RVR New CBCS

II Sem HCT 7 units
SCT 14 Q
OE - 2 units
10 Q

M. Sc BOTANY: II SEMESTER – THEORY SYLLABUS

BOT: HCT 2.1 ECOLOGY AND ENVIRONMENTAL BIOLOGY		64 hours
1	**Ecosystem:** Concept and components; Tropic structure; Diversity and characters of major ecosystems- Aquatic, Terrestrial; Productivity- Primary production and measurement of primary productivity; Energy flow in ecosystems; Biogeochemical cycles- Water, Carbon, Nitrogen, Sulphur and Phosphorus.	16 h
2	**Communities:** Classification, structure and characteristics- Analytic and Synthetic; Plant succession- Views and types; Climatic climax; Genecology- Concepts, ecotypes and ecads; Soil: Formation, profile and properties; Soil erosion and conservation; Plant interaction- Competition and allelopathy; Water bodies and their classification; Methods and importance of rain water harvesting.	16 h
3	**Environmental Biology:** Definition, scope and importance; Structure and composition of atmosphere- Lithosphere, Hydrosphere and Biosphere; Pollution- Air, Water and Land- Sources of pollutants and their effects on plants; Management of pollutants; Greenhouse effect, ozone depletion and acid rain; Climate change and its effects on vegetation and crop productivity; Environmental Toxicology: Definition, toxic chemicals, pesticides and insecticides; Bioaccumulation and their effects.	16 h
4	**Environmental monitoring and management:** Biological and physicochemical monitoring; Remote sensing and geographical information system; Biodegradation of pollutants. Environmental protection and conservation: Environmental education and awareness, Environmental Protection Acts, Current environmental issues in India	16 h

Coordinator

REFERENCES:

1. Fundamentals of Ecology: Odum EP (1971)
2. Elements of Ecology and field Biology : Robert Leo, Smith (1980)
3. Concepts of Ecology: Kormondy E J (1989)
4. Ecology and Environment : Sharma PD (1999)
5. A Text book of plant Ecology : Ambasht RS and Ambasht N K (1999)
6. Terrestrial Plant Ecology: Barbour MG, Burk JH and Pitts WD (1987)
7. Ecology : Begon M, Harpur JL and Townsend CR (Blackwell, Oxford 1996)
8. Ecology: Principles and Applications: Chapman JL and Reiss MJ (Cambridge UnivPress1998).
9. Ecology: Paul, John Wiley & Sons (New York 1993)
10. Principles of Environment Science: Enquiry and Applications Cunningham WP and Cunningham M A (2nd Edn, Tata McGraw Hill, New Delhi 2004)
11. Natural Resource Management: Jha L K (APHA Pubs, New Delhi 1997)
12. Environmental Science: Kemp M J (Tata McGraw-Hill, New Delhi 1997).
13. Fundamentals of Geographical Information Systems: John Michael & N Demers (2008)
14. Ecology of Natural Resources: Ramade F (John-Wiley & Sons, New York 1991).
15. Essentials of Ecology and Environmental Sciences: Rana S V S (Prentice-Hall 2005)

