VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN

(AUTONOMOUS)

ELAYAMPALAYAM, THIRUCHENGODE (Tk.), NAMAKKAL (Dt.) - 637 205

(Affiliated to Periyar University, Approved by AICTE & Re-Accredited with "A" by NAAC)

DEPARTMENT OF BOTANY

MASTER OF SCIENCE

SYLLABUS & REGULATIONS

CANDIDATES ADMITTED FROM 2020 - 2021 ONWARDS
UNDER OBE AND CBCS PATTERN

VIVEKANANDHA EDUCATIONAL INSTITUTIONS

ANGAMMAL EDUCATIONAL TRUST

ELAYAMPALAYAM, THIRUCHENGODE (Tk.), NAMAKKAL (Dt.) - 637 205

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COLLEGE OF ARTS AND SCIENCES FOR WOMEN

(AUTONOMOUS)

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Reaccredited with "A" Grade by NAAC

(Affiliated to Periyar University, Salem – 636 011)

M.Sc., Botany - Branch V

Vision:

- To imparting skills and values for the women graduates through innovative teaching, learning and research in plant science to meet the needs of youth and national demand.

Mission:

- To create demand for Botany.
- Strengthen the Department by research.
- To provide quality education through field study and projects, laboratory courses and entrepreneurial skills in Botany to achieve their diligence.
- To raise the students high academic caliber to meet the requirements of industries through productive research in various fields of Botany.
- To enhance opportunities to the rural women students for their successful career.

Programme Educational Objectives (PEOs):

1. To acquire knowledge on the basic and applied aspects of various fields of Botany thereby develop a self employment opportunities.
2. To obtain knowledge on logical, creative thinking and analytical aspects on the current of biological sciences.
3. To promote research in various thrust areas of Botany such as diversity of plants, conservation of biodiversity, environmental pollution, cell and molecular biology, taxonomy, anatomy, phytochemistry and pharmacognosy.

Programme Specific Objectives (PSOs):

1. To focus on different fields of plant science to become researcher, entrepreneur and professionals to develop certain life skills and analytical skills in plant science.

2. To expose the students to a wide range of careers that combine biology, plants and medicine and render graduates with field projects and research project in a research laboratory to further development in the career prospects.

3. To create awareness on conservation and to develop aesthetical values on nature and management of plant ecosystem.

Programme Outcomes (PO's):

POs	OUTCOME	CPD
PO-1	Students will able to understand the concepts that mould the understanding of biological function within this organizational hierarchy, and also garner a perspective for the historical development of understanding through the investigative use of life science.	K2
PO-2	Students shall become knowledgeable about molecular, cellular, physiological, behavioural, ecological and evolutionary levels of biological organization, whose emphases will be relevant to each of the courses of bioscience departments.	K1
PO-3	Students shall be able to explain the roles of evolution, information flow, structure – function relationship, transformation of energy matters, and systems in understanding and explaining the biological principles.	K2
PO-4	The postgraduate candidate will be able to develop problem-solving skills through the use of critical thinking, quantitative measurement and analysis in seminar hall, laboratory classes, writing exercises in lecture classes, and in mentored rsesearch experiences.	K4
PO-5	Students are intended that our students will make links among classes to understand how knowledge can be used to promote application for the nature of life on Earth.	K4
PO-6	Students shall able to use research based knowledge and research methods to design an experiment, analysis and interpreting the date to generate appropriate information for coming up with valid conclusions.	K5
PO-7	Students shall be able to design, conduct experiments, analyse and interpret data for investigating problem in biological sectors and allied fields	K3
PO-8	Students shall able to apply knowledge of basic cell systems of living organisms along with master specialization to find out solutions for complex problems and questionnaires that are existing among society	K4
PO-9	Students will be able to write research proposals by adapting appropriate methodologies to fund new research (or) develop new programs that apply biological concepts and encouraged to appreciate ownership of their own intellectual property through recognition of their abilities and efforts to generate ideas, research, concepts and knowledge.	K4
PO-10	Students shall able to demonstrate and develop wide knowledge in diverse life science fields and management principles for effective project management and execution with ethical principles thereby ensuring sustainable development of the society.	K5

PO-11	Students can able to apply selective technical resources and IT tools for predicting and modelling the complex bioscience activities with the knowledge of its shortcomings.	K3
PO-12	Students shall able to generate and develop entrepreneurship ventures, consultancy services and training centres that encourage self employment.	K6
PO-13	Students shall develop tendency to make them enrolled in higher studies (M. Phil., & Ph. D.) related to research, by taking up various competitive examinations such as GATE, ICMR, ICAR, DBT & CSIR-NET which promote financially supported research career.	K6
PO-14	Students shall become as production/technical officer in various sectors such as pharmaceutical companies, fertilizer industries, clinical laboratories, feed formulation firms, food processing industries, environmental assessment units, fisheries units, R&D laboratories of bioscience by developing their technical and managerial skill set.	K6
PO-15	Students shall able to demonstrate the knowledge of life science and biological principles and apply in one's own work, as a team leader and member for managing the projects in multidisciplinary environment in different life science sectors.	K6

For Candidates Admitted from 2020 - 2021 Onwards Under OBE and CBCS Pattern

1. Scope of the Department

Botany is classical science dealing with not merely about morphology of plants but also their functional aspects and economic importance. Further, the study helps us to understand the role of plants in maintaining the environment besides, saving as a renewable energy sources. Plants are most valuable in treating the ailments of mankind. It has several branches such as Plant Diversity, Plant Morphology, Taxonomy, Anatomy, Embryology, Mycology, Pathology, Physiology, Ecology and Ethnobotany, etc., besides serving as the basis for several other biosciences. It is a basic science with several research disciplines like modern transgenic biology.

2. Objectives of the course

This course will enable the students

- To gain knowledge of the importance of plants in conserving food and fuel.
- To acquire skills in drawing by actual observation at its original and natural condition.
- To know the nutritive value of food and maintain 'Health and Care Problems'.
- To create awareness in the understanding of extinct plants.
- To create awareness of natural resources and methods of conservation.

- To develop skill in students of growing various horticultural plants thereby to raise a nursery.
- To train in techniques of vegetative propagation and gardening.
- To motivate for self-employment by knowledge and practicing in the preparation of bio-fertilizers.
- 'Earn while learn' can be done with the acquirement of basic knowledge in growing some medicinal plants.
- To gain knowledge for exploration of new plants unknown value and known plants of unknown value of their secondary metabolites.
- To gain a knowledge of the techniques of producing desirable plants through the study of molecular biology and genetic engineering.

3. Conditions for Admission:

A candidate who has passed B.Sc., Examination with Botany as main subject of any university or an examination accepted as equivalent thereto or as per norms said by the Government of Tamil Nadu is permitted to appear and qualify for M.Sc., Degree examination of this university after a course of study of two academic years.

4. Duration of the Course:

The course for the degree of Master of Science in Botany shall consist of two academic years divided into four semesters.

5. Course of Study:

The course of study shall comprise of instruction in the following subjects according to the syllabus and books prescribed from time to time.

Semester I

1. Core Course I - Diversity of Plants – I
2. Core Course II - Diversity of Plants – II
3. Core Course III - Taxonomy of Angiosperms
4. Core Course IV - Practical - I - Comprising Core Course I and II
5. Core Course V - Practical – II – Core Course – III
6. Elective I - Intellectual Property Rights / Evolutionary Biology

Semester II

7. Core Course VI - Anatomy and Embryology of Angiosperms and Plant Microtechnique
8. Core Course VII - Cell and Molecular Biology and Genetics
9. Core Course VIII - Practical - III - Comprising Core Course VI and VII
10. Elective II - Herbal Technology / Soil Science and Biology
11. Elective III - Plant Bio-technology and Bioinformatics / Algal Cultivation Technology

Semester III

12. Core Course IX - Plant Physiology
13. Core Course X - Environmental Biology and Resource Management
14. Core Course XI - Microbiology and Plant Pathology.
15. Core Course XII - Practical - IV - Comprising Core Course IX, X and XI
16. EDC - Sericulture

Semester IV

17. Core Course XIII - Biophysics and Biochemistry
18. Core Course XIV - Instrumentation Techniques
19. Core Course XV - Practical – V - Comprising Core Course XIII and XIV
20. Elective IV - Research Methodology / Palynology
21. Project Work

6. Examinations:

The theory examination shall be of three hours duration to each paper at the end of the semester. The candidates failed in any subject will be permitted to appear for each failed subject or subjects in the subsequent examination. The practical examination is of four hours duration at the end of even semester. However in the final semester examination in the failure of one or two subjects they can appear for a supplementary exam within a month.

The examination consists of Continuous Internal Assessment (CIA) and External Assessment (EA) along with viva-voce examination.

Internal Assessment Marks for Theory papers are as follows

Attendance	-	5	Marks
Assignment	-	5	Marks
Seminar	-	5	Marks
Test	-	5	Marks
Model	-	5	Marks
Total	-	25	Marks

Internal Assessment Marks for Practical papers are as follows

Attendance	-	10	Marks
Observation	-	10	Marks
Test	-	20	Marks
Total	-	40	Marks

7. Distribution of Marks for Attendance:

Percentage	Marks	
	Theory	Practical
75 – 80	1	2
81 – 85	2	4
86 – 90	3	6
91 – 95	4	8
96 – 100	5	10

Note:

Minimum 75 % of attendance is compulsory to sit for the exam. A condonation can be permitted between “65 %” and “74.9 %”.

8. Scheme of Examination:

The scheme of Examinations for different semesters shall be as follows.

Vivekanandha

College of Arts and Sciences for Women

(Autonomous)

Elayampalayam, Tiruchengode

M. Sc., Botany – Outcome Based Education

(For the candidates admitted from the Academic year 2020 - 2021 Onwards)

Semester	Course	Code	Course Title	Inst. Hrs.	Credits	Exam Hrs.	Marks		
							CIA	EA	Total
I	Core Course I	20P1BO01	Diversity of Plants – I	6	5	3	25	75	100
	Core Course II	20P1BO02	Diversity of Plants - II	6	5	3	25	75	100
	Core Course III	20P1BO03	Taxonomy of Angiosperms	6	5	3	25	75	100
	Core Course IV (Practical I)	20P1BOP01	Comprising Core Course I and II	6	3	4	40	60	100
	Core Course V (Practical II)	20P1BOP02	Comprising Core Course III	3	3	4	40	60	100
	Elective I	20P1BOE01	Intellectual Property Rights / Evolutionary Biology	3	3	3	25	75	100
			Total	**30**	**24**	**-**	**200**	**420**	**600**
II	Core Course VI	20P2BO04	Anatomy and Embryology of Angiosperms and Plant Microtechnique	6	5	3	25	75	100
	Core Course VII	20P2BO05	Cell and Molecular Biology and Genetics	6	5	3	25	75	100
	Core Course VIII (Practical III)	20P2BOP03	Comprising Core Course VI and VII	6	4	4	40	60	100
	Elective II	20P2BOE02	Herbal Technology / Soil Science and Biology	6	4	3	25	75	100
	Elective III	20P2BOE03	Plant Biotechnology and Bioinformatics / Algal Cultivation Technology	6	4	3	25	75	100

			Total	**30**	**22**	**-**	**140**	**360**	**500**
Semester	**Course**	**Code**	**Course Title**	**Inst. Hrs.**	**Credits**	**Exam Hrs.**	**Marks**		
							CIA	**EA**	**Total**
III	Core Course IX	20P3BO06	Plant Physiology	6	5	3	25	75	100
	Core Course X	20P3BO07	Environmental Biology and Resource Management	5	5	3	25	75	100
	Core Course XI	20P3BO08	Microbiology and Plant Pathology	5	5	3	25	75	100
	Core Course XII (Practical IV)	20P3BOP04	Comprising Core Course IX, X and XI	8	4	4	40	60	100
	EDC	20P3ZOED01	Sericulture	4	4	3	25	75	100
	Value Education	20P3HR01	Human Rights	2	1	2	25	75	100
			Total	**30**	**24**	**-**	**165**	**435**	**600**
IV	Core Course XIII	20P4BO09	Biophysics and Biochemistry	5	4	3	25	75	100
	Core Course XIV	20P4BO10	Instrumentation Techniques	5	4	3	25	75	100
	Core Course XV (Practical V)	20P4BOP05	Comprising Core Course XIII and XIV	6	4	4	40	60	100
	Elective IV	20P4BOE04	Research Methodology / Palynology	4	3	3	25	75	100
	Project Work	20P4BOPR01	-	10	5	-	40	60	100
			Total	**30**	**20**	**-**	**155**	**345**	**500**
			Total No. of Hours and Credits	**120**	**90**	**-**	**2200**		

Question Paper Pattern for M.Sc., Botany Course

Time: 3 Hrs **Max. Marks: 75**

PART – A (20 x 1 = 20 Marks)
(*Answer all questions*)
(Multiple Choice Questions - Four questions from each unit)

PART – B (5 x 5 = 25 Marks)
(*Answer all questions*)
(One question from each unit with internal choice)

PART – C (3 x 10 = 30 Marks)
(*Answer any three questions)*
(One question from each unit)

9. Format to be followed in dissertation

The formats / certificate for dissertation to be submitted by the students are given below:

1) Format for the preparation of project work

(a) Title page

(b) Bonafide certificate

(c) Acknowledgement

(d) Table of contents

Contents

Format of the title Page

TITLE OF THE DISSERTATION

Dissertation Submitted in partial fulfillment of the

requirement for the award of the Degree of

Master of Science in Botany

to the Periyar University, Salem - 636011

By

Student Name

Register Number

Under the Guidance of

Guide Name

College / University Department

Year

Format of the Certificate

CERTIFICATE

This is to certify that the dissertation entitled …….(title of the dissertation)…..submitted by ……. (name of the candidate)…. in partial fulfillment of the requirement of the degree of Master of Science in Botany to the Periyar University, Salem is a bonafide record of independent research work done by her during the period …. (Year)… of her study in the Department of Botany at Vivekanandha College of Arts and Sciences for Women, Elayampalayam, under my supervision and guidance. This dissertation has not formed the basis for the award of any Degree, Diploma, similar titles or associate ship to any candidates of this University.

Viva –Voce Examination Date:

Signature of Head **Signature of the Guide**

Examiners: 1.

2.

10. Passing Minimum:

The Candidate shall be declared to have passed the examination if the candidate secures not less than 38 marks out of 75 marks in the university examination in each theory paper. There is no passing minimum for internal assessment. For the practical paper, a minimum of 30 marks out of 60 marks in the University practical examination and the record notebook taken together. There is no passing minimum for internal assessment and record note book. However submission of a record note book is a must.

