Course Name: Master of Science
Discipline: Botany
(For those who join in 2024 and after)
Course Scheme:

I year M.Sc. BOTANY

Semester	Part	Subject Name	Hours	Credit	Int + Ext =Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised / New / No Change / Interchanged & Percentage of Revision
I	Core-1	**Taxonomy of Angiosperms and Economic Botany**	6	4	25+75=100				✔					✔	✔	✔	**P24BYC11**	**New**
	Core 2	**Algae, Bryophytes and Lichens**	6	4	25+75=100				✔					✔	✔	✔	**P24BYC12**	**New**
	Core 3	**Environmental Biology**	5	4	25+75=100				✔					✔	✔	✔	**P24BYC13**	**New**
	Core 4	**LAB I: Taxonomy of Angiosperms and Economic Botany**	4	3	40+60=100				✔					✔	✔	✔	**P24BYCP11**	**New**
	Core 5	**LAB II : Algae, Bryophytes and Lichens & Environmental Biology**	4	2	40+60=100				✔					✔	✔	✔	**P24BYCP12**	**New**
	Elective I	**Pharmacognosy**	5	5	25+75=100				✔					✔	✔	✔	**P24BYE11**	**New**
	Total		**30**	**22**														
II	Core -6	**Pteridophytes, Gymnosperms and Paleobotany**	6	4	25+75=100				✔					✔	✔	✔	**P24BYC21**	**New**
	Core 7	**Cell Biology and Internal Morphology**	6	4	25+75=100				✔					✔	✔	✔	**P24BYC22**	**New**
	Core 8	**Genetics and Molecular Biology**	6	4	25+75=100				✔					✔	✔	✔	**P24BYC23**	**New**

	Core 9	**LAB III: Pteridophytes, Gymnosperms and Paleobotany**	4	3	40+60=100				✔					✔	✔	✔	**P24BYCP21**	**New**
	Core 10	**LAB IV : Cell Biology and Internal Morphology and Genetics & Molecular Biology**	4	3	40+60=100				✔					✔	✔	✔	**P24BYCP22**	**New**
	NME	**Herbal Botany**	4	4	25+75=100				✔					✔	✔	✔	P23BYN21	No Change
	Total		**30**	**22**														

Core I : Course Title : **Taxonomy of Angiosperms and Economic Botany**	Total Hours : 90
Course Code : **P24BYC11**	Total Credits : 4

Course Outcomes:

COs	CO Statement
CO1	Attain sufficient knowledge in plant classification, ICN and understand the relationship of plant taxonomy with other fields of plant science.
CO2	Understand the morphology, identification and evolutionary trend of Polypetalae.
CO3	Understand the morphology, identification and evolutionary trend of Gamopetalae, Monochlamydeae and Monocotyledons.
CO4	Understand the commercial utilization of selected plants.
CO5	Know about the economic importance of selected plants.

Unit – I: 18 hours

Scope of Plant systematics; Systems of classification, Principle, features, merits and demerits - Bentham and Hooker, Hutchinson and APG IV; Plant identification with keys - Dichotomous Keys and Polyclave key; Typification; Phylocode – an overview and its principles. Taxonomy in relation to embryology palynology & chemotaxonomy, numerical taxonomy, cluster analysis & cladistics (in brief).

Unit – II: 18 hours

Taxonomy in relation to Anatomy, Cytology and Phytochemistry; Cladistics and Phenetics. Salient features, evolutionary trend and Economic importance of the following families: Polypetalae - Ranunculaceae, Capparidaceae, Polygalaceae, Zygophyllaceae, Rhamnaceae, Moringaceae, Combretaceae, Lythraceae, Passifloraceae and Myrtaceae.

Unit –III: 18 hours

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

Unit –IV: 18 hours

General account on Cultivation and utilization of selected crop plants: Cereals - Paddy, Pulses - red gram, Drug yielding plants - *Withania somnifera*, Oil yielding plants - Groundnut. Sugar yielding plants- sugarcane, Spices and condiments – cardamom and cinnamon.

