MANONMANIAM SUNDARANAR UNIVERISTY,
TIRUNELVELI-12

SYLLABUS

PG - COURSES – AFFILIATED COLLEGES

Course Structure for M. Sc. Botany

(Choice Based Credit System)

(with effect from the academic year 2024-2025 onwards)

Semester-II				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
3	Core 5	TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY		4
3	Core 6	PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS		4
3	Core 7	ECOLOGY, PHYTOGEOGRAPHY, CONSERVATION BIOLOGY AND INTELLECTUAL PROPERTY RIGHTS		4
3	Practical	LABORATORY COURSE - 3 : COVERING CORE PAPERS V		2
3	Practical	LABORATORY COURSE - 4 : COVERING CORE PAPERS VI AND VII		2
3	Elective	RESEARCH METHODOLOGY, COMPUTER APPLICATIONS & BIOINFORMATICS		2
3	Elective	NANOBIOTECHNOLOGY		2
3	SEC 1	AGRICULTURE AND FOOD MICROBIOLOGY		2

Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

A. **Scheme for internal Assessment**:
Maximum marks for written test: **15 marks**
3 internal tests, each of **I hour** duration shall be conducted every semester.
To the average of the **best two** written examinations must be added the marks scored in. The **assignment** for 5 marks and Seminar for 5 marks

The break up for internal assessment shall be:
Written test- 15 marks; Assignment -5 marks; Seminar-5 Marks Total - 25 marks

B. Scheme of External Examination
3 hrs. examination at the end of the semester
A – Part : 1 mark question two - from each unit
B – Part : 5 marks question one - from each unit
C – Part : 8 marks question one - from each unit

- **Conversion of Marks into Grade Points and Letter Grades**

S.No.	Percentage of Marks	Letter Grade	Grade Point	Performance
1	90 - 100	O+	10	Outstanding
2	80 - 89	O	9	Excellent
3	70 - 79	A+	8	Very Good
4	60 - 69	A	7	Good
5	55 - 59	B+	6	Above Average
6	50 - 54	B	5	Pass
7	0 - 49	RA	-	ReAppear
8	Absent	AA	-	Absent

- **Cumulative Grade Point Average (CGPA)**

$$\mathbf{CGPA} = \frac{\mathbf{\Sigma\,(GP \times C)}}{\mathbf{\Sigma C}}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

- **Classification**
  a) First Class with Distinction : CGPA $\geq$ 7.5*****
  b) First Class : CGPA $\geq$ 6.0
  c) Second Class : CGPA $\geq$ 5.0 and $<$ 6.0
  d) Third Class : CGPA$<$ 5.0

TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

Learning Objectives

- To be familiar with the basic concepts and principles of plant systematics.
- To develop a suitable method for correct characterization and identification of plants.
- To understand the importance of taxonomic relationships in research of plant systematics.
- To provide information on various classification systems
- To know about the economic importance of plants.

UNIT I

TAXONOMY AND SYSTEMATICS

Botanical Exploration and Contribution with special reference to India by William Roxburgh, J. D. Hooker, Robert Wright, Nathanial Wallich and Gamble, J. S. Principles of classification as proposed – Artificial – Linnaeus, Natural – Bentham and Hooker, Phylogenetic system - Hutchinson, Modern – Takhtajan. Botanical gardens and herbaria of world, preparation and maintenance of Herbarium, Botanical survey of India – its organization and role.

UNIT II

MODERN TRENDS IN TAXONOMY

Modern trends in Taxonomy, Chemotaxonomy, Numerical Taxonomy, Biosystemics. ICBN uninominal systems - genesis binomial nomenclature, importance and principle. Important articles, typification, principles of priority, effective and valid publication, author citation, recommendations and amendents of code. Glossories and dictionaries, Taxonomic Literature (Index Kewensis).

UNIT III

SYSTEMATIC ANALYSIS OF PLANTS-I

Polypetalae, Nympheaceae, Sterculiaceae, Portulacaceae, Rhamnaceae, Vitaceae, Sapindaceae, Combretaceae and Apiaceae.

UNIT IV

SYSTEMATIC ANALYSIS OF PLANTS-II

Gamopetalae, Sapotaceae, Oleaceae, Boraginaceae, Scrophulariaceae, Bignoniaceae, Convolvulaceae, Acanthaceae, Verbenaceae.

Monochlamydeae, Nyctaginaceae, Aristolochiaceae, Casuarinaceae.

Monocots – Orchidaceae, Amarylidaceae, Lilliaceae, Commelinaceae, Cyperaceae.

