M. Sc., Botany

Syllabus 2017 - 2018 onwards

Since 1951

DEPARTMENT OF BOTANY
Jamal Mohamed College (Autonomous)
College with Potential for Excellence
Re-Accredited (3rd Cycle) with 'A' Grade by NAAC
(A f f i l i a t e d t o B h a r a t h i d a s a n U n i v e r s i t y)
Tiruchirappalli – 620 020

JAMAL MOHAMED COLLEGE (Autonomous), Tiruchirappalli-620 020

M. Sc. Botany – Course Structure under CBCS

(For candidates admitted from the academic year 2017-2018 onwards)

SEM	Course Code	Course	Course Title	Ins.Hrs / Week	Credit	Marks		
						CIA	ESE	Total
I	17PBO1C1	Core I	Plant diversity I (Thallophytes and Bryophytes)	6	5	25	75	100
	17PBO1C2	Core II	Plant diversity II (Pteridophytes, Gymnosperms and Paleobotany)	6	5	25	75	100
	17PBO1C3	Core III	Microbiology, Plant Pathology and Immunology	6	4	25	75	100
	17PBO1C4P	Core IV	Laboratory Course for Core I, II & III	6	4	20	80	100
	17PBO1CE1 A/B	Elective I#		6	4	25	75	100
	TOTAL			**30**	**22**			**500**
II	17PBO2C5	Core V	Cell and Molecular Biology	6	5	25	75	100
	17PBO2C6	Core VI	Plant Anatomy and Embryology	6	5	25	75	100
	17PBO2C7	Core VII	Genetics, Evolution and Plant breeding	6	4	25	75	100
	17PBO2C8P	Core VIII	Laboratory Course for Core V, VI & VII	6	4	20	80	100
	17PBO2CE2 A/B	Elective II#		6	4	25	75	100
	TOTAL			**30**	**22**			**500**
III	17PBO3C9	Core IX	Plant Physiology	6	5	25	75	100
	17PBO3C10	Core X	Biochemistry, Biophysics and Bioinstrumentation	6	5	25	75	100
	17PBO3C11	Core XI	Plant Systematics and Ethnobotany	6	4	25	75	100
	17PBO3C12P	Core XII	Laboratory Course for Core IX, X & XI	6	4	20	80	100
	17PBO3CE3 A/B	Elective III#		6	4	25	75	100
	17PBO3EC1	Extra Credit Course I	Organic Farming	-	5*	-	100	100*
	TOTAL			**30**	**22**			**500**
IV	17PBO4C13	Core XIII	Plant Biotechnology	6	5	25	75	100
	17PBO4C14	Core XIV	Plant Ecology and Conservation Biology	6	5	25	75	100
	17PBO4C15P	Core XV	Laboratory Course Core XIII & XIV	6	5	20	80	100
	17PBO4CE4 A/B	Elective IV#		6	4	25	75	100
	17PBO4PW	Project Work		6	5	-	100	100
	17PBO4EC2	Extra Credit Course - II	Botanical pharmacy	-	5*	-	100	100*
	TOTAL			**30**	**24**			**500**
GRAND TOTAL					**90**			**2000**

Core Based Electives, ***Not considered for grand total and CGPA**

SESMESTER	COURSE CODE	COURSE TITLE
I	**17PBO1CE1A**	**Industrial Botany**
	17PBO1CE1B	Agricultural Microbiology
II	**17PBO2CE2A**	**Horticulture and Greenhouse Management**
	17PBO2CE2B	Floriculture
III	**17PBO3CE3A**	**Biostatistics and Bioinformatics**
	17PBO3CE3B	Biodiversity and Conservation
IV	**17PBO4CE4A**	**Plant Tissue Culture**
	17PBO4CE4B	Marine Ecology

SEMESTER I : CORE I

Plant Diversity I (Thallophytes and Bryophytes)

Course Code: 17PBO1C1 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

Objectives:

- To acquire knowledge on the life histories of algae, fungi and bryophytes.

Unit 1: Phycology **18 Hrs**

General characteristics, Classification by Fritsch (1985), History of phycology, Habit and Habitat, organization of the thallus, Structure of algal cell (Prokaryotic and Eukaryotic), Nutrition, Reserve foods, Pigments, distinctive characters of algae and life cycle patterns. Evolutionary trends in algae – Vegetative, reproductive and life cycles. Salient features of important classes of algae. #Algal blooms and algal biofertilizers#.

Unit 2: Phycology **18 Hrs**

Study on the structure, reproduction and life cycle of the following genera: *Gloeocapsa, Scytonema, Spirulina, Vaucheria, Ulva, Botrydium, Navicula* and *Pinnularia*(Diatoms), *Padina, Gracilaria, Sargassum, Batrachospermum, #Laminaria* and *Gelidium#.*

Unit 3: Mycology **18 Hrs**

Classification by Alexopoulos (1979), Origin and Phylogeny of fungi. Habitat, Modes of life, Somatic or vegetative phase, Thallus, Kinds of mycelia, Structure of fungal cell, Homo and Hetero Thallism, Parasexuality, Culture of fungi, Nutrition in fungi, Reproductive phase, #Mycorrhizae#.

