemical/instrument - Spotter from molecular Biology).

**Note:**

- Submission of 5 double stained permanent slides (Microtome or free hand sections 2, Cleared material-1, Peel –1 and Maceration-1).
- Certified record work done in the laboratory during practical classes.



Program: M.Sc. Botany				
Core – VII		Course Code: 21PBO3C07	Course Title: Ecology, Phytogeography and Remote Sensing	
Semester III	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To study the Ecosystems.
2. To create an awareness on ecological issues.
3. To provide an understanding of the use of biological organisms as agents for monitoring toxicity.
4. To apply the modern Biomonitoring tools.

UNIT – I

Ecology – concept, scope – Ecosystem components: Abiotic and Biotic factors – Major ecosystem; Lake, Desert, and Forest – Plant Succession and its types – Concepts of productivity- Measurement of productivity- Food chain, Food web, Energy flow, Biogeochemical cycles – Homeostasis and Ecological pyramids. Quantitative and qualitative methods of analysis of plant community – classification of plant community and adaptations.

UNIT – II

Ecological Niche: Concept of habitat and niche. Population ecology: population characteristics: population density, basic concepts grading rates – natality – mortality – population age distribution – carrying capacity – r and k selection.

UNIT – III

Major terrestrial biomes: Tundra, Northern coniferous forest biomes, temperate deciduous forest biomes, Tropical rain forest biome, aquatic biomes and desert biomes. Biodiversity – types – distribution and measurement – species and genetic diversity – loss of biodiversity – conservation – *in situ* and *ex situ*. Afforestation – social forestry, agro forestry, IBP, MAB, IUCN, National parks, sanctuaries, wild resources – Biosphere reserves in India, Green belt, Wild Life Preservation Act (1972).



UNIT – IV

Phytogeography: Principles of phytogeography – world flora – types, pattern and distribution – age and area hypothesis – continental drift; theories and evidences, plant distribution – Wilds, Endemism, Discontinuous distribution – Botanical zones of India – Forest types of India.

UNIT – V

Remote sensing: Concept of remote sensing – Platforms for remote sensing – satellites, sensors and satellite data products – study of geographical patterns – world flora types and patterns and distribution. Vegetation studies using remote sensing technique – role of GIS, Remote sensing and its application.

Text Books

1. Barucha, F.R. (1983). A Text Book of Plant Geography. Oxford University. Press, London.
2. Chandra, A.M. and Ghosh, S.K. (2010). Remote Sensing and Geographical Information System, Narosa Publishing House Pvt. Ltd. New Delhi.
3. Misra K.C. (1989). Manual of Plant Ecology. Oxford IBH Publishing Co. Pvt. Ltd. London.
4. Misra, R and Puri, G.S. (1954). Indian Manual of Plant Ecology. The English Book Depot, Dehradun.
5. Neeraj Nachiketa 2nd Edition (2018) Environmental & Ecology A Dynamic approach. GKP Access Publishing. New Delhi.
6. Odum, E.P. and Barrett G.W. (2005) Fundamentals of Ecology 5th Edition-. Belmont, CA. Thomson Brooks/Cole.

References Books

1. Cain.S.A. (1944). Foundations of Plant Geography. New York and London
2. Crawley, M.J. (1986) Plant Ecology. Backwell Scientific Publication, London Oxford University.
3. Kellman Methuen, M.C. (1980) Plant Geography. London Oxford University.
4. Rampal, K.K. (1982). Text Book of Photogrammetry. Oxford and IBH Publishing Co. New Delhi. India.
5. Turrill,W.B. (1959). Plant Geography, In W.B. Turrill (ed.) Vistas in Botany. Pergamon Press, London.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Recognize the various types of ecosystems.	K1
CO2	Describe the population ecology.	K2
CO3	Explain impact of afforestation and importance of conservation.	K2
CO4	Discover the role of GIS, LGPS, Remote sensing and its application.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core – VIII		Course Code: 21PBO3C08	Course Title: Plant Biotechnology and Nanotechnology	
Semester III	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To study the basic and advanced developments in the field of Plant Biotechnology.
2. To equip students with theoretical knowledge regarding the techniques and applications of plant tissue culture and Micropropagation.
3. To help students to get a career in Industry/R &D/Academic.
4. To have a basic knowledge on nanotechnology.

UNIT – I

Biotechnology – Definition, history, scope and importance – Cloning vehicles, Plasmids, Cosmids, Phages, Shuttle vectors – transposons, Gene cloning in prokaryotes – endonuclease; Recombinant DNA technology.

UNIT – II

Gene transfer methods – Direct method - gene gun and indirect method; *Agrobacterium tumefaciens* mediated gene transfer in plants – Selection of recombinants by different methods. Genomic library and cDNA libraries.

UNIT – III

Genetic engineering for human welfare – Insulin, interferon genes – vaccines – Hepatitis-B virus – Monoclonal antibodies-herbicide resistance – resistance against pests and insects – Bt genes – endotoxins – resistance against pathogens – DNA finger printing and applications.

UNIT – IV

Plant tissue culture: History and scope – applications: laboratory organization – culture media preparation – explant selection and their preparation – micropropagation –isolation, culture and fusion of protoplast – synthetic seed preparation.

**UNIT – V**

Nanotechnology: Introduction – Nanomaterials and Nanoparticles – applications – Quantum dots – Nanorobots for medical application DNA – protein nanostructures. – Nanomedicine – Targeted drug delivery using Nanoparticles – Molecular therapeutics.