For the project work and viva – voce the candidate should secure 30 marks out of 60 marks for pass. There is no passing minimum for internal assessment. The candidate should compulsorily attend viva-voce examination to secure pass in that paper. Candidate who does not obtain the required minimum marks for a pass in a paper / project report shall be required to appear and pass the same at a subsequent appearance.

11. Classification of successful candidates

Candidates who secure not less than **60%** of the aggregate marks in the whole examination shall be declared to have passed the examination in first class. All other successful candidates shall be declared to have passed in the **second class.**

Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in **first class with Distinction** provided they pass all the examinations prescribed for the course at the first appearance.

12. Maximum duration for the completion of the PG Programme

The maximum duration for completion of the PG Programme shall not exceed 4 semesters.

13. Commencement of this Regulation

These regulations shall take effect from the academic year 2020-21, i.e., for students who are to be admitted to the first year of the course during the academic year 2020-21 and thereafter.

14. Transitory Provision

Candidates who were admitted to the PG course of study before 2020-21 shall be permitted to appear for the examinations under those regulations for a period of three years i.e., up to and inclusive of the examination of April / May 2020. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

SEMESTER I

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P1BO01	Title	Batch	2020 -2022
Hours/Week	6	Diversity of Plants – I (Algae, Fungi, Lichens and Bryophytes)	Semester	I
			Credits	05

Course Objective

To study the general characters, classification, thallus structure, reproduction, life cycle and economic importance of algae, fungi, lichens and bryophytes.

Course Outcomes (CO)

K1	CO1	To acquire knowledge on Morphology, Ecology and Economic importance of Algal forms.
K2	CO2	To understand and analyse structure, Reproduction and Characteristic feature of Fungal Organisms.
K3	CO3	To develop an entrepreneurship skill among the plant Science graduates for the production of industrial products.
K4	CO4	To create awareness on conservation of lower plants of Thallophytes.
K5	CO5	To evaluate the role of thallophytes in environmental sustainability.

UNIT - I **(15 Hours)**

Algae: General characteristics with reference to thallus structure, pigmentation and life cycle. Classification of algae (Bold and Wynne, 1978) - Criteria used in algal classification - Ecology of algae - Economic Importance of algae (Micro- and Macro-algae).

UNIT - II **(15 Hours)**

Structure and reproduction of the following genera of algae: *Lyngbya*, *Nostoc*, *Cladophora*, *Codium, Padina*, *Batrachospermum* and *Gracilaria*.

UNIT – III **(15 Hours)**

Fungi: General characteristics of fungi with reference to their occurrence, thallus structure and reproduction - Classification of fungi by Alexopoulos and Mims (1979). Nutrition in fungi – Heterothallism - Parasexuality - Phylogeny and affinities of fungi – Economic importance of fungi.

UNIT - IV **(15 Hours)**

Detailed study of the occurrence, thallus structure and reproduction of the following genera of fungi: *Peronospora*, *Aspergillus*, *Polyporus*, *Fusarium* and *Ustilago*

UNIT - V **(15 Hours)**

A general account of lichens with special reference to their structure and reproduction - Life history and classification of Bryophytes (Watson, 1963) - Ecology and evolution of Bryophytes - Fossil Bryophytes - A detailed study of *Targionia*, *Dumortiera*, *Lunularia* and *Marchantia*

Text Books:

1. Sharma, P.D. 2003. The Fungi. ELBS Publication, London
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 2007. Introductory Mycology. 4th Edt., Wiley India Pvt. Ltd., New Delhi.
3. Chopra, R.N., Kumar, P.K. 2005. Biology of Bryophytes. New Age International Pvt. Ltd., New Delhi.
4. Smith, A.J.E. 2012. Bryophyte ecology. Springer Netherlands, London.
5. Dubey, H.C. 2013. An introduction to Fungi. Scientific Publisher, India.

Reference Books:

1. Sharma, S. 2012. Advances In Mycology, Random Publications Publishers and Distributors, New Delhi.
2. Graham, L.E., Graham, L.F., Wilcox, L.W. 2010. Algae, Prentice Hall
3. Lee, R.E. 2008. Phycology. Cambridge University Press, Cambridge.
4. Dube, H.C. 2013. An Introduction to Fungi. Scientific Publishers, India
5. Nash, T.H.III. 2008. Lichen Biology. Cambridge University Press, Cambridge.
6. Shaw, A.J., Goffinet, B. 2000. Bryophyte Biology. Cambridge University Press, Cambridge.
7. Church, J.M. 2001. Mosses and Liverworts. Joint Nature Conservation Committee, Great Britain.

Web links:

1. https://plantlet.org/divisions-pyrrhophyta-cryptophyta-rhodophyta/
2. https://science.jrank.org/pages/205/Algae.html
3. https://www.biologydiscussion.com/algae/algae-definition-characteristics-and-structure-with-diagram/46727
4. https://www.biologydiscussion.com/fungi/classification-of-fungi-by-various-botanists/46471#:~:text=Later%2C%20C.%20J.-,Alexopoulos%20and%20C.%20W.,%2C%20class %20and%20form%2Dclass.

5. https://www.biologydiscussion.com/botany/bryophytes/list-of-4-important-fossil-brophytes/46208
6. https://www.biologydiscussion.com/lichens-2/lichens-definition-structure-and-reproduction-with-diagram/69697

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER I

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P1BO02	Title	Batch	2020 -2022
Hours/Week	6	Diversity of Plants – II (Pteridophytes, Gymnosperms and Fossils)	Semester	I
			Credits	05

Course Objective

To study the general characters, classification, reproduction and life cycle of Pteridophytes, Gymnosperms and fossils.

Course Outcomes (CO)

K1	CO1	To bridge the gap between fossils and present day living forms
K2	CO2	To acquire knowledge on phylogenetic trends occur in Plant.
K3	CO3	To understand the structure and reproduction of Pteridophytes and Gymnosperms.
K4	CO4	To acquire knowledge on plants existing in the past.
K5	CO5	Evaluating the geological time scale of pteridophytes and gymnosperms fossil forms.

UNIT - I **(15 Hours)**

Classification of Pteridophytes (Sporne, 1976) - Evolution of sorus in ferns – General characters of the following orders - Psilotales, Isoetales, Equisetales, Filicales and Salviniales - Stelar evolution in Pteridophytes – Heterospory and seed habit.

UNIT - II **(15 Hours)**

Detailed study of range in structure, reproduction and affinities of the gametophytes and sporophytes with special reference to *Psilotum*, *Isoetes*, *Equisetum*, *Angiopteris*, *Pteris*, *Osmunda* and *Salvinia.*

UNIT - III **(15 Hours)**

Classification of Gymnosperms (Sporne, 1967). General account of Pteridospermales and Bennettitales. Comparative morphology and phylogeny of Cycadales, Coniferales and Gnetales. Evolution of male and female gametophyte.

UNTI - IV **(15 Hours)**

Study of morphology and anatomy of the vegetative and reproductive structures of *Araucaria*, *Podocarpus*, *Cupressus* and *Ephedra*

UNIT - V **(15 Hours)**

Fossils and fossilization- methods, types of fossils. Study of morphology and anatomy of the vegetative and reproductive structure in the following fossil forms: *Sphenophyllum, Sigillaria*, *Lyginopteris* and *Cordaites*

Text Books:

1. Sharma, O.P. 2012. Pteridophyta. Tata McGraw Hill Publishing Company, New Delhi.
2. Biswas, C., Johri, B.M. 2004. The Gymnosperms. Narosa Publishing House, New Delhi.
3. Coutler, J., Chamberlain, C.J. 2018. Morphology of Gymnosperms. CreateSpace Independent Publishing Platform, United States.
4. Sporne, K.R. 2018. The Morphology of Pteridophytes; The Structure of Fern and Allied plants. Creative Media Partners, LLC, United States.
5. Cleal, C.J., Thomas, B.A., 2019. Introduction to Plant Fossils, Cambridge University Press, United Kingdom.
6. Pooja, 2004. Pteridophyta. Discovery Publishing House Pvt. Ltd., New Delhi.
7. Sambamurthy, A.V.S.S. 2010. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I.K. International Publishing House Pvt. Ltd., New Delhi.
8. Connors, K. 2012. Plant Fossils. Gareth Stevens Publishing LLLP, New York.

Reference books:

1. Stewart, P., Globig, S. 2012. Vascular Plants and Paleobotany, Apple Academic Press, New York.
2. Biswas, C., Johri, B.M. 2013. The Gymnosperms. Springer Berlin Heidelberg, New York.
3. Anderson, J.M., Anderson, H.M., Cleal, C.J., 2007 Brief History of the Gymnosperms - Classification, Biodiversity, Phytogeography and Ecology. South African National Biodiversity Institute, South Africa.
4. Pant, D.D., Osborne, R. 2002. An Introduction to Gymnosperms, Cycas, and Cycadales. Birbal Sahni Institute of Palaeobotany, Lucknow.
5. Taylor, L., Taylor, T.N. Krings, M. 2009. Paleobotany - The Biology and Evolution of Fossil Plants, Elsevier Science, USA.

Web links

1. http://www.biologyreference.com/Po-Re/Pteridophytes.html
2. https://www.biologydiscussion.com/pteridophytes/heterospory-and-seed-habit-in-pteridophytes-botany/53013#:~:text=The%20adoption%20of%20heterospory%20and,characteristic%20feature%20of%20the%20spermatophytes.
3. https://www.biologydiscussion.com/plants/plant-kingdom/biology-notes-on-fern/52315
4. https://www.easybiologyclass.com/general-characters-of-gymnosperms-lecture-notes with-ppt/
5. https://biologyboom.com/fossil-and-fossilization/

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER I

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P1BO03	Title	Batch	2020 -2022
Hours/Week	6	Taxonomy of Angiosperms	Semester	I
			Credits	05

Course Objective

To study the general characters, identification, classification of angiosperms.

Course Outcomes (CO)

K1	CO1	To develop knowledge on identification of plants.
K2	CO2	To develop the skills on preparation of keys for plant identification.
K3	CO3	To understand the different system of classification.
K4	CO4	To apply the knowledge of the herbarium techniques in the preservation, conservation and identification of plants.
K5	CO5	To evaluate the various plant identification techniques.

UNIT - I **(15 Hours)**

History and principles of classification. Natural system of classification. Detailed account of the system of classification proposed by Taktajan, Hutchinson and Cronquist, APG III (Including merits and demerits) - Herbarium techniques, Digital herbarium.

UNIT - II **(15 Hours)**

Modern trends in classification - Taximetrics, Chemotaxonomy and Biosystematics. BSI- Organization, function and contribution - Taxonomic literature – Taxonomic index, Flora, Monographs and Revisions, e- flora and xerology. Plant Molecular Systematics – an introduction and its practical implications.

UNIT - III **(15 Hours)**

Plant identification – Methods of identification - Keys: Types of keys, rules for construction of keys, advantages and disadvantages - Nomenclature, ICBN, Typification, Priority, Publication, Author citation and retention, Choice and rejection of names.

UNIT - IV **(15 Hours)**

A detailed account of the following families and their economic importance- Menispermaceae, Magnoliaceae, Caryophyllaceae, Oxalidaceae, Meliaceae, Sapindaceae, Polygalaceae, Lythraceae, Aizoaceae and Moringaceae.

UNIT - V **(15 Hours)**

Boraginaceae, Bignoniaceae, Rhizophoraceae, Oleaceae, Moraceae, Orchidaceae, Nyctaginaceae, Loranthaceae, Aristolochiaceae, Cactaceae, Cyperaceae and Poaceae.

Text Books:

1. Pullaiah, T. 2007. Text Book of Angiosperms, Regency Publications.
2. Roland, A. 2005. Taxonomy of Angiosperms, Saras Publication, Nagercoil.
3. Lawrence, G.H.M. 2012. Taxonomy of vascular plants. Scientific Publishers, India.
4. Sambamurthy, A.V.S.S. 2010. Taxonomy of Angiosperms. I.K. International Publishing House Pvt. Ltd., New Delhi.
5. Simpson, M.G. 2019. Plant Systematics. Elsevier Science, UK.
6. Subramaniyam, N.S. 2009. Modern Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.

Reference Books:

1. Verma, B.K. 2011. Introduction to Taxonomy of Angiosperm. PHI Learning Private Limited, New Delhi.
2. Gamble J.S. and Fisher, L.E.F. 1967. The Flora of the Presidency of Madras (Volume I. III). BSI, Calcutta.
3. Grant, E.F. 2013. Plant Biosystematics. Elsevier Science, Academic Press Inc., Canada.
4. Festschrift, P.S. 2012. Plant taxonomy – Past, Present and Future. Energy and Resources Institute, New Delhi.
5. Takhtajan, A. 2009. Flowering plants. Springer Netherlands, Russia.
6. Nayar, T.S., Beegam, A.R., Sibi, M. 2014. Flowering Plants of the Western Ghats, India: Dicots. Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Kerala.
7. Hajra, P.K., Mudgal, V. 2001. Floristic Diversity and Conservation Strategies in India: Angiosperms (selested groups) and Ethnobotany, Botanical Survey of India, Ministry of Environment and Forests, India.

Web links:

1. https://biologyboom.com/besseys-classification-system/
2. https://www.biologydiscussion.com/angiosperm/methods-of-preparation-of-herbarium-specimens-with-diagram/6532
3. https://www.biologydiscussion.com/india/botanical-survey/botanical-survey-of-india-bsi-an-overview/47599

4. https://www.biologydiscussion.com/plant-taxonomy/taxonomic-keys-meaning-suggestions-and-types/30278
5. https://www.biologydiscussion.com/plants/flowering-plants/an-overview-on-family-caryophyllaceae-botany/19762#:~:text=It%20consists%20of%20two%20or,most%20characteristic%20of%20the%20family.
6. https://www.biologydiscussion.com/angiosperm/dicotyledons/nyctaginaceae-characters-distribution-and-types/48472

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER I

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P1BOE01A	Title	Batch	2020 -2022
Hours/Week	3	Intellectual Property Rights	Semester	I
			Credits	03

Course Objective

To study the theories of intellectual property rights, patents and copyrights protection of plant varieties and biological intellectual property rights.

Course Outcomes (CO)

K1	CO1	To acquire knowledge on concept, scope, types and theories of intellectual property rights.
K2	CO2	To understand the patents and copyrights.
K3	CO3	To understand the traditional knowledge protection, bio-prospecting and bio-piracy.
K4	CO4	To create awareness on biological intellectual property rights.
K5	CO5	To evaluate the role of Intellectual Property Rights on Biosafety.