Unit 4:Mycology **18 Hrs**

Salient features, Thallus structure, reproduction and life history of the following types; *Plasmodiophora*, *Pythium, Pilobolus, Taphrina, Lycoperdon*, *Fusarium*.Lichens – Ecological significance, economic importance, external and internal structure of thallus, #Asexual and sexual reproduction, *Usnea, Parmelia#.*

Unit 5: Bryology **18 Hrs**

General characters, Morphology, Structure and Economic importance of bryophytes, phylogeny of bryophytes, Evolution of sporophytes.Classification by Watson (1963),General account of Marchantiales, Jungermaniales, Anthoceratales, Sphagnales, Funariales and Polytrichales. Life history of the following types; *Targionia, Reboulia, Anthoceros* and *Poganatum*. #Bryophytes as bio indicators of pollution#.

#----------# Self Study Portion:

Text Books (T.B.):

1. Vashishta BR and Sinha AK. Text book of Algae, S. Chand Publishing Company, 2011.
2. Vashishta BR. SinhaAK and Singh VP.Text book of Fungi,S.Chand Publishing company, 2011.
3. Sharma, PD. The Fungi, Rastogi publications, 2003.
4. Vashishta BR. Sinha AK and Kumar A. Text book of Bryophyta, S. Chand Publishing company, 2011.

Reference Books:

1. Fritsch, FE. An introduction to the study of algae, The Macmillan Company, New York, 1941.
2. Chapman VJ and Chapman DJ. The Algae Macmillan C Publishers, New York, 1973.
3. Alexopoulos, CJ. Algae and Fungi, Macmillan Publishers, New York, 1967.
4. Sporne**,** Bryophytes, Hutchinson & Co, London, 1967.

Unit I, II	:	T.B.1
Unit III, IV	:	T.B.2
Unit V	:	T.B.3

SEMESTER I :CORE II

Plant Diversity II (Pteridophytes, Gymnosperm and Paleobotany)

Course Code: 17PBO1C2 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

Objective:

- To understand the biology and diversity of non flowering vascular plants and lower seed plants.

Unit I: Pteridophytes **18 Hrs**

Introduction – first land vascular plants – Progressive and retrogressive evolution of sporophyte and gametophytes in green plants – Origin and success of land plants – general characters of Pteridophytes - life cycle of homosporous and heterosporous forms – general classification of Pteridophytes by Sporne – Four major subdivisions (Psilopsida, Lycopsida, Sphenopsida and Pteropsida) and its classes – Economic importance of Pteridophytes

Unit II: Pteridophytes **18 Hrs**

General characters, Morphology and anatomy of its representatives of the groups Psilopsida (*Psilotum*), Lycopsida (*Lycopodium, Selaginella* and *Isoetes*), Sphenopsida (*Equisetum, Ophioglossom*), Pteropsida (*Angiopteris, Gleichenia*, *Salvinia* and *Azolla*).

Unit III: Gymnosperms **18 Hrs**

General characters – morphology of vegetative (Habit, stem and leaves) and reproductive organs (microsporophylls and megasporophylls) – Classification of Gymnosperms Sporne's system and Bhatnager system – Gymnosperms of India and their distribution – Economic importance of Gymnosperms

Unit IV: Gymnosperms **18 Hrs**

General characters, Morphology and anatomy of its representatives of the groups Cycadopsida (*Cycas*), Coniferapsida (*Pinus, Podocarpus, Araucaria*) and Gnetopsida (*Ephedra and Gnetum*).

Unit V: Paleobotany **18 Hrs**

Fossil forms of Pteridophytes – Anatomy (*Lepidodendron, Lepidocarpus, Calamites* and *Williamsonia*) – Origin (Algal and Bryophytic) of Pteridophytes and evolution – Fossil record for heterospory – Stelar evolution – Origin and development of fern leaf, sporophyll and sporangium (Eusporangium and leptosporangium) – Evolution and morphology of sorus in ferns – Origin of Gymnosperms – Evolution of male gametophytes – Origin and evolution of ovule – Paleozoic ovule (*Cardiocarpales*) – Comparison of ovules in gymnospermsand angiosperms.

#----------# Self Study Portion

Text Books (T.B.):

1. Rashid A. An introduction to Pteridophyta – Diversity, Development and Differentiation (2nd edition), Vikas Publications, 2013.
2. VastishtaPC Sinha AK Anikumar. Gymnosperms (Revised edition), S. Chand and Company, Pvt. Ltd., New Delhi, 2006.

Reference Books:

1. Sporne KR. The morphology of Pteridophytes (The structure of Ferns and Allied Plants). Hutchinson University, London, 1970.
2. Vastishta PC Sinha AK Anikumar. Pteridophyta (Revised edition), S. Chand and Company, Pvt. Ltd. New Delhi, (2006).
3. Stuart WN. Paleobotany and Evolution of Plants, New York Publications, 1998.

Unit I	:	T.B.1
Unit II	:	T.B.2
Unit V	:	T.B.3
Unit IV, V	:	T.B.2

SEMESTER I :CORE III

Microbiology, Plant Pathology and Immunology

Course Code: 17PBO1C3 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objective:

- To acquire knowledge on bacteria, virus and their infections on plants and to understand the immune system.

Unit I: Fundamentals of Microbiology **18 Hrs**

Fundamentals of Microbiology: Microscopy – Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes - Bright field, Dark field, Phase-contrast, Fluorescence, Electron Microscopy (TEM & SEM) and Confocal microscopy. Staining techniques – simple stain, negative stain, gram stain and acid fast stain. Freeze-etch and freeze fracture methods for EM, image processing methods in microscopy#. Introduction and Bacterial taxonomy – History, scope, bacterial classification - Bergey's manual of systematic bacteriology 9th Edition. #Sterilization- physical agents and chemical agents#.