UNIT V

ECONOMIC BOTANY

General account on utilization of selected crop plants: (i) Cereals (rice and wheat) – (ii) Pulses (red gram and black gram), (iii) Drug yielding plants (Withania somnifera and Coleus aromaticus) (iv) Oil yielding plants (Groundnut, sunflower). (v) Sugar yielding plants (sugarcane and sugar beet), (vi) Spices and condiments (Cardamom, Cinnamon). (vii) Commercial crops - fibre (jute), (viii) Timber (Teak and red sanders wood), (ix) Resins and gums (Asafoetida and Gum arabic) – (x) Essential oils (lemon grass and menthol), (xi) Beverages (tea, coffee), (xii) Plants used as avenue trees for shade, pollution control and aesthetics (xiii) Energy plantation - uses of Casuarina.

Recommended texts

1. Pandey, B.P. 2013. Taxonomy of Angiosperms, S. Chand Publishing, New Delhi.
2. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
3. Singh, G. 2007. Plant systematics theory and practices. Oxford and IBH Publishing Co.
4. Jain, S.K and Rao R.R. 1993. A handbook of field and herbarium methods. Today and Tomorrow Publ.
5. Pandurangan, A.G., Vrinda, K.B and Mathew Dan. 2013. Frontiers in plant taxonomy. JNTBGRI, Thiruvananthapuram, Kerala.
6. Vardhana, R. 2009. Economic Botany. 1st ed. Sarup Book Publishers Pvt Ltd. New Delhi.
7. Subramaniam, N.S. 1997. Modern plant taxonomy. Vikas Publishing House, New Delhi.

Reference Books

1. Wallis, T.E. 1999. Text book of Pharmacognosy. CBS Publishers and Distributors, New Delhi.
2. Kumaresan, V and Annie Regland. 2004. Taxonomy of Angiosperms systematic Botany, Economic Botany, Botany & Ethnobotany.
3. Anonymous, 2004. Cultivation of Selected Medicinal Plants. National Medicinal Plants Board, Govt. of India, New Delhi.
4. Vallabh. 2000. Practical Pharmacognosy, Kolkata. New Delhi.
5. Acharya Vipul Rao. 2000. Herbal cure for common diseases. Diamond books, Pvt. Ltd.
6. Dey, A.C. 1998. Indian medicinal plants used in Ayurvedic preparations, Bishen Singh Mahendra Pal Singh.
7. Sathya, S., Jaiganesh, K.P and Sudha, T. 2019. Current Trends in Herbal Drug
8. Technology. Pharmacy Council of India New Delhi.
9. Mohamad Ali. 2009. Pharmacognosy and Phytochemistry. CBS Publications& Distribution, New Delhi, Volume.1.
10. Lewis, W.H and M.P.F. Elwin Lewis. 1976. Medical Botany. Plants affecting

Man's Health. A Wiley Inter Science Publication. John Wiley and Sons, New York.

Web resources

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

PLANT ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Learning Objectives

- To acquire knowledge on the anatomical structure and reproductive phase of angiosperms
- Learn the importance of plant anatomy in plant production systems.
- Classify meristems and identify their structures, functions and roles in monocot and dicot plants growth and secondary growth of woody plants.
- Understand the mechanism underling the shift from vegetative to reproductive phase.
- Trace the development of male and female gametophyte.
- Understand the recent advances in palynology.

UNIT I

CELL WALL:

Morphological and physico-chemical changes; Plasmodesmata- types of pits – growth of cell wall – formation of intercellular spaces; Meristems: Classifications: Theories of shoot and root apices, Cytological zonation in shoot apex. Vascular Cambium: Composition and organization – multiplicative and additive divisions. Xylem: Primary and secondary xylem – tracheary elements and vessels – vesselless dicots – xylem rays and axial parenchyma of angiosperm wood; Dendrochronology – grain, texture and figure in wood; reaction wood; ring porous and diffuse porous wood. Phloem: Ultra structure and ontogeny of sieve tube elements and companion cell. Evolution of tracheary elements.

UNIT II

PERIDERM:

Structure, organization and activity of phellogen. Polyderm and Rhytiderm – wound periderm. Normal secondary thickening in Dicots; Anomalous secondary

growth in Dicots (Amaranthaceae, Aristolochiaceae, Bignoniaceae, Piperaceae, Nyctaginaceae) and arborescent Monocots. Primary thickening in palms; Ontogeny of leaf, Structure and types of Stomata; Leaf abscission; Major nodal types; Kranz anatomy and its significance. Microtechnique: Principle of killing and fixation, dehydration and rehydration of botanical specimens. Stains: Principle of double staining (fast-green and light green) of free hand sections; Protocol for serial sectioning of paraffin wax impregnated specimens; Mounting and mounting media.

