VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
[Re-accredited with 'A' Grade by NAAC]
Virudhunagar – 626 001.

Course Name: Master of Science
Discipline: Botany
(For those who join in June 2022 and after)
Course Scheme:

Sem	Part	Course Title	Hours	Credit	Int+Ext =100	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Course Code	Revised/ New/ No Change/ Interchanged. (If revised % of change)
I	Core I	Gymnosperms and Taxonomy of Angiosperms	6	4	40+60=100				✔							✔	**P22BYC11**	Revised - 20%
	Core II	Cell Biology and Internal Morphology	6	4	40+60=100				✔							✔	**P22BYC12**	Revised - 20%
	Core III	Entrepreneur Botany	5	4	40+60=100				✔					✔	✔	✔	**P22BYC13**	Revised - 50%
	Core IV	LAB I: Gymnosperms and Taxonomy of Angiosperms	4	3	40+60=100				✔							✔	**P22BYP11**	Revised - 10%
	Core V	LAB II : Cell Biology and Internal Morphology and Entrepreneur Botany	4	2	40+60=100				✔					✔	✔	✔	**P22BYP12**	Revised - 30%
	Elective I	Pharmacognosy	5	5	40+60=100				✔					✔			**P22BYE11**	Revised - 20%

II	Core VI	Algae, Lichens, Bryophytes and Pteridophytes	6	4	40+60=100				✔							✔	**P22BYC21**	Revised - 20%
	Core VII	Genetics and Molecular Biology	6	4	40+60=100				✔					✔		✔	**P22BYC22**	Revised - 10%
	Core VIII	Environmental Biology	6	4	40+60=100				✔					✔		✔	**P22BYC23**	Revised - 10%
	Core IX	LAB III: Algae, Lichens, Bryophytes and Pteridophytes	4	3	40+60=100				✔							✔	**P22BYP21**	Revised - 10%
	Core X	LAB IV :Genetics, Molecular Biology and Environmental Biology	4	3	40+60=100				✔					✔		✔	**P22BYP22**	Revised - 20%
	NME	Herbal Botany	4	4	40+60=100				✔					✔			**P22BYN21**	Revised – 20%

Core I : Course Title : **Gymnosperms and Taxonomy of Angiosperms**	Total Hours :90
Course Code : **P22BYC11**	Total Credits : 4

Course outcomes

COs	CO Statement
CO1	Gain knowledge on classification, morphology anatomy, reproductive structures and economic importance of gymnosperms.
CO2	Develop basic understanding on paleobotany.
CO3	Attain sufficient knowledge in plant classification, ICN and understand the relationship of plant taxonomy with other fields of plant science.
CO4	Understand the morphology, identification and evolutionary trend of Polypetalae.
CO5	Understand the morphology, identification and evolutionary trend of Gamopetalae, Monochlamydeae and Monocotyledons.

Unit - I **18 hours**

Gymnosperm classification (C.J. Chamberlain 1935); Evolutionary trends, vegetative, anatomical and reproductive structure of *Cycadales*, *Coniferales*, *Ephedrales*, *Ginkgoales* and *Gnetales* its economic importance.

Unit - II **18 hours**

Principles of Paleobotany, Paleobotanical sites and Research institutes, Geological time scale, Process of fossilization and Types of fossils; Carbon dating techniques; Salient features, morphology and reproductive structures of the fossil groups – *Bennettitales*, *Pentoxylales* and *Cordaitales*.

Unit - III **18 hours**

Scope of Plant systematics; Systems of classification - Bentham and Hooker's system, Engler and Prantl system, Takhtajan system and APG IV system - Principle, features, merits and demerits; Plant identification with keys - Dichotomous Keys and Polyclave key; Plant Nomenclature; Principles of priority; Effective and valid publication; Author citation; Retention, choice and rejection of names; Typification and Type concepts; Phylocode – an overview and its principles; Taxonomy in relation to Anatomy, Cytology, Phytochemistry, Embryology and Molecular taxonomy; Cladistics and Phenetics.

Unit - IV **18 hours**

Salient features, evolutionary trend and Economic importance of the following families: Polypetalae - Ranunculaceae, Capparidaceae, Tiliaceae, Polygalaceae, Zygophyllaceae, Rhamnaceae, Combretaceae, Lythraceae, Passifloraceae.

Unit -V **18 hours**

Salient Features, evolutionary trend and Economic importance of the following families: Gamopetalae – Asteraceae, Sapotaceae, Oleaceae, Gentianaceae, Bignoniaceae, Verbenaceae; Monochlamydeae – Nyctaginaceae, Aristolochiaceae, Euphorbiaceae; Monocotyledons – Liliaceae, Arecaceae, Typhaceae, Cyperaceae

Students must be taken a minimum of 3 days field trip for plant exploration to Western Ghats/ Research institutes.

Text Books:

- Vashishta.P.C., Gymnosperms. S.Chand& Company Ltd., New Delhi, 1999
- Subrahmanyam, N.S., Modern plant Taxonomy. Vikas Publishing House Ltd. New Delhi. 1999.
- S.N.Pandey and S.P.Misra. 2009, Taxonomy of Angiosperms, Ane Books Pvt. Ltd, New Delhi. 2009
- Dr.K.A.Siddiqui., Elements of Paleobotany, Kitab Mahal, Allahabad, 2003.

Reference Books:

- Biswas.C and Johri, B.M., The Gymnosperms. Narosa publishing house, New Delhi, I999.
- Sporne,K.R., Morphology of Gymnosperms, Hutchison University press, 1986.
- Bhatnagar,S.P. and Moitra,A, Gymnosperms. New Age Int LTd. New Delhi, 1996.
- Heywood.V.H. and Moore, N, Current concepts in plant taxonomy,Academic Press London, 1994.
- Lawrence ,GHM, Taxonomy of Vascular plants. Mac Millan, New York, 1959.
- Sokal, R.R. and Sneath P.H.A., Principles of Numerical Taxonomy. Freeman & Co. San Francisco, USA, 1963.
- Stace, C., Plant taxonomy and Biosystematics, Edward Arnold, London, 1985.
- Cole .A.J., Numerical Taxonomy. Academic Press, London, 1969.
- Woodland, D.W., Contemporary Plant Systematics. Prentice Hall, New Jersey.1996
- Mondal. A.K., Advanced Plant Taxonomy, New Central Book Agency, Kolkata. 2005
- Stewart, W.N.& Rothwell, G.W, Paleobotony and the evolution of Plants,Cambridge University Press 2005.

E-sources:

- Systematics & Phylogenetics | University of New Hampshire (unh.edu)
- Introduction to Plant Systematic - YouTube
- Ch-09 Life Sciences, Botany, Zoology, Bio-Science - YouTube
- Flowering plant - Wikipedia
- 9.6: Plant Classification - Biology LibreTexts
- classification-and-naming-of-plants.pdf (unl.edu)
- update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV | Botanical Journal of the Linnean Society | Oxford Academic
- Plant taxonomy: a historical perspective, current challenges, and perspectives - PubMed (nih.gov)

Question Bank

1. Explain the general characters of Gymnosperms
2. Describe the male and female reproductive structure of Cycadales
3. Explain the draw and structure of ovule in Coniferales.
4. Describe the important characters of Pentoxylales.
5. Explain the plant identification with keys and their types.
6. Briefly explain the typification and type.
7. Explain the floral characters of the family Lythraceae and their economic importance.
8. Compare the important floral characters of the family Rhamnaceae and Passifloraceae.
9. Describe the vegetative and floral characters of the Sapotaceae.
10. Explain the floral characters of the Cyperaceae and their economic importance.
11. Describe in detail the salient features and reproductive structure of Gnetales.
12. Explain in detail the morphological and reproductive structures of Cordaitales.

13. Briefly explain the Principle, salient features, merits, demerits and versions of APG
14. Describe the salient features and economic importance of the family Nymphaceae with suitable diagrams.
15. Briefly explain the important morphological characters and economic importance of the family cyperaceae with suitable diagrams.
16. Write an essay on the economic importance of various orders of gymnosperms studied by you.

Core II : Course Title**: Cell Biology and Internal Morphology**	Total Hours:90
Subject Code: **P22BYC12**	Credit:4

Course Outcomes

COs	CO Statement
CO1	Distinguish the structure and functions of various cell organelles.
CO2	Compare and contrast the events of cell cycle and its regulation.
CO3	Explain the communications of cells with other cells and to the environment.
CO4	Distinguish the various processes involved in plant development.
CO5	Understand the internal anatomy and enables to identify fragmentary plant materials, wood, forensic investigation, and applied aspects of meristem cultures.

Unit - I **18 hours**

Ultrastructure of Cell wall - Primary and Secondary structure and functions; Plasma membrane - Structure, Models and Functions, Passive and active transport, Permeases, Ion Channels, ATP Pumps, , uniport, symport, antiporter systems, Plasmodesmata; Structure and functions of cell organelles: Nucleus, Endoplasmic Reticulum, Chloroplast and Mitochondria.

Unit –II **18 hours**

Structure and functions of cell organelles: Golgi complex, Ribosomes, Lysosomes, Peroxisomes and Glyoxysomes; Cell cycle and Cell division; Chromosomes - Numerical, Structural variations and banding patterns; Special types of chromosomes: Lamp brush chromosomes Polytene and B chromosomes; Cytoskeleton – microtubules, microfilaments and intermediate filaments.

Unit -III **18 hours**

General account and theories of Apical meristems (shoot apex and root apex); Quiescent centre; Cambium - origin, structure, division and factors influencing the activity of vascular cambium, Storied and non-storied types; Types of vascular bundles, anomalous behavior; Role of cambium in wound healing; Periderm - Structure and development.

Unit - IV **18 hours**

Stomatal types; Secretory tissues in Plants-Structure and distribution of Secretory Trichomes, salt glands, colleters, nectaries, resin ducts and laticifers; Secondary xylem and Phloem-

Ontogeny, structure and function;Transfer cells -Structure and functions; Tyloses; Anomalous secondary growth in dicot stem and monocot stem.

Unit - V **18 hours**

Structure of wood – sap wood and heart wood, hard wood and soft wood, pycnoxylic and manoxylic wood, early wood and late wood; Reaction wood – compression and tension; Factors affecting reaction wood formation. Wood: physical, chemical and mechanical properties; Growth rings in wood; Identification of common timbers in Tamil Nadu.

A field study / trip or research institute / universities / industrial visit should be carried out for Three days.

Text books:

1. Gupta. Cell and Molecular Biology. Rastogi publications meerut. New Delhi, 2003
2. Pandey, B. P. Plant Anatomy. S. Chand and Co. Ltd., New Delhi,1989.