UNIT – I **(12 Hours)**

Intellectual Property Rights - An introduction, concept and scope, origin and development. Kinds of Intellectual Property Rights. Intellectual Property Rights in India and world. Theories of Intellectual Property Rights –Natural Theory, Personality Theory and Economic Theory.

UNIT – II **(12 Hours)**

Patents: Objectives and Scope, Rights, Patent Act 1970 and its amendments. Types of patents. Procedure of obtaining patents. Working of patents. Limitations, exceptions and infringement. Copyrights: Nature and Scope. Works protected under copyright law. Rights - Economic and Moral. Transfer of Copyright, Infringement and remedies.

UNIT – III **(12 Hours)**

Traditional Knowledge Protection: Objective, Concept of traditional knowledge, Need for protection, holders, issues concerning. Bio-Prospecting and Bio-Piracy. Institutional Biosafety Committee. Alternative ways, Protectability, Traditional Knowledge on the International Arena-at WTO, at National level, Traditional Knowledge Digital Library.

UNIT – IV **(12 Hours)**

Protection of Plant Varieties: Introduction to plant varieties – Law and science, Plant Varieties Protection - Objectives, evolution, justification, international position and plant varieties protection in India. Rights of farmers, Breeders and Researchers. National gene bank, Benefit sharing. The Biological Diversity Act, 2002; Protection of Plant Varieties and Farmers' Rights Act, 2001.

UNIT –V **(12 Hours)**

Biology and Intellectual Property Rights: Patenting Biological Inventions: Objective, Applications, Concept of Novelty, Concept of invention; Moral Issues in Patenting Biological inventions, patent and human right issues.

Text Books:

1. Verkey, E. 2007. Law of Plant Varieties Protection, Eastern Book Company, Bengaluru.
2. Gopalakrishnan, N.S., Ajitha, T.G. 2014. Principles of Intellectual Property, 2nd Ed., Eastern Book Company, Bengaluru.
3. Watal, J. 2002. Intellectual Property Rights in the WTO and Developing Countries, Oxford University Press, Oxford, United Kingdom.
4. Verma, S.K., Mittal, R. 2004. Intellectual Property Rights – A Global Vision, Indian Law Institute, New Delhi.
5. Rao, M.B., Rao, M.B., Guru, M. 2010. Patent Law in India. Kluwer Law International, Netherlands.

Reference Books:

1. Pandey, N., Dharni, K. 2014. Intellectual Property Rights, PHI Learning, New Delhi.
2. Cornish, W. R. 2010. Intellectual Property: Patents Copyright Trademarks and Allied Rights, Sweet and Maxwell, London.
3. Sreenivasulu, N.S. 2013. Law relating to Intellectual Property, Patridge Publishing, India.
4. Sreenivasulu, N.S., Raju, C.B. 2008. Biotechnology and Patent Law, Patenting Living Beings, Manupatra, India.
5. Paul Goldstein, 2012. International Copyright: Principles, Law and Practice, Oxford University Press, Oxford, United Kingdom.

Web links:

1. https://www.abyssinialaw.com/online-resources/study-on-line/item/468-theories-of-intellectual-property#:~:text=Property%20right%20is%20a%20natural%20right.&text=This%20theory%20may%20be%20justifiable,part%20of%20the%20public%20domain.
2. https://www.investopedia.com/articles/investing/111014/patents-trademarks-and-copyrights-basics.asp
3. https://en.wikipedia.org/wiki/Bioprospecting
4. https://www.indiacode.nic.in/bitstream/123456789/1909/1/200153.pdf
5. https://www.eubios.info/Papers/PATENT.htm

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER I

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P1BOE01B	Title	Batch	2020 -2022
Hours/Week	3	Evolutionary Biology	Semester	I
			Credits	03

Course Objective

To study the theory of evolution with respect to the time scale, phenotypic and genotypic traits, and phylogeny

Course Outcomes (CO)

K1	CO1	To understand the modern evolutionary theory in relation to the origin and time scale
K2	CO2	To explain the origin of life of prokaryotes and eukaryotes
K3	CO3	To provide information of population genetics and various sources of variation in the evolution
K4	CO4	To develop comprehensive knowledge on microevolution and macroevolution.
K5	CO5	Evaluating the importance of evolution.

UNIT – I **(12 Hours)**

Evolution - History, Time scale, Eras, periods and epoch; Major events in the evolutionary time scale; Before and After Darwin; Evolutionary synthesis – Modern Synthesis.

UNIT – II **(12 Hours)**

Origin of Biological molecules – an Introduction; Concept of Oparin and Haldane; Experiment of Miller (1953); The first cell; Origin and Evolution of prokaryotes and eukaryotes – an outline; Major groups of plants; Anaerobic metabolism and aerobic metabolism. Neolithic founder crops

UNIT – III **(12 Hours)**

Evolutionary ecology - concepts and principles; Biological diversity - classification and species; Phylogeny, Phylogenetic trees – Usage, Tree of Life; The fossil record; Evolutionary trends; Rates of evolution; Biogeography – History, Major patterns of distribution. Genetic diversity - Genetic variation among populations.

UNIT – IV **(12 Hours)**

Microevolution: Genetic drift, sampling, Genetic bottleneck - Founder effects; molecular evolution - Neutral theory; Natural selection – Adaptation; Levels of selection. Genetical theory -Fitness and models of selection – an outline; Evolution of phenotypic traits, Species and speciation, Co-evolution.

UNIT – V **(12 Hours)**

Macroevolution: Introduction, Types; Patterns of evolutionary change. Evolution and development. Diversity and Classification of flowering plants; Taxonomic evidence - structural and biochemical; Diversity- patterns and applications.

Text Books:

1. Ridley, M. 2003. Evolution, 3rd Edt., Blackwell, UK.
2. Scott, R., Freeman, Herron, J.C. 2000. Evolutionary Analysis, Prentice Hall, US.
3. Barton, N.H., Briggs, D.E.G, Eisen, J.A., Goldstein, D.B., Patel, N.H. 2007. Evolution. Cold Spring Laboratory Press, New York.
4. Futuyma, D.J. 2009. Evolution. Sinauer Associates, New England.
5. Kliman, R.M. 2016. Encyclopedia of Evolutionary Biology. Academic Press, London.

Reference Books:

1. Barraclough, T.G. 2019. The Evolutionary Biology of Species. Oxford University Press, London.
2. Serreli, E., Gontier, N. 2015. Macroevolution – Explanation, Interpretation and Evidence. Springer International Publishing, Switzerland.
3. Bock, J.H., Linhart, Y.B., Stebbins, G.L., Turner, C.E. 2019. The Evolutionary Ecology of Plants, CRC Press, London.
4. Larson, E.J. 2006. Evolution: The Remarkable History of a Scientific Theory. Random House Publishing Group, US.
5. Briggs, D. 2009. Plant Microevolution and Conservation in Human-influenced Ecosystems. Cambridge University Press, US.

Web links:

1. https://en.wikipedia.org/wiki/Evolutionary_biology#:~:text=Evolutionary%20biology%20is%20the%20subfield,diversity%20of%20life%20on%20Earth.
2. https://www.biologydiscussion.com/evolution/mechanism-of-evolution-4-theories-biology/49525
3. https://www.biologydiscussion.com/essay/macroevolution/essay-on-macroevolution-species-biology/84936
4. https://biologydictionary.net/microevolution/
5. https://organismalbio.biosci.gatech.edu/biodiversity/phylogenetic-trees/

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

Core Practical

For Students Admitted from the academic year 2020 – 2021

Core Major Practical I – Core Course IV (For Core Course I)

(Paper Code 20P1BOP01)

Algae, Fungi, Lichens and Bryophytes

Algae:

Study of morphology and anatomy of the vegetative and reproductive organs of *Lyngbya, Nostoc, Cladophora, Codium, Padina, Batrachospermum* and *Gracilaria.*

Fungi:

Study of morphology and anatomy of the vegetative and reproductive organs of *Peronospora, Aspergillus, Polyporus, Fusarium* and *Ustilago.*

Lichens:

Study of vegetative structures and structure of apothecium.

Bryophytes:

Study of morphology and anatomy of the vegetative and reproductive organs of *Targionia, Dumortiera, Lunularia* and *Marchantia*.

Note:

1. Field trip to a hill station and coastal area for a minimum period of five days for the collection of herbarium specimens and to observe and study the lower plants in their natural habitat.
2. Submission of 15 Herbarium sheets from Algae, Fungi, Lichens and Bryophytes.
3. Certified record work done in the laboratory during practical classes.

For Students Admitted from the academic year 2020 – 2021

Core Major Practical I – Core Course IV (For Core Course II)

(Paper Code 20P1BOP01)

Pteridophytes, Gymnosperms and Palaeobotany

Pteridophytes:

Study of morphology and anatomy of the vegetative and reproductive organs of *Psilotum, Isoetes, Equisetum, Angiopteris, Pteris, Osmunda* and *Salvinia.*

Gymnosperms:

Study of morphology and anatomy of vegetative and reproductive organs of *Araucaria, Podocarpus, Cupressus* and *Ephedra.*

Palaeobotany:

Study of the fossil forms: *Sphenophyllum*, *Sigillaria, Lyginopteris, Cordaites* and *Sigillaria*.

Note:

Certified record work done in the laboratory during practical classes

Core Practical

Model Practical Question Paper M. Sc., Botany Degree Examination

For Students Admitted from the academic year 2020 – 2021

Core Major Practical I – Core Course IV (For Core Course I & II)

(Paper Code 20P1BOP01)

Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms & Palaeobotany

Practical 50

Record : 5

Viva-voce : 5

Time: 4 Hrs **Max. Marks 60**

1. Make suitable micro preparations of **A, B, C, D** and **E.** Draw labeled sketches. Identify giving reasons. Submit the slides for valuation. **(5 x 4 = 20 Marks)**

2. Make suitable micro preparation of **F** and **G.** Draw labeled sketches identify giving reasons. Submit the slides for valuation. **(2 x 5 = 10 Marks)**

3. Identify any two algae from the given algal mixture **H**. Draw diagrams only. **(4 Marks)**

4. Name the genus and group of the given specimens **I** and **J.** **(2 x 2 = 4 Marks)**

5. Draw diagrams and notes of interest on **K, L**, **M** and **N.** **(4 x 3 = 12 Marks)**

Key:

A, B, C, D and **E** - Materials one each from Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms. (Preferably Vegetative)

F and **G** - Reproductive part one each from Pteridophytes and Gymnosperms.

I and **J** - Macroscopic structure one each from Pteridophytes and Gymnosperms.

K, L, **M** and **N** - Materials one each from Algae, Fungi, Bryophytes, Lichens and Fossils.

Note:

1. Submission of 15 Herbarium sheets from Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms.
2. Certified record work done in the laboratory during practical classes.

Core Practical

For Students Admitted from the academic year 2020 – 2021

Core Major Practical II – Core Course V (For Core Course III)

(Paper Code 20P1BOP02)

Taxonomy of Angiosperms

Taxonomy of Angiosperms

Identification of the specimens at family, Genera and species level belonging to the following hierarchy:

Dicotyledons:

1. Thalamiflorae – Menispermaceae, Magnoliaceae, Oxalidaceae, Caryophyllaceae and Polygalaceae
2. Disciflorae – Meliaceae and Sapindaceae
3. Calyciflorae – Lythraceae, Aizoaceae and Moringaceae
4. Bicarpellatae – Boraginaceae, Bignoniaceae, Oleaceae, Nyctaginaceae
5. Monochlamydeae – Cactaceae, Loranthaceae and Aristolochiaceae

Monocotyledons:

6. Orchidaceae, Cyperaceae and Poaceae

Economic Importance

7. Economic importance of families mentioned above.
8. Familiarity with the use of Floras.
9. Preparation of dichotomous artificial keys using locally available plants.
10. A field trip of not less than 5 days to a place of luxuriant vegetation to study the flora and to study the different types of vegetation.
11. Submission of tour report and 25 Herbarium sheets (specimens collected from tour collection/ locally available plants) during practical examination.

- Certified record work done in the laboratory during practical classes.

Core Practical

Model Practical Question Paper M. Sc., Botany Degree Examination

For Students Admitted from the academic year 2020 – 2021

Core Major Practical II – Core Course V (For Core Course III)

(Paper Code 20P1BOP02)

Taxonomy of Angiosperms

Practical	**44**
Record	**5**
Herbarium	**6**
Viva-voce	**5**
Time: 4Hrs	**Max. Marks 60**

1. Find out the binomials (or) C.S. of ovary slide submission of **A** and **B.** **(2 x 3 = 6)**

2. Refer specimens **C** and **D** to their respective families giving reasons at each level of hierarchy. **(2 x 4 = 8)**

3. Construct key using **E**, **F, G, H, I** and **J.** **(6 x 1 = 6)**

4. Mention the Family, Genus and Species of **K, L** and **M**. **(3 x 3 = 9)**

5. Write short notes on Taxonomic Literature on **N** and **O.** **(2 x 3 = 6)**

6. Write Economic importance of **P, Q** and **R.** **(3 x 3 = 9)**

Key:

A, B, C and **D** - Flowering plants from families prescribed in the syllabus

E, **F, G, H, I** and **J** - Flowering Twigs.

K, L and **M** - Flowering plants from the families given in the syllabus.

N and **O** - Taxonomic literature mentioned in the syllabus

P, Q and **R** - Economic Botany.

Note:

- Submission of tour report and 25 Herbarium sheets (specimens collected from tour collection/ locally available plants) during practical examination.
- Certified record work done in the laboratory during the practical classes.
- Dissection of a flower/flower parts during semester practical

SEMESTER - II

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P2BO04	Title	Batch	2020 -2021
Hours/Week	6	Anatomy and Embryology of Angiosperms and Plant Micro technique	Semester	II
			Credits	05

Course Objective

To study the anatomy and embryology of angiosperms, microscopy and plant microtechnique steps.

Course Outcomes (CO)

K1	CO1	To develop the skill of sectioning.
K2	CO2	To understand the internal tissue system of plants.
K3	CO3	To apply the skill of microtechnique for the preparation and identification of slides for industries.
K4	CO4	To acquire anatomical knowledge which are pointers for identification.
K5	CO5	To evaluate the permanent slide preparation techniques.

UNIT - I **(15 Hours)**

Cell inclusions, Cell wall- pits, plasmodesmata and functions. Meristems – types - theories on shoot and root apical meristems. Procambium - cambium, Vascular cambium - structure and function. Ontogeny and phylogeny of cambium and vascular cambium. Seasonal activity, role in wound healing and grafting.