Text Books

1. Hammond, J. Mc Garvey P. and Yusibow, V. (2004). Plant Biotechnology (New products and applications). Rekha printers Pvt. Ltd. New Delhi. India.
2. Kalyan Kumar, D. (1992). Plant Tissue culture, New Central Book Agency. Calcutta.
3. Kumar, Pradeep. (2018). Advances in Microbial Biotechnology: Current Trends and Future Prospects. Oakville, ON; Waretown, NJ
4. Satyanarayana, U and Chakrapani U (2006) Biotechnology. Publishers: Books & Allied Ltd. New Delhi, India.
5. Thieman (2014) Introduction to Biotechnology 3rd Edition. Pearson Education, Noida, Uttar Pradesh. India

Reference Books

1. Claudio Nicolini (2009). Nanotechnology Nanosciences Pon Stansford Pub. Pvt. Ltd. California, USA.
2. John E. Smith. (1996) Biotechnology, 3rd edition. Cambridge University Press. London.
3. Prashant Kesharwani (2019). Nanotechnology-Based Targeted Drug Delivery Systems for Lung Cancer. Academic Press. An imprint of Elsevier. Amsterdam. Netherland.
4. Robert, A., Freitas Jr. (1999). Nanomedicine, Volume I: Basic capabilities, California, US.
5. Slater, Scott, N.W. and Fowler, M.R. (2003). Plant Biotechnology (The genetic Manipulation of plants) Oxford press. London.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Define the biotechnology.	K1
CO2	Explain the techniques of gene manipulation and their rapid applications in field of plant tissue culture.	K2
CO3	Discover the application of DNA finger printing technology in plants.	K3
CO4	Apply the concept of nanotechnology for achieving major task using the nanoparticles.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Elective – II		Course Code: 20PBO3E02	Course Title: Herbal Technology	
Semester III	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To create an awareness on the understanding of Indian Systems of Medicine.
2. To discover the importance of medicinal plants.
3. To characterize the bioactive compounds from the medicinal plants.
4. To explore the various application of bioactive compounds.

UNIT – I

Pharmacognosy: Scope and importance – Crude Drugs; Sources, Scope and Importance, classification (Taxonomical, Morphological, Chemical, Pharmacological); Cultivation, Collection and processing of Crude Drugs. Cultivation and Utilization of Medicinal and Aromatic plant in India.

UNIT – II

Plant Tissue Culture as source of medicines. Role of Plant tissue culture in enhancing secondary metabolite production (*Withania somnifera*, *Rawolfia serpentina*, *Catharanthus roseus*, *Andrographis paniculata*, *Dioscorea* spp.) – Elicitation – Biotransformation, Hairy root culture. Factors affecting secondary metabolites production.

UNIT – III

Analysis of Phytochemistry: Methods of Drug evaluation (Morphological, Microscopic, Physical and Chemical). Preliminary screening. Assay of Drugs – Biological and Chemical. Detection of Adulterants: Chemical estimations, Spectrophotometry and Fluorescence analysis. Drug adulteration – Types of adulterants.

UNIT – IV



Types of Phytochemicals I: Carbohydrates and derived products; Glycosides – extraction methods (*Digitalis*, *Aloe*, *Dioscorea*); Tannins (Hydrolysable and condensed types); Volatile Oils – extraction methods (Clove, *Mentha*).

UNIT – V

Types of Phytochemicals II: Alkaloids – extraction methods (*Taxus*, *Papaver*, *Cinchona*); Flavonoids – extraction methods, Resins – extraction method – Applications of Phytochemicals in Phytopharmaceuticals; Biocides, Biofungicides, Biopesticides.

Text Books

1. Chopra, R.N., Chopra, I.C., Handa, K.L. and Kapur, L.D. (1994). Indigenous drugs of India, U.N. Dhur and Sons, Calcutta, India.
2. Chopra, R.N., Nayar, S.L., Chopra, I.C., Asolkar, L.V., Kakkar, K.K., Chakre, O.J. and Varma, B.S. (1956). Glossary of Indian Medicinal plants. Council of Scientific & Industrial Research, New Delhi, India.
3. Mohamad Ali. (2009). Pharmacognosy and Phytochemistry. CBS Publications & Distribution, New Delhi.
4. Sathya, S., Jaiganesh, K.P. and Sudha, T. (2019). Current Trends in Herbal Drug Technology. Pharmacy Council of India New Delhi.

Reference Books

1. Lewis, W.H. and M.P.F. Elwin Lewis. (1976). Medical Botany. Plants affecting Man's Health. A Wiley Inter Science Publication. John Wiley and Sons, New York.
2. Rastogi, R.R. and Mehrotra, B.N. (1993). Compendium of Indian Medicinal Plants Vol. I and Vol. II. CSIR Publication & Information Directorate, New Delhi.
3. Wallis, T.E. and Churchill, A. (1995). Text Book of Pharmacognosy. J & A Churchill Ltd, CBS Publishers & Distributors. Ed. 3. London.

Course Outcomes (COs)



On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Define pharmacognosy and recognize the Indian Systems of Medicine.	K1
CO2	Describe the role of Plant tissue culture in enhancing secondary metabolite production.	K2
CO3	Explain the process of extraction and characterization of bioactive compounds using analytical techniques.	K2
CO4	Analyze different types of phytochemicals.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Elective – III		Course Code: 20PBO3E03		Course Title: Wood Technology
Semester III	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To study physiology and anatomy of the wood.
2. To understand the physical, mechanical and chemical properties of wood.
3. To explore the commercial applications of wood.

UNIT – I

Wood science – scope, Wood formation – role of hormones, water, internal and external factors – Growth rings – Heart wood and sap wood, juvenile and reaction wood – Vessels – length, shape, lateral wall pittings, perforations, intervessel pits, tyloses, tracheids, size and wall characteristics – rays – classification and types.

UNIT – II

Density and specific gravity of the wood – significance – Calculation of moisture content and specific heat of wood – Wood biodegradation – fungal and bacteria attack on wood – symptom and causes. Principles of wood preservation – preservatives – process of preservation (Pressure and non-pressure methods) – Seasoning of wood.

UNIT – III

Medicinal properties of wood – tensile strength – compression strength – shearing strength – bending strength – stiffness capacity – hardness. Factor affecting mechanical properties of wood.

UNIT – IV

Chemical properties of wood – Cellulose – lignin, mineral matter – essential oil, tannins, resins gums, eco-friendly dyes from bark and wood. Wood and climate change mitigation – SFM and climate change – SEA and EIA.