Reference Books:

1. Cutler, D. F. Applied Plant Anatomy. Orient Longman Publishers, New Delhi,1978.
2. David. E. Sadava. Cell Biology. Jones and Bartlett Publishers, Boston, 1993.
3. Gahan, P.B. Plant Histochemistry and Cytochemistry, Academic Press, London, 1984.
4. Johanson, W.A. Plant Microtechnique. Mc Graw Hill,1984
5. Johanson, W.A. Botanical Histochemistry-Principles and Practice. Freeman & Co.,1982.
6. Kochar, S.L. Economic Botany in the Tropics. MacMillan India, New Delhi, 1999.
7. Kierman, J.A. Histological and Histochemical Methods. Butterworth Publications, London, 1999.
8. Pearse, Histochemistry, Vol. I and Vol.II.1985.
9. Ruzin, Z.E. Plant Microtechnique and Microscopy. Oxford University Press, NewYork, 1999.

e - Resources

1. https://www.britannica.com/science/cell-biology
2. https://kashanu.ac.ir/Files/Content/toluei/Botany_Plant_Anatomy_microscope_pic.pdf

QUESTION BANK/MODEL QUESTION

1.Briefly describe the structure of chloroplast.
2.Write about the plasmodesmata.
3.Give a brief note on glyoxysomes.
4.Write about the polytene chromosomes.
5.Briefly describe the types of vascular bundles
6.Write about the shoot apex.
7.Give a concise account on monocot stem.
8.Briefly describe the secondary system with the help of diagrams
9.Comment on growth rings in wood.
10.What is heart wood? Explain.
11.Describe the structure and functions of endoplasmic reticulum.
12.Write the structure and functions of the Golgi complex.
13.Explain the types of storied and non-storied cambium.
14.Draw the structure and explain the distribution of secretory trichomes.
15.Comment on (i) Pycnoxylic wood (ii) Manoxylic wood

Core III :Course Title : **ENTREPRENEUR BOTANY**	Total Hours : 90
Course Code : **P22BYC13**	Total Credits : 4

Course Outcomes

COs	CO Statement
CO1	Exploration of knowledge in establishment of garden, organic farming and various horticultural practices.
CO2	Enrichment with commercialization of dry and fresh flowers.
CO3	Adapting the methods of preservation of vegetables and fruits.
CO4	Training on skill development and employability abilities in plant based products.
CO5	Marketing credibility through marketing and entrepreneurship development.

Unit – I **18 hours**

Commercial Botanicals

Landscaping - formal and informal miegakure garden design; Architectural designing - Artificial pond, Trellis, Pergolas, Astro turf, Gabion, Hedges, Topiary, Rockery, Bonsai, Terrarium, Saikei, Kokedama, Vertical garden, Junk art; Plant Nursery - Preparation of soil mixture for beds and pots-akadama; Establishment of Kitchen garden; Miyawaki plantation; Bio-conversion of organic wastes into organic manure by adapting different technologies.

Unit - II **18 hours**

Commercial Floriculture

Cut flowers - Cultivation and conditioning of cut flowers (Rose and Gerbera), Packing. Ikebana - Principles and its types. Preparation of bouquet, wreath. Methods of drying, pressing, dyeing plant materials-dry arrangements, greeting cards, Wall hangers, potpourii.

Unit - III **18 hours**

Fruits and Vegetables preservation

Fruits and vegetables preservation - Dehydrating, canning, salting, pickling,freezing; Fruits and Vegetables Products-Tutti frutti; Health drink, mango pulp, pickle, jam, jelly, Amla candy, raisin; Factors influencing the growth of microorganisms in food - Sources of contamination of fruits - Types of Spoilage.

Unit – IV **18 hours**

Value added plant based products

Cosmetics-Herbal skin care powder, herbal hair wash powder. Mehandi, organic hair oil and hair dye. Mushroom recipes (soup, omelette, pakoda and briyani). Preparation of - Coco peat, Banana products, Palmproducts, Resinart; Packing techniques – low, trans wrap, deep drawing, doy, sachet, top seal, vacuum: Cost management and estimation.

Unit - V

Marketing and trade **18 hours**

Steps for starting a small scale industry; Registration as SSI. Role of SIDBI. Advantages and problems of SSI. Government Schemes for SSI; NABARD, NCDC, MSME, NSIC. Marketing and entrepreneurship - different types of marketing, identification of types of consumer and their needs, building consumer relationship. FSSAI, GMP, FAO, ICDS, import and export business development and strategies.

- ***A field study / trip or research institute / universities / industrial visit should be carried out for three days.***

Text Books:

1. Bahi,N, Hand Book on Mushrooms,(4th ed.), New Delhi,India:Oxford and IBH Publishing Co.Pvt.Ltd.Print, 2015.
2. Chaudhari, H.K, Elementary Principles of Plant Breeding. New Delhi,India:Oxford&IBH Publishing Co Pvt Ltd.Print. 1992.
3. Desrosier, N.W.andDesrosier ,J.N, The Technology of Food Preservation,(4th ed).CBS Publishers & Distributors. Print, 1987.
4. Haroid Piercy, Flower arranging, London: Sundial Publication.Print, 1980
5. Kumar, N, InTroduction to Horticulture,(7thed). New Delhi,India : Oxford &IBHPublishingCo.Pvt Ltd .Print, 2011.
6. Narayanaswami, R.V.andRao.K.N. Outlines of Botany, Chennai, India: Esvee Press. Print.
7. Sheen,J, Pressing flowers, London: Merehurst Press, Print. 1988
8. Shirley,M, Arranging flowers, London: Merehurst Press, Print. 1989.

Reference Books:

1. Acquaah,G, Horticulture Principles and practices,(4th ed). New Delhi, India: PHI LearingPvt.Ltd.Print, 2009
2. Bahl, N,Hand Book on Mushroom,(3rd ed). New Delhi, India: Oxford and IBH Publishing Co.Pvt.Ltd. Print. 1995.
3. De, L.C, Handbook of Gardeing, Jaipur, India: Aavishkar Publishers & Distributors. Print, 2012.
4. Nandan, H, Fundamenatals of Entrepreneurship, (2nd ed), New Delhi: PHI Learning Pvt. Ltd. Print. 2011.
5. Rekha sarin, The art of Flower Arrangment, London : UBS Publishers. Print, 1995.
6. Sharma, R.D, Designing and Managing of Marketing Research, New Delhi, India: Deep and Deep Publications. Print. 1991.

E-Resource:

https://foodsafetyhelpline.com/what-are-the-different-methods-of-food-preservation/
https://microbenotes.com/factors-affecting-the-growth-of-microorganisms-in-food/
https://www.highspeedtraining.co.uk/hub/food-preservation-methods/
https://byjus.com/free-ias-prep/fssai-food-safety-and-standards-authority-of-india/
https://carrerstudies.blogspot.com/2021/01/9-skills-to-be-successful-export-import.html
https://www.biologydiscussion.com/ecology/ecology-definition-scope-and-history-biology/59649
https://microbenotes.com/food-spoilage-microorganisms/
https://www.packagingpartners.nl/en/packaging-techniques
https://cocoandcoir.com/blogs/gardening/how-is-coco-peat-made
https://carrerstudies.blogspot.com/2021/01/9-skills-to-be-successful-export-import.html

Question Bank

Short Question

1. Write short notes on construction of trellis and its importance.
2. give a brief account on Miyawaki plantation
3. write briefly on a) Bonsai b) Daisugi
4. how will you construct a terrarium &saikei
5. give a brief account on cut flowers
6. How will you prepare a bouquet 7 a wreath.
7. Differentiate Akadama& soil mixture
8. Write briefly on amla candy preparation
9. What is raisin? How are they made?
10. write briefly on pickling of vegetables

11. give a brief account on preparation of Jam.
12. Write about the ingredients of herbal skin care powder
13. Write briefly on resin art
14. Give a briefly account on cost management and estimation
15. Write short notes on FSSAI
16. Write briefly on NABARD
17. What are the steps taken to register as a SSI
18. Write short notes on FAO
19. How will you build s customer relationship
20. Write briefly on MSME

Essay question

1. Describe the Landscaping designing and its types with miegakure garden design
2. Discuss Architectural design and its types
   a) Artificial pond b) Trellis c) pergolas
3. Discuss Architectural design and its types
   b) Topiary b) Astro turf c) Junk art
4. Describe the establishment of kitchen garden.
5. Explain the import and export development and strategies
6. Explain the principles and its type of Ikabaena
7. Explain the different methods of drying and pressing dyeing of plant materials

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Core IV: **LAB – I: Gymnosperms and Taxonomy of Angiosperms**	Total Hours : 4
Course Code : **P22BYP11**	Total Credits : 3

COs	CO Statement
CO1	Develop skill in the micro preparations of wood, leaves of cones of Gymnosperms species
CO2	Develop skills microscopic observation
CO3	Understand the rules of botanical nomenclature and taxonomical hierarchy
CO4	Develop skill plant identification using flora and punch cards and o describe plant species using technical terms
CO5	Become expertise in making sketches of the sections observed under dissection microscope and compound microscope

Practical Syllabus

Gymnosperms

- Study of the external, internal and reproductive structures of *Cycas, Cupressus, Araucaria, Podocarpus, Agathis, Ephedra* and *Gnetum*.
- Observation of fossil slides.
- Submission of 5 permanent slides.

Angiosperms

- Preparation of dichotomous key.
- Solving nomenclatural problems.
- Identification of families with the help of their vegetative and floral characters.
- Submission of 20 herbarium sheets, report submission of field trip

Students must be taken Three days field trip for floristic study to Western Ghats (Hill areas)

Practical Question

Duration ; 4 hours Max marks – 100

1. Make temporary preparation of 'A'. Submit the slide for valuation. Identify, give reasons and draw labeled sketches. 8 marks
2. Take T.S for the given wood 'B'. Submit the slide for valuation. Identify, give reasons and draw labeled sketches. 8 marks
3. Assign 'C' to its geological era. Identify, give the reasons and draw labeled sketches. 8 marks
4. Describe the taxonomically important characters of 'D' and assign it to its respective family.(Diagrams not necessary) 8 marks
5. Describe the flower 'E' in technical terms, Draw the L.S of flower, Floral diagram and write the floral formula. Submit a dissected flower for valuation. 10 marks
6. Write down the binomial of 'F' with the help of flora supplied. 4 marks
7. Prepare a Dichotmous key for 'G' on the basis of their vegetative and floral characters. 6 marks
8. Solve the Nomenclatural problem given in 'H'. 4 marks
9. Identify the family for the given plant 'I' using punch cards. 5 marks
10. Identify, give reasons and draw labeled sketches for 'J' and 'K' 2x5=10 marks
11. Write down the genera and family for the given plant 'L' and 'M'. 2x2=4 marks
12. Submission herbarium. 10 marks
13. Submission of five double stained permanent slides. 5 marks
14. Submission of certified record work done in the laboratory during the practical classes. 10 marks

Key & Valuation Scheme

KEY & VALUATION SCHEME

l. A - Gymnosperm —Leaf/ Cone
Slide - 2, Identification -l, diagram -2, Reasons -3 8 marks

2. B - Gymnosperm —Wood
Slide - 2, Identification -l, diagram -2, Reasons -3 8 marks

3. C - Fossil Gymnosperm
Era l, Identification -1, diagram -3, Notes -3 8 marks

4. D - Any plant prescribed in the syllabus
Family identification -2, Characters -6 8 marks

5. E - Any Flower prescribed in the syllabus
Characters -4, flower Dissection -2. Floral diagram -1,
Floral formula -l, L.S of Flower -2 10 marks

6. F - Any plant prescribed in the syllabus (Binomial Name)
Value as a whole 4 marks

7. G - Any Five plants from one family (Dichotomous Key)
Value as a whole 6 marks

8. H - Any one Nomenclatural problem 4 marks

9. I Any plant prescribed in the syllabus (Punch Card) 5 marks

10. J , K — Gymnosperms (macro specimen)
Identification -1, diagram -2, Reasons -2 2x5=10 marks

11. L , M - Any two plants prescribed in the syllabus
Genus name -1, Family name –l 2x2=4 marks

12. Herbarium 10 marks

13. Permanent slides Five 5 marks

14. Record note book 10 marks

Core V: Course Title : **LAB II : CELL BIOLOGY AND INTERNAL MORPHOLOGY AND ENTREPRENEUR BOTANY**	Total Hours : 4
Course Code : **P22BYP12**	Total Credits : 2

COs	CO Statement
CO1	Understand the structure of basic organelles of plant cells.
CO2	Identify living and non-living cell inclusions in the plant cells.
CO3	Gain knowledge in comparing the anatomy of wood.
CO4	Develop skill in establishing various type of garden and raising nursery plants.
CO5	Gets trained in the preparation of plant based products.
CO6	Understand the importance of organic manures and develop skill in the preparation of vermicompost.