UNIT - II **(15 Hours)**

Complex tissues - secondary xylem and secondary phloem - structure and functions. Tyloses, heart wood and sap wood and growth rings. Anatomy of Leaf. Secondary thickening in stem and root and periderm formation - lenticels. Anomalous secondary growth in dicot and monocot stems. Nodal anatomy- uni, tri and multilacunar nodes.

UNIT – III **(15 Hours)**

Microsporogenesis and Megasporogenesis. Sexual incompatibility - genetic basis, barriers to fertilization, physiology and biochemistry of incompatibility. Endosperm and embryo- structure, types and development. Polyembryony – causes – types. Apomixis, Agamospermy, Apogamy and Parthenocarpy.

UNIT – IV **(15 Hours)**

Light microcopy - optical principles, resolution, magnification and aberrations. Phase contrast microscopy - Dark field illumination. Fluorescence microscope. Electron Microscope - Transmission Electron Microscope, Scanning Electron Microscope and Atomic Force Microscope - Principle and Operation techniques.

UNIT – V **(15 Hours)**

Microtechnique steps - fixation and fixatives, dehydration, clearing, infiltration, embedding block making and sectioning. Microtomes types and operating mechanism – Rotary and Sledge microtome. Stains and staining techniques. Preparation of temporary and permanent slides. Camera lucida – types – principle and use. Micrometry. Maceration, Squashes, Smears and Clearing techniques.

Text Books:

1. Bhojwani, S.S., Bhatnagar, S.P. 2013. The Embryology of Angiosperms. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Singh, V., Pandey, B.P., Jain, D.K. 2009. Plant Anatomy and Embryology of Angiosperms. Rastogi and Company, Meerut.
3. Pandey, B.P. 2010. Plant anatomy, S. Chand and Company Pvt. Ltd., New Delhi.
4. Pandey, B.P. 2012. A Textbook of Botany: Angiosperms - Taxonomy, Anatomy, Embryology and Economic Botany. S. Chand and Company Pvt. Ltd., New Delhi.
5. Singh, V. 2010. Plant Anatomy and Embryology of Angiosperms, Global Media Publications, New Delhi.

Reference Books:

1. Bonham, D. 2018. Plant Anatomy. Larsen and Keller Education, NZ.
2. Mishra, S.R. 2009. Understanding Plant Anatomy, Discovery Publishing House Pvt. Ltd., New Delhi.
3. Esau, K. 2006. Anatomy of Seed plants. 2nd Ed., Wiley Publications, New Delhi
4. Ghoal, S., Avasthi, A.S. 2018. Fundamentals of Bioanalytical Techniques and Instrumentation, PHI Learning Pvt. Ltd., New Delhi.
5. Rudall, P.J. 2007. Anatomy of Flowering Plants - An Introduction to Structure and Development. Cambridge University Press, Cambridge.
6. Roy, P. 2010. Plant anatomy. New Central Book Agency Pvt. Ltd., India.
7. Maheswari, P. 2018. An introduction to the Embryology of angiosperms, Franklin Classics Trade Press, London.

Web links:

1. https://www.easybiologyclass.com/meristematic-tissue-structure-and-classification-key-points/#:~:text=What%20are%20meristems%3F,to%20assist%20in%20plant%20growth.
2. https://www.askiitians.com/biology/anatomy-of-flowering-plants/secondary-growth.html
3. http://virtualplant.ru.ac.za/Main/ANATOMY/prac5.htm
4. https://microbenotes.com/scanning-electron-microscope-sem/
5. https://www.biologydiscussion.com/botany/practicals-botany/study-notes-on-microtome -sections/57074
6. https://en.wikipedia.org/wiki/Camera_lucida

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - II

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P2BO05	Title	Batch	2020 -2020
Hours/Week	6	Cell and Molecular Biology and Genetics	Semester	II
			Credits	05

Course Objective

To study the structure and functions of cell organelles, DNA structure, RNA, protein synthesis, linkage, chromosome mapping, mutation and Hardy-Weinberg law.

Course Outcomes (CO)

K1	CO1	To acquire knowledge on various organelles present in the plant cell.
K2	CO2	To acquire knowledge on inheritance of characters and structure of genetic material.
K3	CO3	To understand the process of central dogma of molecular biology.
K4	CO4	To enhance the knowledge on cytogenetic research.
K5	CO5	Evaluating the structural aspects of types DNA and RNA.

UNIT - I **(15 Hours)**

Cell cycle, Programmed Cell Death - Apoptosis, Organization of genetic material - nucleosome concept, Techniques involved in nucleosome, Chromosome DNA content and C-Value paradox; repetitive DNA, satellite DNA; selfish DNA. Vector, Plasmid - Ti Plasmid; Cosmids.

UNIT - II **(15 Hours)**

DNA structure – A, B, C and Z forms – replication, damage and repair. Chromosomes – morphology, ultra structure, types - Isochromosome and B-chromosome. Structural and numerical variations and aberrations in chromosomes. Chromatin – Euchromatin and Heterochromatin; Role of chromatin in gene expression and gene silencing; Genomic cDNA library, Modern conceptof gene – introns, extrons and their significance.

UNIT - III **(15 Hours)**

RNA types and biosynthesis of mRNA – Prokaryotic and Eukaryotic transcription – RNA polymerase - General and specific transcription factors - regulatory elements and

mechanism of transcription regulation- transcriptional and post transcriptional gene splicing. Translation- initiation, elongation and termination. Regulation of gene expression in prokaryotes.

UNIT - IV **(15 Hours)**

Mendelian Principles - Segregation, Independent assortment, Co-dominance; Extension of Principles - Gene interaction, pleiotropy, genomic imprinting, penetrance and expressivity; Modified Mendel's F_2 ratio. Multiple alleles and pseudo alleles. Polygenic inheritance. Chromosome mapping. Sex determination- sex linked inheritance – cytoplasmic inheritance.

UNIT - V **(15 Hours)**

Mutation- types and its role in evolution. Molecular basis of mutation. Mutagens- physical and chemical mutagens. Population genetics. Hardy – Weinberg law and its applications. Cis-trans effects. Signal transduction – signaling molecules – signal receptors – signaling pathways.

Text Books:

1. Gupta, P.K. 2008. Cytology, Genetics and Genetic Engineering. Rastogi Publication, Meerut.
2. Hawes, C., Satiat-Jeunemaitre, B. 2001. Plant Cell Biology: Practical Approach. Oxford University Press, Oxford.
3. Karp, G. 2008. Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons.
4. Gelvin, S.B., Schilperoort, R.A. 2000. Plant Molecular Biology Manual. Springer, Netherlands.
5. Hartl, D.L., Jones, E.W. 2009. Genetics: Analysis of genes and genomes. Jones and Bartlett Publication, USA.
6. Sen, S., Kar, D.K., Johri, B.M. 2005. Cytology and Genetics, Narosa Publishing House, New Delhi.
7. Sharma, A., Sharma, A. 2014. Chromosome Technique. Elsevier Science, London.

Reference Books:

1. Waddington, C.H. 2016. An Introduction to Modem Genetics. Taylor and Francis, New York.
2. Hawkins, J.A., Cronk, Q.C.B., Bateman, R.M. 2004. Developmental Genetics and Plant Evolution. Taylor and Francis, New York.

3. Ashley, R., Hann, G., Han, S.S. 2002. Cell Biology. New Age International Pvt., Ltd., India.
4. Orgogozo, V. 2016. Genes and Evolution. Elsevier Science, USA.
5. Rastogi, S.C. 2006. Cell and Molecular Biology. New Age International Pvt., Ltd., India.
6. Freifelder, 2008. Molecular Biology. Narosa Publishing House, New Delhi.
7. Lodish. H. 2008. Molecular Cell Biology. W. H. Freeman Publication, New York.

Web links:

1. https://www.khanacademy.org/science/biology/developmental-biology/apoptosis-in-development/a/apoptosis
2. https://www.biologydiscussion.com/chromosomes/useful-notes-on-chromosomes/34691
3. https://microbenotes.com/prokaryotic-transcription-enzymes-steps-significance/
4. https://www.easybiologyclass.com/difference-between-prokaryotic-eukaryotic-transcription/
5. https://microbenotes.com/mendels-experiment-and-laws/#:~:text=Mendel%20believed%20that%20heredity%20is,passing%2Don%20of%20these%20units.
6. https://microbenotes.com/hardy-weinberg-equilibrium/#:~:text=The%20Hardy%E2%80%93Weinberg%20principle%2C%20also,absence%20of%20other%20evolutionary%20influences.

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - II

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P2BOE02A	Title	Batch	2020 -2021
Hours/Week	5	Herbal Technology	Semester	II
			Credits	04

Course Objective

To study the classification, nomenclature, source, importance, structure and chemistry of steroids, terpenoids, flavonoids, alkaloids and cardiac glycosides.

Course Outcomes (CO)

K1	CO1	To study scope and development of pharmacognosy and methods and types of extraction.
K2	CO2	To understand the classification, nomenclature, source, importance, structure and chemistry of steroids, terpenoids and flavonoids.
K3	CO3	To develop entrepreneurship skill on drug production.
K4	CO4	To create awareness on problems involved in standardization of herbal medicine.
K5	CO5	Evaluating the structural aspects of types DNA and RNA.

UNIT – I **(15 Hours)**

Definition, history, scope and development of pharmacognosy. Importance of pharmacognosy with special reference to herbal drug industry. Natural drugs- Classification, Sources of natural medicinal products, Herbal drugs preparation and products. Drug adulteration, evaluation and toxicity.

UNIT - II **(15 Hours)**

Extraction - Introduction, definition, factors influencing the choice of extraction, principles of extraction methods, types of extraction (extraction of plant drugs). Selection and purification of solvents for extraction. Methods of isolation, (including industrial methods), purification and characterization.

UNIT – III **(15 Hours)**

Introduction, definition, classification, nomenclature, source, importance, structure and chemistry of Steroids, Terpenoids and Flavonoids.

UNIT – IV **(15 Hours)**

Introduction, definition, classification, nomenclature, source, importance, structure and chemistry of alkaloids - quinine, morphine, atropine, reserpine and ergot alkaloids and cardiac glycosides.

UNIT – V **(15 Hours)**

Importance of standardization and problems involved in the standardization of herbs. Standardization of single drugs and compound formulations. WHO guidelines for quality standardized herbal formulations. Estimation of the parameter limits used for standardization. Ethical committee - drug preparation, Ethics committees in India.

Text Books:

1. Maheshwari, J.K. 2000. Ethnobotany and medicinal plants of Indian Subcontinent. Scientific Publishers, India.
2. Agarwal, S.S., Paridhave, M. 2007. Herbal Drug Technology. University Press, New Delhi.
3. Bhattacharjee, S.K. 2004. Hand Book of Medicinal Plants. Pointer Publishers, Jaipur
4. Biswas, P.K. 2006. Encyclopedia of Medicinal Plants (Volume I - VII). Dominant Publishers, New Delhi.
5. Wallis, T.E. 2005. Text Book of Pharmacognosy. CBS Publishers and Distributors Private Limited, Bengaluru.
6. Bhat, S.V., Nagasampagi, B.A., Meenakshi, S. 2009. Natural Products - Chemistry and Applications. Narosa Publishing House, New Delhi.
7. Horborne, J.B. 2012. Phytochemical Methods: A guide to Modern Techniques of Plant Analysis. Springer Netherlands, New York.
8. Gokhale, S.B., Kokate, C.K., Purohit, A.P. 2009. Pharmacognosy. Nirali Prakashan, Pune.

Reference Books:

1. Seigler, D., Nigg, H.N. 2013. Phytochemical Resource for Medicine and Agriculture, Springer US, USA.
2. Anonymous, 2004. Cultivation of Selected Medicinal Plants. National Medicinal Plants Board, Government of India, New Delhi.
3. Chaudhry, B. 2019. A Hand Book of Common Medicinal Plants used in Ayurveda. Kojo Press, New Delhi.
4. John Jothi Prakash, E. 2003. Medicinal Botany and Pharmacognosy. JPR Publication, Valliyur, Tirunelveli.

5. Gokhale, S.B., Kokate, C.K., Purohit, A.P. 2003. Pharrmacognosy. Nirali Prakashan, Pune.

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1. http://cst-kh.edu.ps/staff/mabujamee/wp-content/uploads/2010/10/unit-1.pdf
2. http://www.separationprocesses.com/Extraction/SE_Solvent.htm#:~:text=Extraction%20%2D%20Solvent%20Selection&text=This%20is%20the%20ratio%20(at,affinity%20in%20the%20two%20phases.
3. https://www.intechopen.com/books/terpenes-and-terpenoids/introductory-chapter-terpenes-and-terpenoids
4. https://www.britannica.com/science/atropine
5. https://www.pharmatutor.org/articles/who-guidelines-for-quality-standardized-herbal-formulations.

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - II

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P2BOE02B	Title	Batch	2020 -2021
Hours/Week	5	Soil Science and Biology	Semester	II
			Credits	04

Course Objective

To study the soil types, nutrients in the soil, role of air and temperature in soil and the types of soil erosion and their control measures.

Course Outcomes (CO)

K1	CO1	To understand the basic knowledge of soil properties and processes in associate with plant growth.
K2	CO2	To describe the soil nutrients and estimating techniques, and how it subsequently interacts with plant growth.
K3	CO3	To study the role of air and temperature in soil.
K4	CO4	To provide information on various types of erosion in soil and their control measures.
K5	CO5	To acquire knowledge on role of microbes in soil fertility.

UNIT –I **(12 Hours)**

Soil structure - Origin, types, characterization and management; Soil Profile, Weathering of rocks; soil aggregation - stability; soil tilth - characteristics; soil crusting – Introduction, factors affecting soil crusting; soil physical and chemical properties; Soil water-content and potential, hydrologic cycle, soil-plant-atmosphere continuum.

UNIT –II **(12 Hours)**

Nutrient movement in soils; nutrient absorption by plants; soil solution and plant growth; movement of major micronutrients in soils; Modern concepts in fertilizer application; soil fertility evaluation techniques; role of soil tests in fertilizer use recommendations; site-specific nutrient management for precision agriculture

UNIT –III **(12 Hours)**

Air in Soil - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management; Modes of energy transfer in soils; energy

balance; thermal properties of soil; soil temperature – measurement and management; soil temperature in association with plant growth.

UNIT –IV **(12 Hours)**

Erosion – Definition and types; Soil Erosion – Origin, forms and factors affecting; Soil Erosion in India; Water Erosion - types and mechanisms of water erosion; soil losses in relation to soil properties and precipitation; Wind erosion - types, mechanism and factors affecting.