UNIT III

MICROSPORANGIUM AND MALE GAMETOPHYTE:

Structure and development of Anther; Ultrastructure and physiology of anther tapetum; Male gametophyte; Palynology: Morphology and ultrastructure of pollen wall, pollen kitt, pollen analysis, pollen storage, pollen sterility and pollen physiology.

UNIT IV

MEGASPORANGIUM AND FEMALE GAMETOPHYTE:

Structure and development of Megasporangium; Types of ovules, Endothelium, obturator and nucellus. Megasporogenesis: Female gametophyte: Structure, types, Haustorial behavior and Nutrition of embryo sacs. Fertilization: Double fertilization and triple fusion; Endosperm: Development of endosperm, types, physiological efficiency of endosperm haustoria and functions; Ruminate endosperm. Embryogeny: Development of monocot (Grass) and dicot (Crucifer) embryos.

UNIT V

POLYEMBRYONY:

Causes of Polyembryony, classification, induction and practical application. Apomixis and its significance. Seed and Fruit development and role of growth substances. Parthenocarpy and its importance.

Recommended texts

1. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.
2. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
3. Sharma, P.C. 2017. Text Book of Plant Anatomy. Arjun Publishing House, New Delhi.
4. Pandey. S.N and Ajanta Chandha. 2006. Plant Anatomy and Embryology. Vikas Publishing House Pvt. Ltd, New Delhi.
5. Narayanaswamy, S. 1994. Plant Cell and Tissue Culture. Tata McGraw Hill Ltd. New Delhi.

Reference Books

1. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry. S. Viswanathan & Co.,Madras.
2. Swamy, B.G.L and Krishnamurthy. K.V 1990. From flower to fruits, Tata – McGraw Hill publishing Co Ltd, New Delhi.
3. Pullaiah, T., Lakshiminarayana, K and Hanumantha Rao, B. 2006. Text book of Embryology of Angiosperms. Regency Publications, New Delhi.
4. Bierhorst, D.W. 1971. Morphology of Vascular Plants. Macmillan publishers, New York.
5. Crang, R., Lyons-Sobaski, S and Wise, R. 2018. Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants. Springer International Publishing.
6. Cutler, D. F., Botha, T and Stevenson, D.W. 2008. Plant Anatomy: An Applied Approach. Blackwell Publishing, Malden, USA.
7. Eames, A.J and Mac Daniels, L.H. 2013. Introduction to Plant Anatomy, 3rd Edition. McGraw-Hill Inc., US.

Web resources

1. https://www.ipni.org/
2. http://www.theplantlist.org/
3. https://faculty.etsu.edu/liuc/plant_anatomy_sites.htm
4. http://aryacollegeludhiana.in/E_BOOK/Botany/plant_anatomy.pdf
5. https://www.uou.ac.in/sites/default/files/slm/BSCBO-202.pdf
6. http://greenlab.cirad.fr/GLUVED/html/P1_Prelim/Bota/Bota_typo_014.html
7. https://www.askiitians.com/

ECOLOGY, PHYTOGEOGRAPHY, CONSERVATION BIOLOGY & INTELLECTUAL PROPERTY RIGHTS

Learning Objectives

- To analyze and comprehend the fundamental ideas of plant ecology as a scientific study of environment.
- To study the plant communities and plant succession stages.
- To be aware of the causes, impacts and control measures of pollution.
- To study biodiversity management and conservation.
- To enhance the knowledge of the students and equip them in evaluate and protecting invaluable components of nature and interactions with the environment.

UNIT I

ECOLOGICAL PRINCIPLES:

Introduction – History, scope, concepts. Diversity of plant life; growth form, life form. Basic concepts of population ecology– population dynamics – Regulation of population density. Basics concepts of community–characteristics, composition, structure, origin and development – community dynamics –t rends of succession.

UNIT II

ECOSYSTEM ECOLOGY AND RESOURCE ECOLOGY:

Introduction – kinds – major types – functional aspects of ecosystem: Food chain and food web, energy flow, laws of thermodynamics. Productivity–primary and secondary productivity –GPP & BPP.

Resource Ecology: Energy resources; renewable and non-renewable.

Soil: Formation, types and profile-erosion and conservation, Water resources – conservation and management.