	BOT: HCT 2.2 PLANT ANATOMY AND EMBRYOLOGY	64 hours
1	**Anatomy:** Organization of primary plant body, Apical meristems and primary growth, Primary xylem – composition, Primary phloem - composition, Shoot Apex: Apical Cell Theory, Tunica Corpus Theory, Cyto-histological Zonation Theory. Root Apex: Histogenic boundries; Quiscent center. Structure and development of the cell wall – Structure (light microscopic and ultramicroscopic structure), composition of the cell wall, Cell wall development. The effect of hormones on cell differentiation, Genetic control of cell growth and development, Role of the cytoskeleton in cell growth and development, Cell shaping by microtubules.	16 h
2	Development of the secondary vascular system of the stem and root. Role of the vascular cambium, the effect of secondary growth on the primary body on leaf and branch traces. Secondary Xylem: Structure of secondary xylem, Secondary xylem of gymnosperms and dicotyledons. Patterns of distribution of xylary elements and rays, Tyloses, Gentic control of differentiation of secondary xylem. Evolution in secondary xylem of dicotyledons. Seconadary phloem: Gross and Ultra structure, development of the phloem. Nature and development of the cell wall of sieve elements. Nature of protoplast of sieve elements, Nature and function of P-protein, Distinctive features of phloem of gymnosperms, The nature and function of companion cells and Strasburger cells, Nodal anatomy, Anamalous secondary growth: Aristolochia, Boerhaavia, Dracaena, Periderm, Secretary tissues in plants.	16 h
3	**Embryology:** Introduction, Brief history of Embryology with particular reference to the contribution of Indian embryologists, Male gametophyte: Microsporogenesis, tapetum, types, function of tapetum. Pollen morphology – structure, stratification, unit of dispersal, aperture, types arrangement, classification NPC system. Female gametophyte: Types of embryosac development, organisation of an embryosac, Ultrastructural studies, Embryosac haustoria. Pollination: Structure of the style and stigma, histochemical studies, pollen - pistil interaction, compatability/ incompatability ,pollen germination, pollen embryosac.	16 h
4	**Fertilization:** Post pollination events; Path pollen tube, site of pollen discharge, double fertilization, Embryogenesis: Monocot (Najas), Dicot embryo development (Capsella), genetics of embryo development (Arabidopsis), Endosperms: Types, structure, development and function of Endosperm, Endosperm haustoria. Polyembryony & Apomixis – a brief account, Experimental Embryology: Intra ovarian pollination, in vitro Pollination and in vitro fertilization, ovule and embryo culture and somatic embryogenesis.	16 h

REFERENCES:

1. Cutter, D.G. (1971) Plant anatomy- Part-1. Cell and Tissues. Edward Arnold, London.
2. Pandey, (20010. Plant anatomy, S. Chand Limited
3. Raghavan V. (1997) molecular embryology of flowering plants. Cambridge University press, Cambridge.
4. Santra S. C., Chatterjee, T.P. & Das A.P. College Botany practical vol. I. New central book agency, Calcutta.
5. Shivanna K.R. and Sawhney V.K. (eds) 1997. Pollen Biotechnology for crop production and improvement. Cambridge University Press, Cambridge.
6. Cutter, D.G. 1971. Plant Anatomy, Part II, Cell and tissues, Edward Arnold, London.
7. Beck, C. 2010. An Introduction to plant structure and Development. 2nd ed. Cambridge Univ. Press. New York.
8. Bhojwani S. S. and Bhatnagar S. P. (2000) The Embryology of Angiosperms. Vikas Publishing House. New Delhi
9. Cutter, E. G. (1969 & 1971) Plant anatomy: Experiments and interpretations vol I & II. Edward Arnold, London.
10. Fahn, plant anatomy (4th Ed.) Pergamon press, Oxford.
11. Maheshwari P. (1950) An introduction to Embryology of angiosperms. Mc graw Hill,New york.
12. Metcalf and Chalk, Anatomy of dicotyledons, Vol.I, anatomy of monocotyledons Vol.II
13. Eames E. J. and Macdaniels (1947) An introduction to plant anatomy. Mc Graw Hill, New york & London.
14. Chand, S. 2005. Plant Anatomy, S, Chand and Company Ltd., New Delhi.
15. Cutler Botha and Stevenson (2007)-Plant anatomy and applied approach. Blackwell Publishing, USA.
16. Esau, K. (1965) Plant anatomy. Wiley publishers.
17. Easu, K.1996. Anatomy of seed plants, First Wiley prints, New Delhi.