UNIT -V **(12 Hours)**

Erosion control – Principles and measures; agronomical and engineering; erosion control structures - design and layout; Soil conservation plan; soil conservation in special areas like hill, arid and semi-arid regions.

Text Books:

1. Biswas, T.D., Mukherjee, S.K. 2001. Textbook of Soil Science. Tata McGraw-Hill Education, New Delhi.
2. Weil, R.R., Brady, N.C. 2016. The Nature and Properties of Soils. 15th Ed. Pearson Education Limited, US.
3. Bakiyathu, B., Saliha, B.B. 2017. Fundamentals of Soil Science, Scientific Publisher, India.
4. Stirling, G., Hayden, H., Pattison, T., Stirling, M. 2016. Soil Health, Soil Biology, Soil borne Diseases and Sustainable Agriculture -A Guide. CSIRO Publishing, Australia.
5. Troeh, F.R., Thompson, L.M. 2005. Soils and Soil Fertility. Blackwell, London.

Reference Books:

1. Hakeem, K.R., Akhtar, J., Sabir, M. 2016. Soil Science: Agricultural and Environmental Prospectives. Springer International Publishing, US.
2. Gobat, J.M., Aragno, M., Matthey, W., Sarma, V.A.K. 2004. The Living Soil: Fundamentals of Soil Science and Soil Biology, Science Publishers, USA.
3. Plaster, E., 2013. Soil Science and Management. Cengage Learning, USA.
4. Rai, M.M. 2002. Principles of Soil Science. Macmillan Publishers India Ltd., India.
5. Summer, M.E., Huang, P.M., Li, Y. 2018. Handbook of Soil Sciences: Properties and Processes. CRC Press, London.

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1. https://www.biologydiscussion.com/essay/soil-essay/essay-on-soil-introduction-and-formation/70730

2. https://www.biologydiscussion.com/soil/soil-definition-components-and-role-of-soil-organisms-with-diagram/7155

3. https://en.wikipedia.org/wiki/Soil_erosion

4. http://www.omafra.gov.on.ca/english/engineer/facts/12-053.htm#:~:text=Soil%20erosion%20is%20a%20naturally,farming%20activities%20such%20as%20tillage.

5. https://www.biologydiscussion.com/soil/soil-erosion-factors-types-and-causes/7250

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - II

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P2BOE03A	Title	Batch	2020 -2021
Hours/Week	5	Plant Bio-technology and Bio-informatics	Semester	II
			Credits	04

Course Objective

To study the application of biotechnology, DNA recombinant technology, genetic engineering, enzymes, cloning and bio-informatics.

Course Outcomes (CO)

K1	CO1	To apply the skill of *in vitro* regeneration techniques in plants.
K2	CO2	To create awareness on conservation of rare species through the tissue culture technique.
K3	CO3	To apply the skill of amplifying the industrial useful genes through PCR technology.
K4	CO4	To acquire knowledge on biological databases for analyzing and sequencing genomes of plants.
K5	CO5	To evaluate the various mode of preservation through plant tissue culture techniques.

UNIT - I **(12 Hours)**

Biotechnology - scope and potentialities. Plant tissue culture – concept of totipotency – organization of tissue culture laboratory. Sterilization methods – Plant tissue culture media (MS) and plant hormones. Callus culture, Micro-propagation, Organogenesis. Application of plant tissue culture in agriculture and crop improvement.

UNIT - II **(12 Hours)**

Somatic embryogenesis – encapsulated seeds. Production of haploids plants through anther culture –Protoplast isolation, culture and regeneration, methods of fusing protoplasts, somatic hybridization. DNA transfer by particle bombardment, micro and macro injection methods – lipofection and electroporation. Application of plant tissue culture in agriculture and crop improvement.

UNTI - III **(12 Hours)**

Genetic engineering – enzymes – nucleases, polymerases, ligases, alkaline phosphatase, reverse transcriptase – SI nucleases – vectors – use of plasmids, cosmids, phage and transposans as vectors – gene cloning – cloning in eukaryotes. Amplification of genes by PCR. Germplasm storage – Cryopreservation.

UNIT - IV **(12 Hours)**

Recombinant DNA technology – gene transfer in plants – aims, strategies for development of transgenic plants — organization of Ti plasmid, *Agrobacterium tumifaciens*mediated gene transfer. Transgenic plants with stress tolerance for drought and salinity, crop improvement, herbicide resistance, insect resistance, virus resistance, plants as bioreactors.

UNTI - V **(12 Hours)**

Bio-informatics – introduction, role of bioinformatics in various fields. Biological databases – Classification of biological databases – protein data base (SWISS-PROT). Bioinformatics tools – Fasta and Blast Version. Nanobiotechnology – Applications of nanotechnology in biology. Drug discovery. Diagnosis – DNA microarray.

Text books:

1. Dubey, R.C. 2001. A text book of biotechnology. S. Chand and Company Pvt. Ltd., New Delhi.
2. Gupta, P.K. 2009. Elements of Biotechnology. Rastogi Publications, Meerut.
3. Ignacimuthu, S. J. 2003. Plant Biotechnology. Oxford and IBH Publishing, New Delhi.
4. Jha, T.B. 2005. Plant tissue culture: Basic and Applied. University Press, India.
5. Bhatia, S.C. 2005. A Text book of Biotechnology. Atlantic Publishers and Distributors, New Delhi.
6. Kumaresan, P. 2007. Biotechnology. Saras Publications, Nagercoil.
7. Shanmugavel, P. 2005. Principles of Bioinformatics, Pointer Publishers, Jaipur, India.

Reference Books:

1. Mount, D.W. 2001. Bioinformatics Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press, New York.
2. Levin. 2000. Genes (Vol. I-VII). Oxford University Press, London.
3. Nicholl, D.S.T. 2002. Introduction to Genetic Engineering. Cambridge University Press, London.
4. Pennigton, S. R. and Dunn, M.J. 2002. Proteomics. Viva Books Private Limited, New Delhi.
5. Purohit, S. S. 2003. Biotechnology – Fundamentals and Applications. Agrobios, New Delhi.
6. Satyanarayana, U. 2005. Biotechnology. Books and Allied Private Limited, Kolkata.
7. Singh, B. D. 2003. Biotechnology. Kalyani Publishers, New Delhi.

Web links:

1. https://microbenotes.com/micropropagation-stages-types-applications-advantages-limitations/#:~:text=Micropropagation%20is%20the%20rapid%20vegetative,commercial%20vegetatively%20propagated%20plant%20species.

2.https://www.biologydiscussion.com/biotechnology/protoplast-isolation-sources-and-methods-biotechnology/61336

3. https://en.wikipedia.org/wiki/Ti_plasmid

4. https://www.promega.in/resources/guides/nucleic-acid-analysis/pcr-amplification/

5.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC102476/#:~:text=SWISS%2DPROT%20(1)%20is,(EMBL)%2C%20since%201987.

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - II

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P2BOE03B	Title	Batch	2020 -2021
Hours/Week	5	Algal Cultivation Technology	Semester	II
			Credits	04

Course Objective

To study the algal groups, production techniques, nutrient compositions and their various applications

Course Outcomes (CO)

K1	CO1	To understand the basic structural defines of various groups of algae.
K2	CO2	To learn about the structure, pigmentation, food reserves and methods of production of various algae
K3	CO3	To enhance the knowledge of application aspects of algae in nano-biotechnology
K4	CO4	To know the bioremediation and the production of biofuels in algae
K5	CO5	To evaluate the production of different types of algae.

UNIT-I **(12 Hours)**

Algae: Classification, Thallus organization, cellular structure and reproduction in various groups - Cyanophyta, Chlorophyta, Phaeophyta and Rhodophyta; Molecular taxonomy – recent developments, phylogeny.

UNIT -II **(12 Hours)**

Source and commercial utilization of algae; Algae - source of food and feed; Pigmentation, chemicals, fuel and bio-fertilizers. Distribution of economically important algae in India; Production and Uses of some Algae: *Spirulina*, *Gelidium*, *Sargassum*, *Ulva*

UNIT –III **(12 Hours)**

Algal production: culture Techniques - Strain selection, Culture media, cultivation methods (indoor) and scaling up. Algal growth curve, Measurement of algal growth; Large-scale cultivation of algae; Nutrient dispersal; Harvesting and Drying.

UNIT -IV **(12 Hours)**

Chemical composition: protein, amino acids, lipids, waxes, glycerol, vitamins, chlorophyll, carotenoids and phycobiliproteins. Algal immobilization and its applications; Blue-green algal bio-fertilizer: Method of preparation, application and its advantages in inorganic fertilizers. Algae in nanobiotechnology. Algae culture collection centers in India

UNIT -V **(12 Hours)**

Bioactive compounds from algae: Bio-fertilizers; Bioengineering, photo-bioreactors; Bioremediation; Algal biofuels – biodiesel and bio-ethanol; Involvement in global warming – carbon absorption; Seaweeds polysaccharides like Agar, Carrageenan and Alginates

Text Books:

1. Trivedi, P.C. 2001. Algal Biotechnology. Pointer publishers, Jaipur, India.
2. Sambamurty, A.V.S.S. 2010. Algae. I.K. International Publishing House Pvt. Ltd., India.
3. Lee, D-J., Chisti, Y., Soccol, C.R. 2013. Biofuels from Algae. Elsevier Science, USA.
4. Sambamurty, A.V.S.S. 2017. Textbook of Algae. Wave Books, New Delhi.
5. Sharma, O.P. 2011. Algae. Tata McGraw-Hill Publisher, New Delhi.

Reference Books:

1. Andersen, R.A. 2005. Algal Culturing Techniques. Physiological Society of America. Elsevier Academic Press, USA.
2. Laura, B., Gualtieri, P. 2005. Algae-Anatomy, Biochemistry and Biotechnology. Taylor & Francis, London.
3. Singh, D.P., Kaur, G. 2009. Algal Biology and Biotechnology. I.K. International Publishing House Pvt. Ltd., India.
4. Sahoo, D., Seckbach, J. 2015. The Algae World. Springer Netherlands, USA.
5. Lee, R.E. 2008. Phycology. Cambridge University Press, UK.

Web links:

1. https://www.biologydiscussion.com/algae/algae-definition-characteristics-and-structure -with-diagram/46727
2. https://www.biologydiscussion.com/biotechnology/algae-biotechnology/algae-biotechnology-features-techniques-and-achievements/8516
3. https://www.biologydiscussion.com/algae/algae-definition-occurrence-and-affinities /53530
4. https://www.easybiologyclass.com/algae-general-characters-ppt-power-point-presentation/
5. https://en.wikipedia.org/wiki/Algae

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

Core Practical

For Students Admitted from the academic year 2020 – 2021

Core Major Practical III – Core Course VIII (For Core Course VI & VII)

(Paper Code 20P2BOP03)

Anatomy and Embryology of Angiosperms and Plant Micro technique

Anatomy:

1. Study of the anatomical characters and anomaly of *Nyctanthus.*
2. Study of the anatomical characters and anomaly of *Bignonia.*
3. Study of the anatomical characters and anomaly of *Boerhaavia.*
4. Study of the anatomical characters and anomaly of *Leptadenia.*
5. Study of the anatomical characters and anomaly of *Bougainvillea.*
6. Study of the anatomical characters and anomaly of *Cucurbita.*
7. Study of the anatomical characters and anomaly of *Achyranthus.*
8. Study of the anatomical characters and anomaly of *Dracaena.*

Embryology:

1. With the help of suitable examples, to illustrate the features of the theory syllabus by whole mounts, embryo mounting and permanent micro-slides.

Plant micro-technique

1. Knowledge of functioning of rotary and sledge microtome.
2. Demonstration of section cutting using a rotary microtome and staining.
3. Measurement and calculation of macerated elements by micrometry.
4. Submission of five double stained permanent slides as follows: Microtome section- 2 (or) Free hand sections- 2, Peel-1, Cleared material- 1, Maceration- 1

Note:

• Certified record work done in the laboratory during practical classes.

Core Practical

For Students Admitted from the academic year 2020 – 2021

Core Major Practical III – Core Course VIII (For Core Course VI & VII)

(Paper Code 20P2BOP03)

Cell and Molecular Biology and Genetics

1. Study of squash with suitable materials.
2. Study of smear with suitable materials.
3. Observation of electron micrographs of cellular structures.
4. Simple problems on monohybrid cross
5. Simple problems on monohybrid test cross
6. Simple problems on Dihybrid cross
7. Simple problems on Dihybrid test cross
8. Physical basis of monohybrid cross
9. Physical basis of Dihybrid cross
10. Simple problems on genetic interaction
11. Chromosome mapping from three point test cross – data, Calculation & Interference (Linkage & Crossing over Percentage).
12. To study the population genetics problems applying Hardy-Weinberg law.

Note:

- Certified record work done in the laboratory during practical classes.

Core Practical

Model Practical Question Paper M.Sc., Botany Degree Examination

For Students Admitted from the academic year 2020 – 2021

Core Major Practical III – Core Course VIII (For Core Course VI & VII)

(Paper Code 20P2BOP03)

(Anatomy of Angiosperms, Embryology of Angiosperms and Plant Micro technique, Cell and Molecular Biology and Genetics)

Practical : 50
Record 5
Viva-voce 5

Time: 4 Hrs. **Max. Marks : 60**

1. Cut transverse section of **"A".** Identify the anomaly by giving reasons. Draw diagrams and submit the slides for valuation. **(6)**

2. Macerate and identified the elements in the **"B".** Measure the length or breadth using micrometer. **(6)**

3. From the given material **"C"** dissect and mount any two stage of embryo. Draw diagrams. Submit the slides for valuation. **(6)**

4. With the flower bud given in **"D",** identify any 2 developmental stages of microsporogenesis. Draw diagrams. Submit the slides for valuation. **(6)**

5. Prepare a squash of **"E".** Display any 2 stages of cell divisions. Draw labeled sketches. **(4)**

6. Construct a chromosome map of a three point test cross using the given data **F**. **(8)**

7. Solve the genetic problem **"G"** and **"H"**. **(2 x 3 = 6)**

8. Write notes of interest on **"I, J, K** and **L"**. **(2 x 4 = 8)**

Key:

A, B, C, D and **E**	- Material given in the practical class.
F	- Chromosome map data
G & H	- Genetic problem given in the practical (Mono & Dihybrid ratio)
I, J & K	- Spotters from Anatomy, Micro technique and Embryology (Slide/ Chemical/instrument)
L	- Spotter from molecular Biology

Note:

- Certified record work done in the laboratory during practical classes.