UNIT – V



Wood products – Timber, railroad ties, veneer plywood – furniture, wood fuel – lead pencils – matches, tooth picks – paper pulp – filaments and yarn cellulose- gums, resins, turpentine-resins, barks, tannins and dyes. Wood product certification.

Reference Books

1. Baily, I. W. (1954). Contribution to Plant Anatomy. Chronica Botanica Waltham Mass. Waltham, Massachusetts.
2. Brown, H.P. (1964) Text Book of Wood Technology. Vol.1. McGraw-Hill. New York.
3. Gamble, J.S. (1902). A Manual of Indian Timbers Sampson Low, Marston & Company Limited. London.
4. Metcalfe, C.R. (1962). Anatomy of Dicotyledons Vol 2. Ciaredon Press. London.
5. Michael Cross (2019). Wood Technology – Junior cycle Publisher. Edco. Ireland
6. Panshin, A. J. And De Zeeuw, Carl. (1970). Text of wood Technology. Vol-I McGraw Hill Book Co. New York.
7. Pearson, R.S. and Brown, H.P. (1932). Commercial Timbers of India. Govt. Of India, Central Publication Branch, Calcutta.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Describe the various types of woods.	K1
CO2	Explain the physicochemical and mechanical properties of wood.	K2
CO3	Illustrate various commercial aspects of wood products.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core Practical – IV		Course Code: 20PBO3P04	Course Title: Ecology, Phytogeography, Remote sensing, Plant Biotechnology and Nanotechnology	
Semester III	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To learn various techniques involved in studying plant ecology.
2. To familiarize with the fundamental principles of biotechnology.
3. To have basic knowledge on Nanotechniques.
4. To develop practical skills on plant tissue culture.

Plant Ecology

1. Analysis of vegetation – by using quadrat method to find out frequency, density and abundance of different species.
2. Analysis of vegetation – by using line transect to find out frequency, density and abundance of different species.
3. Garden soil experiment to make textures.
4. pH of the soil/water.
5. Chemistry of the soil (NO_3 , PO_4 and SO_3).
6. Determination of dissolved oxygen in different types of water samples.
7. Estimation of carbonate, bicarbonate and chloride content in water samples.

Phytogeography

1. A study of plant distribution maps - continuous, discontinuous, circumpolar, circumtropical, endemic distribution.
2. Mapping of world vegetation and Indian vegetation.
3. Two days field trip to study natural vegetation/flora.

Remote sensing

1. Analysing and interpretation of Satellite photographs – Vegetation/weather

**Note**

1. Field study of an area (not less than a period of 2 days) to document environmental assets and study the ecosystems and different types of vegetation (Forest / Grassland / Mountain / National parks / Sanctuary / Botanical garden / Lake / Pond / River / Waterfalls / Estuary / Mangrove / Sea coast) submit a tour report (during the internal practical examination).
2. Certified record of work done in the laboratory during practical classes.

Plant Biotechnology and Nanotechnology

1. *Agrobacterium tumefaciens*, Plasmids, Gene gun, DNA Finger printing, Patent and Trade mark. (showing the Photograph).
2. Design of the small, medium, large scale, laboratory – Autoclave – Laminar Air flow chamber, Sterilization of media – Surface sterilization of explants – Inoculation of explants – Culture medium – Composition of Medium (Nutrient, Skoog, Whites Linsmaier and Skoog medium, Nitsch, B5 Medium) Vitamins – Preparation of Iron chelate solution – Preparation and use of coconut milk.
3. Preparation of synthetic seeds.
4. Nanobiotechnology: Quantum Dots, Carbon nanotubes etc. (Photographs).



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Analyze vegetation using various ecological techniques.	K4
CO2	Estimate biochemical content of water samples.	K5
CO3	Design plant tissue culture laboratory and culture plants.	K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S

S – Strong

H – High

M – Medium

L – Low



SRI VIDYA MANDIR ARTS AND SCIENCE COLLEGE (Autonomous)
KATTERI – 636 902
PG MODEL PRACTICAL QUESTION PAPER
End semester Examination Question Paper Pattern
 (For the candidates admitted from the academic year 2020-21 onwards)

Core Practical: IV Ecology, Phytogeography and Remote sensing & Plant Biotechnology and Nanotechnology

Time: 4 Hours

Max. Marks: 60 Marks

Practical : 50 Marks

Record : 5 Marks

Viva –Voce : 5 Marks

BREAK UP OF MARKS

1. Construct a meter quadrat (A). studies the plant community by determining frequency, Density and abundance of different species. Analyses the vegetation. Record your data and interpret the results. 10 marks
2. Determine the content of the given sample 'B'. (pH/ dissolve oxygen/ bicarbonate Content/Primary productivity) 8 marks
3. Inoculate the given ex-plant (C) in LAF chamber and write down the steps involved in the inoculation process. 8 marks
4. Preparation of synthetic seeds (D) 5 marks
5. (E) Mapping of world vegetation and Indian vegetation 5 marks
6. Comment on Biotechnology setup (F) 4 marks
7. Write notes on G, H, I, J, and K 5 × 2 = 10 marks

Key



A - Meter Quadrat. (Aim -1, Procedure - 3, Tabulation -2, graph -2, results -2)	10 marks
B- Soil/Water sample (Aim-1, Procedure-2. Tabulation-2, results-2)	7 marks
C- Inoculate the given ex-plant (Innoculation -2, Procedure-4, Inference-2)	8 marks
D – synthetic seeds (Preparation -2, Procedure -3)	5 marks
E - Mapping of world vegetation and Indian vegetation (Marking – vegetation -5)	5 marks
F - Comment on Biotechnology setup	4 marks
Write notes on G, H, I, J, and K	$5 \times 2 = 10$ marks
Spotters on <i>Agrobacterium tumefaciens</i> , Plasmids, Gene gun, DNA finger printing, IPR spotters – Patent, Trademark, Copyright, Quantum Dots, etc.)	



Program: M.Sc. Botany				
Core – IX		Course Code: 20PBO4C09	Course Title: Plant Physiology, Plant Biochemistry and Biophysics	
Semester IV	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To study the basic physiological functions of plants.
2. To understand the importance of phytohormones in the growth of plants.
3. To know the biological importance of the macromolecules.
3. To know the principle and concepts of biophysical techniques.