SCT 2.1

BOT: SCT. 2.3.1 MEDICINAL AND AROMATIC PLANTS		64 hours
1	**Ethnobotany and ethno medicine:** History and importance of ethnobotany and ethnomedicine in modern health care system; Basic concepts and development of Traditional systems of medicine-Ayurveda, Tibetan, Unani, Siddha systems and ethno medicines of Hyderabad Karnataka Region.	16 h
2	**Herbal drugs:** Methods of preparation and their use in the treatment of coronary, respiratory, urinary, gastrointestinal, gynecological, nervous, diabetics, cancer and other common disorders; Plants used as general tonics; Medicinal food plants- Cereals, pulses, vegetables and wild food plants.	16 h
3	**Cultivation and microbial association:** Cultivation of medicinal and aromatic plants - *Chlorophytum borivillianum, Cassia angustifolia, Stevia rebaudiana, Aloe vera, Gloriosa superba, Withania somnifera, Mentha piperata, Ocimum sanctium and Cymbopogon flexuosus.* Methods employed in disease and pest control, harvesting and storage of crude drugs; Post-harvest care, deterioration and disintegration of active compounds by microbes.	16 h
4	**Pharmacognosy:** Raw drug analysis, microscopic and macroscopic characteristics; Preliminary chemical analysis of *Mentha piperata, Ocimum sanctum, Withania, Rauwolfia;* Phytochemistry- Classification and properties of alkaloids, steroids, terpenoids, lectins, non-proteinous amino acids; Controversial drugs and IPR related to medicinal and aromatic plants.	16 h

REFERENCES:

1. Anatomy and Activities of Plants- A guide to the study of flowering plants: Clegg CJ and Cox G (1974)
2. Indian Medicinal Plants: Kirtikar KR and Basu B D (1932)
3. Indian Materia Medica Vol I & II: Nadkarni A K(1954)
4. Ayurvedic drugs and their plant sources: Sivarajan V V and Indira B (Oxford &IBH, New Delhi 1994).
5. Pharmacognosy 12th edn: Trease G E and Evans W L (Bailliere Tindall, London 1983).
6. Some controversial drugs in Indian Medicine: Vaidya B (Chaukamba Orientalia, Varanasi 1982)
7. Phytochemical Methods: Harborne J. Edr (Chapman & Hall, London 1984).
8. The chemotaxonomy of plants: Smith P M (Edward Arnold, London 1976).

SCT 2.2.

BOT: SCT 2.3.2 METHODS IN PLANT SCIENCES		64 hours
1	**Microbiological methods:** Microscopy (Optical, Phase contrast, Fluorescence, Confocal and Electron – TEM & SEM). Microbial Technique: Sterilization, fungal and Bacterial stains, culture media, Staining techniques simple, negative and Gram's staining and endospore, isolation of microbes from soil, air, water and other substrates. Microbial enumeration techniques- Heamocytomter, Dilution plate technique, selective culture media. Micrometry and different types.	16 h
2	**Aerobiological techniques:** Spore sampling techniques- Slides, Petri plates, vertical cylinder, Anderson sampler and Burkard spore trap. Microtomy and staining: Microtomy and double staining of plant sections. **Radioisotope Techniques:** Types of isotopes, radioactive decay. Detection and measurement of radioactivity- GM counter, scintillation counter, autoradiography. Isotopes used in biology, safety methods in handling radioisotopes.	16 h
3	**Centrifugation, principles and application:** Sedimentation coefficient, types of centrifuges, differential centrifugation, density-gradient, analytical, and ultracentrifugation and their applications. **Chromatography, principles and application:** Paper chromatography, Thin layer chromatography (TLC), 2-Dimensional chromatography, HPTLC. Detection methods. Column chromatography, gel filtration, adsorption, partition, affinity, ion exchange and HPLC. Gas chromatography	16 h
4	**Electrophoresis:** Principle and applications; SDS-PAGE, isoelectric focussing, 2D electrophoresis. Agarose Gel Electrophoresis: Preparation, separation and determination of molecular size of DNA, denaturing agarose gel electrophoresis and their applications. **pH meter:** Principle, Glass electrode, Reference electrode, Combination Electrode; **Spectroscopy:** Principles and application: Beer and Lambert law, Colorimetry and UV-Visible spectrophotometry, Flame photometry and Atomic absorption spectrophotometry.	16 h

REFERENCES:

1. Upadhyay, Upadhyay, Nath, 2002.Biophysical Chemistry-Principals and Techniques (3rd edition). Himalaya Publishing House.
2. P.K. Bajpai (2012).Biological Instrumentation & methodology (Tools and Techniques of Biology) S Chand & Company Pvt Ltd.
3. Wilson & Walker 2000. Practical biochemistry: Principles & Techniques. Cambridge Univ. Press, New York.
4. Williams and Wilson, K. 1991. A Biologist's guide to principles and techniques of practical biochemistry, 2nd ed. Edward Arnold.
5. Lain, D. Campbell and Raymond A. Dwek Biological Spectroscopy Benjamin/Cumming Pub. Co., California, London.
6. Cantor, C.R. and Schimmel, P.R. Biophysical Chemistry by, W.H. Freeman & Co.,
7. Glàsel, A and Deutscher, M.P. 1995. Introduction to Biophysical Methods for Protein and Nucleic Acid Research. Academic Press.
8. Principles of gene manipulation- An introduction to genetic engineering: Bold R W and Primerose S B (Black Well, London)
9. Introduction to plant Biotechnology: Oxford and IBH, New Delhi.
10. Experimental Biology-A Laboratory Manual: Datta A (Narosa, New Delhi 2009).
11. Research methodology for Biological Sciences: Gurumani N (2006). 6. Microscopy and microtechniques: Marimuthu R (2011)
12. Principles and Methods of plats molecular Biology, Biochemistry and Genetics: Pratibha Devi (Agrobios, India 2000).
13. Gel electrophoresis of Nucleic acid – A practical approach. III edition Rick Wood D and Hames B D (Oxford. New York 1990)
14. Bioinstrumentation: Veera kumara (MJP Publication 2006)
15. Genome Analysis – A Laboratory manual Vol.-I: Analyzing DNA-Birren et al. (Panima, New Delhi/Blore 2006).

2 Units

BOT: OET. 2.4.1 BIOFERTILIZERS AND BIOPESTICIDES		64 hours
1	**Biofertilizers**: Introduction and scope, Definition and classification; Role of biofertilizers in modern agriculture, Bacterial biofertilizers- Symbiotic nitrogen fixers: Root nodules, General account of *Azospirillum, Azotobacter, Frankia, Phosphobacteria and Rhizobium.* Mass production of *Azospirillum, Azotobacter* and *Phosphobacteria*, host specificity and life cycle, Organisms and their importance and asymbiotic nitrogen fixation.	16 h
2	**Cyanobacteria (BGA) as biofertilizers:** General account of *Anabaena, Cylindrospermum, Gloeocapsa, Lyngbya, Nostoc, Plectonema and Tolypothrix.* Symbiotic association of cyanobacteria; Heterocyst and nitrogen fixation Field application of cyanobacterial inoculants; *Azolla* as biofertilizer.	16 h
3	**Mycorrhizae as Biofertilizer:** Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield, colonization of VAM, methods of isolation and multiplication- wet sieving and decanting method, inoculum production through trap culture. Culturing of Mycorrhizae in modified Melin-Norkran's agar medium (MMN). Application of mycorrhizae; Tricoderma as biofertilizer.	16 h
4	**Biopesticides:** History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Mass production of Trichogramma, Cryptolaemus, Crysoperla, Mass HaNPV, and EPN. Importance of *Verticillium/ BeauveriaMetarhzium/ Nomuraea/ Paecilomyces/ Hirsutellathompsoni/ Trichoderma/ Pseudomonas/ Bacillus* organic matter decomposers. Testing of quality parameters and standardization of biopesticides.	16 h

OE: Biofertilizers

Unit	Content	Hours
I	Biofertilizers: definition and advantages. Bacterial Biofertilizers: General account on Azatobacter, Azospirillium, Frankia and Rhizobium. Cyanobacteria (BGA) as biofertilizers: general account and applications of Anabaena, Nostoc, Plectonema, Tolypothrix and Azolla. Mass production of bacterial and cyanobacterial biofertilizers and applications methods.	16
II	Mycorrhizae as biofertilizers: general account and applications of mycorrhizae. Trichoderma as biocontrol agent. Biopesticides: general account and fungal biopesticides. Bacillus thuringiensis and insecticidal plants. Mass production and application methods of mycorhizae and biopesticides. Biopesticidal transgenic plants and its consequences.	16