SEMESTER - III

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P3BO06	Title	Batch	2020 -2021
Hours/Week	6	Plant Physiology	Semester	III
			Credits	05

Course Objective

To study the water and plant relation, photosynthesis, mechanism of respiration and role of plant growth regulators.

Course Outcomes (CO)

K1	CO1	To acquire knowledge on water and plant relation, stomatal physiology, mechanism of mineral absorption and types of stress.
K2	CO2	To understand the pigment system and photosynthesis cycles.
K3	CO3	To develop an entrepreneurship skill among the plant science graduates for the production of plant growth regulators.
K4	CO4	To create awareness on physiological effects of plant growth regulators.
K5	CO5	To evaluate the role plant growth regulators.

UNIT - I **(15 Hours)**

Stomatal physiology, transpiration flux, antitranspirant. Mechanism of mineral absorption - passive and active uptake and transport, H+ ATPase as carrier, Nernst equation, Donnan's potential and phloem transportation. Hydroponics.

UNIT - II **(15 Hours)**

Photosynthesis: Pigment system I and II – Emerson's enhancement effect. Photochemical reactions. Cyclic, Non-cyclic and Pseudocyclic Photophosphorylation. Oxygen Evolving Complex (OEC), Kok's model. C3 and classification of C4 pathways. Photorespiration, CAM pathway. Factors affecting photosynthesis.

UNIT-III **(15 Hours)**

Respiration- mechanism of respiration – Glycolysis – oxidation of Pyruvic acid – Krebs'cycle - Electron transport system – Hexose Monophosphate shunt – Enter- Doudoroff pathway – Respiratory quotient. Nitrogen Metabolism: Asymbiotic and symbiotic nitrogen fixation. Nitrogenase, Leghamoglobin, nod and nif genes. Nitrate and Nitrite reduction. NR

and NIR–assimilation of ammonia. Transamination interrelation between photosynthesis and nitrogen fixation.

UNTI - IV **(15 Hours)**

Physiological effects of plant growth regulators- Auxins, Gibberellins. Cytokinins, Ethylene, Abscisic acid, Morphatins, Cycocel (CCC) and Malic hydrazide (MH). Phytochrome – role and mode of action. Photoperiodism and mechanism of flowering. Vernalaization – Senescence – Dormancy. Physiology of seed germination.

UNTI - V **(15 Hours)**

Plant Stress - Type of stresses, Plant responses and mechanisms of tolerance of biotic and abiotic stresses; HR (Hypersensitive response) and SAR (Systemic Acquired Resistance); Water deficit and drought resistance, Salinity stress; metal toxicity; freezing and heat stress; oxidative stress. Biotechnological approaches for tolerance in plants. Molecular Biology of stress tolerance, Genetic Engineering in stress tolerance. Environmental stress: Types of stress. Effect of water stress on crop plant.

Text Books:

1. Hopkins, W.G., Huner, N.P.A. 2004. Introduction to Plant Physiology, J.Wiley, NJ.
2. Verma, S.K., Verma, M. 2008. A Textbook of Plant Physiology, Biochemistry and Biotechnology, S. Chand and Company Private Limited, New Delhi.
3. Pandey, S.N., Sinha, B.K. 2001. Plant Physiology. 3rd Revised Edt., Vikas Publishing House Pvt. Ltd., New Delhi.
4. Jain, V.K. 2007. Fundamentals of Plant Physiology. S. Chand and Company Limited, New Delhi.
5. Mohr, H., Schopfer, P. 2012. Plant Physiology. Springer Berlin Heidelberg, UK.

Reference Books:

1. Sinha, R.K. 2004 Modern Plant Physiology. Alpha Science, England.
2. Hemantaranjan, A. 2019. Advances in Plant Physiology. Scientific Publishers, India.
3. Gupta, N.K., Gupta, S. 2005. Plant Physiology. Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
4. Shabala, S. 2012. Plant Stress Physiology. C.A.B. International, USA.
5. Poulton, J.E., Romeo, J.T. 2012. Nitrogen Metabolism in Plants, Springer US, USA.
6. Ratnadewi, D., Hamim, 2018. Plant Growth and Regulation: Alterations to Sustain Unfavorable Conditions. Intech Open, UK.

Web links:

1.https://www.biologydiscussion.com/plants/ascent-of-sap/ascent-of-sap-path-mechanism-and-theories/22736

2.https://www.biologydiscussion.com/photosynthesis/photosystem-i-ps-i-and-photosystem-ii-ps-ii-photosynthesis/51599

3. https://microbenotes.com/glycolysis/

4.https://www.toppr.com/guides/biology/plant-growth-and-development/plant-growth-regulators/#:~:text=Plant%20Growth%20Regulators%20can%20be,carotenoid%20derivates%20(abscisic%20acid).&text=Plant%20Growth%20Promoters%20%E2%80%93%20They%20promote,are%20auxins%2C%20gibberellins%20and%20cytokinins.

5.https://www.intechopen.com/books/abiotic-and-biotic-stress-in-plants/biotic-and-abiotic-stresses-in-plants

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - III

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P3BO07	Title	Batch	2020 -2021
Hours/Week	5	Environmental Biology and Resource Management	Semester	III
			Credits	05

Course Objective

To study the ecology, ecosystem, environmental pollution, biodiversity, threats to biodiversity, endemism, vegetation and afforestation.

Course Outcomes (CO)

K1	CO1	To study the autecology, population ecology, positive and negative interactions between species and qualitative and quantitative characters of community.
K2	CO2	To understand the various types of ecosystem.
K3	CO3	To develop an entrepreneurship skill among the plant science graduates for the eco-friendly products.
K4	CO4	To create awareness on conservation of biodiversity.
K5	CO5	To evaluate the various advanced techniques in environmental pollution control.

UNIT - I **(15 Hours)**

Aim and scope of Ecology. Autecology – Population ecology – characteristics of Population. Positive and negative interactions between species (Plant and animal interactions) – Synecology - Qualitative and Quantitative characters of community. Niche – definition and types. Methods of studying plant community.

UNIT - II **(15 Hours)**

Ecosystem: Kinds and structure – trophic levels. Food chain, Food webs and Ecological pyramids. Energy flow in the ecosystem. Characteristic features, structure and functions of forest, Grassland, Pond, Estuary and Manmade Ecosystem (Crop land). Biogeochemical cycles – Hydrological, Carbon and Nitrogen and Phosphorus cycles. Biome.

UNIT - III **(15 Hours)**

Environmental pollution – Air, Water, Soil, radiation and noise pollution – Ozone depletion – global warming and climate change – consequence –Rio de Janeiro summit

(2092), Kyoto protocol (2005). Disaster management – floods, earth quake, cyclone, Tsunami and Landslides. Dams and their effects on forest and tribal people.

UNTI - IV **(15 Hours)**

Biodiversity: Definition - Genetic, species and ecosystem diversity. Value of biodiversity, consumptive use, productive use, social, ethic, aesthetic values. Biodiversity - at global and national levels. Hot spots of biodiversity. Threats to biodiversity – IUCN. Red data book. Ecosystem approaches – species based approaches – social approaches – Chipko movement – *insitu* and *exsitu* conservation. Ecological indicators.

UNTI-V **(15 Hours)**

Endemism – Continuous and discontinuous distribution of vegetation. Continental drift. Phytogeographical regions of World – Types of vegetation in India. Types of soil. Deforestation and Afforestation - Age and area hypothesis – Remote sensing – Principle, tools and applicationin agriculture and forestry.

Text books:

1. Sharma, P.D. 2009. Ecology and Environment, Rastogi Publishers, Meerut.
2. Crawley, M.J. 2009. Plant ecology. Wiley, Singapore.
3. Shukla, R.S., Chandel, P.S. 2006. A Text Book of Plant Ecology, S. Chand and Company Ltd., New Delhi.
4. Mishra, D.D. 2009. Fundamental Concepts in Environmental Studies. S. Chand and Company Ltd., New Delhi.
5. Vandermeer, J. 2011. The Ecology of Agroecosystems. Jones and Bartlett Learning, USA.

Reference books:

1. Osborne, P.L. 2000. Tropical Ecosystems and Ecological Concept. Cambridge University Press, UK.
2. Smith, T.M., Smith, R.L. 2014. Elements of Ecology. Pearson Education, UK.
3. Agarwal, S.K. 2008. Fundamentals of Ecology. APH Publishing Corporation, New Delhi.
4. Mishra, D.D. 2009. Fundamental Concepts in Environmental Studies, S. Chand and Company Ltd., New Delhi.
5. Asthana, D.K., Asthana, M. 2010. Environment Problems and Solutions. S. Chand and Company Ltd., New Delhi.

Web links:

1. https://en.wikipedia.org/wiki/Autecology
2. https://biologydictionary.net/ecological-pyramid/
3. https://www.biologydiscussion.com/environment/pollution-environment/pollution-types-3-main-types-of-pollution-with-sources-and-control/16723
4. https://www.biologydiscussion.com/biodiversity/list-of-global-hotspots-of-biodiversity/7138
5. https://www.amu.ac.in/emp/studym/99993557.pdf

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - III

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P3BO08	Title	Batch	2020 -2021
Hours/Week	5	Microbiology and Plant Pathology	Semester	III
			Credits	05

Course Objective

To study the microbes classification, microbial culture, beneficial and harmful role of microbes, biodegradation, role of microbes in agriculture and plant diseases.

Course Outcomes (CO)

K1	CO1	To study the sterilization techniques and culture media.
K2	CO2	To understand the biopesticide, viral insecticide and fungal insecticide.
K3	CO3	To develop an entrepreneurship skill among the plant science graduates for the production of biofertilizer.
K4	CO4	To create awareness on plant diseases management.
K5	CO5	To evaluate the severe diseases causing microorganisms.

UNIT - I **(15 Hours)**

Microbiology – Definition – Sterilization techniques. Culture media (Chemical, complex and special media). Decimal dilution techniques. Soil and rhizosphere microorganisms. Microbial stains - staining methods - simple, differential and special stains.

UNIT - II **(15 Hours)**

Microorganism – sources and types - air and water- source and types. Water and air sample techniques. Food spoilage – fruits and vegetables. Microbes of milk and milk products. Viruses – plant viruses- types. Differences between plant and animal viruses. Bacteriophage, Cyanophage, Mycophages and Mycoplasma. Viroids and Interferons. Biopesticide - *Pseudomonas putida, Bacillus thuringiensis*, viral insecticides, fungal insecticides –*Trichoderma sp., Gliocladium virens.*

UNIT - III **(15 Hours)**

Waste as a resource; organic compost – factor affecting composting – Sewage treatment – microbial leaching – biodegradation: biodegradation of petroleum, Xenobiotics; biosorption of heavy metal – biofiltration – bio deterioration of leather, paper, metal, plastics,

safe practices. Agricultural microbiology - Biofertilizer - mass cultivation of *Rhizobium*, *Azotobacter*, phosphate solublizing bacteria and production of mycorrhizal biofertilizer.

UNIT - IV **(15 Hours)**

Introduction to plant pathology – disease – concept, component and causes – classification of disease, brief account on general symptoms of Plant disease – modes of Infection and dissemination – defense mechanisms in plants – phytoalexin – pathogen related protein, Systemic Acquired Resistance (SAR)- Plant diseases forecasting – Plant disease management – plant quarantine, chemical, cultural and biological control – bioformulation – integrated disease management.

UNIT - V **(15 Hours)**

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

1. Damping off of *Pythium*
2. Little leaf of Brinjal (Mycoplasma)
3. Bacterial Blight of Paddy
4. Bunchy top of Banana
5. Red rust of Mango

Text Books:

1. Jamaluddin, Malaviya, N. 2007. General Microbiology. Scientific Publishers, India.
2. Singh, R.S. 2018. Plant Diseases. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Davet, P. 2004. Microbial Ecology of Soil and Plant growth. CRC Press, London.
4. Annadurai, B. 2008. A text book of Immunology and Immunotechnology. S. Chand & Co., Ltd., New Delhi.
5. Kuby, J. 2000. Immunology. 4th ed. W. H. Freeman & Co., New York.
6. Dubey, R.C., Maheswari, D.K. 2010. A text book of Microbiology. S. Chand & Co. Ltd.

Reference Books:

1. Ingraham, J.L., Inngraham, C.A. 2000. Introduction to microbiology, Brooks/Cole Publishing Company, US.
2. Dixon, G.R., Tilston, E.L. 2010. Soil Microbiology and Sustainable Crop production. Springer Netherlands, London.
3. Phillip, L. 2016. Microbiology: Concepts and Application, Syra wood Publishing House, New York.

4. Nayudu, M.V. 2008. Plant Viruses. Tata McGraw Hill., New Delhi.
5. Mehotra, R.S., Agarwal, A. 2003. Plant Pathology. Tata McGraw-Hill Publication.
6. Shetty, N. 2008. Immunology introductory text book. New age International Publishers, New Delhi.
7. Mehrotra, R.S., Aggarwal, A. 2013. Fundamentals of Plant Pathology, McGraw Hill Education, India.

Web links:

1. https://www.biologydiscussion.com/soil-microbiology/rhizosphere-origin-and-effects-microbiology/66666
2. https://www.biologydiscussion.com/milk-microbiology/milk-products-top-7-products-of-milk-microbiology/66099
3. https://www.biologydiscussion.com/environmental-microbiology/biodeterioration-of-various-materials-microbiology/66809
4. https://en.wikipedia.org/wiki/Systemic_acquired_resistance
5. https://www.biologydiscussion.com/plants/plant-diseases/bacterial-leaf-blight-disease-of-rice-discussed-plant-diseases/43228#:~:text=Bacterial%20blight%20has%20three%20significant%20symptoms%20viz.&text=In%20rice%20seedlings%20small%20water,grayish%20brown%20and%20finally%20wither.

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - III

Programme Code	M. Sc.	Programme Title	Master of Science (Zoology and Biochemistry)	
Course Code	20P3BOED01	Title	Batch	2020 -2021
Hours/Week	4	Herbal Botany	Semester	III
			Credits	04

Course Objective

Acquiring knowledge on Indian systems of medicine, drug adulteration, drug evaluation, therapeutical and pharmaceutical uses and cultivation of selected medicinal plants.

Course Outcomes (CO)

K1	CO1	To study the various Indian systems of medicines and classification of crude drugs.
K2	CO2	To understand the drug adulteration, drug evaluation and phytochemical investigation.
K3	CO3	To develop entrepreneurship skill on cultivation of medicinal plants.
K4	CO4	To create awareness on importance of natural drugs preparation and natural pesticides.
K5	CO5	To evaluate the different types of medicinal plants cultivation.