Practical Syllabus

Cell Biology and Internal Morphology

- Identification of different stages of mitosis from Onion root meristems.
- Study of living and non-living cell inclusions
- Techniques of preparation of permanent and semi permanent slides
- Study of wood anatomy (*Bombax, Tectona, Azadirachta* and *Dalbergia*)
- Structural anomalies in the Stems of *Dracaena, Achyranthus, Nyctanthus* and *Antigonon.*

Entrepreneur Botany

- Establishment of Kitchen garden, vertical garden, raising nursery plants.
- Preparation of Bouquet, wreath, ikabana
- Dry arrangement,
- Cosmetics preparations
- Preparation -Jam, jelly, health drinks
- Preparation of Mushroom recipes
- Preparation of vermi compost
- Submission of any Craft work
- Preparation of salad

Practical Question

1. Make temporary preparation of "A" and submit atleast two stages. (2x2= 4marks)
2. Take transverse section of "B". Identify the anomaly by giving reasons. Draw diagram and submit the slides for valuation. 8 marks
3. Take T.S, T.L.S and R.L.S of the wood "C" and "D". Draw labelled sketches. Identify by giving reasons. Submit the slides for valuation. 2x 9= 18marks
4. Demonstrate the Terrarium/Hanging pot by taking a lot. Draw diagrams and write notes. 5 marks
5. Perform flowers arrangement. Write notes 5marks
6. Write the procedure for the preparation of the given food item "F" in the form of flow chart. Add note on the ingredients required and its nutritive values. 5marks.
7. Taste the value added/plant based product and comment on it. 3 marks
8. Submission of any plant based craft work. 4 marks
9. Perform a salad preparation 3 marks
10. Work done on grow bag cultivation of greens and vegetables. 5 marks

11. Work done on raising of nursery plants through stem and leaf cuttings. 5 marks
12. Submission of report of vertical garden. 5 marks
13. Write notes of interest on "G"," H", "I" and "J" (4x5=20 marks)
14. Submission of five double stained permanent slides 5 marks
15. Submission of record work (10 marks)

Key scheme of valuation

1. Submission of 2 stages – 4marks
2. Slide submission - 2
Identification -1
Diagram - 3
Notes - 2
3. Slide submission – T.S, T.L.S, R.L.S – 3
Identification -1
Diagram - 3
Notes - 2
4. Sumission -3
5. Flower arrangement
6. value as a whole
7. Ingrediants – 2
Identification – 1
8. Innovation – 1 creativity – 1 Material used – 1 submission -1
9. Creativity – 1 1/2; Display 1 ½
10. Follow up the submission of photograph
11. Value as a whole
12. Value as a whole
13. Identification – 2
Diagram – 2
Note -2
14. Slides (5) – 5
15. Record – 10 marks

ELECTIVE- I: **PHARMACOGNOSY**	Total Hours :90 Hours
Course Code : **P22BYE11**	Total Credits : 5

Course Outcomes:

COs	CO Statement
CO1	Understand the history of Pharmacognosy, general cultivation and Processing of medicinal plants, classification of crude drugs and Basic principles and concepts of Alternative system of medicine.
CO2	Attain sufficient knowledge on evaluation of crude drugs, extraction and isolation of crude drugs and quality control of herbal drugs.
CO3	Understand pharmacological action of plant drugs on nervous system and other organs.
CO4	Competent enough to perform phytochemical tests in order to find plant secondary metabolites.
CO5	Wisdom on drugs obtained from various plant parts and its medicinal values.

UNIT - I

Brief history and scope of raw drugs of plant origin. Definition, classification and description. Classification of crude drugs –Morphological, pharmacological and taxonomical. General cultivation, collection of vegetable drugs of commercial significance, processing, storage and preservation of crude drugs. Systems of Medicine - Ayurveda, Siddha, Homeopathy, Unani.

UNIT - II

Analytical Pharmacognosy - Drug adulteration - Drug evaluation (organoleptic, microscopical, physical, chemical and biological evaluation of crude drugs as per WHO guidelines). Biological testing of herbal drugs (analgesics, anti-inflammatory and antioxidant agents). Methods of extraction (percolation, maceration, soxhlet extraction, decoction and sonication) of phytochemicals from crude drugs. Separation and isolation of constituents - distillation, chromatography - TLC.

UNIT - III

Pharmacological action of plant drugs-action on the autonomic nervous system, central nervous system, heart muscle, blood vessels, the respiratory system, gastro-intestinal tract and urino genital system.

UNIT - IV

Preliminary Phytochemical screening of secondary metabolites: alkaloids, flavonoids, steroids, terpenoids, saponins, phenolic compounds. Basic study on the source, structure, medicinal value of the following Phytochemicals - glycosides, alkaloids and steroidal saponins. Natural steroid production for pharmaceuticals –*Dioscorea*root.

UNIT - V

Drugs obtained from plant parts, structure and medicinal values - Roots and underground parts - *Rauwolfia. Aconitum, Sarsaparilla, Curcuma, Asparagus* and *Acorus.* Leaves - *Eucalyptus, Adhatoda, Solanum trilobatum, Digitalis, Andrographis* and *Leucas aspera*. Fruits - *Emblica, Cuminum, Tribulus, Terminalia chebula and Piper longum.*

A field study / trip or research institute / universities / industrial visit should be carried out for three days.

Text books

1. Mohammed Ali. Pharmacognosy, CBS Publishers and Distributors,2008.
2. C.K. Kokate, A.P. Purohit& S B. Gokhale. Pharmacognosy ,NiraliPrakashan.2008
3. AshutoshKar. Pharmacognosy and Pharmaco biotechnology, New Age. 2007.
4. Biren Shah and Seth. Textbook of Pharmacognosy and Phytochemistry. Elsevier Publishers, 2010.

Reference books

1. G.E. Trease, W.C. Evans, Pharmacognosy, ELBS. 2009
2. Varro E.Tyler, Lynn. R.Brady, James E.Robbers.Pharmacognosy, Lee &Febigerpublisher, 1988.
3. T.E. Wallis,Text Book of Pharmacognosy, CBS Pub. Delhi, 1967.
4. Kirthikar, Basu,Indian Medicinal Plants. Lalit Mohan Basu publishers, Dehra Dun, India, 1998.
5. K.M. Natkarni, Indian Meteria Medica, Bombay Popular Prakashan, 2011
6. A Hand Book of Common remedies in Siddha system of medicine- CCRIMH, 2000.

e-resources:

1. http://www.pharmacy180.com/article/classification-of-crude-drugs-17/ 2.

2. https://agritech.tnau.ac.in/gap_gmp_glp/gap_medicinal%20crops.html
3. https://www.ayush.gov.in/
4. https://copbela.org/downloads/2020/SELF%20LEARNING%20MATERIAL%20BPHARMA/semester%206/BP603T/MODULE%2004.pdf
5. http://www.jiwaji.edu/pdf/ecourse/pharmaceutical/Adulteration%20of%20drugs%20of%20natural%20origin.pdf
6. https://www1.health.gov.au/internet/publications/publishing.nsf/Content/drugtreat-pubs-front6-wk-toc~drugtreat-pubs-front6-wk-secb~drugtreat
7. https://cms.galenos.com.tr/Uploads/Article_19407/TJPS-15-156-En.pdf
8. https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/phytochemical-screening
9. https://www.unmc.edu/elearning/egallery/drugs-of-the-autonomic-nervous-system-acetylcholinesterase-agents/
10. https://www.ncbi.nlm.nih.gov/books/NBK538180/

Question Bank

1. Write a note on history and development of pharmacognosy.
2. Classify the drugs based on chemical and morphological classification with examples
3. What are the merits and demerits of Pharmacological and Chemical classification?
4. Discuss in detail about processing and collection of medicinal plants.
5. What do you mean by GAP? Explain its feature in cultivation of medicinal plants.
6. Explain in detail about chemical and microscopic method of evaluation for crude drugs.
7. How adulterants are detected by organoleptic and biological method of evaluation?
8. Write biological source, chemical constituent and uses of drugs obtained from roots.
9. Write about the chemical tests used for identification of various chemical constituents found in natural products
10. Write notes on the following i) Froth floating technique ii) TLC in natural product isolation iii) Soxhlet Extraction
11. Write in detail on chemotaxonomy
12. Discuss the importance of soil, temperature and altitude on cultivation of medicinal plants.
13. Discuss the history, evolution, relevance and importance of pharmacognosy
14. Discuss the basic principles, diagnosis and treatment in Ayurveda
15. Define the term adulteration? Write the different methods of adulteration of crude drugs and explain physical and chemical method of evaluation of crude drugs
16. Explain the methods for the isolation of secondary metabolites from crude plant material
17. Describe the WHO guidelines for assessment of herbal medicines
18. Discuss in detail the various methods involved in extraction, purification and identification of phyto constituents of crude drugs
19. Write a brief note on chromatographic techniques employed in phytochemical analysis.
20. Discuss the pharmacological action of plant drugs acting on central nervous system
21. *Dioscorea* is a starting material for natural steroid production-Discuss

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SEMESTER - II

Core VI: Course Title **: ALGAE, LICHENS, BRYOPHYTES AND PTERIDOPHYTES**	Total Hours : 90
Course Code : **P22BYC21**	Total Credits : 4

Course Outcomes

COs	CO Statement
CO1	Understand the diversity, distribution and classification of Algae.
CO2	Develop knowledge about the thallus organisation, reproduction, life cycle and cultivation of Algae.
CO3	Familiarize with Lichen morphology and reproduction.
CO4	Understand the evolutionary relationships among Bryophytes and their fossils.
CO5	Gain knowledge about the structural variations among Pteridophytes.

Unit – I **18hours**

Classification of Algae by F.E.Fritsch (1935); Contributions by Indian Phycologists; Range of thallus organization; A brief study on the prokaryotic, mesokaryotic and eukaryotic construction among Algae; Brief study on - Plastids, Pyrenoids, stigma, flagella, and neuromotor apparatus; Reproduction and various life cycle patterns among Algae; Thallus organization and reproduction of the following classes of Algae – Chlorophyta and Cyanophyta.

Unit – II **18 hours**

Thallus organization and reproduction of the following classes of Algae - Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta; Economic importance of Algae; Cultivation of Algae – *Nostoc* and *Kappaphycus*.

Unit - III **18 hours**

Lichens -Classification, Distribution, and structure of thallus; Special vegetative structures of thallus; Nutrition and Reproduction; Economic importance and their ecological significance; Biochemical tests to identify Lichens; Contributions of Erik Acharius and Edouard Bornet.

Unit - IV **18 hours**

Origin of Bryophytes; Contributions by Bryologists; Classification of Bryophytes by Rothmaler (1951); Ecology of Bryophytes; Structural variation, evolution of gametophytes and sporophytes among Bryophytes; Fossil bryophytes and their significance. General characters of Hepaticopsida, Anthoceropsida and Bryopsida. Economic importance of bryophytes.

Unit V **18 hours**

Origin and evolution of Pteridophytes; Classification of Pteridophytes by Smith system(1955); Contributions of Indian Pteridologists; Telome concept; Phyletic slide; Stelar evolution in Pteridophytes; Heterospory and seed habit; Evolution of sori in Ferns;

Morphology, reproduction and phylogeny of the following groups -Psilopsida, Lycopsida and Pteropsida; Comparative morphology and fructifications of fossil Pteridophytes - Lepidodendrales, Calamitales and Sphenophyllales.