Unit II:Morphology and physiology of Bacteria **18 Hrs**

Morphology and physiology of bacteria – size and shape of bacteria. Bacterial anatomy- cell wall, cytoplasmic membrane, cytoplasm, ribosomes, mesosomes, intracytoplasmic inclusions, nucleus, slimlayer and capsule, flagella, fimbriae, spore, pleomorphism and involution forms and L forms. Physiology of Bacteria – Culture media - Types of culture media, special media, selective media, and differential media. Culture methods - aerobic culture methods and anaerobic culture methods, strategies of cell divisions, growth, bacterial growth curve and Bacterial counts. Bacterial nutrition- #factors that affects growth#.Bacteriocins.

Unit III: Viruses **18 Hrs**

Viruses – Origin; occurrence; morphology of viruses – shape, size, Structure – helical viruses (naked and enveloped viruses), icosahedral (naked and enveloped virus), complex viruses; viral envelope; Nucleic acids; protein and carbohydrates. General characteristics of plant, animal and bacterial viruses.Outlne of virus classification – LHT system of classification and Dimmock et al classification.Isolation, cultivation and identification of viruses. #Host parasite

interaction Recognition and entry processes of viruses into plant host cells, alteration of host cell behavior by pathogens, #virus- induced cell transformation#, pathogen -induced diseases in plants, cell-cell fusion in both normal and abnormal cells.

Unit IV: Plant diseases **18 Hrs**

Nature and concept of plant diseases, Koch's postulates. Pathogenesis – Host Parasite Inter relationship and Interaction, Enzymes and toxins in plant diseases, Defense mechanism in plants, principles of plant disease control. Study of the following plant diseases – Downy mildew of grapes, smut of paddy, Rust of wheat, wilt of cotton, Brown rot of potato and #early blight of potato#.

UnitV: Immunology **18 Hrs**

Immunology: Innate and adaptive immune system-Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. Generation of antibody diversity, monoclonal antibodies, antigen –antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cell receptors, humoral and cell-mediated immune responses, the complement system, Toll- like receptors, cell-mediated effector functions, inflammation, #hypersensitivity and autoimmunity#.

#----------# Self Study Portion

Text Books (T.B.):

1. Dubey RC and Maheshwari DK. A text book of Microbiology, S.Chand &Company Ltd, 2010.
2. Ananthanarayan and Paniker's. Text Book of Microbiology 9th Edition, Universities press (India), Hyderabad, 2015.
3. Pandey BP. Plant pathology, S. Chand & company Ltd, 2011.
4. Mehrotra RS.Text book of Plant Pathology, Tata McGraw Hill publishing company, New Delhi, 2000.

Reference Books:

1. Pelczar MH Chan ECS and Krieg NR. Microbiology, Tata McGraw Hill Publishing co., Ltd, New Delhi, 1993.
2. Joanne M. Prescott, Microbiology (Eighth edition), 2011.
3. Mehrotra RS. Text book of Plant Pathology, Tata McGraw Hill publishing company, New Delhi, 2000.

Unit I : T.B.1; Unit II, III : T.B.2; Unit IV : T.B.4; Unit V : T.B.5

SEMESTER I : CORE IV

Laboratory Course for Core I, II, & III

Course Code: 17PBO1C4P **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 20**

Credits: 4 **External Marks: 80**

Objective:

- To develop skill in the micropreparation of thallophytes and bryophytes
- To develop skills in microbiological techniques and analysis of infected plant materials
- To acquire knowledge on the observation of morphology, vegetative and reproductive features of Pteridophytes and Gymnosperms.

1. Study of morphology of algae, fungi and archegoniatae prescribed in the syllabus. Make suitable micro preparation of types prescribed in the syllabus:

   Algae: *Gloeocapsa,Scytonema, Spirulina, Vaucheria, Ulva, Botrydium, Navicula*, *Pinnularia, Padina, Gracilaria, Sargassum, Batrachospermum, Laminaria* and *Gelidium.*

   Fungi: *Plasmodiophora, Pythium, Pilobolus, Taphrina, Lycoperdon, Fusarium, Usnea, Parmelia*

   Bryophytes:*Marchantia, Anthoceros, Sphagnum, Funaria, Polytrichum, Targionia, Reboulia*
2. Observation through permanent slides
3. Field trip of minimum three days to study the forms in native habitat.

Microbiology Immunology, Plant Pathology:

1. Isolation of microbes from soil by serial dilution and plating methods.
2. Gram's staining of bacteria in curd/root nodules.
3. Construction of growth curve of bacteria.
4. Isolation of Rhizobium from rootnodules of legumes.
5. Microbial analysis of Milk by Methylene-Blue Reduction Test
6. Micro preparation of infected plant materials - wilt of cotton, smut of paddy, rust of wheat, leaf and stem (T.S and L.S).