UNIT - I **(12 Hours)**

Traditional medicinal system: Ayurveda, Siddha. Unani and Naturopathy. Definition of Drug - Classification of natural drugs (Alphabetical, Morphological, Pharmacological, Chemical and Chemotaxonomical classifications). Traditional and folklore medicine – native medicine.

UNIT - II **(12 Hours)**

Pharmacognosy - Definition and Scope. Drug adulteration, Drug evaluation - Chemical, Physical and Biological. Phytochemical investigations, standardization and quality control of herbal drugs.

UNIT - III **(12 Hours)**

Therapeutical and pharmaceutical uses of the following medicinal plants: *Adadhoda vasica, Centella asiatica, Piper nigrum, Ocimum sanctum* and *Vinca rosea.*

UNIT - IV **(12 Hours)**

Cultivation and utilization of selected medicinal plants – *Bacopa monnieri, Aloe vera, Gloriosa superba, Phyllanthus amarus* and *Rauwolfia serpentina.*

UNIT – V **(12 Hours)**

A Brief account of the following drugs - Drugs containing carbohydrates- *Isapgol* and Indian gum, Drugs containing resin and resin combination - *Cannabis* and Drugs containing alkaloids- *Cinchona.* Natural pesticides – Neem.

Text Books:

1. Kumar, G.S., Jayaveera, K.N. 2014. Text book of Pharmacognosy and Phytochemistry. S. Chand and Company Pvt. Ltd., New Delhi.
2. Bhattacharjee, S.K. 2004. Hand Book of Medicinal plants. Pointer Publishers, Jaipur.
3. Biswas, P.K. 2006. Encyclopedia of Medicinal plants (vol. I-VII). Dominant Publishers, New Delhi.
4. Gokhale, S.B., Kokate, C.K., Purohit, A.P. 2003. Pharrmacognosy. Nirali Prakashan, Pune.
5. John Jothi Prakash, E. 2003. Medicinal Botany and Pharmacognosy. JPR Publication, Valliyur, Tirunelveli.

Reference Books:

1. Agarwal, S.S., Paridhave, M, 2007. Herbal Drug Technology. University Press, New Delhi.
2. Anonymous, 2004. Cultivation of selected Medicinal Plants. National Medicinal Plant Board, Govt. of India, New Delhi.
3. Chaudhuri, A.B. 2007. Endangered Medicinal plants. Daya Publishing House, New Delhi.
4. Kokate, C.K., Purohit, A.P., Gokhale, S.B. 2009. Pharmacognosy. Nirali Prakashan, Pune.
5. Mccreath, S.B. 2017. Pharmacognosy – Fundamentals, Applications and Strategy. Elsevier Science, New York.

Web links:

1. http://www.jiwaji.edu/pdf/ecourse/pharmaceutical/classification%20of%20crude%20drugs.pdf

2. https://www.biologydiscussion.com/essay/essay-on-drugs-definition-classification-and-moral-implication/5389
3. https://www.biologydiscussion.com/economic-botany/10-main-types-of-condiments/56892
4. https://vikaspedia.in/agriculture/crop-production/package-of-practices/medicinal-and-aromatic-plants/bacopa-monnieri
5. https://www.biologydiscussion.com/plants/5-important-drugs-obtained-from-plants-biology/56265

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

Core Practical - Syllabus

For Students Admitted from the academic year 2020 – 2021

Core Major Practical IV – Core course - XII (For Core Course IX, X and **XI)**

(Plant Physiology, Environmental Biology and Resource Management and Microbiology and Plant Pathology – 20P3BOP04)

Plant Physiology:

1. Measurement of stomatal index and frequency.
2. Measurement of membrane permeability as affected by chemicals and temperature.
3. Separation of photosynthetic pigments by paper chromatography.
4. Estimation of photosynthetic pigments by Arnon's method.
5. Estimation of leghaemoglobin content of root nodules.
6. Estimation of total nitrogen by Microkjeldhal method.
7. Seed viability - Tetrazolium chloride test.
8. Measurement of Hill reaction.

Demonstrations:

9. Determination of relative water content of leaf material.
10. Preparation of knops' solution - Hydroponics study.
11. Warburg manometer - principle and application.
12. Absorption spectrum of chlorophylls.

Environmental Biology and Resource Management:

1. Estimation of soil moisture content.
2. Determination of soil pH.
3. Study the plant community by Quadrat method by determining frequency, density and abundance of different species.
4. Determination of minimum size of the quadrats by species area curve method.
5. Line transects method to study vegetation.
6. Belt transect method to study vegetation
7. Measuring the transparency level of an aquatic system using Secchi disc.
8. Spotting of Phytogeographical regions of India in maps - Soil
9. Spotting of Phytogeographical regions of India in maps - Vegetation
10. Spotting of Phytogeographical regions of India in maps - Botanical.
11. Study the Ecological interest of Ecosystems / Ecological tools / Photographs / Models / Plants - studied in the theory syllabus (spotters).

Microbiology:

1. Cleaning and sterilization methods. (Laminar air flow chamber, Autoclave and Oven)
2. Preparation of culture media -agar slant- agar plate.
3. Isolation of Microbes by streak and pour plate method.
4. Isolation of microbes by soil dilution techniques.
5. Isolation and identification of Bacteria and fungi from spoiled food – Vegetables/Fruits.
6. Gram staining of Bacteria.
7. MBRT of milk (Phosphates test).

Plant Pathology:

Study the disease symptoms causal organisms, transmission and control measures of the following plant diseases:

8. Damping of Pythium
9. Little leaf of brinjal (Mycoplasma)
10. Bacterial blight of paddy
11. Bunchy top of banana (Virus)
12. Red rust of Mango

Note:

1. Field study of an area (not less than a period of 4 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).

- Certified record of work done in the laboratory during practical classes.

Model practical question paper for M. Sc., Botany Degree Examination

Core Major Practical IV - Core course XII (For Core Course IX, X & XI)

(Plant Physiology, Environmental Biology, Resource Management and Microbiology and Plant Pathology) – 20P3BOP04

Practical : 50

Record 5

Viva-voce 5

Max. Marks : 60

Time: 4 Hrs

1. Set up the experiment **A** assigned to you. Record your observation and interpret the results. Leave the set up for valuation. **(1 x 10 = 10)**

2. Write notes on physiological interest of **B, C** and **D.** **(3 x 3 = 9)**

3. Construct a quadrat **E**. Study the plant community by determining frequency, densityand abundance of different species. Analysis the vegetation. **(1 x 10 = 10)**

4. Write notes of ecological interest of **F** and **G.** **(3 x 2 = 6)**

5. Determine whether the given sample **H** is contaminated with bacteria or not. Leave the sample for valuation. **(1 x 5 = 5)**

6. Name the causal organism, disease symptoms and control measures of the given material **I.** **(1 x 4 = 4)**

7. Write notes on **J** and **K.** **(3 x 2 = 6)**

Keys:

A - Plant Physiology experiment given in the syllabus (Selected by each student by lot)

B, C and **D** - Charts / Figures / Graphs/ Tables / Instruments / Apparatus / Chemicals / Models/ Photographs

E - Simple quadrat

F and **G** - Ecological tools / Chemicals / Graphs / Photographs / Maps of Phytogeographical regions / Vegetations of India

H - Samples given in the practicals

I - Pathological material specified in the syllabus

J and **K** - Spotters from Microbiology (Equipments / Instruments/ Chemicals / Culture media/ Stains/ Photographs /Slides)

SEMESTER - IV

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P4BO09	Title	Batch	2020 -2021
Hours/Week	5	Biophysics and Biochemistry	Semester	IV
			Credits	04

Course Objective

Acquiring knowledge on basic concepts of atoms and molecules and occurrence, structure and properties of carbohydrates, proteins and lipids.

Course Outcomes (CO)

K1	CO1	To study the bioenergetics and photobiology.
K2	CO2	To understand the carbohydrates, proteins and lipids.
K3	CO3	To develop the entrepreneurship skill on industrial production of carbohydrates, proteins and lipids.
K4	CO4	To create awareness on role of carbohydrates, proteins and lipids.
K5	CO5	Evaluating the various bio-molecules in plant metabolism.

UNTI - I **(15 Hours)**

Bioenergetics – laws of thermodynamics. Enthalpy, Entropy, free energy. Mitochondrial bioenergetics, chloroplast bioenergetics, ATP bioenergetics, NADP / NADPH redox couple bioenergetics. Photobiology – light characterization of solar radiation. Absorption spectrum, action spectrum and emission spectrum in molecules Fluorescence and Phosphorescence. Bioluminescence.

UNIT - II **(15 Hours)**

Basic concepts of atoms and molecules – chemical bonds – covalent bonds, hydrogen bond, electrostatic interactions, hydrophobic interactions, Vander Waals forces. Optical isomerism, pH and its significance, isoelectric point. Buffer systems, Redox potential, Molarity, Molality and Normality.

UNIT - III **(15 Hours)**

Carbohydrates: Occurrence, structure and properties of monosaccharides, oligosaccharides and polysaccharides. Biological significance of carbohydrates. Protein:

Classification, structure – primary, secondary, tertiary and quaternary. Properties and purification of protein.

UNIT - IV **(15 Hours)**

Amino acids – classification and peptide bonds, Ramachandran plots, properties of amino acids, non-protein amino acids, amines and the role in cell function- amino acids metabolism. Synthesis of amino acids. Chemistry of Enzymes- Classification and Nomenclature – Mechanism of action – Factors affecting enzyme activity. Michaelis – Menten model of enzyme kinetics. Co- enzymes, isoenzymes allosteric enzymes, ribozymes and abzymes.

UNIT - V **(15 Hours)**

Lipids: Components of lipids – classification of fatty acids. Simple lipids, compound lipids and derived lipids (Steroids) – properties of lipids. Synthesis of lipids. Vitamins: Structure, type, source and their role.

Text Books:

1. Rastogi, S.C. 2003. Outlines of Biochemistry. CBS Publishers and Distributors, New Delhi.
2. Hames, B.D., Hooper, N.M. 2005. Biochemistry. Taylor and Francis, UK.
3. Jain, J.L., Jain, S., Jain, N. 2009. Fundamentals of Biochemistry. S. Chand and Company, New Delhi
4. Conn, E.E., Stump, Bruening, G., Doi, R.H. 2005. Outlines of Biochemistry. 5th Edt., Wiley and Sons Pvt. Ltd., New York.
5. Satyanarayana, U., Chakrapaani, U. 2009. Essential of Biochemistry. Books and Allied Pvt. Ltd., Kolkata.
6. Dey, P.M., Harborne, J.B. 2000. Plant Biochemistry. Harcourt Asia Pvt. Ltd., New Delhi.
7. Plummer, D.T. 2003. An Introduction to Practical Biochemistry. 3rd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi.

Reference Books:

1. Harvey, R.A., Harvey, R.A., Ferrier, D.R. 2011. Biochemistry. Lippincott Williams and Wilkins, Philadelphia.
2. Nelson, D.L., Cox, M.M. 2005. Principles of Biochemistry. W.H. Freeman and Company, New York.
3. Walker, J., Wilson, K. 2000. Principles and Techniques of Practical Biochemistry. Cambridge University Press, UK.

4. Fursule, R.A., Kulkarni, J.S., Agarkara, P.H. 2008. Biochemistry Basics and Applied. Nirali Prakashan, Pune.
5. Kirkland, K. 2014. Basics of Biochemistry. Rosen Publishing, New York.

Web links:

1. https://en.wikipedia.org/wiki/Bioluminescence#:~:text=Bioluminescence%20is%20the%20production%20and,terrestrial%20arthropods%20such%20as%20fireflies.
2. https://byjus.com/chemistry/atoms-and-molecules/
3. https://microbenotes.com/proteins-properties-structure-classification-and-functions/
4. https://en.wikipedia.org/wiki/Ramachandran_plot
5. https://microbenotes.com/lipids-properties-structure-classification-and-functions/#:~:text=Structure%20of%20Lipids,-Lipids%20are%20made&text=They%20are%20made%20from%20two,atoms%20occupying%20the%20remaining%20positions.&text=Monounsaturated%20fatty%20acids%20have%20one,than%20one%20C%3DC%20bond.

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - IV

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P4BO10	Title	Batch	2020 -2021
Hours/Week	5	Instrumentation Techniques	Semester	IV
			Credits	04

Course Objective

Acquiring knowledge on principles, components, working mechanism and applications of biological instruments.

Course Outcomes (CO)

K1	CO1	To know the principle, components and working mechanism Colorimeter, UV and Visible Spectrometer, AAS and NMR.
K2	CO2	To understand the centrifugation basic principles and types chromatography.
K3	CO3	To develop entrepreneurship skill on bioscience research laboratories.
K4	CO4	To create awareness on importance of biological research.
K5	CO5	To evaluate the efficiency of different types of instruments used in biological research.

UNIT - I **(15 Hours)**

Spectroscopy- Principle, components and working mechanism of Colorimeter, UV and Visible Spectrophotometer. Principle, working mechanism and applications of Flame photometer, Atomic Absorption Spectrophotometer (AAS) and Nuclear Magnetic Resonance Spectrometry (NMR).

UNIT – II **(15 Hours)**

Centrifugation – Principles, types of centrifuges- low speed, high speed and ultra centrifuges - preparative and analytical centrifuges. Types of centrifugation- Differential centrifugation and Density gradient centrifugation– operations and uses. Chromatography – basic principles and types – Paper Chromatography, Thin Layer Chromatography (TLC), Ion – exchange Chromatography, Gas Chromatography (GC) and High Performance Liquid Chromatography.

UNIT – III **(15 Hours)**

Basic principles, types of electrodes, working mechanism, standardization of pH meter and measurement of pH. Electrophoresis – Principles and types- Agarose Gel Electrophoresis, Horizontal and vertical types, mechanism and staining of electrophoresis. SDS - PAGE. Isoelectric focusing- principles and applications.

UNTI - IV **(15 Hours)**

Radiation dosimetry- Radioactive isotopes and half life of isotopes - Effects of radiation on biological system– G.M. counter and Scintillation counter – Autoradiography and Application of tracer technique in Biology. Photomicrography: Digital camera types – shutter speed – aperture – depth of field- digital imaging, transfer of digital signals to computer.