Unit –V: 18 hours

General account, Preparation, processing and uses of selected Commercial crops: Fibre –Jute, Timber - Teak and red sanders wood, Resins and gums - Asafoetida and Gum arabic, Palm jaggery – Palmyra, Essential oils - Lemon grass and Mint, Beverages – Cultivation and processing of tea.

Text Books:

- Vashishta.P.C., Gymnosperms. S.Chand& Company Ltd., New Delhi, 1999
- Subrahmanyam, N.S., Modern plant Taxonomy. Vikas Publishing House Ltd. NewDelhi. 1999.
- S.N.Pandey and S.P.Misra. 2009, Taxonomy of Angiosperms, Ane Books Pvt. Ltd,New Delhi. 2009
- Vardhana, R. 2009. Economic Botany. 1st ed. Sarup Book Publishers Pvt Ltd. New Delhi.
- Subramaniam, N.S. 1997. Modern plant taxonomy. Vikas Publishing House, New Delhi

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 PressLondon, 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

e-Resources:

- https://www.ipni.org/
- http://www.theplantlist.org/
- https://www.amazon.in/PLANT-TAXONOMY-Sharma/dp/0070141592
- https://www.tropicos.org/home
- http://apps.kew.org/herbcat/gotoHerbariumGrowthPage.do
- https://www.absbooksindia.com/shop/science/botany/textbook-of-economic-botany

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Core II : Course Title : **ALGAE, BRYOPHYTES AND LICHENS**	Total Hours : 90
Course Code : **P24BYC12**	Total Credits : 4

COs	CO Statement
CO1	Relate to the structural organizations in the various groups of Algae.
CO2	Know about the methods of cultivation of sea weeds and the importance of Algae.
CO3	Understand the structural variations of different groups of Bryophytes.
CO4	Acquire knowledge on the fossil bryophytes, ecology of bryophytes and their ecological significance.
CO5	Acquire knowledge about various groups of Lichens and their ecological significance.

UNIT - I **(18 hours)**

General account of algology, Contributions of Indian Phycologist (T.V.Desikachary, V.Krishnamurthy and V.S. Sundaralingam), Classification of algae by F.E. Fritsch (1935-45). Range of thallus organization among algae; A brief study on –Plastids, Pyrenoids, flagella and Neuromotor apparatus found among algae; Life cycle patterns among algae; Thallus organization and reproduction of the following classes of algae - Cyanophyceae, Chlorophyceae and Xanthophyceae.

UNIT - II **(18 hours)**

Thallus organization and reproduction of the following classes of algae - Euglenophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae; Algae of diverse habitats; Cultivation of sea weeds; Economic importance of algae.

UNIT - III **(18 hours)**

Distribution and Classification of Bryophytes by Rothmaler (1951). Evolution of gametophytes and sporophytes among Bryophytes. Structural variations and reproduction in Hepaticopsida and Anthocerotopsida.

UNIT - IV **(18 hours)**

Structural variations and reproduction in Bryopsida; Ecology of bryophytes; Fossil bryophytes; Spore dispersal mechanisms in bryophytes; Spore germination patterns in bryophytes; Economic importance and ecological significance of bryophytes.

UNIT - V **(18 hours)**

Distribution and Classification of lichens (Hale, 1969); Nutrition in lichens; Occurrence, inter-relationship of phycobionts and mycobionts, structure and reproduction in Ascolichens,

Basiodiolichens and Deuterolichens; Economic importance and ecological significance of lichens.