REFERENCES:

1. Gautam, R.D. (2006). Biological suppression of insect pests. Kalyani Publisher, New Delhi.
2. Huffaker, C.B. and Messenger, P.S. (1976). Theory and Practice of Biological control. Academic Press, New York.
3. Ignacimuthu, S.S. and Jayaraj, S. (2003). Biological Control of Insect Pests. Phoenix Publ. New Delhi.
4. Saxena, A.B. (2003). Biological Control of Insect Pests. Anmol Publ. New Delhi.
5. Huffaker, C.B. and Messenger, P.S. (1976). Theory and Practice of Biological control. Academic Press, New York.
6. Pepper HJ and Perlman D. 1979. Microbial Technology. 2nd Ed. Academic Press.
7. A century of Nitrogen Fixation Research Present status and Future propects. 1987. F.J. Bergersen and J.R. Postgate The Royal Soc., London.
8. Biology and Biochemistry of Nitrogen fixation. 1991. M.J. Dilworth,and A.R. Glenn, Elsevier, Amsterdam.
9. Nitrogen Fixation in plants. 1986. R.O.D. Dixon,and C.T. Wheeler, Blackie USA, Chapman and Hall, New York.
10. A treatise on dinitrogen Fixation Section IV. Agronomy and Ecology 1977. R.W.F Hardy, and A.H. Gibson John Wiley & Sons, New York.
11. Bioresearches technology for sustainable agriculture. 1999. S. Kannaiyan, Assoc. Pub. Co., New Delhi.
12. Biofertilizer Technology, Marketing and usage- A source Book -cum-glossary 1995. Motsara, I. M.R., P. Bhattacharyya and Beena Srivastava, FDCO, New Delhi.
13. Symbiotic nitrogen fixation in plants, 1976. P.S. Nutman, Cambridge Univ. Press, London.
14. Hand book for Rhizobia; Methods in legume Rhizobium Technology, 1994. P. Somasegaran and H.J. Hoben Springer-Verlag, New York.
15. Biofertilizers in Agriculture and Forestry 1993. N.S. Subba Rao Oxford and IBH Publ. Co., New Delhi.

PRACTICALS

BOT: HCP. 2.5 (HCT - 2.1) Ecology and Environment Biology

1. Determination of leaf area by Planimeter method.
2. Determination of available soil moisture by Moisture meter.
3. Determination of stomatal index.
4. Determination of organic content of soil.
5. Determination of soil pH using pH meter.
6. Water quality analysis- DO, COD, BOD, Chlorides, Sulphates, TDS, Carbon dioxide.
7. Determination of minimum size of the quadrate by species area curve method.
8. Study of frequency of herbaceous plants by applying Law of frequency.
9. Study of plant abundance and density by quadrat method.
10. Metereological instruments and their working principles.

BOT: HCP. 2.6 (HCT - 2.2) Plant anatomy and Embryology

1. Preparation of fixatives and stains for anatomical studies.
2. Preparation of double stained permanent slides.
3. Preparation and identification of the Trtansverse section of the following plants: *Tridax procumbens, Boerhaavia diffusa, Nyctanthus arborterrestris, Leptadenia reticulate, Aristolochia indica, Salvadora persica.*
4. Preparation and identification based on TS, TLS and RLS of the following wood: *Michelia champaca, Dalbergia sisso, Tectona grandia, Azadirachta indica, Mangifera indica and Tecoma stans.*
5. Epidermal studies- trichomes and stomata
6. Preparation of Microtome section and staining procedure.
7. Identification of different developmental stages of Embryosac.
8. Identification of different developmental stages of Anther.
9. Histochemical studies for cellulose, callose, chitins, PAS reaction, Lignin.
10. Embryo and endosperm mounting.

Note: submission of 10 permanent slides.