UNIT – I

Water relations of plants: Uptake, transport and translocation of water, ions, and solutes through xylem and phloem; stomatal movement – transpiration – antitranspirants; Stress physiology: Biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; resistance mechanisms of biotic stress - tolerance to abiotic stress – heat shock proteins.

UNIT – II

Photosynthesis: Radiant energy – mechanisms of electron transport; CO₂ fixation – C₃, C₄ and CAM pathways. Respiration – Glycolysis – Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway – Nitrogen fixation – Nitrate and ammonium assimilation; amino acid biosynthesis through pathway.

UNIT – III

Plant hormones: Auxins, Gibberellins, Cytokinins, Abscisic acid and ethylene – Biosynthesis – physiological effects and mechanisms of action. Sensory photobiology: Structure, function and mechanisms of action of phytochromes, cryptochromes – photoperiodism and biological clock. Secondary metabolites – Biosynthesis of flavonoids, terpenes, phenols, nitrogenous compounds and their role.

UNIT – IV



Biochemistry: Structure of atoms, molecules and chemical bonds. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins – secondary, tertiary and quaternary structure) Enzymes – Nomenclature – Classification – enzyme action, enzyme regulation, isozymes.

UNIT – V

Biophysics: Bioenergetics – Laws of thermodynamics- enthalpy – entropy – free energy –exergonic and endergonic reactions – redox potential. Principles of biophysical chemistry (pH, buffer, colligative properties) –Protein folding – Ramachandran plot – Levinthal’s paradox.

Text Books

1. Bidwell, R.G.S. (1974). Plant Physiology. Macmillan Pub. Co., New York.
2. Devlin, R.M. (1974). Plant Physiology, Affiliated East West Press Pvt. Ltd. London.
3. Fiona C. Denisona Anna-LisaPaul Agata K. Zupanska Robert J. Ferl. (2011). 14-3-3 proteins in plant physiology. Seminars in Cell & Developmental Biology. U.S.
4. Guowei Li Veronique Santoni ChristopheMaurel. (2014). Plant aquaporins: Roles in plant physiology. Biochimica et Biophysica Acta (BBA). U.S
5. Jain, V.K (2007). Fundamentals of Plant Physiology, S. Chand & Company ltd, New Delhi.
6. Lehninger, A.L. (1982). Principles of Biochemistry, CBS Publication & Distribution Pvt. Ltd. New Delhi.
7. Nobel, P.S. (1970) Introduction to Biophysical Plant Physiology. W. H. Freeman and Company, San Francisco, London.
8. Noggle, G.R. and Fritz, G.J. (1976). Introductory Plant Physiology, Prentice Hall, New Delhi, India.
9. Pandey, S.N and Sinha, B.K (2001). Plant Physiology. Third revised edition, Vikas Publishing House Pvt. Ltd, New Delhi.
10. Salisbury, F.B. and Ross, C. (1978). Plant Physiology. Wadsworth Publishing Company. Belmont. London.
11. Verma, V. (2008). Text book of plant Physiology, Ane's student edition, New Delhi.

Reference Books

1. Beevers, L. (1976). Nitrogen metabolism in plants. William & Sons Ltd. London.
2. Bidwell RGS (1979). Plant Physiology, Mac Millan Publishing Company. New Delhi.



3. Bray, CM. (1983). Nitrogen Metabolism in Plants, Publisher: Longman Inc. New York pp.214 pp.
4. Casey, E. J. (1962). Biophysics: Concepts and Mechanics. Van Nostrand Reinhold Co. and East-West Press, New Delhi.
5. Casey, E.J. (1962). Biophysics: Concepts and Mechanics. Van Nostrand Reinhold Co. and East-West Press, New Delhi.
6. Hess, D. (2012). Plant Physiology: Molecular, Biochemical, and Physiological Fundamentals of Metabolism and development. Springer Science & Business Media, New York.
7. Kramer, PJ, (1969). Plant and soil water relationship, A Modern Synthesis. New York, USA. McGraw-Hill Book Company
8. Lehninger, A.L. (1971). Bioenergetics: The Molecular Basis of Biological Energy Transformation. Addison Wiley.
9. Levitt, (1972). Responses of Plants to Environmental Stress, Academic press, New York.
10. Moore, T.C. (1979). Biochemistry and Physiology of Plant Hormones. Springer-Verlag. Berlin.
11. Salil Bose, S. (1982). Elementary Biophysics. Vijaya Printers, Madurai.
12. Salisbury, F, B and Ross, C.W (1986). Plant Physiology. Third edition, CBS Publishers and Distributors, New Delhi
13. Stryer, L. (1981). Biochemistry. W.H. Freeman and Company. New York.
14. Taiz, L. and Zeiger, E. (2010). Plant Physiology. Sinauer Associates, India. Cummings Publishing company, Inc., California, New York.
15. Ting, I.P. (1982). Plant Physiology. Addison Wesley Pub. Co. Philippines.

Course Outcomes (COs)



On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Acquire knowledge on water relations in plants and define hormones.	K1
CO2	Understand the significance of metabolic pathways in plants.	K2
CO3	Demonstrate the photosynthesis and respiration of plants.	K3
CO4	Assess the stress resistance mechanism for the better yield of the crops.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core – X		Course Code: 20PBO4C10	Course Title: Research methodology, Bioinstrumentation, Biostatistics and Bioinformatics	
Semester IV	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To gain knowledge on scientific research
2. To know the principles and operational techniques of bioinstruments.
3. To learn the data processing and analysis using biostatistical tools.
4. To understand the structure of biological databases and their utilities.

UNIT – I

Choosing the problem for research – literature collection – Primary, secondary and tertiary sources – Bibliography – indexing and abstracting – Reporting the results of research in conferences – Oral and Poster presentation. Thesis writing – Research journals – National and International – monographs – reprints – proof correction – Full paper – Short Communication – Review paper – Research publications and ethics, PPT preparations – Google scholar, Research Gate, Scopus, Plagiarism, Impact factor (h-index; i10-index) and citation.