Pteridophytes:

Study of morphology and anatomy of the vegetative and reproductive partsof the following:

- *Psilotum, Lycopodium, Selaginella, Isoetes, Equisetum, Angiopteris, Ophioglossom, Gleichenia*, *Salvinia* and *Azolla*

Gymnosperms:

Study of morphology and anatomy of the vegetative and reproductivepartsof the following-

- *Cycas, Pinus, Podocarpus, Araucaria, Ephedra, Gnetum*

Paleobotany:

Study of following fossil forms

- *Lepidodendron, Calamites, Williamsonia,*
- Botanical tour for three days to study the native vegetation

SEMESTER I : ELECTIVE – I#

Industrial Botany

Course Code: 17PBO1CE1A **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objectives:

- To familiarize the students with the basics ofplant science related industrial techniques and help them employable.

Unit I: Algal biotechnology **18Hrs**

Commercial utility of algae– food and feed – pigments – pharmaceuticals – #neutraceuticals# – five chemicals – biofertilizers – importance of seaweeds SCP – *Spirulina* –mass culture and its applications.

Unit II: Biofertilizer technology **18 Hrs**

Concept and significance of biofertilizers – rhizobium biofertilizers – azotobacterbiofertilizers – azospirillum biofertilizers – azolla and BGA biofertilizers – VAM biofertilizers–#phosphate solubilizing bacterium (PSB) biofertilizers#.

Unit III: Biopesticide technology **18 Hrs**

Concept and significance of biopesticide – types of biopesticide and their application – Herbal biopesticide (azadiractine, rotenone and vitexpyrethrins) – Insect predators/parasites (lady bird beetle, Trichograma – fungal (*Trichoderma*, its isolation, mass multiplication and application) – #bacterial biopesticide (*Bacillus thuringensis*)#.

Unit IV: Fermentation technology **18 Hrs**

Fermentation-bioreactors-designing and types (stirred tank, airlift, tower type, cyclone column, hollow fibre and cylindro conical)-stages of fermentation-fermentation process- upstream stage, fermentation stage and downstream stage-fermentation products-amino acids, alcohols, organic acids (citric acid, lactic acid), polysaccharides, antibiotics-#alcoholic beverages-beer production, vine production#.

UnitV: Medicinal plant industry **18 Hrs**

Systemic method of cultivation and post harvest technology of medicinal & aromatic plants cultivated in India. I) senna ii) opium iii) aswagandhaiv) lemon grass v) bacopa vi) turmeric vii) ginger viii) jasmine-Import and export strategies of medicinal and aromatic plants in India. Nutraceuticals-antioxidants, polyunsaturated fatty acids, probiotics, prebiotics, #dietary fibers#.

#----------# Self Study Portion

Text Books (T.B.):

1. Kumaresan V. Biotechnology, Saras Publication, Nagercoil, 2013.
2. Dubey RC. A Text book of Biotechnology. Chand Publication, New Delhi 2006.
3. Kokate CK, Purohit AP and Gokahale. Phamacognosy, NiraliPrakasan, 2002.

Reference Books:

1. Hema Sane, SavitaRahangdale, SanjaykumarRahangdale. Text book of industrial botany. Vision Publication, India, 2013.
2. El-Mansi EMT Bryce CFA Demain AL Allman AR. Fermentation microbiology and biotechnology. Taylor&Francis, New York, 2006.

Unit I, II, III	:	TB 2
Unit IV	:	TB 1
Unit V	:	TB 3

SEMESTER I : ELECTIVE - I

Agricultural Microbiology

Course Code: 17PBO1CE1B **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 100**

Objective:

To understand the different aspects of agriculture microbiology

Unit I: Microbial World **18 Hrs**

Important groups of prokaryotes – photosynthetic bacteria, blue green algae, chemoautotrophic bacteria, spore forming bacteria, mycoplasma, viruses, bacteriophages and actinomycetes. Heterotrophic bacteria nitrobacteria, nitrogen-fixing bacteria and cyanabacteria, lactic acid bacteria, halophiles, thermophiles acidophiles and methanogens. Structure and classification of viruses, growth of viruses, lytic and lysogenic cycles, plant viruses, viroids.

Unit II: Microbial Ecology and Physiology **18 Hrs**

Microbiology of ecosystems - soil, rhizosphere, phyllosphere, water - fresh and marine, and air. Microbial interactions - symbiosis, synergism, commenalism, parasitism, amensalism, antagonism and predation, adoption of micro-organisms to various ecosystems. Microbial growth curve. Mathematical expression of growth -continuous and batch cultures. Diauxic and synchronous growth. Microbial nutrition. Bacterial metabolism - aerobic and anaerobic respiration, electron transport chain, microbial photosynthesis, oxidative and substrate level photo-phosphorylation.

Unit III: Soil Microbiology **18 Hrs**

Major groups, decomposition of organic matter, soil health. Root exudates and rhizosphere effects. Nitrogen cycle: ammonification, nitrification and denitrification. Biological nitrogen fixation–symbiotic and asymbiotic. Biochemistry and genetics of nitrogen fixation. Microbial

transformations of phosphorus, sulphur and minor nutrients. Role of bio-fertilizers in agriculture and forestry. Bioremediation of problem soils, plant growth promoting rhizobacteria and their mode of action.

Unit IV: Environmental Microbiology **18 Hrs**

Isolation and preservation of different types of microorganisms. Methods of sterilization and disinfection. Microbial assay of vitamins, enzymes and antibiotics, Pollution of soil, water and air, Role of microorganisms in pollution, sources of pollution and their impact on environment, microbiology of sewage and industrial effluents and their safe disposal, management of solid and liquid organic wastes, composting, biogas, water purification, sewage treatment, water-borne diseases and effluent management.