Text Books:

1. Kumar, H.D.1999. Introductory Phycology. Affiliated East-West Press, Delhi.
2. Sharma, O.P. 2011. Fungi and Allied Microorganisms, Mc Graw Hill, ISBN:9780070700383, 0070700389
3. Pandey, P.B. 2014. College Botany-1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.
4. Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.
5. Sharma, O.P. 2014. Bryophyta, Mcgraw Hill, ISBN: 9781259062872, 1259062872

Reference Books:

1. Sundaralingam, V. 1991. Marine algae. Bishen Singh and Mahendra Pal Singh Publishers, Dehradun.
2. Edwardlee,R. 2018. Phycology, 5thEd., Cambridge UniversityPress, London.
3. Nash, T.H. 2008. Lichen Biology, Cambridge University press.
4. Johri, R.M., Lata, S. and Tyagi, K. 2012. A Textbook of Bryophyta. Dominant Publishers & Distributors Pvt., Ltd., New Delhi. ISBN: 9789384207335.
5. Alexopoulos, C.J. and Mims, M. 2007. Introductory Mycology. 4th Edition, Wiley Publishers, ISBN: 9780471522294

Web Resources:

1. https://www.britannica.com/science/algae
2. https://en.wikipedia.org/wiki/Bryophyte
3. https://www.britannica.com/plant/bryophyte/Ecology-and-habits
4. https://www.livescience.com/53618-fungus.html.
5. http://www.uobabylon.edu.iq/eprints/paper_11_20160_754.pdf
6. https://www.youtube.com/watch?v=vcYPI6y-Udo
7. https://www.youtube.com/watch?v=XQ_ZY57MY64
8. http://www-plb.ucdavis.edu/courses/bis/1c/text/Chapter22nf.pdf

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Core III : ENVIRONMENTAL BIOLOGY	**Total Hours : 75**
Course Code : P24BYC13	**Total Credits : 4**

Course Outcomes:

COs	CO Statement
CO1	Understand the influence of abiotic components in the ecosystem
CO2	Understand the effect of Community ecology
CO3	Know about the impact of population ecology
CO4	Learn about the Environmental impact assessment
CO5	Analyse and approach Social and environmental issues

UNIT – I **15 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].

UNIT –II **15 hours**

Classification [Holdridge Life Zone Classification].Terrestrial communities, aquatic communities – marine and freshwater [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.

UNIT – III **15 hours**

Characteristics of population, survivorship 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 **15 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 **15 hours**

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, solid waste and plastics.

A field study/trip or visit to research institute/universities/industries is mandatory for atleast two days.

Text Books:

- Kumar. H.D. 1997. General Ecology. Vikas Publiting house pvt ltd, New Delhi
- Ambasht, R.S and Ambasht, N.K., 1996 A Text book of Plant Ecology.
- Arora, 1995. Fundamentals of environmental biology. Kalyani Publishers, New Delhi.

Reference Books:

- Billings, W.D. 1972. Plant man and ecosystem. Macmillan India, New Delhi.
- Chapman, 1999. Ecology - Principles and Applications. Cambridge University Press. Foundation Books, New Delhi.

Core IV: LAB : TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY	**Total Hours : 60**
Course Code : P24BYCP11	**Total Credits : 3**

Course Outcomes:

COs	CO Statement
CO1	Able to identify the families of the given plants using flora.
CO2	Gain knowledge to distinguish and differentiate the characters of various plants under different families.
CO3	Able to prepare dichotomous keys.
CO4	Understand the commercial utilization of selected plants.
CO5	Know about the economic importance of selected plants.

Practical Syllabus

- Preparation of dichotomous key.
- Solving nomenclatural problems: Plant Nomenclature; Principles of priority; Effective and valid publication; Author citation; Retention, choice and rejection of names
- Description of a species, based on virtual herbarium and live specimens of the families mentioned in the theory with the help of their vegetative and floral characters.
- Study the useful parts of plants mentioned in the syllabus with special reference to their scientific name, family, morphology and its uses.
- Submission of 15 herbarium sheets.
- Submission of field trip report.

Students shall be taken for three days field trip for floristic study to any hill stations.

Core V: Course Title : LAB III : ALGAE, BRYOPHYTES AND LICHENS & ENVIRONMENTAL BIOLOGY	**Total Hours : 60**
Course Code : P24BYCP12	**Total Credits : 2**

COs	CO statement
CO1	Study the vegetative and reproductive features of Algae
CO2	Know the vegetative and reproductive features of Bryophytes
CO3	Know the vegetative and reproductive features of Lichens.
CO4	Develop skills in identifying the adaptive features in Hydrophytes, Halophytes, Epiphytes and Xerophytes.