Environment Deterioration: Climate change – Greenhouse effect and global warming, ozone depletion and acid rain. Waste management - Solid and e-waste, recycling of wastes. Eco-restoration/remediation ecological foot prints - carbon foot print – eco labeling - environmental auditing.

UNIT III

PHYTOGEOGRAPHY:

Phytogeographical Zones - Vegetation types of India and Tamil Nadu, Distribution: Continuous, Discontinuous and Endemism. Theories of discontinuous distribution: Continental drift, Age and area hypothesis. Geographical Information System (GIS) Principles of remote sensing and its applications.

UNIT IV

BIODIVERSITY AND CONSERVATION ECOLOGY:

Definition, types of biodiversity – values of biodiversity – Hot spots – Threats to biodiversity: habitat loss. Poaching of wild life – Invasion of exotic species, man and wild life conflicts-endangered and endemic plants species of India, Red list categories of IUCN, Biotechnology assisted plant conservation-insitu and exsitu methods.

UNIT V

INTELLECTUAL PROPERTY RIGHTS:

Intellectual Property Rights – Introduction, Kinds of Intellectual Property Rights- Patents, Trademarks, Copyrights, Trade Secrets. Need for intellectual property right, Advantages and Disadvantages of IPR. International Regime Relating to IPR – TRIPS, WIPO, WTO, GATTS. IPR in India genesis and development. Geographical Indication – introduction, types. Patent filing procedure for ordinary application.

Recommended texts

1. Sharma, P.D. 2017. Ecology and Environment- Rastogi Publication, Meerut.
2. Pushpa Dahiya and Manisha Ahlawat. 2013. Environmental Science- A New Approach, Narosa Pub. House, New Delhi.pp.2.1-2.60.
3. Eugene Odum, 2017. Fundamentals of Ecology 5th Ed. Cengage, Bengaluru.

4. Sharma P.D. 2019. Plant ecology and phytogeography, Rastogi Publications, Meerut.
5. Neeraj Nachiketa. 2018 Environmental & Ecology A Dynamic approach. 2nd Edition GKP Access Publishing.
6. Chandra, A.M and Ghosh, S.K. 2010. Remote sensing and Geographical Information System, Narosa Publishing House Pvt. Ltd. New Delhi.

Reference Books

1. Keddy, P.A. 2017. Plant Ecology: Origins, processes, consequences. 2nd ed. Cambridge University Press. ISBN. 978-1107114234.
2. Krishnamurthy, K.V. 2004. An Advanced Text Book of Biodiversity-Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
3. Ahuja, V.K. 2017. Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
4. Nithyananda, K.V. 2019. Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
5. Venkataraman M. 2015. An introduction to Intellectual property rights. Create space Independent Pub.North Charleston, USA.
6. Kormondy, E.J. 2017. Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
7. Gillson, L. 2015. Biodiversity Conservation and Environmental Change, Oxford University Press, Oxford.

Web resources

1. https://www.intechopen.com/chapters/56171
2. https://plato.stanford.edu/entries/biodiversity/
3. https://sciencing.com/four-types-biodiversity-8714.html.
4. https://www.iaea.org/topics/plant-biodiversity-and-genetic-resources
5. http://www.bsienvis.nic.in/Database/Status_of_Plant_Diversity_in_India_17566.aspx
6. https://www.youtube.com/watch?v=qtTLiQoYTyQ
7. https://www.youtube.com/watch?v=208B6BtX0Ps
8. https://www.youtube.com/watch?v=6p1TpVJYTds
9. https://www.amazon.in/Intellectual-Property-Rights-Vijay-Durafeebook/dp/B08N4VRQ86

LABORATORY COURSE – 3 COVERING PAPER - V

Learning Objectives

- Understand and develop skill sets in plant morphological, floral characteristics and artificial key preparation.
- Expedite skilled workers to carry out research in frontier areas of plant science.
- Classify meristems and identify their structures, functions and roles in monocot and dicot plants growth and secondary growth of woody plants
- Learn the importance of plant anatomy in plant production systems.
- Know about different vegetation sampling methods.

UNIT I

TAXONOMY AND ECONOMIC BOTANY OF ANGIOSPERMS

Preparation of dichotomous key

UNIT II

Description of a species, live specimens of the families mentioned in the theory.

UNIT III

Study the products of plants mentioned in the syllabus of economic botany with special reference to the morphology, botanical name and family.

UNIT IV

Workout nomenclatural problems regarding priority and author citations.

Identification of Binomial using flora (J.S. Gamble).