Unit V: Microbial Biotechnology **18 Hrs**

Industrial production of metabolites - organic acids, alcohols, antibiotics. Fermentor designs and types. Control of fermentation process - batch, feed batch and continuous. Downstream processing in fermentation industry. Production of single cell proteins and probiotics, hormones, biofertilizers, biopesticides. Phytoremediation. Microbiology of raw and processed foods. Fermented food – vinegar, wine saucrkraut, pickles, cheese, yogurt.

Text Books (T.B.):

1. Stanier, PR Ingraham Wheelis ML and Painter PR. The microbial world, Prentice. Hall of India Private Limited, New Delhi, 1990.
2. Alexander M. Microbial Ecology, John Wiley and Sons Inc. NY, 1971.
3. Marshall KC. Advances in Microbial Ecology. Vol.8, Plenum press, 1985.
4. Dirk J Elas V Trevors JT Wellington EMH. Modern Soil Microbiology. Marcel Dekker INC, New York, Hong Kong, 1997.
5. Atlas RM and Bartha R. Microbial Ecology Fundamentals and Application (4th edition) - LPE, Pearson Education. Inc., 2005.
6. Forster CF. Biotechnology and Wastewater Treatment, Cambridge Uni. Press. Cambridge, 1985.
7. Gray NF. Biology of waste water Treatment, Oxford University Press Oxford, 1989.

Unit I : T.B. 1; Unit II : T.B. 2, 3; Unit III : T.B.4, 5; Unit IV : T.B. 6, 7; Unit V : T.B. 8

SEMESTER II : CORE V

Cell and Molecular Biology

Course Code: 17PBO2C5 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

Objective:

- To understand the biological phenomena of cell

Unit I: Cell biology **18 Hrs**

Cell theory – Comparison of archaea and eukarya – General structure – Plasma membrane – composition – bilayer and micellar models – freeze fracture and FRAP techniques – cross membranal transport of water and glucose – types of transport ATPases – ion-selective channels – #Cell wall – ultra structure# – plasticity – secondary cell wall – fixation – purpose and types – stains, mordants, and differential staining

Unit II: Cell organelles **18 Hrs**

Nucleus – structure – functions of nuclear pore complex – nucleolus – chromatin –ultrastructure of mitochondria – mitrochondrial genome – general properties– Ultra structure of chloroplast – molecular organization of thylakoid membrane – photosynthetic apparatus – symbiont nature – chloroplast DNA – #Structure and functions of ER#, Golgi complex, ribosome – cytoskeletons.

Unit III: Cell cycle and division **18 Hrs**

Cyclins and cdk – events of cell cycle - M-Phase – cell growth and cycle progression – genetic regulation of cell cycle in Yeast – Cellular check points – DNA replication – DNA polymerases – eukaryotic system – origin, elongation and termination mechanisms – replication models – Cairn's model, linear DNA model, rolling circle model – #inhibitors of replication#.

Unit IV: Gene expression **18 Hrs**

Expression of genome – Transcription – RNA polymerases – prokaryotic, eukaryotic - transcription in eukaryotes – promoters mediated initiation – #RNA polymerases I, II and III# – elongation and termination – post transcriptional processing – genetic code – Wobble's hypothesis – protein synthesis – activation of amino acids – initiation, elongation and termination of translation.

Unit V: Regulation of gene expression **18 Hrs**

Proteins of transcriptional regulation – regulation in prokaryotes – Lac Operon model – Eukaryotic regulation - response elements – DNA binding domains – promoters, repressors, coactivators, corepressors, enhancer elements – #DNA repair mechanisms#.

Text Books (T.B.):

1. Ajoy Paul Text Book of Cell and Molecular Biology, Books and Allied (P)Ltd, 2007.
2. Buchanan BB Gruissem W Jones RL. Biochemistry and Molecular biology of Plants, IK International Publishers, New Delhi. 2000.
3. Freifelder D. Molecular Biology (2nd edition) Narosa Publishers, New Delhi. 1994.
4. Verma PS Agarwal VK. Molecular Biology (First edition),S.Chand and Company Ltd. New Delhi, (2009).

#----------# Self Study Portion

Unit I, II, III, IV, V : T.B.1

SEMESTER II : CORE VI

Plant Anatomy and Embryology

Course Code: 17PBO2C6 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

Objectives:

- To understand the concept of plant internal structure and reproductive mechanism.

Unit I: Meristems and permanent tissues **18 Hrs**

General account and theories of organization of shoot and root apical meristems, quiescent centre. Structural diversity and phylogenetic trends of specialization of xylem and phloem. Cambium – origin, cellular structure, cell division, storied and nonstoried types. Cambium in budding and grafting - Wound healing role. #Periderm and lenticels#.

Unit II:Structure of plant organs **18 Hrs**

Anatomical characteristics and vascular differentiation in primary and secondary structure of root and stem in dicot and monocot. Origin of lateral roots – Root - stem transition - Anatomy of dicot and monocot leaves. Leaf abscission and #stomatal types#.

Unit III:Normal andanomalous secondary growth **18 Hrs**

Secondary growth in normal dicot stem and root. Anomalous secondary growth in dicot (*Boerhaavia, Achyranthes* and *Bignonia*) and monocot (*Dracaena*) stems. Nodal anatomy – Anatomy and vascularisation of flower, seed coat anatomy. Ecological anatomy (hydrophytes and xerophytes) Wood anatomy #Vessel features and Wood parenchyma#.