UNIT – II

Microscopy – Principles and applications of bright field, dark field, fluorescence, scanning and transmission microscopy. Spectroscopy: Principles, Beer Lambert's Law, components and working mechanism – Colorimetric principles, UV-Visible, Infra-Red (IR), atomic absorption spectroscopy (AAS), Nuclear Magnetic Resonance (NMR) spectroscopy.

UNIT – III

Centrifugation: Principles, components, mechanism and application of clinical, refrigerated and ultra centrifuges. Chromatography: Principles (absorption – partition – ion exchange – affinity), components, methodology and applications of the different types of chromatography – Thin layer, GC, HPLC. Autoradiography, Geiger Muller counter, Radioisotopes and its applications.



Electrophoresis: Principles, equipment, methodology and applications- PAGE, AGE, SDS –PAGE, 2D electrophoresis, isoelectrofocusing.

UNIT – IV

Biostatistics: Data; Collection, Classification, Tabulation and presentation of data (Diagrammatic and graphical). Measures of central tendency – Arithmetic mean – median and mode. Measures of dispersion – Standard deviation. Probability analysis, correlation- types of correlation, correlation coefficient, Regression – simple, Linear. Test of significance, parametric- student's t-test, ANOVA. Non parametric tests – Chi-square test.

UNIT – V

Bioinformatics: Scope and applications of Bioinformatics. Need of computer in biological research, Internet – Biological Databases – Classification, Nucleic and Protein - mining the database. Database similarity searching – BLAST N, BLAST P – structural, sequence data bases for nucleic acid and proteins. Sequence alignment – Pairwise and multiple. Gene sequence submission format – FASTA.

Text Books

1. Attwood, T.K and Parry Smith D.J, (1999). Introduction to Bioinformatics Addison Wesley Longman Limited, England.
2. Khan, I.A., and Khannum, A., (1994). Fundamentals of Biostatistics, Vikas, Pub., Hyderabad.
3. Marimuthu, R. (2008). Microscopy and Microtechnique. MJP Publishers, Chennai.
4. Moorthy. C.S.V. (2004). Bioinformatics, Himalaya Publishing House, New Delhi, India.
5. Sree Ramulu, V.S., (1988). Thesis Writing, Oxford & IBH Pub., New Delhi.
6. Veerakumari, L. (2017). Bioinstrumentation. MJP Publisher, Chennai, India.
7. Wilson, K, and Walker, J. (1994). Principle and Techniques of Practical Biochemistry, 4th Edn.) Cambridge University Press, Cambridge.

Reference Books

1. Bryan Bergeron, M.D. (2006). Bioinformatics Computing, Prentice – Hall of India. New Delhi.
2. Connor and Peter Woodford (1979). Writing Scientific Paper in English Pitman. Medical Publishing Co. Ltd., England.
3. Cooper, T.G. (1991). The Tools of Biochemistry, John Wiley & sons, London.



4. Dheenadayalu, R. (1987). Computer Science (Vol. I). Tata McGraw Hill Publishing Co. Ltd., New Delhi.
5. Gupta, S.P. (1990). Statistical Methods. S. Chand & Co. Ltd., New Delhi.
6. Gurumani, N., (2006). Research Methodology for Biological Sciences. MJP Publishers, Triplicane, Chennai.
7. Harisha, S. (2007). Fundamentals of Bioinformatics. IK International Publishing House, Pvt. Ltd. New Delhi.
8. Jayaraman, J. (1972). Techniques in Biology. Higginbotham's Pvt. Ltd., Madras.
9. Jayaraman, J. (1985). Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
10. Kothari, C.R. (1991). Research Methodology: Methods and Techniques. Wiley Eastern Ltd., New Delhi.
11. Pavel A.P. (2005). Computational Molecular Biology Algorithmic approach. Prentice- Hall of New Delhi, India. Pvt. Ltd.
12. Plummer D.T (2003). An Introduction to Practical Biochemistry. 3rd Edn. Tata McGraw Hill Publishing Company Ltd. New Delhi.
13. Rastogi, V.B. (2006). Fundamentals of Biostatistics. Ane Book India, New Delhi.
14. Sree Ramulu, V.S. (1988). Thesis Writing. Oxford & IBH Publishing Co.Pvt. Ltd., New Delhi.
15. Stephen Misener and Stephen A. Krawetz. (2000). Bioinformatics Methods and Protocols. Humana Press, Totowa, New Jersey.
16. Theil T., Bissen S. and Lysons E.M. (2002). Biotechnology DNA to Protein. A Laboratory Project in Molecular Biology, Tata McGraw Hill Publishing Company, New York.
17. Zar, J.H. (1984). Biostatistics Analysis. Prentice Hall International, New Jersey.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Explore the scientific research and its methods.	K1
CO2	Implement knowledge for the separation of bioentities.	K2
CO3	Apply the statistical tools in analyzing the experiment.	K3
CO4	Experiment the bioinformatic tools.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Elective – IV		Course Code: 20PBO4E04	Course Title: Horticulture and Forestry	
Semester IV	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To learn about the propagation methods of horticultural crops.
2. To study about gardening, landscaping and their maintenance.
3. To acquire knowledge about commercial floriculture and cut flower arrangements.
4. To know the diversity and importance of forest.

UNIT – I

Importance and History of Gardening – garden implements – Indoor plants and Outdoor plants – Flower arrangement-massing and ikebana – Fruit and Vegetable carving.

UNIT – II

Pods and vegetables. Nursery structures – Green house, shade house, Mist chamber – topiary – Bonsai cultivation. Floriculture – Rose, Chrysanthemum, Jasmine – cultivation. Hydroponics.

UNIT – III

Types of pots, Potting media – components and types. Propagation; vegetative – cutting, layering and grafting – Role of phytohormones in horticulture – Irrigation – methods.

UNIT – IV

Gardening – Types of gardens – formal garden – vegetable garden – orchard – terrace garden – Rockery and water garden. Landscape layout designing – types – formation and maintenance of lawns. Manures – microbial inoculants – composting – vermicomposting – fertilizers and their application.