·*Students must be taken for a minimum of 3 days field trip to coastal areas to study the distribution of flora*

Text Books:

1.Sharma, OP..Text book of Algae. Tata McGraw Hill, New Delhi.1998
2.Vashishta, B.R. Algae, S.Chand& Company, New Delhi.1999.
3.Parihar, N.S. An Introduction to Embryophyta Vol.1. Bryophyta. Central Book Depot.1980.
4.PremPuri, Bryophytes: Morphology, Growth and differentiation. Atma Ram and Sons, New Delhi. 1981.
5.Vashishta, P.C. Bryophyta, S.Chand& Company, New Delhi.I999.
6.Rashid,A.Pteridophytta. Vikas Publishing House Pvt. Ltd., New Delhi.1999.
7.Sharma, OP., Textbook of Pteridophyta. Macmilan India Ltd., New Delhi. 1990.

Reference books:

1. Lee, R.E. Phycology. Cambridge University Press, Cambridge, UK.2008.
2. Fritsch.F.E. Structure and reproduction of Algae. Cambridge University press. 1945.
3. Pandey.B.P. Algae.S. Chand & Company Ltd. New Delhi.1994.
4. Round, F.E. The Ecology of Algae. Cambridge University Press.1984.
5. Hale, M.E..(Jr) The Biology of lichens. Edward Arnold. Mayland.1983.
6. Watson, E.V. The Structure and Life of Bryophytes. Hutchinson & Co. Ltd., London. 1964.
7. Sporne, K.R. The morphology of Pteridophytes. Hutchinson University Press I986.
8. SundaraRajan, S. Introduction to Pteridophyta. New Age International publishers, New Delhi.1999.
9. Stewart,W.N.&Rothwell,G.W. Paleobotany and the evolution of Plants. Cambridge University. 2005.

e- Resources

1. www.plantscience4u.com/2014/04/fritsch-classification-of-algae.html
2. https://byjus.com/biology/prokaryotic-and-eukaryotic-cells
3. https://www.biologydiscussion.com/algae/biology-notes-on-xanthophyta-algae/58055
4. https://byjus.com/neet/economic-importance-of-algae/

Question Bank

1. Describe the thallus organization in algae studied by you.
2. Explain the positive importance of algae.
3. Briefly describe the important characters of chlorophyta.
4.Give an account on general characters of bacillariophyta.
5. Explain the classification of lichens.
6.Describe the economic importance of lichens.
7.Explain the general characters of hepaticopsida.
8.Trace the evolution of the sporophyte in the various members of bryophytes.
9.Describe briefly the merits and demerits of the telome theory.
10.Describe the international structure of lepidodendron stem and draw a neat diagram P.T.O.
11. Briefly describe the different types of life cycle in algae.
12. Enumerate the important characters of Rhodophyta.
13. Describe the internal structure of lichen thallus and draw diagram.
14. Explain the classification of bryophytes by Rothmaler.

15. Describe the different types of stele found in pteridophytes and draw diagram

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Core -VII : Course Title**: GENETICS AND MOLECULAR BIOLOGY**	Total Hours :90
Course Code : **P22BYC22**	Total Credits : 4

Course Outcomes:

COs	CO Statement
CO1	Enlighten the basis of Mendelian genetics concepts and gene interaction
CO2	Attain the knowledge in population genetics
CO3	Gain the basic knowledge of Central dogma of molecular biology
CO4	Know the concept of gene regulation
CO5	Understand the causes of gene mutation, implications and repair mechanism

Unit - I **18 hours**

Mendelian Principles: Alleles, Dominance, Segregation, Independent assortment – Co-dominance, Incomplete dominance, Test cross, Back cross; Non-allelic gene interactions - complementary gene interaction (9:7), Epistasis-Dominant (12:3:1) and recessive (9:3:4); Polymorphic gene (9:6:1); Duplicate factor(15:1); Inhibitory factor (13:3);Polygeneic inheritance - Kernel colour in Wheat, Ear size in Maize; Extranuclear inheritance

Unit - II **18 hours**

Linkage-complete and incomplete linkage, Molecular mechanism of crossing over, Cytological basis of crossing over in corn, position effect and gene conversion, Chromosome map; Sex determination in plants, sex linked inheritance. Lethal genes, Pleiotropy, Genomic printing; Population genetics - Allele frequencies – Hardy Weinberg Law.

Unit - III **18 hours**

Structure and types of DNA and RNA, DNA as the Genetic Material,Hershey-Chase experiment,DNAreplication - associated enzymes and proteins, Meselson – Stahl experiment. Models of replication: Cairn's model and rolling circle model, RNA as Genetic Material in Small Viruses, Transcription in prokaryote. Transcription and RNA processing in eukaryotes.

Unit - IV **18 hours**

Protein synthesis: Translation (initiation, elongation and termination); Genetic code - codon and tRNA interactions - Regulation of gene expression in prokaryotes - Operon concept (Lactose, Arabinose & Tryptophan) - Regulation of gene expression in eukaryotes; Controlled transcription of DNA; Alternate splicing of RNA; Induction of transcriptional activity by environmental and biological factors; Post-transcriptional regulation of gene expression by RNA interference; Transposable elements.

Unit - V **18 hours**

Mutations-spontaneous and induced mutation (chemicals, radiation and transposans); Detection of mutations-CIB method; Molecular basis of mutation; Substitution and Frame shift Mutation – Different forms and ways of arising mutation: Tautomeric shifts, Base analogs, Alkylating agents, Apurinic sites, Thymine Dimers, DNA damage and repair mechanisms.

Text Book:

1. Singh.B.D.Fundamentals of Genetics. Kalyani Publishers, New Delhi,2000
2. Tamarin, R.H., Principles of Genetics. Tata McGraw-Hill Edition. 2012.
3. Klug and Cummings, Concepts of Genetics. Pearson Education. Indian branch, Patparganj. Delhi. 2005.

4. Gardner and Peter Snustad, Principles of genetics. John wiley& sons, New York,1984.
5. Veer Bala Rastogi, Genetics, Medtech, 2019.

Reference Books:

1. Strickberger,M.W.,**Genetics** .Prentice Hall of India Pvt Ltd.New Delhi 1999
2. Mirta,S. **Genetics** -A Blue print of life.Tata McGraw Hill, New Delhi. 1994.
3. Gupta,P.K..**Genetics** .Rastogipublishers,Meerut,2002.
4. Dyansager,V.R.**Cytology and Genetics**.Tata McGrew-Hill, New Delhi,1986.
5. Karp,G.**,Cell and Molecular Biology** John Wiley and Sons, New York,1995.
6. Snustad, D.P& Simmons, M.J.. Principles of Genetics, John Wiley & Sons,2006.

E-sources:

- Genetics and Genomics - Course (swayam2.ac.in)https://onlinecourses.swayam2.ac.in/cec20_bt03/preview
- Classical and molecular genetics | Biology library | Science | Khan Academy
- Principles of Genetics - Course (swayam2.ac.in) https://onlinecourses.swayam2.ac.in/cec22_bt10/preview
- Microbial Genetics - Course (swayam2.ac.in) https://onlinecourses.swayam2.ac.in/cec22_bt05/preview
- Learn Genetics Online - HMX | Harvard Medical School https://onlinelearning.hms.harvard.edu/hmx/courses/hmx-genetics-2/?utm_source=google&utm_medium=cpc&utm_campaign=Genetics&utm_term=online%20genetics%20certificate&utm_content=395613280455&gclid=Cj0KCQiA5aWOBhDMARIsAIXLlkfjZH9AdiD_dMn7DuG0GqUtLjpKOFbuOYjPSLkuvD_NjA30Qmo9sSoaAqyjEALw_wcB
- Learn Genetics with Online Courses, Classes, & Lessons | edX https://www.edx.org/learn/genetics
- Genetics - Wikipediahttps://en.wikipedia.org/wiki/Genetics

Question Bank:

1. Discuss about complementary gene interaction with suitable examples?
2. Explain polymerism and give suitable examples
3. Write an essay on extra nuclear inheritance
4. Give an account on polygeneic inheritance
5. Briefly explain the linkage and its types
6. Explain the molecular mechanism of crossing over
7. Write notes on chromosome map
8. Write an account on sex determination in plants
9. Explain Hardy Weinberg Law
10. DNA as the Genetic Material – Justify
11. How you consider RNA as genetic material
12. Write notes on Genetic code
13. Write an essay on lac-Operon
14. Write an account on gene regulation of in eukaryotes
15. Specify the post-transcriptional regulation of gene expression by RNA interference.
16. Write notes on transposable elements
17. Write an essay on molecular basis of mutation.
18. Explain about mutation detection methods by CIB method
19. Give a note on Mutagens
20. Explain DNA damage and repair mechanisms

Core VIII: Course Title**: ENVIRONMENTAL BIOLOGY**	**Total Hours : 90**
Course Code : P22BYC23	**Total Credits : 4**

Course Outcomes

COs	CO Statement
CO1	Understand the history and scope of ecology on climatic factors and vegetation
CO2	Gain knowledge on different types of ecological communities
CO3	Identifies environmental problem vs population and sustainable development in urban areas
CO4	Develop skills in identifying methods of environmental impact assessment, ecological, economic and biodiversity.
CO5	Analyse social issues such as natural calamities, nuclear disaster, resettlement and rehabilitation

UNIT - I **18 hours**

History and scope of ecology; Light - effect on photosynthesis, chlorophyll, leaf structure and orientation, growth and development, transpiration; Temperature - effect on plant height; leaf reflectance, flower level, dormancy, vernalization, summorization, Water - different forms, adaptations of plants to drought - leaf drop, dessication, resurrection and leaf role]; Soil - soil profile, paedogenic regimes - podzolization, laterization, calcification, salinization, gleization, Forest Fire - types, effect of fire on vegetation - seed setting, viability, germination, reproduction, serotiny, bud protection and resprouting.

UNIT -II **18 hours**

Holdridge Life Zone Classification; Terrestrial communities, aquatic communities - marine and fresh water [with reference to zonation]; Ecological succession - characteristics, sequential stages, types of succession, climax theories. Ecological niches - parameters,types - habitat, trophic and multifactors. Factors affecting Niches.Adaptations of plants in tundra, tropical and subtropical regions.

UNIT - III **18 hours**

Characteristics of population, survivor ship curves, age pyramids. Growth patterns - exponential, Malthusian and Logistics. r and k selection. Urban ecology - urban resources and environmental problems, Urban land use planning, sustainable development in urban areas.

UNIT - IV **18 hours**

Origin, values and principles. EIA - process, participants, impact, identifying methods. Climate change conferences. Role of UNFCCC, Blue carbon and IPCC. Tools to study global climate change. Remote sensing and GIS. Approaches to deal global warming. Ecological economics - global sustainability, ecosystem services - linking forest ecosystem services and market based mechanism, selling water services and biodiversity payment for carbon sequestration and economic valuation.

UNIT -V **18 hours**

Effect of Resettlement and Rehabilitation - construction of dams, roads, railways, industrial development, mining, establishment of national parks and sanctuaries, draining and filling

wetlands, land degradation, desertification.desalination, reclamation of land, nuclear disasters. Natural calamities. Restoration of lakes and wetlands. Recycling of waste water and plastics; Solid waste management practices.

·A field study/trip or visit to research institute/universities/industries must be taken for 3 days.

Text Books:

1. Kumar. H.D. General Ecology. VikasPubliting house pvt ltd, New Delhi, 1997.
2. Ambasht, R. S and Ambasht, N.K., A Text book of Plant Ecology.1996.
3. Arora,. Fundamentals of enironmental biology. Kalyani Publishers, New Delhi. 1995.

Reference Books:

1. Billings, W.D.. Plant man and ecosystem. Macmillan India, New Delhi.1972
2. Chapman, Ecology - Principles and Applications. Cambridge University Press. Foundation Books, New Delhi.1999
3. Crawford, R.M.M (Ed) Plant life in aquatic and amphibious habitats Black Well Scientific Publications, Oxford London.1986.
4. Jeffrey, D.W. Soil Plant relationship - An ecological approach.1987.
5. Odum, F.E. Fundamentals of Ecology. W.B Saunders& Company.1971.
6. Singh, J.S, Singh, S.P. and Gupta, S.R Ecology, Environment and Resource Conservation. Anamaya Publishers, New Delhi.2010.