Unit IV: Micro and megasporangium **18 Hrs**

Embryology: Microsporangium - structure, Microsporogenesis - Microspores – arrangement, morphology, ultrastructure - Microgametogenesis - Pollen stigma incompatibility - Methods to overcome incompatibility - Megasporangium - Megagametogenesis - Femalegametophyte – Types of embryosac - monosporic(*Oenothera*), bisporic (*Allium*) and tetrasporic (*Plumbago*). # Nutrition of embryo sac and double fertilization.#

Unit V: Reproductive and vegetative embryology **18 Hrs**

Endosperm - types - endosperm haustoria. Cytology and physiology of endosperms - Functions of endosperms - Embryo development in dicot and monocot, Nutrition of embryo - Polyembryony - causes, Apomixis - causes, Apospory and their role in plant improvement #seed development#.

#..... # Self-study portion

Text Books (T.B.):

1. Pandey SN and Chadha A. Plant Anatomy and Embryology. Vikas Publishing house (P) Ltd, New Delhi, 2009.
2. Pandey BP. Plant Anatomy. S.Chand and Company Ltd, 2009.

Reference Books:

1. Vasishta PC. A Text Book of Plant Anatomy S. Nagin& Co., New Delhi, 1977.
2. Eames AJ and Mc Daniels LH. An Introduction to Plant Anatomy Tata-McGraw-Hill Publishing Co., (P)Ltd., New Delhi, 1979.
3. Esau K. Plant Anatomy, (2nd edition) Wiley Eastern Ltd., New Delhi,1980.
4. Charles B. Beck. An Introduction to Plant Structure and Development: Plant Anatomy for the Twenty-First Century (2nd edition), Cambridge University Press, 2010.

Unit I, II, III, IV, V : T.B. 1, 2

SEMESTER II :CORE VII

Genetics, Evolution and Plant Breeding

Course Code: 17PBO2C7 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objectives:

- To understand the concept of heredity and extra chromosomal inheritances.
- Acquire knowledge on genetic transformation, recombination, evolution, molecular mutation, plant breeding and ploidy breeding.

Unit I: Mendelian principles **18Hrs**

Mendelian principles – Dominance, segretation, independent assortment. Concept of gene – allele, multiple alleles, pseudo allele, complementation of tests. Extensions of Mendelian principles – codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, #sex limited and sex influenced characters#.

Unit II: Microbial Genetics **18Hrs**

Microbial genetics- Methods of genetic transfers – transformation, conjugation, transduction and sexduction, mapping genes by interrupted mating, fine structure analysis of genes. #Mutation – Types, causes and detection#, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. Structural and numerical alterations of chromosomes – Deletion, duplication, inversion, translocation.

Unit III: Evolution **18Hrs**

Emergence of evolutionary thoughts: Lamarck; Darwin – concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; the evolutionary synthesis. Origin of cells and unicellular evolution – Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of oparin and Haldane; Experiment of Miller (1953); The first cell; Evolution of prokaryotes; #Origin of eukaryotic cells#.

Unit IV: Introduction to Plant Breeding **18Hrs**

Introduction to Plant Breeding- Introduction, scope of plant breeding, History of plant Breeding, Indian Agricultural Research Institute (IARI) and achievements in plant breeding. Crop improvement- objectives of crop improvement, methods of crop improvement, acclimatization, mass selection, pure line selection, objectives of hybridization, #hybridization technique#, emasculation, bagging and crossing.

UnitV: Ploidy Breeding **18Hrs**

Ploidy breeding- Types of polyploids, auto polyploids, allopolyploids. Mutation breeding- Types of mutations, spontaneous mutations, induced mutations, induced mutations by radiations, ionizing radiations, non ionizing radiations and Gamma garden. Breeding for disease resistance- Resistance breeding method, advantages of resistance breeding, disadvantages of resistance breeding.Non conventional methods anther culture, embryo/ovule culture, somoclonal variation, #somatic embryogenesis and high yielding varieties#.

#----------# Self Study Portion

Text Books (T.B.):

1. Verma PS and Agarwal VK. Genetics, S Chand & Co., Pvt. Ltd., New Delhi, 2009.
2. Shukla and Chand. Cytogenetics, Evolution and Biostatistics, S. Chand Publications, 2009.
3. Kumaresan V. Horticulture and Plant Breeding (First edition),Saras Publications, 2009.

Reference Books:

1. Verma PS and Agarwal VK. Genetics (9th edition), S. Chand& company Ltd, 2010.
2. Gardner EJ and Shusted DP. Principles of Genetics (7th edition), John Wiley & Sons, NY Chichester, Brisbane, Toronto, Singapore, 1984.
3. Gupta PK. Genetics, Rastogi Publishers, Meerut, India, 2000.
4. Shukla and Chand. Cytogenetics, Evolution and Biostatistics, S.Chand Publications,2009.

Unit I, II	:	T.B. 1
Unit III	:	T.B. 2
Unit IV, V	:	T.B. 3

SEMESTER II : CORE VIII

Laboratory Course for Core V, VI & VII

Course Code: 17PBO2C8P **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 20**

Credits: 4 **External Marks: 80**

Objectives:

To enable the students to

- Develop skills in plant molecular biology techniques
- Understand internal organization of plant body.
- Learn, perform and develop skills in plant propagation and nursery techniques under laboratory and field conditions.