UNIT V

Identification of common plants in the families mentioned in the theory

Field trip: A field trip at least 3-4 days to a floristically rich area to study plants in nature and field report submission of not less than 10 herbarium sheets representing the families studied.

Recommended texts

1. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Gokhale, S.B., Kokate, C.K. and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. Nirali Prakashan, 1st Edition. ISBN: 9351642062.
3. Joshi, S.G. 2018. Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi.ISBN: 9788120414143.

Reference Books

1. Aler Gingauz.2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.
2. Mann J. Davidson, R. Sand J.B. Hobbs, D.V. Banthorpe, J.B .Harborne. 1994. Natural Products. Longman Scientific and Technical Essex.
3. Gopalan,C., B.V. Ramasastriand S.C. Balasubramanian. 1985. Nutritive Value of Indian Foods. National Institute of Nutrition, Hyderabad.
4. Harborne. J.B. 1998. Phytochemical methods. A guide to modern techniques of Plant Analysis, Chapman and Hall publication, London.
5. Traditionalplantmedicinesassourcesofnewdrugs.P.JHoughtoninPharmacognosy. Treaseand Evan's.16Ed.2009.

Web resources

1. https://www.amazon.in/Textbook-Pharmacognosy-Phytochemistry-Kumar-Jayaveeraebook/dp/B06XKSY76H
2. https://www.amazon.in/Computational-Phytochemistry-Satyajit-Dey-Sarkerebook/dp/B07CV96NZJ

3. https://studyfrnd.com/pharmacognosy-and-phytochemistry-book/
4. https://www.worldcat.org/title/textbook-of-pharmacognosy-andphytochemistry/oclc/802053616
5. https://www.worldcat.org/title/phytochemistry/oclc/621430002

LABORATORY COURSE – 4 COVERING PAPERS VI AND VII

Learning Objectives

- Classify meristems and identify their structures, functions and roles in monocot and dicot plants growth and secondary growth of woody plants
- Expedite skilled workers to carry out research in frontier areas of plant science.
- Learn the importance of plant anatomy in plant production systems.
- Know about different vegetation sampling methods.
- Know about the remote sensing techniques

UNIT I

ANATOMY

1. Study of shoot apex of Hydrilla
2. Observation of cambial types.
3. Sectioning and observation of nodal types.
4. Study of anomalous secondary growth of the following
   STEM - Nyctanthus, Bignonia, Piper and Mirabilis.
   ROOT: Acyranthus
5. Observation of stomatal types by epidermal peeling.
6. Maceration of wood and observation of the components of xylem.
7. Double staining technique to study the stem anomali.

UNIT II

EMBRYOLOGY

1. Observation of T.S. of anther.
2. Observation of ovule types.
3. Observation of mature embryo sacs.
4. Dissection and observation of embryos (globular and cordate embryos).
5. Study of pollen morphology
6. Study of in vitro pollen germination.
7. Observation of endosperm types.

UNIT III

ECOLOGY

1. Determination of the quantitative characters of a plant community by quadrat method, line transect method (abundance, density, dominance, species diversity, frequency), Raunkiaer's life forms method, Shannon-Weiner Index in vegetative lands.

2. Estimation of above ground and below ground biomass in a grazing land employing minimum size of quadrat.

UNIT IV
ECOLOGY

1. To determine soil moisture, porosity and water holding capacity of soil collected from varying depth at different locations.
2. Estimation of organic carbon (Walkley - Black method).
3. Determination of dissolved oxygen.
4. Estimation of carbonate.
5. Estimation of bicarbonate.

UNIT V PHYTOGEOGRAPHY, CONSERVATION BIOLOGY & INTELLECTUAL PROPERTY RIGHTS

1. Mapping of world vegetation
2. Mapping of Indian vegetation.
3. Remote sensing – Analyzing and interpretation of Satellite photographs-Vegetation/ weather.
4. Visit to remote sensing laboratory (Regional Meteorological Centre).