**UNIT – V**

Forest Types: Major Forest types in India– Forest Ecosystem – Forests as Centres of Biodiversity – Biodiversity Hotspots – Conservation – *in situ* and *ex situ* – National Forest Policy, Forest Conservation Act – National Sanctuaries, National Parks and Biosphere Reserves – Role of People: Chipko Movement.

Text Books

1. Bridger Blackeney. (2013). Handbook of Forestry. Agrotech. Publ. New Delhi, India.
2. Gurcharan Singh Randhawa (1973). Ornamental Horticulture in India- Today and Tomorrow printers & publishers, New Delhi, India.
3. M.S. Randhawa, (1986). Beautiful garden Trees – ICAR – New Delhi.
4. Manibushan Rao, K. (1995). Text book Horticulture. Macmillan India Ltd. New Delhi.

Reference Books

1. Manikandan K, Prabhu S, (2018). Indian Forestry A Breakthrough Approach to Forest Services, Jain Brothers. New Delhi.
2. Pathak, P.S, Ram Newaj (2012). Agroforestry: Potentials and Opportunities. Agrobios, New Delhi. India.
3. Powell, Baden B.H. (2004). Manual of Forest Law. Biotech. New Delhi.
4. Uthappa, A.R. (2015). Sangram Bhanudas Chavan, Competitive Forestry, New Vishal Publications, New Delhi.
5. Vyas, G.P.D. (2006). Community Forestry. Agrobios, Jodhpur.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Gain knowledge on horticulture and gardening.	K1
CO2	Understand the components and adornments of gardening.	K2
CO3	Explain role of phytohormones in horticulture	K2
CO4	Know the role of Indian Forest Law for forest protection.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Core Project – I		Course Code: 20PBO4PR	Course Title: Project Work	
Semester	Hours/Week	Total Hours	Credits	Total Marks
IV	6	90	5	100

Project Work

(For Candidates Joining the Course from 2020-2021 Onwards)

Project is a component of the active learning module that teaches approach and research techniques. Students would have hands on experience in investigating a selected research problem where he/she shall be trained in framing and testing hypothesis through suitable research design. Students are required to select their research topic in the one of the following domain.

Broad Research Areas

- Plant diversity and Systematic.
- Plant physiology and Biochemistry.
- Plant Molecular Biology and Biotechnology.
- Microbiology and Plant pathology.
- Environmental biology.
- Any other area.

Allocation

- Student may select their broad research area during the end of the third semester and will be guided by a suitable research supervisor in the area allotted by the HOD.
- Each research supervisor may be allotted with one or two students based on the number of students.
- Summer vacation may be used by the students to initiate their internship.

Objective of the study

- Topic investigated will have defined area of study.



- Project students will have hands on experience in all the instruments and techniques conduct his/her original research.
- Minimum of 5-10 years of literature will be added in the review with recent publication of the year.
- Standard of the project work should be high enough to be presented in conferences or to communicate as a paper and be subjected to peer review.

Evaluation

Internal Assessment Mark (40 marks) Based on

1. Literature collection (10 marks)
2. Data collection (10 marks)
3. Methodology (10 marks)
4. Presentation of result - Statistical analysis/tabulation/Thesis writing /Reference citing (10 marks).

External Mark (60 marks)

1. Dissertation 40 marks
2. Viva-voce 20 marks

Dissertation Format

- Introduction
- Review of literature
- Materials and methods
- Results
- Discussion
- Summary
- Bibliography

**Dissertation Work Done Should be Submitted in the Form of Thesis Before the
Viva-Voce Examination**



Program: M.Sc. Botany				
Core Practical – V		Course Code: 20PBO4P05		Course Title: Plant Physiology, Plant Biochemistry, Biophysics Bioinstrumentation, Biostatistics, Bioinformatics
Semester IV	Hours/Week 6	Total Hours 90	Credits 4	Total Marks 100

Course Objectives

1. To obtain knowledge on physiological functions of the plants.
2. To quantify the biochemical contents present in a given plant sample.
3. To utilize proper analytical instruments based on the need.
4. To learn the data processing and analysis using biostatistical and bioinformatics tools.

Plant Physiology and Biophysics

1. Determination of water potential (Shardakov's method)
2. Determination of solute potential
3. Estimation of Chlorophyll
4. Estimation of Carotenoids.
5. Estimation of anthocyanin
6. Estimation of Leghemoglobin content
7. Estimation of starch by perchloric method.
8. Estimation of proline and phenols in plant tissues under different environmental and physiological conditions.
9. Calculation of stomatal index of upper and lower epidermal peelings of *Moringa*.

Demonstration

1. Plant physiology experiment
 - a) Demonstration experiment on aerobic respiration.
 - b) Demonstration of photosynthetic experiment.
 - c) Demonstration of transpirational water loss by using Ganong's Photometer.
2. In vivo assay of NR and NiR.



3. Estimation of IAA
4. C3 and C4 anatomy, C4 subtypes

Biochemistry

1. Preparation of Phosphate and Citrate buffers.
2. Estimation of Carbohydrate by Anthrone method.
3. Estimation of proteins by Lowry method.
4. Estimation of DNA by Diphenylamine method.
5. Estimation of free fatty acid by titration.
6. Catalase assay from plant source.
7. Peroxidase assay from plant source.

Demonstration

1. Determination of k_m -value and V_{max} , Michaelis constant for amylase or phosphorylase.
2. Estimation of oil in oil seed by Soxhlet apparatus.
3. Preparation of silver nanoparticles.

Bioinstrumentation

Biological Analysis – Instruments such as pH meter, Centrifuge, Double beam spectrophotometry, Atomic absorption spectroscopy, Autoradiography, HPLC, GC-MS, NMR. PAGE, AGE, SDS-PAGE, 2 D electrophoresis.