CO5	Develop skills in the estimation of various compounds in the water and soil samples.

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, 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.*

Environment Biology

- Morphological and anatomical features of typical Xerophytes: *Phyllode* - Acacia Phylloclade -*Opuntia*, Cladode -*Casurina*, Succulent -*Bryophyllum* Hydrophytes -*Hydrilla*, Epiphytes - *Vanda*, Halophytes- Pneumatophore- *Avecinia*
- Estimation of dissolved Oxygen in water sample by Winkler's method
- Estimation of Organic carbon in different soils
- Determination of Primary Productivity in Pond ecosystem
- Estimation of Carbonate and Bicarbonate content in water samples.

Field trip and Visit to forest areas

ELECTIVE- I: PHARMACOGNOSY	**Total Hours :75 Hours**
Course Code : P24BYE11	**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 knowledgeon 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 **18 hours**

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

UNIT - II **18 hours**

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 etc.) of phytochemicals from crude drugs.Separation and isolation of constituents - distillation, chromatography - TLC. Quality control of herbal drugs.

UNIT - III **18 hours**

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 on the uterus.

UNIT - IV **18 hours**

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 **18 hours**

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 Pharmacobiotechnology , 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, IndianMeteriaMedica, 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/

SEMESTER - II

Core VI: Course Title : PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY	**Total Hours : 90**
Course Code : P24BYC21	**Total Credits : 4**

COs	CO Statement
CO1	Recall on classification, recent trend sinphylo genetic relationship, General characters of Pteridophytes and Gymnosperms.
CO2	Learn the morphological/anatomical organization, life history of major types of Pteridophytes and Gymnosperms.
CO3	Comprehend the economic importance of Pteridophytes, Gymnosperms, and fossils.
CO4	Understanding the evolutionary relationship of Pteridophytes and Gymnosperms.
CO5	Awareness on fossil types, fossilization and fossil records of Pteridophytes and Gymnosperms.

UNIT - I **(18 hours)**

General characteristics and classification (Reimer, 1954). Range of structure, reproduction and evolution of the gametophytes, Gametophyte types – sex organs. Apogamy and

Apospory. Life cycles. Stelar evolution. Heterospory and seed habit, Telome theory, morphogenesis, Economic importance of Pteridophytes.

UNIT - II **(18 hours)**

Structure, anatomy and reproduction of the following genera: *Isoetes, Equisetum, Angiopteris, Osmunda, Pteris* and *Azolla.*

UNIT - III **(18 hours)**

General characters and classification of Gymnosperms (K.R.Sporne, 1965). Morphology, anatomy and reproduction of *Cycas* and *Cupressus*.

UNIT - IV **(18 hours)**

Morphology, anatomy and reproduction of *Araucaria, Podocarpus, Gnetum* and *Ephedra*. Economic importance of Gymnosperms.

UNIT - V **(18 hours)**

Geological Time Scale; Radiocarbon dating; Contribution of Birbal Sahni to Paleobotany. Gondwana flora of India; Fossilization methods; Economic importance of fossils – fossil fuels and industrial raw materials; Brief study about following fossils: *Rhynia, Lepidocarpon, Calamites, Cordaites* and *Lyginopteris.*

Recommended Text:

1. Vashishta, P.C. Sinha, A.K and Anil Kumar. 2016. Botany for Degree students. Gymnosperms. S. Chand and Company Ltd., New Delhi.
2. Singh,V.,Pande,P.C andJain,D.K. 2021. A Text Book of Botany.Rastogi Publications, Meerut.
3. Bhatnagar, S.P and AlokMoitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
4. Sharma, O.P. 2017. Pteridophyta, McGraw Hill Education, New York.
5. Vashishta.P.C.,A.K.Sinhaand AnilKumar.2018. Botany for Degree students-Gymnosperms.S. Chand and Company Ltd., NewDelhi.
6. Johri, R.M, Lata, S, Tyagi, K. 2005. A text book of Gymnosperms, Dominate pub and Distributer, New Delhi.