Recommended texts

1. Cutler, D.F., Botha, C.E.J., Stevenson, D.W., and William, D. 2008. Plant anatomy: an applied approach (No. QK641 C87). Oxford: Blackwell, UK.
2. Sundara, R. S. 2000. Practical manual of plant anatomy and embryology. Anmol Publ. PVT LTD, New Delhi.
3. Panshin, A.J and C. de Zeeuw.1980.Textbook of wood technology. Structure, identification and uses of the commercial woods of the United States and Canada. Fourth Edition. New York: McGraw-Hill Book Company.
4. Sharma, H.P. 2009. Plant Embryology: Classical and Experimental, Bombay Popular Prakashan, ISBN-8173199698, 9788173199691

Reference Books

1. Harborne. J.B. 1998. Phytochemical methods. A guide to modern techniques of Plant Analysis, Chapman and Hall publication, London.
2. Traditionalplantmedicinesassourcesofnewdrugs.P.JHoughtoninPharmacognosy. Treas and Evan's.16Ed.2009.
3. Sundara Rajan, S, 2003. Practical Manual of Plant Anatomy and Embryology 1st ed, Anmol Publications, ISBN-812610668.
4. Katherine Esau. 2006. Anatomy of Seed Plants. 2nd edition, John Wiley and Sons.

Web resources

1. https://studyfrnd.com/pharmacognosy-and-phytochemistry-book/
2. https://www.youtube.com/watch?v=Inm5oE1U8qw
3. https://www.youtube.com/watch?v=GlCOQijkIKc
4. https://www.jove.com/science-education/11090/basic-plant-anatomy-roots-stems-andleaves

RESEARCH METHODOLOGY, COMPUTER APPLICATIONS & BIOINFORMATICS

Learning Objectives

- To equip students to collect, analyze and evaluate data generated by their own inquiries in a scientific manner.
- To provide an overview on modern equipments that they would help students gain confidence to instantly commence research careers and/or starts entrepreneurial ventures.
- To develop interdisciplinary skills in using computers in botany to learn about the biological database.
- Students aware with the most recent technologies for sequencing and bioinformatics analysis and is able to apply them to the structural and functional genomics of plants.
- Operate various software resources with advanced functions and its open office substitutes.

UNIT I

Literature collection and citation: bibliography —bibliometrics (scientometrics): definition-laws — citations and bibliography - *biblioscape— plagiarism— project proposal writing — dissertation writing – paper presentation (oral/poster) - E-learning tools- monograph — introduction and writing-Standard operating procedure (SOP) – introduction and preparation — Research Institutions - National and International.

UNIT II

Basic principles and applications of pH meter, UV-visible spectrophotometer, centrifuge, lyophilizer, chromatography- TLC, Gas chromatography with mass spectrum (GC/MS), and HPLC-Scanning electron microscopy-Agarose gel Electrophoresis — Polyacrylamide Gel Electrophoresis – Polymerase Chain Reaction.

UNIT III

Introduction to computers and Bioinformatics. Types of hardware and software operating systems. Fundamentals of networking, operation of networks, telnet, ftp, www, Internet. Biological Research on the web: Using search engines, finding scientific articles.

UNIT IV

Public biological databases, searching biological databases. Use of nucleic acid and protein data banks.

UNIT V

NCBI, EMBL, DDBJ, SWISSPORT, Protein prediction and Gene finding tools. Techniques in Bioinformatics - BLAST, FASTA, Multiple Sequence Analysis.

Recommended texts

1. Veerakumari, L. 2017. Bioinstrumentation. MJP Publisher, India. p578.
2. SreeRamulu, V.S.1988. Thesis Writing, Oxford& IBH Pub. New Delhi.
3. Kothekar, V and T.Nandi. 2009. An introduction to Bioinformatics. Panima publishing crop, New Delhi.
4. Mani, K and N. Vijayaraj. 2004. Bioinformatics – A Practical Approach.1st Edn. Aparna publication, Coimbatore.
5. Gurumani, N. 2019. Research Methodology: For Biological Sciences, MP. Publishers.

Reference Books

1. Jayaraman, J. 2000. Laboratory manual of Biochemistry, Wiley Eastern Limited, New Delhi 110 002.
2. Pevsner, J. 2015. Bioinformatics and functional genomics. Hoboken, NJ:Wiley Blackwell.
3. Arthur Conklin W.M and Greg White, 2016. Principles of computer security. TMH. McGraw-Hill Education; 4 edition.
4. Irfan Ali Khan and Attiya Khanum (eds.). 2004. Introductory Bioinformatics. Ukaaz Publications, Hyderabad.
5. Arthur Conklin W.M., and Greg White. 2016. Principles of computer security. TMH., McGraw-Hill Education; 4th edition
6. Mishra Shanthi Bhusan. 2015. Handbook of Research Methodology - A Compendium for Scholars & Researchers, Ebooks2go Inc.
7. Narayana, P.S.D. Varalakshmi, T. Pullaiah. 2016. Research Methodology in Plant Science, Scientific Publishers, Jaipur, Rajasthan.