Demonstration

1. Electrophoretic separation of Nucleic acid /protein.
2. Separation of lipids by TLC.

Biostatistics

1. Collection and tabulation of data (Continuous and discrete).
2. Calculation of Measures of central tendency (Mean, Median and Mode).
3. Calculation of measures of Dispersion (Standard Deviation and standard error).
4. Calculation of Chi – square test (To test the goodness of fit, to test the detection of linkage).
5. Calculation of student's 't' test. Comparison of means of two samples ('t' test for paired samples).
6. Construction of Bar diagrams, Pie Diagrams.



7. Construction of Histogram, Frequency polygon, Frequency curve.

Bioinformatics

1. Exploring NCBI database system.
2. Querying the PUBMED and GenBank databases.
3. EBI server and searching the EMBL databases.
4. Exploring and querying SWISSPROT & UniProt KB.
5. Structural Visualization of DNA, Proteins by using RCSB website.

Reference Books

1. Jeyaraman, J. (1998). Laboratory Manual in Biochemistry, New Age International Publishers Ltd
2. Khan, I.A., and Khannum, A. (1994). Fundamentals of Biostatistics. Vikas, Pub., Hyderabad.
3. Moorthy, C.S.V. (2004). Bioinformatics, Himalaya Publishing House.
4. Palanivelu, P. (2009). Analytical Biochemistry and Separation Techniques – A Laboratory manual for B.Sc. and M.Sc. Students. 21st Century Publications, Madurai.
5. Rajan, S. (2010). Experimental Procedures in Life Sciences. ANJANAA book house, Chennai.
6. Sadasivam, S. and Manicam, A. (2008). Biochemical Methods, New Age International Publishers, New Delhi.

Important Websites for Bioinformatics

1. <http://www.ncbi.nlm.nih.gov/Entrez/nucleotide.html>.
2. <http://www.ddbi.nig.ac.jp/>
3. www.ncbi.nlm.nih.gov/blast/db/
4. <http://www.rcsb.org/pdb/indea.html>



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Calculate for correlation and regression significance test.	K3
CO2	Demonstrate the photosynthetic and respiration experiment.	K4
CO3	Explain the metabolic process of plants using standard procedures.	K4
CO4	Estimate the various biochemical content.	K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



SRI VIDYA MANDIR ARTS AND SCIENCE COLLEGE (Autonomous)
KATTERI – 636 902
PG MODEL PRACTICAL QUESTION PAPER
End semester Examination Question Paper Pattern
(For the candidates admitted from the academic year 2020-21 onwards)

**Practical: V Plant Physiology, Plant Biochemistry, Biophysics
Bioinstrumentation, Biostatistics, Bioinformatics**

Time: 4 Hours

Max. Marks: 60 Marks

Practical : 50 Marks

Record : 5 Marks

Viva – Voce : 5 Marks

BREAK UP OF MARKS

1. Set up the experiment (A) assigned to you. Record your observation and interpret the Results.
Leave the set up for valuation. 8 marks
2. Comment on the setup (B). 4 marks
3. Conduct the experiment (C) assigned to you. Record your results. Leave the set-up Valuation.
8 marks
4. Verify Beers law using the given solution / Determine the pH of given sample by using pH
meter and comment on it (D) 6 marks
5. Separate and identify the given sample (E) using either TLC or Paper Chromatography
8 Marks
6. From the given material (F) find out mean and calculate the standard deviation
with Reference to its length. Present your data in the form of a graph. 6 marks
7. Writes notes on G, H, I, J, K and L 10 marks

**Key**

A - Plant physiology experiment given the syllabus (Selected by each student by lot).	8 marks
B - Plant physiology experiment (Set up)	4 marks
C Biochemistry experiment from the syllabus (Selected by each student by lot)	8 marks
D CuSO ₄ solution /K ₂ Cr ₂ O ₇ solution/ Determine the pH	6 marks
E Amino acid / Sugar/ pigments	8 marks
F Statistical data and tables are to be provided	6 marks
G, H, I, J, K and L	10 marks

Physiology, Biochemistry, Bioinstrumentation, Biostatistics and Bioinformatics
(spotters may given as charts, diagrams, equipments, apparatus, chemicals, etc.)



EXTRA DISCIPLINARY COURSE



Program: M.Sc. Botany				
Extra Disciplinary Course (EDC)		Course Code: 20PBO2EDC01	Course Title: Horticulture	
Semester II	Hours/Week 4	Total Hours 60	Credits 4	Total Marks 100

Course Objectives

1. To know the basics in the field of Horticulture.
2. To develop skills in the area of Horticulture.
3. To create knowledge on self employment through entrepreneur skills.

UNIT – I

Importance and History of Gardening – garden implements – Indoor plants and Outdoor plants – Flower arrangement-massing and ikebana – Fruit and Vegetable carving.

UNIT – II

Pods and vegetables. Nursery structures – Green house, shade house, Mist chamber – topiary – Bonsai culture. Floriculture – Rose, Chrysanthemum, Jasmine – cultivation. Hydroponics.

UNIT – III

Types of pots and containers, Potting media – components and types. Propagation, seed and vegetative – cutting, layering and grafting.

UNIT – IV

Gardening- Types of gardens – formal garden – vegetable garden – orchard – terrace garden – Rockery and water garden. Landscaped layout designing – types – formation and maintenance of lawns.

UNIT – V

Manures – microbial inoculants – composting – vermicomposting – fertilizers and their application – Role of phytohormones in horticulture – Irrigation methods.

**Text Books**

1. Adams, C.R. and Early, M.P. (2004). Principles of Horticulture. Elsevier, New Delhi.
2. Arumugam, N. and Kumaresan, V. (2014). Fundamentals of Horticulture and Plant Breeding. Saras Publication Biosciences Book Publisher. Kanyakumari, India.
3. Barton West, R. (1999). Practical Gardening in India. Discovery Publishing House, New Delhi.
4. Chadha, K.L. (2001). Hand Book of Horticulture, ICAR Publications, New Delhi.
5. George Acquaaah. (2009). Horticulture Principles and Practices. PHI Learning Private Limited, New Delhi.
6. Kumar, N. (2014). Introduction to Horticulture. Rajalakshmi Publications, Nagercoil.
7. Manibhushan Rao, K. (2009) Text book of Horticulture. Macmillan India Ltd. New Delhi.
8. Mazundar, B.C. and Mukhopadhyay, P.M. (2006). Principles & Practices of Herbal Garden. Daya Publishing House, New Delhi.
9. Percy Lancasher. (2004). Gardening in India. Oxford IBH Publishing Company Private Limited, New Delhi.
10. Sadhu, M.K. (1996). Plant Propagation. New Age International Publishers, New Delhi.
11. Sheela, V. L. (2011). Horticulture. MJP Publishers, Chennai.