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1.https://unfccc.int/about-us/about-the-secretariat
2.https://www.yourarticlelibrary.com/environment/environmental-impact-assessment-definition-roles-and-classification/27468
3.https://www.environment.nsw.gov.au/topics/fire/plants-animals-fire
4.http://www.agritech.tnau.ac.in/agriculture/agri_agrometeorology_temp.html
5.https://www.frontiersin.org/articles/10.3389/fpls.2021.619987/full
6.https://www.biologydiscussion.com/ecology/ecology-definition-scope-and-history-biology/59649

Question Bank

1. Outline the environmental factors that effect on transpiration.
2. Briefly explain the seed dormancy and regulation of the process.
3. Point out the characteristic feature of community ecology.
4. Illustrate the identifying methods to document EIA.
5. Why global warming is pronounced as a burning issue in recent times.
6. Explain the survivorship curves with suitable diagram.
7. Define growth curve. Explain the significance of its sigmoidalpattern.
8. Differentiate resettlement and rehabilitation.
9. Write therole of green environment in making clean environment.
10. Describe the profile of soil. Add on notes on the biogeo process of soilformation.
11. Write an essay on the terrestrial community ecology.
12. Explain the relevance of selling water services with biodiversitypayment in responseto carbon sequestration and its valuation.
13. How can urban resource management toolbe used to overcome urban environmental problem.
14. Discuss the inter relevance between waste water and solid wastemanagement in recycling.

Core IX: Course Title **: LAB III : ALGAE, LICHENS, BRYOPHYTES & PTERIDOPHYTES**	Total Hours : 4
Course Code : **P22BYP21**	Total Credits : 3

COs	CO Statement
CO1	Differentiate the vegetative and reproductive structures of Algae, Lichens, Bryophytes and Pteridophytes.
CO2	Acquires skill in sea weeds and ferns collection.
CO3	Get trained in the preparation of Herbaria for algae and ferns.
CO4	Acquires skill in the micro preparations of Rachis and sporophyll of ferns/ Bryophytes and Lichens.
CO5	Identify the variation in steles among Peridophytes.

Algae - To study the vegetative and reproductive structures of the following genera:-*Lyngbya, Stigonema, Microcystis, Nostoc, Chlorella, Pediastrum, Draparnaldia, Pithophora, Closterium, Fritchiella, Stigeoclonium, Acetabularia, Ulva, Codium, Halimeda, , Chara, Diatoms, Colpomenia, Turbinaria, Stoechospermum, Padina, Gelidium, Polysiphonia.*
Lichens - To study the vegetative and reproductive structures of *Usnea* and *Parmelia.*
Bryophytes - To study the external and internal structure of the gametophyte and sporophyte of the following: *Dumortiera,Targionia, Pellia, Porella, Sphagnum, Polytrichum.*
Pteridophytes - To study the external morphology and internal structure of the rachis and sporophyll of the following genera:-
Psilotum, Isoetes, Ophioglossum, Adiantum, Alsophila, Pteris, Pteridium, Angiopteris, Lygodium, Nephrolepis.
Students must be taken a minimum of two days field trip for Algal collection. Materials collected in the Field trip should be submitted for external valuation.

Practical Question

Duration ; 4 hours Max marks – 100

1.Make suitable temporary micro-preparations of "A", "B" and "C". submit the slides for valuation. Identity reasons and draw diagrams (3x8 = 24 marks)
2.Identify any 3 genera from the given mixture "D" draw diagram and give reasons. (3x5=15 marks)
3.Identify the given fossil genera "E" draw diagram and give reasons. (1x7=7marks)
4.Identify, draw diagrams and write critical notes on, "F", "G", "H" and "I" (6x4=24marks)
5. Identify J and K. give the ecological significance / economic importance (2x5=10marks)
6.Submission of algal herbarium sheets (minimum 10) (10 marks)
7.Submission of record note book (10 marks)

Key and Scheme of Evaluation

1. A-algae, B- Lichen/ Bryophytes C- Pteridophytes
   Identification – 1, slide – 2, Diagram -3 Reasons – 2
2. D- Algal mixture/sporophyll mixture
Identification – 1, reasons –2, diagram – 2
3. E- Fossil pteridophytes
Identification – 1, reasons – 3, diagram – 3
4. F – Algae
   G – Lichens
   H – Bryophytes
   I – Pteridophytes
Identification – 1, diagram – 2reasons – 3
5. J and K
   J – Liches
   K – Bryophytes and Algae

Core X: LAB IV: GENETICS, MOLECULAR BIOLOGY AND ENVIRONMENTAL BIOLOGY	**Hours/week: 4**
Subject Code: P22BYP22	**Credit: 3**

COs	CO Statement
CO1	Understand the Mendelian genetics concepts and gene interactions
CO2	Attain knowledge in population genetics and Central dogma of molecular biology
CO3	Gain knowledge to solve the problems on chromosome mapping
CO4	Explore the chemical components present in various water and soil samples
CO5	Acquire knowledge to survey the plant diversity in the campus
CO6	Develop skill in the study of anatomical and adaptive structure present in the hydrophytes, mesophytes and xerophytes through micro preparation

Genetics and Molecular Biology

1. Solving problems related to monohybrid and dihybrid crosses.Test cross, incomplete dominance and multiple alleles
2. Solving problems related to gene interactions mentioned in the syllabus
3. Calculating Gene frequency
4. Problem in the three point test cross and chromosome mapping
5. Spot at sight

Environment Biology

1. Assessment of Plant Diversity-Field work to list herbs, shrubs and trees in the college campus and mapping them on graphs.
2. Morphological and anatomical features of typical Xerophytes: Phyllode - Acacia Phylloclade -Opuntia, Cladode -Casurina, Succulent -Bryophyllum Hydrophytes - Hydrilla, Epiphytes - Vanda, Halophytes- Pneumatophore-Avecinia
3. Submission of report on any Natural Disasters.
4. Estimation of dissolved Oxygen in water sample by Winkler's method
5. Estimation of Organic carbon in different soils
6. Determination of Primary Productivity in Pond ecosystem
7. Estimation of Carbonate and Bicarbonate content in water samples.
8. Biodiversity centres marking location on world map

9. Field trip and Visit to forest institution

Practical Question

Duration : 4 hours Max marks – 100

1. Solve the given genetics problems "A" and "B" 2 X 7 = 14 marks
2. Find out the mean, variance and standard deviation for the given sample 15 marks
3. Study the vegetation of the given area by line transect method 15 marks
4. By taking a lot, write the procedure, do the experiment and interpret the result 15 marks
5. identify, draw diagrams and write critical notes on C, D , E, F and G 5 X 5 = 25 marks
6. Submission of case study report 6 marks
7. Submission of record note books 2 X 5 = 10 marks

Non-Major Elective - HERBAL BOTANY	Total Hours :4 (60) Hours
Course Code : **P22BYN21**	Total Credits : 4

Course Outcomes

COs	**CO Statement**
CO1	Know about history and relevance of herbal drugs in Indian system of medicine
CO2	Learn the macroscopic characters, therapeutically and pharmaceutical uses of medicinal plants
CO3	Understand the techniques for medicinal gardening, Cultivation practices and utilization of selected medicinal plants.
CO4	Know the technique of herbal formulation to cure various ailments
CO5	Learn about value added herbal products

Unit - I **12 hours**

Introduction to Medicinal Practices in India History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences; Definition and Scope Ayurveda: History, origin, panchamahayurvedic treatments, Siddha: Origin, Basis of Siddha system; Unani system of medicines.Chinese traditional system of medicine.

Unit - II **12 hours**

Overview of selected Medicinal Plants Morphology, family, vernacular and botanical names, useful parts, active principles and phytotherapeutics of the following: Whole plant – Keezhanelli, Root Aloe, Flower – Clove, Underground stem Oil – Caster, Neem, Mustard.

Unit - III **12 hours**

Cultivation and uses of Medicinal Herbs - harvesting, processing, packing and storage Kitchen Herbs – Mint, Coriander, Fenugreek, Garlic, Onion. Herbal formulation for treating cough, cold, skin diseases; Kabasura kudineer: ingredients and preparation; Herbs for treating gastro-intestinal ailments.

Unit - IV **12 hours**

Herbal formulations - Kashayam, Choornam, Lagiyam, Tincture, Poultice. Food: herbal salad, chutney, soup and Tea. Ethnic communities in Tamil Nadu and their medicinal plant usage.

Unit - V **12 hours**

Herbs for Cosmetics preparations: Incorporating the herbal extracts in various cosmetic formulations like Skin care preparations (Creams and Lotions), Sunscreens and Sunburn applications, Hair care preparations shampoo, Hair wash powder. Beautifying preparations

Text books:

- Mohammed Ali, PharmacognosyVol-1, CBS Publishers and DistributorsPvt. Ltd, 2008.
- C.K. Kokate, A.P. Purohit& S B. Gokhale, Pharmacognosy, NiraliPrakashan. 2008.
- Textbook of pharmacognosy and Phytochemistry by Biren Shah and Seth. Elsevier Publishers
- John Jothi Prakash, E., Medicinal Botany and Pharmacognosy. JPR Publication, Vallioor,Tirunelveli,2003.

Reference Books:

- C.K. Kokale, C.K. Kokate&Purohit–Text Book of Pharmacognosy and Phytochemistry, CBS Publishers Dist., New Delhi. 1994.
- Wallis,T.E, Text Book of Pharmacognosy by CBS Pub. Delh,2005
- Prajapathi ND Agrobios, A Hand Book of Medicinal Plants, Jodhpur, 2003
- Deshpande DJ Agrobios, A Hand Book of Medicinal Herbs, Jodhpur,2011.
- Kirthikar and Basu. Indian Medicinal Plants, 2012.
- AshutoshKar, Pharmacognosy and Pharmaco Biotechnology - New Age. Publisher NewDelhi, 2007.

E-resources

1. https://krishijagran.com/news/export-of-herbs-value-added-extracts-of-medicinal-herbs-gradually-increasing/
2. https://www.hindawi.com/journals/ecam/2013/376327/
3. https://www.dabur.com/amp/in/en-us/about/science-of-ayurveda/herbal-medicinal-plants
4. https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=1&contentid=1169
5. https://medcraveonline.com/PPIJ/promising-medicinal-plants-their-parts-and-formulations-prevalent-in-folk-medicines-amongnbspethnic-communities-in-madhya-pradesh-india.html
6. https://www.researchgate.net/publication/235944029_Herbal_Cosmetics_Used_for_Skin_and_Hair
7. http://www.eolss.net/sample-chapters/c03/E6-79a-13.pdf

Question Bank

1. Discuss the Medicinal Practices in India.
2. Write down the differences between Ethnobotany and Economic botany.
3. State the reasons for the critical analysis of research trends in exploring medicinal plants as medicine.
4. Mention the importance of herbal botany
5. What are the advantages and disadvantages of Ayurvedic Medicines?
6. Narrate the Challenges and guidelines for clinical trial of herbal drugs
7. List out the Kitchen herbs
8. Briefly explain the importance of Kitchen herbs
9. What is Kashayam? What are the benefits of Kashayam?
10. Describe about the Herbal Tea preparation.

11. Enumerate the Skin care products.
12. Comment on the Herbal Hair care shampoo.
13. What is meant by Hair wash powder? What are its merits and demerits?
14. Critically examine herbal extracts in various cosmetics.
15. Explain different barriers of Purchasing Green Cosmetic Products.