Reference books:

1. Parihar, N.S. 2019. An Introduction to Embryophyta Pteridophytes. 5th Edition, Surjeet Publication, Delhi.
2. Pandey, S.N and Trivedi, P.S. 2015. A Text Book of Botany Vol. II- 12 th edition (Paper back), Vikas Publishing.
3. Rashid, A. 2013. An introduction to Pteridophyta – Diversity, Development and differentiation (2nd edition), Vikas Publications.
4. ArnoldA.C.2005.An Introduction to Paleobotany. Agrobios(India).Jodhpur.
5. Sporne, K.R. 2017. The morphology of Pteridophytes (The structure of Ferns and Allied Plants) (Paper back), Andesite Press.
6. Sporne, K.R. 1967. The Morphology of Gymnosperms. Hutchinson & Co., London.
7. Taylor, E, Taylor, T, Krings, M. 2008. Paleobotany: The Biology and Evolution of FossilPlants,2nd Edition, AcademicPress.

Web resources:

1. https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/
2. http://www.bsienvis.nic.in/Database/Pteridophytes-in-India_23432.aspx
3. https://books.google.co.in/books?hl=en&lr=&id=Pn7CAAAQBAJ&oi=fnd&pg=PA1&dq=Int

roduction+to+Gymnosperms&ots=sfYSzCL02&sig=ysX1KRvetV0bAza4Sq6RWau4XU8&redir_esc=y#v=onepage&q=Introduction%20to%20Gymnosperms&f=false
4. https://books.google.co.in/books/about/Botany_for_Degree_Gymnosperm_Multicolor.html?id=HTdFYFNxnWQC&redir_esc=y
5. https://books.google.co.in/books/about/Gymnosperms.html?id=4dvyNckni8wC
6. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf
7. https://www.palaeontologyonline.com/
8. https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ
https://trove.nla.gov.au/work/11471742?q&versionId=46695996

Core VII :Course Title : CELL BIOLOGY AND INTERNAL MORPHOLOGY	**Total Hours : 90**
Course Code : P24BYC22	**Total Credits : 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, Na +/K + /Ca + 2T 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, 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; Defects of wood – knots; 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:

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

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Core -VIII : GENETICS AND MOLECULAR BIOLOGY	**Total Hours :90**
Course Code : P24BYC23	**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, DNA replication - 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, UV radiation and Thymine Dimers: Mutagens: Radiation and Chemical agents, 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-Resources:

- 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

Core IV: LAB – I: PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY	**Total Hours : 60**
Course Code : P24BYCP21	**Total Credits : 3**

Practical Syllabus

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.

Gymnosperms

Study of the external, internal and reproductive structures of *Cycas, Cupressus, Araucaria, Podocarpus, Agathis, Ephedra* and *Gnetum*.

Micropreparation of leaves and wood of Gymnosperms.

Observation of fossil slides.

Submission of 5 permanent slides.

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

LAB : **CELL BIOLOGY AND INTERNAL MORPHOLOGY AND GENETICS & MOLECULAR BIOLOGY**	**Hours/week:4 (60 Hrs)**
Subject Code: P24BYCP22	**Credit: 3**

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*.

Genetics and Molecular Biology

1. Solving problems related to dihybrid 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
6. Isolation of microbial/ plasmid DNA (Demonstration)
7. Isolation of total RNA (Demonstration)
8. Quantitative estimation of DNA
9. Agarose gel electrophoresis and SDS PAGE

Non-Major Elective - HERBAL BOTANY	**Total Hours : 60**
Course Code : P23BYN21	**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, panchamah ayurvedic 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, Leaf -Aloe, Flower – Clove, Underground stem – Ginger, Oil – Castor and Neem.

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. ElsevierPublishers
- 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. PublisherNew Delhi, 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&content id=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_S kin_and_Hair
7. http://www.eolss.net/sample-chapters/c03/E6-79a-13.pdf