Cell and Molecular Biology:

1. Observation of cells in onion peeling
2. Observation of cell division stages in onion root tips / Rheo flower buds.
3. Differential staining for characterization of cells.
4. Isolation of total DNA from onion bulbs.
5. Isolation of plasmid DNA from bacteria.
6. Demonstration of agarose gel electrophoresis of plasmid and genomic DNA
7. Construction of restriction map of plasmids using geometric method.

Plant Anatomy:

Preparation of transverse sections of the following plant parts to observe and record their internal structure.

1. Monocot and dicot stem
2. Monocot and dicot leaf
3. Normal secondary thickening in dicot stem
4. Anomalous secondary thickening in *Dracaena, Nyctanthes* and *Boerhaavia, Achyranthes, Bougainvillea, Aristolochia, Bignonia* stems.
5. Nodal anatomy- uni and trilacunar nodes – *Polyalthia, Azadirachta, Aralium*.

Embryology:

1. T.S. of anther (young and mature).
2. Pollen types.
3. L.S. of ovule.
4. Types of ovules-orthotropous and anatropous.
5. Dicot embryo dissection – *Tridax, Cucumber*

Genetics, Evolution:

- Genetic problems related to monohybrid cross – (Backcross & Test cross), Dihybrid cross, Epistasis, Multiple alleles, Linkage and crossing over, Sex linkage and Sex linked inheritance.

Spotters on:

- Transformation, conjugation, transduction and sex-duction.
- Mapping of genes
- Mutation – somatic mutants
- Chromosomes – Deletion, duplication, inversion and translocation.
- Lamarckism, Darwinism, Experiment of Miller (1953)

Plant breeding:

- Techniques on emasculation, crossing and bagging

SEMESTER II : ELECTIVE II#

Horticulture and Greenhouse Technology

Course Code: 17PBO2CE2A **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objectives:

To enable the students to

- Appreciate the nature of soil required, methods of irrigation and plant propagation
- Learn the production technologies of commercial vegetable, flower and fruit plants
- Acquire knowledge on construction, design and maintenance of a greenhouse

Unit I: Soil, Fertility and Irrigation: **18 Hrs**

Importance and scope, Divisions of Horticulture, Classification of horticultural plants. Types of soils of India, Physical and chemical composition of soil, Soil salinity, Acidic and alkaline soils and their remediation. Soil microbiology, Soil fertility: evaluation, soil testing; Use of manures and fertilizers, Maintenance of soil fertility, Method and time of application of fertilizers. Irrigation water quality, #Different types of irrigation methods and micro-irrigation#.

Unit II: Plant propagation: **18 Hrs**

Natural method: Propagation by seeds and by specialized vegetative structures. Artificial methods: Cutting: Types - root, stem, leaf cuttings. Layering: Types- simple, compound (serpentine), tip, trench, mound, air-layering. Grafting: Types - splice, whip/tongue, side, veneer, cleft, bark, epicotyl, approach, repair grafting- inarching, bridge and bracing. Budding: Tools required for budding, Types - T-budding, shield, patch, and ring budding; #Bud selection and certification, Aftercare of budded plants#.

Unit III: Commercial Horticulture: **18 Hrs**

Importance, species, varieties and production technology of: Rose, Jasmine and Marigold; Mango, Banana and Citrus; Tomato, Brinjal and Cabbage. Ornamental horticulture: #Cultivation, care and maintenance of cacti, succulents, ferns, palms and cycads#.

UNIT IV: Greenhouse Technology: 18 Hrs

Importance, scope and status of producing horticultural crops in greenhouse. Structure and construction of a Greenhouse - location, frame work for various types of greenhouse, covering material, construction of typical glasshouse/poly house/ net house, Construction of floors and layout, #Design and development of low cost greenhouse structures#. Automated greenhouses, microcontrollers, waste water recycling. Heating: Sources of heat, Cooling: Types of cooling, Environmental control: air temperature, sunlight, carbon dioxide, relative humidity.

Unit V: Greenhouse media, Nutrition, Pest and Disease management: 18 Hrs

Root medium: Properties of root medium for greenhouse, Media handling, FYM, concentrated organic manures, macro and micronutrient availability. Media components: peat, bark, sawdust, coir, crop-by product, composted garbage, perlite, vermiculite, sand, rock wool, polystyrene foam.

Plant nutrition: Fertilizers – chemical and organic; Choice of nitrogen fertilizers and time of application; Water quality and sanitation, Methods of irrigation - drip irrigation, micro irrigation; Fertigation, Advanced protected agricultural systems - plastic mulches. #Management of pest and diseases – physical, chemical, biological, Integrated Pest Management (IPM)#.