Course Name: Master of Science
Discipline: Botany
(For those who join in June 2018 and after)
Course Scheme

Semester	Part	Subject	Hour	Credit	Int + Ext = Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Status as on 2019 (Revised / New / No Change / Interchanged (R/N/C/I)) & Percentage of revision 2019-2020
III	Core 11	Microbiology, Fungi and Plant Pathology	6	4	40+60=100				✔							✔	P19BYC31	Revised / 20%
	Core 12	Biotechnology	5	4	40+60=100				✔							✔	P19BYC32	Revised / 20%
	Core 13	Biochemistry	6	4	40+60=100				✔							✔	P19BYC33	Revised / 10%
	Core 14	Lab V –LAB: Microbiology, Fungi and Plant Pathology and Biotechnology	4	3	40+60=100				✔							✔	P19BYP31	Revised / 10%
	Core 15	Lab VI – LAB: Biochemistry	4	3	40+60=100				✔							✔	P19BYP32	Revised / 10%
	Elective II	Biodiversity & Conservation	5	5	40+60=100				✔								P19BYE31	Revised / 10%
IV	Core 16	Plant Physiology	5	4	40+60=100				✔							✔	P19BYC41	Revised / 10%
	Core 17	Bioinformatics and Biostatistics	5	4	40+60=100				✔							✔	P19BYC42	Revised / 10%
	Core 18	Developmental Botany	5	4	40+60=100				✔							✔	P19BYC43	Revised / 10%
	Core 19	Lab VII–LAB: Plant Physiology	4	3	40+60=100				✔							✔	P19BYP41	Revised / 10%
	Core 20	Lab VIII-LAB: Bioinformatics and Biostatistics, Developmental Botany	5	3	40+60=100				✔							✔	P19BYP42	Revised / 10%
	Elective III/ Project	Project work	6	5	50+50=100				✔								P19BY4PV	Revised (revised in Internal & External mark allotments)

Self-Learning Course

Subject	Credit	Ext =Tot	Subject Code
Forestry	5	100 = 100	P19BYSL31

Third Semester

Core 11 - MICROBIOLOGY, FUNGI AND PLANT PATHOLOGY

Hours/week: 6 **Subject Code: P19BYC31**

Credit: 4

Course outcome

- To know the contributions of microbiologists.
- To learn about the structure and growth of bacterial and bacterial culture techniques.
- To understand Bergey's manual of bacterial classification.
- To understand the factors affecting microbial growth.
- To acquire knowledge on the characteristics of viruses.
- To study the morphology and reproduction of major classes of fungi.
- To know the etiology of selected fungal, bacterial and viral diseases and its control measures.

Unit - I Microbiology 18 hours

Early development of microbiology . Contributions of Anton Van Leeuwenhoek, Louis Pasteur, Joseph Lister, Robert Koch and his postulates , Edward Jenner & Alexander Fleming. General characteristics of bacteria – morphological, cultural and serological characteristics. Ultra structure of Bacterial cell, capsule, flagella, pili, fimbriae, mesosome, plasmids. Cell wall chemistry. Endospore - structure, sporulation and its significance.

Unit – II Classification of Bacteria according to Bergey's 18 hours

Manual of systematic Bacteriology, Growth of bacteria, generation time, growth curve, measurement of bacterial growth, effect of pH and temperature on bacterial growth. Nutritional types of bacteria. Bacterial metabolism - EMP pathway, ED pathway and Pentose Phosphate pathway.

Unit – III Mycology 18 hours

General characteristics of fungi. Contributions of Heinrich, Anton De Bary, Miles Joseph Berkeley and Edwin John Butler. Classification of fungi based on C.J Alexopoulos and C.W Mims (1979). Study of somatic and reproductive structures of the following classes: Zygomycetes, Ascomycetes, Basidiomycetes & Deuteromycetes. Nutritional and medicinal importance of *Ganoderma sp* and *Agaricus sp*.

Unit – IV Plant Viruses 18 hours

Classification based on the morphology. Structure of Cauliflower mosaic virus (CaMV) and Tobacco Mosaic Virus (TMV). Transmission & control measures of plant viruses. Bacteriophages - Structure, Lytic and Lysogenic cycles.

Unit - V Plant Pathology 18 hours

Classification and symptoms of plant diseases. Mechanism of infection. Defence mechanism - structural and biochemical changes. Epidemiology and Disease forecasting. Principles of plant disease control. Etiology and control measures of the following plant diseases : Downy mildew of Grapes, Banana leaf spot, Black rust of Wheat, Blast disease of Rice, Citrus canker, Yellow mosaic of Bhendi.

- **A field study/trip or research institute/universities/industrial visit should be carried out for atleast two days.**

Text Books:

- O.P Sharma, 1998 - Text book of Fungi Tata McGrew Hill Publishing Co. New Delhi.
- B P Pandey, 2001 - Plant Pathology - S. Chand & Company.
- P.D Sharma, 2006 - Plant Pathology - Narosa publication, New Delhi.
- R. C. Dubey, D.K. Maheshwari, 2008 - Text Book of Microbiology- S. Chand & Company Limited, New Delhi.
- Vashishta, P.C and Gill, P.C. 1998 - Plant Pathology. Pradeep Publications, Jalandhar.
- Alexopoulos, C.J., Mims, C.W., Blackwell, M.1996 - Introductory mycology. John Wiley & sons. Newyork.

Reference Books:

- Atlas, M. and Bartha, R.2000. Microbial Ecology. Addison Wesley Longman, Inc, New York.
- Pelezar, M.J Chan, E.C.S and Krieg, N.R.1993. Microbiology-concepts and Applictions. McGrew Hill, Inc. Newyork.
- Mehrotra, R.S. 2000. Plant Pathology. Tata McGrew Hill Publishing Co. New Delhi.
- Rangaswamy, G. 1992. Disease of crop plants in India. Prentice Hall of India, New Delhi.
- Wheeler, B.E 1972. An Introduction to Plant Disease. John Wiley & sons. Newyork.
- Introductory Mycology - C.J Alexopoulos, Charles W. Mims, M.Blackwell,2002. 4th Edition. Wiley India Pvt. Ltd. New Delhi.
- Plant Pathology - George, N Agrios, 2005. Academic Press California, USA.
- Plant Pathology - R.S Mehrotra, 2nd Edition, 2003. Tata McGrew Hill Publishing Co. New Delhi.

CORE 12- BIOTECHNOLOGY

Hours/week: 5 **Subject Code: P19BYC32** **Credit: 4**

Course outcome:

- To provide students with a solid foundation in the rapidly expanding field of biotechnology
- To enhance the knowledge about the applications of modern biotechnology for the industrial production with waste minimization and reduced energy consumption.

Unit – I **18 hours**

Scope - multidisciplinary approach of biotechnology. Recombinant DNA technology and its applications - molecular tools - nomenclature and characteristics of Restriction enzymes - ligases and DNA modifying enzymes. Plasmid vectors - properties and classification - pBR 322, M13 phage vectors, cosmids (pJB 8), Construction of Genomic library and cDNA library . DNA finger printing.

Unit – II **18 hours**

Direct gene transfer using PEG, Electroporation, biolistics, microinjection and liposome mediated methods of gene delivery. *Agrobacterium* and CaMV mediated gene transfer- Ti plasmid (Octopine and Nopaline) - Disarmed Ti plasmid, Ri plasmid - Hairy root culture. PCR, RAPD and RFLP - applications.

Unit - III **18 hours**

Industrially important microorganisms - Primary screening, crowded plate technique, enrichment culture technique. Fermentation-submerged fermentation (SM) and Solid state fermentation (SSF). Types of fermentor. Industrial production of penicillin, citric acid, glutamic acid, vitamin B_{12} and SCP.

Unit - IV **18 hours**

Micropropagation – Media, organ culture (Embryo, Anther, Ovary)somatic hybridization, cybrids, artificial seeds and somaclonal variation. Transgenic plants -Bt Brinjal, Golden rice, Flavr Savr Tomato. Biosafety aspects of GMOs and GM foods. GURT. Agricultural biotechnology - Cultivation and Mass Production of Biofertilizers - BGA, Mycorrhiza, *Rhizobium,* Bioinsecticides - viral, bacterial and fungal sources.

Unit - V **18 hours**

Nanotechnology – Nanoparticles synthesis from plants and properties (surface effect, size, shape). Advances made with plant Nanobionics – bomb detection, glowing plants, augumented photosynthesis. Biosensor - types and applications. Bioleaching methods & advantages. Bioremediation, Phytoremediation. DNA vaccines - Plant as edible vaccines- Enzyme immobilization; conservation of germplasm *in vitro* strategies.

- ***A field study/trip or research institute/universities/industrial visit should be carried out for atleast two days.***

Text Books

- Rev Fr Dr. S. Ignacimuthu, S.J., 1995, Basic Biotechnology - Tata Mc Graw Hill Publishing Company Ltd. New Delhi.
- S. Ignacimuthu, 1997, Plant Biotechnology -. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
- S.S. Purohit 2003 - Biotechnology fundamentals and applications, - Published by Agrobios India.
- R.C. Duby, 2006 - A text Book of Biotechnology , S. Chand & Company Ltd, Ram Nagar, New Delhi.
- Kalyan Kumar De., 1992 - Plant tissue culture, New central book Agency P .Ltd, Calcutta.
- M.K Razdan., 2002 - Introduction to plant Tissue Culture, Oxford & IBH Publishing Co.Ltd. New Delhi.

Reference Books

- Chawla, H.S. 2000. Introduction to plant biotechnology. Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
- Dixon, R.A and Gonzales, R.A (Eds.) 1994. Plant Cell Culture- A Practical Approach. Oxford University Press, Newyork.
- Gamborg, O.L and Phillips, G.C. 1998. Plant Cell, Tissue and Organ culture. Narosa Publishing House, New Delhi.
- Griffiths et al., 1999. Modern genetic Analysis. W.H. Freeman & Co. Newdork.
- Gupta, P.K, 1999. Elements of Biotechnology. Rastogi Publications, Meerut.
- Jefrey, M, Backer et al., 1996. Biotechnology - A Laboratory Course. Academic Press, Newyork.
- Keshav Trehan, 1991. Biotechnology. Wiley Eastern Ltd, New Delhi.
- Kumar, H.D. 2000. Modern Concepts of Biotechnology. Vikas Publishing House, Pvt. Ltd. New Delhi.
- Thorpe, T.A. 1981. Plant Tissue Culture. Academic Press, London.

Core 13- BIOCHEMISTRY

Hours/week: 6 **Subject Code:** P19BYC33 **Credit: 4**

Course outcome

- It is an interdisciplinary program that focuses on the chemistry of living systems
- It analyzes the chemical combinations and reactions which take place in biological processes like the process of growth, metabolism, reproduction and heredity
- It also delves deep into the structures and functions of enzymes, proteins, carbohydrates, fats and other numerous processes related to metabolism of the mankind

Unit - I **18 hours**

Amino acids and proteins: biosynthesis of amino acids; properties and chemical reaction concerned with amino acids; proteins: primary, secondary, tertiary structure of protein, 3D structure and protein folding, physiochemical properties of proteins.

UNIT - II **18 hours**

Chemistry of enzymes: classification and nomenclature of enzymes; IUB, isolation and purification of enzymes; concept of active site, mechanism of enzyme action; Michaelis - Menton equation and Km value. Enzyme modifier-activator, inhibitors, allosteric enzymes; regulation of enzyme action; Isozymes and its applications.

UNIT - III **18 hours**

Metabolism of carbohydrates: chemical reactions and derivatives of monosaccharide; Glycolysis, HMP Pathway. Gluconeogenesis , TCA cycle, Electron transport and Oxydative Phosphorylation.

UNIT - IV **18 hours**

Metabolism of lipids - biosynthesis and oxidation of palmitic acid and its bioenergetics, oxidation of unsaturated fatty acids, biosynthesis of cholesterol, importance of cholesterol and plant lipids. Glyoxylate metabolism.