Web resources

1. https://www.kobo.com/in/en/ebook/bioinstrumentation-1
2. https://www.worldcat.org/title/bioinstrumentation/oclc/74848857
3. https://www.amazon.in/Bioinstrumentation-M-H-Fulekar-Bhawana-Pandeyebook/dp/B01JP3M9TW
4. https://en.wikipdia.org/wiki/bioinstrumentation
5. https://www.britannica.com/science/chromatography
6. https://en.wikipedia.org/wiki/electrophoresis

NANOBIOTECHNOLOGY

Learning Objectives

- To introduce the learners to the basic concepts in the emerging frontiers of nanotechnology.
- To give perspective to researchers and students who are interested in nanoscale physical and biological systems and their applications in medicine.
- To introduce the concepts in nanomaterials and their use with biocomponents to synthesize and interact with larger systems.
- To impart knowledge on the most recent molecular diagnostic and therapeutic tools used to treat various diseases.
- Incorporate sustainability in to account when you develop nanotechnology responsibly.

UNIT I

BASIC CONCEPTS IN NANOBIOLOGY

History of Nanotechnology, Difference between Nanoscience and Nanotechnology, Green nanotechnology, Bottom up and top down approaches.

UNIT II

DIVERSITY IN NANOSYSTEMS

Carbon based nanostructures - fullerences, nanotubes, nanoshells, buckyballs – biomolecules and nanoparticles, nanosensors, nanomaterials - Classification based on dimensionality quantum dots, wells and wires – metal based nano materials (gold, silver and oxides) - Nanocomposites- Nanopolymers – Nanoglasses–Nano ceramics.

UNIT III

METHODS OF NANOBIOTECHNOLOGY

Optical tools – Nanoforce and imaging – Surface methods – Mass spectrometry – Electrical Characterization and Dynamics of Transport – Microfludics: Concepts and applications to the Life Sciences.

UNIT IV

NANOBIOTECHNOLOGY

Nanodevices and nanomachines based on biological nanostructures - Protein and DNA nanoarrays, tissue engineering, and luminescent quantum dots for biological labeling.

UNIT V

APPLICATIONS OF NANOBIOTECHNOLOGY

Real Time PCR – Biosensors : From the glucose electrode to the Biochip – DNA Microarrays – Protein Microarrays – Cell Biochips – Lab on a chip – Polyelectrolyte multilayers – Biointegrating materials – Pharmaceutical applications of nanoparticles carriers.

Recommended Text:

1. Dupas, C, Houdy, P., Lahmani, M. 2007. Nanoscience: ―Nanotechnologies and Nanophysics‖, Springer-Verlag Berlin Heidelberg.
2. Sharon, M and Sharon, M. 2012. Bio-Nanotechnology- Concepts and Applications, CRC Press.
3. Atkinson, W.I.2011. Nanotechnology. Jaico Book House, New Delhi.
4. Nalwa, H.S. 2005. Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology. American Scientific Publ.
5. Lindsay, S.M. 2011. Introduction to Nanoscience, Oxford universal Press, First Edition.
6. Jain K.K. 2006. Nanobiotechnology molecular diagnostics: Current techniques and application (Horizon Bioscience).Taylor & Francis 1st edition.
7. Pradeep, T. 2012. Textbook of Nanoscience and Nanotechnology, McGraw Hill Education (India) Private Limited.
8. Xiu Mei Wang, Murugan Ramalingam, Xiangdong Kongand Lingyun Zhao. 2017. Nanobiomaterials: Classification, Fabrication and Biomedical Applications, Wiley-VCH Verlag GmbH & Co. KGa A.

Reference Books:

1. Claudio Nicolini. 2009. Nanotechnology Nanosciences, Pon Stanford Pub.Pvt.Ltd,
2. Robert, A and Ferias, Jr. 1999.Nanomedicine, Volume I: Basic capabilities,Landes Bioscience.
3. Barbara Panessa-Warren. 2006 Understanding cell-nanoparticle interactions making nanoparticles more biocompatible. Brookhaven National Laboratory.
4. European Commission, SCENIHR. 2006. Potential risks associated with engineered and adventitious products of nanotechnologies, European Union.
5. Gysell Mortimer, 2011. The interaction of synthetic nanoparticles with biological systems PhD Thesis, School of Biomedical Sciences, Univ.of Queensland.
6. Murty, B.S., Shankar, P., Raj, B., Rath, B.B., Murday, J. 2013. Textbook of Nanoscience and Nanotechnology. Spirnger Publication.
7. Prashant Kesharwani. 2019. Nanotechnology-Based Targeted Drug Delivery Systems for Lung Cancer. Academic Press. An imprint of Elsevier.