UNTI – V **(15 Hours)**

Basic principles, components, working mechanism and biological applications of Homogenizer, Sonicator, Rotary Evaporator and Lyophilizer

Text Books:

1. Marimuthu, R. 2008. Microscopy and Microtechnique. MJP Publishers, Chennai.
2. Sivasankar, B. 2009. Bioseparations - Principles and Techniques. PHI Learning Private Limited, Delhi.
3. Olaniyan, M.F. 2017. Laboratory: Instrumentation and Techniques. CreateSpace Independent Publishing Platform, US.
4. Nakra, B.C., Chaudhry, K.K. 2003. Instrumentation, Measurement and Analysis. Tata McGraw-Hill, New Delhi.
5. Bakshi, U.A., Bakshi, A.U. 2009. Electrical Measurements and Instrumentation. Technical Publications, Pune.

References Books:

1. Palanivelu, P. 2009. Analytical Biochemistry and Separation Techniques, Kalaimani Printers, Madurai.
2. Bisen, P.S., Sharma, A. 2013. Introduction to Instrumentation in Life Sciences. Taylor and Francis, New York.
3. Cazes, J. 2004. Analytical Instrumentation Handbook. CRC Press, USA.
4. Krishnaswamy, K. 2003. Industrial Instrumentation. Vol.I. New Age International (P) Limited, New Delhi.

5. McMahon, G. 2008. Analytical Instrumentation: A Guide to Laboratory, Portable and Miniaturized Instruments. Wiley and Sons, England.

Web links:

1. https://www.philadelphia.edu.jo/academics/ajaber/uploads/CHEM%20540-061-Atomic%20Absorption%20Spectroscopy.pdf
2. https://microbenotes.com/centrifuge-and-centrifugation/
3. https://microbenotes.com/agarose-gel-electrophoresis/
4. https://www.med.unc.edu/microscopy/files/2018/06/lm-ch-14-photomicrography.pdf
5. https://www.biologydiscussion.com/cell/cell-fractionation-extraction-homogenization-and-centrifugation/5848

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - IV

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P4BOE04A	Title	Batch	2020 -2021
Hours/Week	4	Research Methodology	Semester	IV
			Credits	04

Course Objective

To study the choosing the problems, writing of dissertation and thesis, data classification and ANOVA.

Course Outcomes (CO)

K1	CO1	To acquire knowledge on basic concepts and approaches in research.
K2	CO2	To study the literature collection.
K3	CO3	To develop the skill on dissertation and thesis writing.
K4	CO4	To create awareness on ANOVA.
K5	CO5	To evaluate the importance of ANOVA in biological data.

UNIT – I **(12 Hours)**

Research - Introduction, Basic concepts and Approaches. Types of Research (Descriptive/Analytical, Applied/ Fundamental, Quantitative/Qualitative, Conceptual/ Empirical); Research formulation - Observation and Facts, Prediction and explanation, Induction, Deduction; Defining and formulating the research problem, Selecting the problem and necessity of defining the problem. Research process- steps - Data collection methods - Primary data and Secondary data.

UNIT- II **(12 Hours)**

Literature – various source - Books, Research articles, short communication and e-resources. Structure of literature - thesis and research article. Review of Literature - Review - Importance in defining a problem, Critical literature review, Identifying gap areas from literature review; Manuscript Preparation for publication and proof correction. Research proposal – Aim and scope, Structure and components, National and International funding sources.

UNIT – III **(12 Hours)**

Dissertation and Thesis – Introduction, components in preparation and the presentation of research findings in seminars and workshops - importance. Journals - Types - research journals, review journals and e-journals. Preparation of index cards: Author index and subject index; Open source bibliography management system. Plagiarism. Impact factor, Citation Index, NCBI-Pub Med, open access initiative, INFLIBNET, INSDOC.

UNIT- IV **(12 Hours)**

Data- Classification of study design, Exploration and presentation of data, Sampling: Reasons and methods. Probability distribution: Binomial, Poisson, Standard normal distribution. Data: Tests of significance - estimation - t-test, Chi square test and Z-test. Hypothesis -Null and alternate hypothesis and testing of hypothesis -Theory, Principle, Law and Canon, Types of errors and P-values.

UNIT – V **(12 Hours)**

ANOVA – one way and two way. Statistical methods for multiple variables: Multiple regression, Statistical test for regression coefficient, Predicting categorical outcomes – logistic regression. Pearson's correlation coefficient, Linear regression, Least Square method, Comparing two regression lines, Dealing with nonlinear observation, Comparing correlation and regression. MS – Office, ICT tools and e – learning.

Text Books:

1. Kothari, C.R. 2004. Research Methodology: Methods and Techniques. New Age International Pvt. Ltd., New Delhi.
2. Gurumani, N. 2019. Scientific Thesis Writing and Paper Presentation. MJP Publishers, Chennai.
3. Rastogi, V. B. 2006. Fundamentals of Biostatistics. Anne Book India, New Delhi.
4. Mead, R. 2017. Statistical methods in Agriculture and Experimental Biology, CRC Press, New York.
5. Mastropieri, M.A., Scruggs, T.E. 2006. Applications of Research Methodology. Emerald Group Publishing Ltd., Netherlands.

Reference Books:

1. McMillan, V.E., McMillan, V. 2012. Writing papers in the Biological Sciences. Bedford/St.Martins books, New York.
2. Bhattacharyya, D.K. 2009. Research Methodology. Excel Books, New Delhi.

3. Rahim, F.A. 2007. Thesis Writing: A Manual for Researchers. New Age International Pvt. Ltd., New Delhi.
4. Rosencrantz, W.A. 2009. Introduction to Probability and Statistics for Science, Engineering and Finance. CRC Press, Boca Raton.
5. Rosner, B. 2015. Fundamentals of Biostatistics. Cengage Learning, USA.

Web links:

1. https://courses.lumenlearning.com/boundless-sociology/chapter/the-research-process/
2. https://libguides.usc.edu/writingguide/literaturereview
3. https://en.wikipedia.org/wiki/Index_card
4. https://bookdown.org/jhvdz1/dataanalytics/data-analysis-t-tests-and-chi-square-tests.html
5. https://en.wikipedia.org/wiki/Pearson_correlation_coefficient

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

SEMESTER - IV

Programme Code	M. Sc.	Programme Title	Master of Science (Botany)	
Course Code	20P4BOE04B	Title	Batch	2020 -2021
Hours/Week	4	Palynology	Semester	IV
			Credits	04

Course Objective

To study the pollen morphology, growth pattern, pollen application in biotechnology, and their various branches.

Course Outcomes (CO)

K1	CO1	To provide knowledge in the recognition and identification of pollen and spores.
K2	CO2	To enhance the observation of pollen in the geologic time as per the patterns established in flowering plants.
K3	CO3	To develop the skills of pollen sampling techniques.
K4	CO4	To acquire the knowledge on application aspects in pollen
K5	CO5	To evaluate the role of various agents in effective pollination.

UNIT – I **(12 Hours)**

Palynology – Introduction and Scope, Morphology of Pollen – Polarity, Symmetry, Size and Shape, Pattern of aperture, Sporoderm. Sporopollenin, exine stratification and ornamentation of pollen wall, Pollen preparation, pre-treatment, acetolysis. Concept of non-pollen palynomorphs, Palynofacies.

UNIT – II **(12 Hours)**

Viability and germination of pollen, Pollen preservation and controlling factors, Various factors involved in *In vitro* germination of pollen grains, Pollen banks and their role in agriculture and plant breeding, Pollen-expressed and pollen specific genes. Role of palynology in taxonomy.

UNIT – III **(12 Hours)**

Pollen Biotechnology - Induction of haploids from pollen grains, developmental pathways of embryogenesis from pollen grains and the importance of haploids; Cytoplasmic male sterility (CMS), Genic male sterility (GMS), Pollen sterility induced through recombinant DNA technology, Role of pollen in genetic transformation.

UNIT – IV **(12 Hours)**

Applied palaeobotany: Fundamentals of palaeofloristics, palaeogeography, palaeoecology and palaeoclimatology. Branch and Application of Palynology:

Entomopalynology; palaeopalynology, melissopalynology, forensic palynology, aeropalynology. Indian work on Palynology, Palynological centres in India.

UNIT – V **(12 Hours)**

Sampling methods - Surface and sub-surface, sample processing techniques; Palynomorphs, their preservation in diverse lithic types, Application of Palynology in relation to techniques involved in the recovery and concentration of pollen from clays, rock, oil and lignites. Maceration techniques, Role of spores and pollen in stratigraphy, index spores.

Text Books:

1. Bhattacharya, K., Majumdar, M.R, Bhattacharya, S.G. 2006. A text book of Palynology. New Central Book Agency (P) Ltd., Kolkata.
2. Shripad, N. Agashe, 2006. Palynology and its applications. Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
3. Amstrong, H.A., Brasier, M.D. 2004. Microfossils, Blackwell Publishing Ltd., US.
4. Bhattacharya, K., Majumdar, M.R., Bhattacharya, S.G., 2014. A textbook of palynology. New Central Book Agency (P) Limited, Kolkata.
5. Nair, P.K.K. 1966. Essentials of Palynology. Asia Publishing House, India

Reference Books:

1. Walker, M. 2014. Entomology and Palynology. Mason Crest, PA, USA.
2. Russell, J., Cohn, R. 2012. Palynology. Book on demand Limited.
3. Agashe, S.N., Caulton, E. 2019. Pollen and Spores: Applications with special emphasis on aerobiology and allergy. CRC Press, NY.
4. Mehrotra, N.C. 2002. Palynology in hydrocarbon exploration: The Indian Scenario. Geological Society of India, India.
5. Brown, C.A., Riding, J.B. 2002. Palynology: New directions, other applications and floral history. American Association of Stratigraphic Palynologists Foundation, US.

Web links:

1. https://www.biologydiscussion.com/palynology/morphological-characteristics-of-pollen-grains/64545
2. https://www.biologydiscussion.com/palynology/pollen-viability-in-plants-variations-and-factors/64581
3. https://www.biologydiscussion.com/palynology/top-5-applications-of-pollen-biotechnology/64621
4. https://www.biologydiscussion.com/palynology/branches-palynology/palynology-branches-top-9-branches-of-palynology-plants/68896
5. https://blogs.egu.eu/divisions/ssp/2018/04/16/the-world-about-pollen/

Mapping

PSO / CO	PS01	PS02	PS03	PS04	PS05
CO1	√	√	√	√	√
CO2	√	√	√	√	√
CO3	√	√	√	√	√
CO4	√	√	√	√	√
CO5	√	√	√	√	√

Core Practical Syllabus

Core Course - XV: Practical -V – (Covering the Core Courses XIII and XIV)

(Biophysics and Biochemistry and Instrumentation techniques) - 20P4BOP05

Biochemistry:

1. Preparation of solutions - percent - PPM, molal, molar and normality concentrations.
2. Preparation of buffers (phosphate & citrate)
3. Estimation of reducing sugars (Nelson - Somogyi method, 1952)
4. Estimation of total free amino acids (Moore & Stein, 1948)
5. Estimation of proline (Bates et al., 1973)
6. Estimation of protein (Lowry et al., 1951)
7. Estimation of phenol (Mahadevan, 1996)
8. Estimation of ascorbic acid (Titration method)

Demonstration experiments:

10. Estimation of oil in oil seeds
11. Assay of amylase (or) Peroxidase
12. Study the spotters from the theory syllabus in Biochemistry and Biostatistics (Instruments/ Apparatus / Chemicals / Photographs / Charts / Figures/ Graphs / Tables / Diagrams / Models)

Instrumentation techniques:

1. Measurement of conductivity of water sample
2. Verification of Beer's law using $CuSO_4$ / K_2Cr_2O7 solution
3. Preparation of standard graph for Amino acid
4. Estimation of dissolved Oxygen (Winkler's method)
5. Separation of photosynthetic pigments by Thin Layer Chromatography
6. Separation of sugars by Thin Layer Chromatography
7. Quantitative separation of any three standard amino acids by paper chromatography method

Demonstration Experiments

8. Analysis of minerals K, Ca, Na from soil / water / plant samples using Flame Photometer.
9. Separation of proteins by Electrophoresis.
10. Study the spotters from the theory syllabus in research methodology (Instruments /Apparatus / Chemicals)
11. Study the spotters from the theory syllabus in research methodology (Photographs/ Charts / Figures/ Graphs/ Tables / Diagrams / Models).

Note:

1. Submit a data collection (not less than 20 pages) using internet for Literature Review / References to any one topic in the theory syllabus of Biophysics and Biochemistry (during the Internal practical examination).
2. Certified record work done in the laboratory during practical classes.

Model practical question paper for M. Sc., Botany Degree Examination

Core Course - XV: Practical -V (For Core Courses XIII & XIV)

(Biophysics and Biochemistry and Instrumentation Techniques) - 20P4BOP05

Practical : 50

Record : 5

Viva-voce : 5

Max. Marks : 60

Time: 4 Hrs

1. Conduct the experiment **A** assigned to you. Record your results. Leave the set up for valuation. **(10)**

2. From the given material **B** find out the mean and calculate the standard deviation with reference to its length. Present your data in the form of a graph. **(7)**

3. Determine the dissolved oxygen of the given sample **C** by Winkler's method**.** **(8)**

(Or)

Prepare a standard graph of the given amino acid **D.** **(8)**

4. Separate and identify the photosynthetic pigments from the given sample **E** using thin layer chromatography. **(10)**

(Or)

Separation of amino acid from the given sample **F** by Paper Chromatography method. **(10)**

5. Write notes on **G, H, I, J** and **K.** **(5 x 3 = 15)**

Key:

A - Biochemistry experiment from the syllabus (Selected by each student by lot)

B - Leaf / Fruit (anyone – 50 numbers)

C - Given Sample

D - Glycine

E - Leaves

F - Given Sample

G and **H** - Biochemistry (Equipments / Apparatus / Chemicals / Photographs / Charts/ Diagrams)

I - Biostatistics (Charts/ Diagrams)

J and **K** - Instrumentation techniques (Charts/ Figures/ Graphs/Tables/ Instruments/ Apparatus / Chemicals /Models / Photographs)

Project Work – 20P4BOPR01

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.

Allocation

- Student may select their broad research area during the end of the second 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 project work.

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 o conduct his/her original research.
- Minimum of 5-10 yrs 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

- Interim reports should be submitted by the students during the mid of fourth semester to the Head of the Department. This interim report should form the basis for the final project report. (Change in project work after the submission of interim report may be carried out only with prior permission of the HOD).
- Evaluation will be based on the norms that will look into nature of the project work, the content of the dissertation, presentation duly summed up by a viva-voce examination.
- Attendance of the student for presentation and viva-voce is a must.

Dissertation format

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