UNIT - V **18 hours**

Chemistry of vitamins: vitamins as co-enzymes; chemistry and biosynthesis of hormones-thyroxine, catechalamines, steroidal hormones. Intermediary metabolism; integration of metabolic pathways.

- ***A field study/trip or research institute/universities/industrial visit should be carried out for atleast two days.***

Text Books:

- Conn, E.E. and Stump P.K. et al., 1999. **Biochemistry.** John Wiley and Sons. New Delhi.
- Jain, J.L. 2000. **Fundamentals of Biochemistry.** S. Chand & Co. New Delhi.
- Plummer, D.T. 1996. An Introduction to Practical Biochemistry**.** McGraw Hill.

Reference Books:

- Voet.D and Voet.G.et al, 2016 – Fundamentals of Biochemistry,John Wiley and Sons.USA.
- Lehninger,A.L.,Nelson,d.L,and Cox.M.M(2008).LehningerPrinciples of Biochemistry(5th ed), Palgrave Macmillan, New York.
- Jeremy M.Berg, John. L. Tymoczko, Gregory J.Gatto, Jr. Lubert Stryer(2015) Biochemistry – WH. Freeman.USA.

Core-14-Lab V – LAB: Microbiology, Fungi, Plant Pathology & Biotechnology

Hours/week: 4 **Subject Code: P19BYP31** **Credit: 3**

Microbiology, Fungi and Plant Pathology

Practical syllabus:

- Sterilization method.
- Preparation of culture Media - Nutrient Agar (NA) and Potato Dextrose Agar (PDA)
- Isolation of microbes from soil and water using serial dilution technique.
- Staining of Bacteria - simple and gram staining.
- Hanging drop technique.
- Micro preparation and observation of the following fungi:

Mucor, Rhizopus, Pilobolus, Aspergillus, Penicillium, Xylaria, Peziza, Puccinia, Polyporus, Lycoperdon, Agaricus *and* Alternaria, Cercospora .

- *Observation of infected plant specimens mentioned in the syllabus.*

Biotechnology

Practical Syllabus:

- Isolation of plant chromosomal DNA- CTAB method
- Agarose gel electrophoresis and visualization of DNA.
- Restriction endonucleases
- Amplification of DNA using PCR - demonstration.
- Spotters - vectors, blotting techniques, transgenic plants, fermentor, biogas, methods of gene transfer.
- Demonstration of Artificial seed synthesis.

Core 15 Lab VI – LAB: Biochemistry

Hours/week: 4 **Subject Code:** P19BYP32 **Credit: 3**

1. Qualitative tests for Carbohydrates (reducing sugar, Starch),Protein - amino acid (Tryptophan), Lipid (cholesterol)
2. Quantitative Estimation of Sugar, Starch, Protein and free amino acid by Colorimetric method
3. Quantitative estimation of Lipids by Gravimetric method.
4. Determination of pKa value for acetic acid
5. Enzyme assay (amylase)
   a) Determination of Km value
   b) Effect of pH on enzyme activity.
   c) Effect of inhibitor on Enzyme activity

Elective 2 - BIODIVERSITY AND CONSERVATION

Hours/week: 5 **Subject Code: P19BYE31** **Credit: 5**

Course Outcome

- To provide quick snapshot of biodiversity
- To provide comprehensive methods for inventorying the biodiversity and its assessment
- To give an overview about the various threats to biodiversity and international agencies in conservation
- To give an idea about the biodiversity conservation strategies

- To give an overview about Biodiversity act, various issues and rights related to biodiversity

Unit - I **15 hours**

Biodiversity: definition, concept, scope; levels of biodiversity :Genetic, species and ecosystem diversity; Magnitude of biodiversity-Global pattern of biodiversity (abiotic and biotic theories); Measures of biodiversity-alpha, beta and gamma diversity- key stone species and their significance in an ecosystem function-concept of Hot Spots distribution of hotspots in India and the world; Values of biodiversity: economic, ecological and societal.

Unit - II **15 hours**

Methods of sampling: quadrat method, transect method, plot less method, pitfall method, sweep net method and all out searches. Diversity indices: Dominance indices- Berger and Parker-Simpson; nformation- Statistic Indices- Brillouin- Shannon. Community similarity- Jaccard coefficient -Sorenson coefficient. Brief account on Biodiversity packages – Biodiversity Pro, past Estimates.

Unit - III **15 hours**

Threats to Biodiversity - Habitat loss and fragmentation, Introduction of alien invasive species - Disturbance and pollution - Harvesting and exploitations - GMOs and biodiversity; - Extinction of species - causes for species extinction - IUCN Red list categories. International efforts for conserving biodiversity - CITES, WTO, CBD, International treaty on Plant Genetic Resources.

Unit - IV **15 hours**

Conservation-need for conservation-*in situ* conservation -sanctuaries, national parks, biosphere reserves; *ex situ* conservation- Gene banks, seed banks, Pollen banks, and Cryopreservation -Role of indigenous people in conservation of sacred species, sacred groves; Human and animal conflicts in Biodiversity conservation.

Unit - V **15 hours**

Bioprospecting, Indigenous knowledge, Biopiracy, Impact of new technologies; biotechnology and genetic engineering, Intellectual property rights - Biodiversity act - 2002, Wild Life Protection Act – 1972, PPVFR Act – 2001. International efforts for conserving biodiversity – CITES,WTO, CBD – International treaty on Plant Genetic Resources.

- ***A field study/trip or research institute/universities/industrial visit should be carried out for atleast two days.***

Text Books:

- Krishnamurthy, K.V. 2003. An advanced Book on Biodiversity-Principles and Practice. Oxford and IBH publishing company, New Delhi.
- Singh, J.S., Singh, S.P. and Gupta, S.R. 2010. Ecology, Environment and Resource Conservation. Anamaya Publishers, New Delhi.
- Biodiversity- CPR Environmental Education Center, Chennai

Reference Books:

- Peter Stiling. 2002. Ecology- Theories and Application. Prentice- Hall of India, New Delhi.
- Miller, T. 2010. Environmental Science. Cengage Learning India Pvt. LTD, New Delhi

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Semester – IV

CORE 16 - PLANT PHYSIOLOGY

Hours/week: 5 (75 Hrs) **Subject Code:** P19BYC41 **Credit: 4**

Course Outcome

This subject is designed to investigate plant structure and function at the individual plant level and then apply this understanding to plant strategies and adaptations in different environments. By the end of the course, students will be expected to:

- understand how plant structure relates to function
- understand how and why water and ions are transported through plants
- understand plant strategies in the capture of light
- recognize different methods plants use to sequester nutrients
- understand different plant strategies in the utilization of nutrients
- understand and give examples of plant adaptations to different environments and disturbances like climate change scenarios and their impacts on plant physiology

UNIT I **15 hours**

Water relations - physico chemical properties of water; theories on membrane permeability; diffusion, osmosis and imbibition; plasmolysis and deplasmolysis- significance; water potential - definition, water potential gradient, soil-plant-air-continuum. Absorption of water: types of soil water, water absorbing parts of plants. Mechanism of water absorption, active and passive absorption, significance. Ascent of sap- Transpirational pull theory.

UNIT II **15 hours**

Mineral salt absorption: mechanism of mineral salt absorption theory, passive absorption theory, apoplastic, mass flow theory, Donnan's equilibrium, active absorption theory - symplast, Carrier concept theory, protein lecithin and cytochrome pump hypothesis. Transpiration: types, significance, Mechanism of stomatal movement. Theories - starch, glycolate,K^+ ions. .Ltd, New Delhi. and guttation.

UNIT III **15 hours**

Photosynthesis - excitement and ground state, electromagnetic spectrum, photosynthetic apparatus. PSI and PSII reaction centres, components of cyclic and non cyclic reactions. "Z" scheme, Emerson's enhancement and Red drop. CO_2 assimilatory pathways, C_3, C_4 (three types NADP-ME, NAD-ME & PCK types). CAM pathway - interrelation and differences. Factors affecting photosynthesis.

UNIT IV **15 hours**

Respiration - Aerobic, Anaerobic respiration, RQ. ETP complexes, cyanide resistant pathway. Photorespiration - Dual action of Rubisco - Glycolate pathway (C2 pathway), nitrogen metabolism - Diazotrophs, symbiotic, mechanism of N2 fixation and nitrogen cycle

UNIT V **15 hours**

Growth - Bioassay, chemistry and physiological applications of phytohormones - auxin, gibberellins, cytokinins, ABA, ethylene and brassinosteroids. Role of light - photoperiodism, its type and significance. Vernalization, senescence and ageing mechanism (brief account). Phytochromes - properties, mechanism of action and functions. Stress physiology - drought, salt, heat and radiation stress. Biological clock - Circadian rhythm in plants (brief account).

- ***A field study/trip or research institute/universities/industrial visit should be carried out for atleast two days.***

Text Books:

- S.K.Verma and Mohit Verma, 2008, Plant Physiology, S.Chand Limited, New Delhi.
- R.K.Sinha, 2004, Modern Plant Physiology, Alpha Science International Ltd, England.
- S.N.Pandey and B.k.Sinha,2009, Plant Physiology, Vikas Publishing House Pvt

Reference Books

- Devlin and Witham, 1997. **Plant Physiology.** CBS Publishers and Distributers, New Delhi.
- Lincoln Taiz and Eduardo Zeiger, 1991. **Plant Physiology.** The Benjamin/ Cummings publishing Company, Inc.
- Noggle and Fritz, 1999. **Introductory Plant Physiology.** Prentice hall, London.
- Salisbury, F.B. and Ross. C. 2000. **Plant Physiology.** John Wiley & Sons, New Delhi.
- Wilkins, MB. (Ed) 1984. **Advanced Plant Physiology.** Pitman Publishing Co. New York.

Core-17 - BIOINFORMATICS AND BIOSTATISTICS

Hours/week: 5 **Subject Code:** P19BYC42 **Credit: 4**

Course Outcome

- Provide expertise in study design, including endpoint definition, sample size estimation and power calculation, randomization procedures, data collection from design, plans for report generation, interim reviews, and final analysis.
- Provide analyses and informatics support for all biological research projects using contemporary statistical and computing methodologies by softwares.
- The main aim of this core is to incorporate aspects of high-throughput and high-performance computing with knowledge discovery approaches through the application of neural- networks, probability and statistics to support and enhance each of the participating projects and the Molecular Analysis.

Unit - I **18 hours**

Introduction to Bioinformatics: Definition, objectives. Introduction to Triple letter and single letter code for amino acids, Symbols used in nucleotides, Biological data formats. Retrieval and visualization of Sequence (Nucleotide and protein) and structure of protein. Applications of Bioinformatics in various fields.

Unit - II **18 hours**

Biological Databases-Primary, secondary and specialized databases. Nucleic acid databases-NCBI, DDBJ, and EMBL: Protein databases-PDB, PIR, and SWISSPROT. Structure elucidation -SCOPE and CATH. Sequence retrieval method from different databases. Sequence analysis - Local vs Global : Multple sequence alignment:Dynamic Programming- Smith Waterman/Needle man wunsch algorithm,Online search Tools-BLAST/FASTA

Unit - III **18 hours**

Genome and proteome analysis: genomics - structural, functional and comparative genomics, isolation of genes, Genome sequencing - Sanger method. Genome mapping, Genome analysis - Microarray, proteomics - structural and functional proteomics: tools - proteomic analysis - 2D PAGE, MS MALDI - TOF. Molecular visualization – Drug discovery – Ligand based – Structure based – Drug designing

Unit - IV **18 hours**

Biostatistics: Definition and scope-Descriptive and inferential statistics, Populations, Samples, Variables, Parameters, Collection of data, Sampling methods, organizing the data into summary tables and graphing the data.