Web resources:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/3527602453
2. https://www.elsevier.com/books/nanobiotechnology/ghosh/978-0-12-822878-4
3. https://www.routledge.com/Nanobiotechnology-Concepts-and-Applications-in-Health-Agriculture-and/Tomar-Jyoti-Kaushik/p/book/9781774635179
4. https://www.nanowerk.com/nanotechnology/periodicals/ebook_a.php
5. https://phys.org/news/2014-10-endless-possibilities-bio-nanotechnology.html
6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC419715/
7. https://phys.org/news/2014-10-endless-possibilities-bio-nanotechnology.html
8. http://www.particle-works.com/applications/controlled-drug-release/Applications

AGRICULTURE AND FOOD MICROBIOLOGY

Learning Objectives

- To provide comprehensive knowledge about plant – microbe interactions.
- To provide basic understanding about factors affecting growth of microbes
- To appreciate the role of microbes in food preservation.
- To understand about the benefits of microbes in agriculture and food industry.
- To gain knowledge about practices involved in food industry.

UNIT I

ROLE OF MICROORGANISMS IN AGRICULTURE

Role of symbiotic and free-living bacteria and cyanobacteria in agriculture. Mycorrhiza, Plant Growth Promoting Microorganism (PGPM) and Phosphate Solubilizing Microorganism (PSM).

UNIT II

BIOCONTROL AND BIOFERTILIZATION

Biocontrol of plant pathogens, pests and weeds, Restoration of waste and degraded lands, Biofertilizers: Types, technology for their production and application, vermicompost.

UNIT III

FOOD MICROBIOLOGY

Intrinsic and extrinsic factors influencing growth of microorganisms in food, Microbes as source of food: Mushrooms, single cell protein.

UNIT IV

FOOD MICROBIOLOGY

Microbial spoilage of food and food products: Cereals, vegetables, prickles, fish and dairy products. Food poisoning and food intoxication. Food preservation processes. Microbes and fermented foods: Butter, cheese and bakery products.

UNIT V

PREDICTIVE METHODS:

Using Protein Sequences Protein Identity Based on Composition – Physical Properties Based on Sequence - Motifs and Patterns - Secondary Structure and Folding Classes – Specialized Structures or Features - Tertiary Structure.

Recommended Text:

1. Pelczar M.J., Chan E.C.S. and Krieg N.R. 2003. Microbiology. 5th Edition,

Tata McGraw- Hill Publishing Company Limited, New Delhi.
2. Subba Rao, N. S. 2000. Soil microbiology. 4th Edition, Oxford and IBH publishing Co. Pvt. Ltd., Calcutta, New Delhi, India.
3. Rangaswami, G. and Bagyaraj, D.J. 2006. Agricultural Microbiology. 2nd Unit 2nd Edition, PHI Learning, New Delhi, India.
4. Prescott, L.M., Harley J.P., Klein D. A. 2005.Microbiology,McGraw Hill, India. 6th edition.
5. Goldman, E. and Green, L.H. 2015.Practical Handbook of Microbiology (3rd Ed.).CRC Press

Reference Books:

1. Adams, M.R. and Moss M. O. 2008. Food Microbiology, 3rd Edition, Royal Society of Chemistry, Cambridge, U.K.
2. Sylvia D.M. 2004. Principles and Applications of Soil Microbiology, 2nd Edition, Prentice Hall, USA.
3. Frazier, W.C. 1995. Food Microbiology, 4th Edition, Tata McGraw Hill Education, Noida, India.
4. Waites M.J., Morgan N.L., Rockey J.S. and Higton G. 2001. Industrial Microbiology: An Introduction. 1st Edition, Blackwell Science, London, UK.
5. Das, S. and Saha, R. 2020.Microbiology Practical Manual. CBS Publishers and Distributors (P) Ltd., New Delhi, India.

Web resources:

1. https://www.kopykitab.com/Agriculture-And-Food-Microbiology-In-Hindi-by-Dr-Q-JShammi
2. https://agrimoon.com/agricultural-microbiology-icar-ecourse-pdf-book/
3. https://play.google.com/store/books/details/Applied_Microbiology_Agriculture_Environmental_Foo?id=DgVLDwAAQBAJ&hl=en_US&gl=US
4. https://www.scientificpubonline.com/websitebooks/ebooks/agriculture/microbiology
5. https://www.amazon.in/Food-Microbiology-Martin-R-Adamsebook/dp/B01D6B7V6A