Reference Books

1. Randhava, G.S. (1973). Ornamental horticulture in India. Today and Tomorrow Printers and Publishers, New Delhi.
2. Williams, C.N., Uzo, J.O. and Peregrine, W.T.H. (1991). Vegetable Production in Tropics. Longman Scientific & Technical, Essex (UK).
3. Yawalkar, K.S. (1961). Vegetable Crops of India. Agri Horticultural Publishing House, Dharmapath, Nagpur.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Acquire knowledge on cultivation of economically important plants.	K1
CO2	Understand the techniques involved in Horticulture and Management.	K2
CO3	Describe the cutting, layering and grafting techniques.	K3
CO4	Learn hand's on training on Terrarium and Bonsai techniques.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low



Program: M.Sc. Botany				
Extra Disciplinary Course (EDC)	Course Code: 20PBO2EDC02		Course Title: Herbal Botany	
Semester II	Hours/Week 4	Total Hours 60	Credits 4	Total Marks 100

Course Objectives

1. To learn about the ethnobotanical knowledge.
2. To understand the phytoconstituents in the medicinal plants.
3. To create knowledge on herbal home remedies.

UNIT – I

Brief history of medicinal plants. Indian systems of Medicine: Siddha, Ayurveda, Unani and Naturopathy. Traditional and Folklore medicine – Native medicine. Definition of Drug – Classification of natural drugs: Alphabetical, Morphological, Pharmacological and Chemical.

UNIT – II

Drug adulteration, Drug evaluation, Chemical evaluation and Biological evaluation of drugs, Phytochemical investigations. Chemistry of drugs (Alkaloids, Flavonoids, Glycosides and Tannins). Quality control of herbal drugs.

UNIT – III

Cultivation, macro and microscopic characters, chemical constitutions and therapeutic uses of drugs from root (*Catharanthus roseus* and *Rauwolfia serpentina*), drugs from bark (*Cinchona officinalis*), drugs from stem of wood (*Ephedra* sp) and drugs from underground stem (*Zingiber officinale*).

UNIT – IV

Cultivation, micro and macrostructure, chemical constitutions and therapeutic uses of leaves (*Aloe vera* and *Ocimum sanctum*), flower (*Eugenia jambolana*), fruits and seeds (*Feronia elephantum* and *Coriandrum sativum*).

**UNIT – V**

Pharmacognosy – Definition and scope. A brief account on drugs acting on central nervous system (CNS stimulants, CNS depressants and Hallucinogens). Drugs used in disorders of gastrointestinal tract (Carminatives, Bulk laxatives and Purgatives) and cardio vascular drugs (Cardiotonics, Cardiodepressants and Antihypertensives).

Text Books

1. Arumugam, K.R. and Murugesu, N. (1990). Text book of Pharmacognosy. Sathya Publishers, Chinnalapatti (Tamilnadu) 624 201.
2. Arumugam, N. and Kumaresan, V. (2014). Fundamentals of Horticulture and Plant Breeding. Saras Publication Biosciences Book Publisher, Kanyakumari, India.
3. Bhattacharjee, S.K. (2004). Hand Book of Medicinal plants. Pointer Publishers, Jaipur.
4. George Acquah. (2009). Horticulture Principles and Practices. PHI Learning Private Limited, New Delhi.
5. Gokhale, S.B., Kokate, C.K. and Purohit, A.P. (2003). Pharmacognosy. Nirali Prakashan, Pune.
6. GuhaBakshi, D.N. Sen Sharma, P. and Pal, D.C. (1996). A Lexicon of Medicinal Plants in India. Naya Prakash, Calcutta.
7. Handa, S. S. and V. K. Kapoor, (1993). Pharmacognosy. Vallabh Prakashan. New Delhi.
8. Harbourne, J. B. (1998). Phytochemical methods: A Guide to Modern Techniques of Plant Analysis (3rd edition). Chapman and Hill Co., New York.
9. Jain, (2001). Medicinal plants. National Book Trust, New Delhi.
10. John Jothi Prakash, E. (2003). Medicinal Botany and Pharmacognosy. JPR Publication, Vallioor, Tirunelveli.
11. Joshi, S.G. (2001). Medicinal plants. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
12. Kumar, N. (2014). Introduction to Horticulture. Rajalakshmi Publications, Nagercoil.
13. Medicinal Plants Source Book India, (1996). International Library Association, Switzerland.
14. Prajapathi, Purohit, Sharma and Kumar. (2003). A Hand book of Medicinal plants. Agrobios Publications, Jodhpur.
15. Purohit and Vyas, (2004). Medicinal Plants Cultivation. Agrobios Publications, Jodhpur.
16. Sheela, V. L. (2011). Horticulture. MJP Publishers, Chennai.
17. Thirugnanam, (1995). Muligaimaruthuvam (Tamil). Selvipathipakam, Trichy.



Course Outcomes (COs)

On successful completion of the course, the students will be able to

COs Number	CO Statement	Knowledge Level
CO1	Gain knowledge on ethnobotanical and Indian system of medicine.	K1
CO2	Understand the techniques involved in extraction and characterization of phytoconstituents.	K2
CO3	Explore the various techniques involved in herbal medicines.	K3
CO4	Prepare the herbal medicine as home remedies.	K3

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with PSOs

PSO \ CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	S	M
CO2	S	M	H	M	H
CO3	H	S	H	S	S
CO4	H	H	M	S	M

S – Strong

H – High

M – Medium

L – Low