Unit -V **18 hours**

Measures of central tendency-arithmetic mean mode and median, measures of dispersion- Mean deviation and standard deviation and standard error. Probability-addition and Multiplication theorems-normal distribution and binomial distribution. ANOVA (one way and two way), correlation and regression-Tests of Significance(t,f) - X test and its applications.

- ***A visit to research institute/universities/industries should be carried out for atleast two days.***

Text Books:

- Khan and Khan.1994. **Biostatistics.** Vikas Publishing House Pvt. Ltd. New Delhi.
- Shanmugavel.P.2006. Trends **in Bioinformatics,** Pointer Publishers, Jaipur, India
- Ignacimuthu. S, 1995. Basic Biotechnology, Tata McGraw Hill Publishing Co., New Delhi,

References Books:

- Daniel WW, 1995.Biostastics.7th edition, John wiley and Sons, Newyork,USA
- Bliss CI,1970.Statistics in Biology.Vol I and II, Mc Graw-Hill Inc.USA
- Lehinger,A.L.Principles of Biochemistry.CBS Publishers and distributors,New Delhi,India
- Attwood T.K. and Parry-Smith .1999.Introduction to bioinformatics.A W Longman Ltd.UK.
- R.M.Twyman.2008.Principles of Proteomics.Taylor and francis.UK
- David W Mount 2005.Bioinformatics sequence and genome analysis(2 nd edition) CBS Publishers.Newdelhi
- Jean Michel Claveria and Cedric Notre dome 2006.Bioinformatics-A beginners guide - Wiley Dream tech-Newdelhi
- Orpita Bosu and Simminder Kaur Thukral 2007. Bioinformatics Databases, Tool and Algorithms. Oxford University Press.

Core 18 - DEVELOPMENTAL BOTANY

Hours/week: 5 **Subject Code:** P19BYC43 **Credit: 4**

Course outcome:

- To acquire knowledge the about structure and development of anthers and its functions
- To study concepts of female reproductive organs of angiosperms
- To gain the knowledge of various fertilization process
- To acquire understanding of development of a diversity of embryo development.
- To analyze the morphogenetic potentials pertaining to its development of various organs

Unit - I **18 hours**

A brief historical account, Structure and development of microsporangium and male gametophyte-structure and development; Microsporogenesis, structure and development of pollen wall and its types; Features of pollen wall; structure and development of tapetum; Nuclear behavior in tapetal cells

Unit - II **18 hours**

Megasporogenesis, Types of ovules, Structure and development of female gametophyte (3 types), organization and ultra structure of mature embryosac, nutrition of embryosac.

Unit - III **18 hours**

Pollen-pistil interaction and fertilization: Floral characteristics, pollination mechanisms. Structure of pistil; pollen -stigma interactions, sporophytic and gametophytic self - incompatibility (cytological, biochemical, molecular aspects); Methods to overcome incompatibility; Double fertilization.

Unit - IV **18 hours**

Seed development and fruit growth: Embryogenesis: dicot and monocot, polyembryony, apomixis. Endosperm development and types; storage proteins of endosperm and embryo; Dynamics of fruit growth; biochemistry and molecular biology of fruit maturation. Parthenocarpy – types and importance.

Unit - V **18 hours**

Leaf - heteroblastic development, development of compound leaves, plastochrone index. Flowers – floral induction, evocation and initiation. Structure and development of fruit wall. Structure and development of seed coat. Plant galls: types, structure and development, Role of polarity in cell differentiation, Symmetry; Role of Sucrose in tissue differentiation

. **Text Books:**

- Bhojwani, S.S. and Bhatnagar, S.P. *The Embryology of Angiosperms***.** Vikas Publishing House, New Delhi, 1979.
- Maheswari, P. An *Introduction* to the *Embryology of Angiosperms*. McGraw Hill, New Delhi,1950.

Reference Books:

- Shivanna, K.R. and Johri, 1989. B.M. *The Angiosperm Pollen structure and Function*, Wiley Eastern Ltd., Publications, New Delhi.
- Johri, B.M., Ambegaokar, K.B. and Srivastava, 1992. P.S. *Comparative Embryology of Angiosperms*, Vol. I & II, Springer Verlag.Berlin.
- Kalyan Kumar De 1997 *An Introduction to Plant Tissue Culture*, New Central Book Agency, Calcutta.
- E.W.Sinnott 1960, *Plant Morphogenesis* McGraw-Hill, New York.
- ***A field study/trip or research institute/universities/industrial visit should be carried out for atleast two days.***

Text Books:

- Bhojwani, S.S. and Bhatnagar, S.P. *The Embryology of Angiosperms.* Vikas Publishing House, New Delhi.
- Maheswari, P. An *Introduction* to the *Embryology of Angiosperms.* McGraw Hill, New Delhi.

Reference Books:

- Shivanna, K.R. and Johri, B.M. *The Angiosperm Pollen structure and Function,* Wiley Eastern Ltd., Publications, 1989.
- Johri, B.M., Ambegaokar, K.B. and Srivastava, P.S. *Comparative Embryology of Angiosperms,* Vol. I & II, Springer Verlag.
- Kalyan Kumar De 1997 *An Introduction to Plant Tissue Culture,* New Central Book Agency, Calcutta.
- E.W.Sinnott 1960 *Plant Morphogenesis* McGraw-Hill, New York.

Core 19 Lab VII – LAB: PLANT PHYSIOLOGY

Hours/week: 4 **Subject Code: P19BYP41** **Credit: 3**

Practical Syllabus

1. Determination of Osmotic potential of Rhoeo cell sap by plasmolytic method
2. Determination of Water Potential of Potato tuber by Gravimetric method
3. Determination of Water Potential of Potato tuber by falling drop method
4. Effect of Detergent on membrane permeability.
5. Effect of Organic solvent (acetone) on membrane permeability
6. Effect of temperature on Membrane permeability
7. Determination of Anthocyanin
8. Determination of Stomatal Frequency and stomatal Index.
9. Effect of Leaf age on chlorophyll content

10. Effect of shade and direct sunlight on chlorophyll content.
11. Effect of Cytokinin on the delay of senescence in terms of chlorophyll content
12. Determination of proline from normal and water stressed plant

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CORE-20 Lab VIII – LAB: BIOINFORMATICS, BIOSTATISTICS AND DEVELOPMENTAL BOTANY

Hours/week: 5 **Subject Code: P19BYP42** **Credit: 3**

Practical Syllabus

BIOINFORMATICS, BIOSTATISTICS

1. Computation of mean, median, mode, standard deviation. Frequency distribution, Histogram, frequency polygon, frequency curves and cumulative frequency curves, Graphic location of median and mode
2. Bar and pie Diagrams
3. Pearson co-efficient of correlation and Spearman rank correlation
4. Regression equations of X or Y on X estimation of X and Y values
5. Problems connected with probability rules
6. X^2 test problems-a) Test of Good ness of fit b) Test of independence
7. Calculation of probability using Binomial and normal distribution
8. t-test for significance of mean of a random sample b) testing significance between means of two samples (independent and period samples)
9. Biological Databanks-Sequence databases, structure databases, specialized databases; Data retrieval tools and methods; Database file formats
10. Molecular visualization -Rasmol, Cn3D, Swiss PDB viewer.
11. Database similarity searching and dynamic programming algorithms
    - Sequence similarity searching-NCBI BLAST, FASTA
    - Pair wise and Multiple sequence alignment -Clustal W
12. Analysis of protein and nucleic acid sequences- Dot matrix, Substitution matrix
13. Protein sequence analysis-ExPASY proteomic tools.

DEVELOPMENTAL BOTANY

1. Study of microsporogenesis in sections of anthers.
2. Examination of pollen morphology
3. *In vitro* pollen germination in different concentration of sucrose solution
4. Identification of different types of embryos, endosperm, pollen grains.
5. Examination of haustorial endosperm in *Cucumis* through dissections and staining.
6. Dissection and study of various stages of embryo development in *Tridax.*
7. Study the anatomy of fruit wall, seed coat and galled leaf-as prescribed in the syllabus.
8. Training in paraffin wax method for preparation of serial sections.

PROJECT

Hours/week-6 **Sub code: P19BY4PV** **Credit-5**

Objectives:

The aim of project work (field/ lab work) is to inculcate students to learn adequate knowledge on research methodology in the subject and prepare them for pursuing research in experimental or computational areas of the subject. Students allotment by lot system. The project work or Field Study is to be undertaken under the guidance of a Teacher of the Department. The guiding teacher will make continuous internal assessment of the Project Work/ Field Study. No teacher shall be permitted to guide more than ***three*** students in a semester for Project Work/Field Study under his/her supervision. The project work will be evaluated by the external examiner.

- Project will be done by the final year students in the fourth semester under the guidance of respective guides.
- For projects internal marks (max 50) will be awarded by the respective guide and external marks (max 50) will be awarded in the external examinations.
- Minimum number of Pages for M.Sc. Project thesis should be 40

Course Name: Master of Science
Discipline : Botany
CHOICE BASED CREDIT SYSTEM
(For those who joined in June 2018 and after)
Course Scheme:

Self-Learning Course

Subject	Credit	Ext =Tot	Subject Code
Forestry	5	100 = 100	P19BYSL31

Course Name: Master of Science **Discipline: Botany**

Forestry (Self Learning)

Total Marks 100 **Credit: 5** **Subject Code:P19BYSL31**

Objectives

1. Forestry in India is a significant rural industry and a major environmental resource.
2. Indian forests are more than trees and an economic resource.
3. They are home to some of earth's unique flora and fauna.

UNIT I - SILVICULTURE

Forests - Definition - Extent of forests in india and other countries - Role of forests - Factors of locality - climatic - edaphic - topographic - biotic - Interaction of Forests with the Environment. Silviculture - Objectives - Scope - General Principles - Regeneration - Natural and artificial - Nursery techniques and methods - maintenance.

UNIT II - FOREST UTILIZATION

Logging - Extraction of timber - Felling rules and methods - Conversion methods - Transportation of timbers - Major and minor transportation methods - storage and sales of logs. Forest products - timber industries - plywood - particles boards - fibre products.

UNIT III – FOREST, POLICIES AND LEGISLATIONS

General concept of tree improvement, methods and techniques, genetic testing programming, Forest Policy - Necessity - Formulation of National Forest Policy - History of Forest development in India - Indian Forest Policy of 1894, 1952 and 1988.

UNIT IV - FOREST PROTECTION

Role of Forest Protection in Indian Forestry - Injuries caused by various agencies - Injuries caused by human being - Animals - plants - Forest fire - Fire protection methods - Control measures for pest and diseases for major tree species - biological, chemical and integrated pest management methods. Role of human society in forest protection.

UNIT-V - AGROFORESTRY AND SOCIAL FORESTRY

Definition - Objectives of agroforestry - Classification of agroforestry systems - Ecological aspects of agroforestry. Social forestry - its components and implementation at local and national levels.

REFRENCES:

1. Sagreiya, K.P. Forests and Forestry, 1997. National Book Trust India
2. Khanna, L. S. 1984. Principles and Practice of Silviculture, Khanna Bhandu, Dehra Dun. P. 476.
3. Ram Prakash and L.S. Khanna. 1991. Theory and Practice of Silvicultural systems. International Book Distributors, Dehra Dun. 298p.
4. Dwivedi, A.P. 1993. A Text Book of Silviculture, International Book Distributors, Dehradun. 6. Dwivedi, A. P. 1992. Principles and Practice of Indian Silviculture, Surya Publication, 420p
5. FAO (1987), Forestry Extension Methods, SLNo. 80, FAO Publication, Caracall, Rome, Italy.
6. JHA, L.K. & SEN SARMA, P.K. (Eds)(1996), A manual of Forestry Extension Education, APH Publishing Corporation, New Delhi.