#----------# Self Study Portion

Text Books(T.B.):

1. Sheela VL. Horticulture MJP Publishers, Chennai, 2011.
2. Kumaresan V. Horticulture Saras publication, Nagercoil, 2014.
3. Introduction to soil science: http://www.agrimoon.com/wp-content/uploads/Introduction-to-Soil-Science.pdf

References Books:

1. Prasad S and Kumar U. Green House Management for Horticultural Crops. Agrobios India
2. Ramachandrappa and Nanjappa. Fertigation Technology, Agrobios, India
3. Gupta P K Manures and soil fertilizers.
4. George Acquaah. Horticulture, Principles and Practices. Eastern Economy Edition.
5. Alex Lauric and Victor h Ries. Floriculture, Fundamentals and Practices. Agrobios, India

6. Randhava, GS and Mukhopadhay A. Floriculture in India Allied Publishers Limited
7. Greenhouse BMPs, UMass Extension, MDAR, 2010

Unit I	:	T.B. 2, 3
Unit II	:	T.B. 1, 2
Unit III	:	T.B. 2
Unit IV	:	T.B. 1, 2
Unit V	:	T.B. 1

SEMESTER II : ELECTIVE II

Floriculture

Course Code: 17PBO2CE2B **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objectives:

To understand the fundamentals and potentials of floriculture

Unit I: Breeding **18 Hrs**

Breeding methods suitable for sexually and asexually propagated flower crops and ornamental plants; Breeding constraints and achievements made in commercial flowers - rose, jasmine, chrysanthemum, marigold, dahlia, gerbera, gladioli, orchids, anthurium; Breeding constraints and achievements made in ornamental plants – petunia, hibiscus, bougainvillea, Flowering annuals (zinnia, cosmos, dianthus, snap dragon, pansy) and ornamental foliages– Introduction and selection of plants for waterscaping and xeriscaping.

Unit II: Production Technology of Cut Flowers **18 Hrs**

Scope of cut flowers in global trade, Global Scenario of cut flower production, Varietal wealth and diversity, area under cut flowers and production problems in India, Growing environment, open cultivation, protected cultivation, soil requirements, artificial growing media, soil decontamination techniques, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO2 on growth and flowering; Flower production – water and nutrient management, fustigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

Unit III: Production Technology for Loose Flowers **18 Hrs**

Scope of loose flower trade, Significance in the domestic market/export, Varietal wealth and diversity, propagation, sexual and asexual propagation methods, propagation in mist chambers, nursery management, pro-tray nursery under shade nets, transplanting techniques; Soil and climate requirements, field preparation, systems of planting, precision farming techniques; Water and nutrient management, weed management, rationing, training and pruning, pinching

and disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies.

Unit IV: Protected Floriculture **18 Hrs**

Prospects of protected floriculture in India; Types of protected structures – Greenhouses, polyhouses, shade houses, rain shelters etc., Designing and erection of protected structures; Low cost/Medium cost/High cost structures – economics of cultivation; Location specific designs; Structural components; Suitable flower crops for protected cultivation; Environment control – management and manipulation of temperature, light, humidity, air and CO2; Heating and cooling systems, ventilation, naturally ventilated greenhouses, fan and pad cooled greenhouses, light regulation; Containers and substrates, soil decontamination, layout of drip and fertigation system, water and nutrient management, weed management, physiological disorders, IPM and IDM.

Unit V: Value Addition **18 Hrs**

Prospects of value addition, National and global scenario, production and exports, Women empowerment through value added products making, supply chain management; Types of value added products, value addition in loose flowers, garlands, veni, floats, floral decorations, value addition in cut flowers, flower arrangement, styles, Ikebana, morebana, free style, bouquets, button-holes, flower baskets, corsages, floral wreaths, garlands, etc.; Selection of containers and accessories for floral products and decorations; Dry flowers– Identification and selection of flowers and plant parts; Raw material procurement, preservation and storage.

Text Books (T.B.):

1. Randhawa GS and Mukhopadhyay A. Floriculture in India, Paperback, Allied Publishers, Pvt. Ltd., 1986.
2. Arora JS. Introductory ornamental horticulture, Paperback, Allied Publishers, Pvt. Ltd., 2013.

Unit I, II, III, IV, V : T.B. 1, 2

SEMESTER III : CORE IX

PLANT PHYSIOLOGY

Course Code: 17PBO3C9 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

Objectives:

To enable the students to

- Understand the concepts and mechanism of plant functions

Unit I: Plant water relations **18 Hrs**

Water - Structure and properties, Water transport processes - diffusion, osmosis, chemical potential, water potential, absorption of water, mechanism of water transport – Apoplast and symplast concept –Accent of sap – SPAC concept, Theories explaining accent of sap. Transpiration and its significance, mechanism of stomatal movement. Membrane permeability - Nutrient uptake and transport mechanism - ion pumps and carriers, active and passive transport, transcellular transport, - phloem translocation - phloem loading and unloading, #mechanism of phloem translocation#.

Unit II: Photosynthesis and respiration **18 Hrs**

Photosynthetic pigments and light harvesting complex, photooxidation of water, mechanism of electron and proton transport – Z scheme of e-transport chain and photophorylation. Carbon assimilation – the Calvin cycle, photorespiration and its significance, the C4 cycle, the CAM pathway, CO2 concentration mechanism.Respiration – glycolysis, Krebs cycle, electron transport and ATP synthesis, #pentose phosphate pathway#, cyanide - resistant respiration.

Unit III: Nitrogen fixation, Growth and Development **18 Hrs**

Biological nitrogen fixation - nodule formation and nod factor, mechanism of nitrogen fixation, genes involved in nitrogen fixation, nitrate and ammonium assimilation pathways. Growth and development: Physiological effects and mechanism of action auxins, gibberellins, cytokinins, ethylene and abscisic acid. Photomorphogenesis– concept, types of photoreceptors, phytochromoes, photorespornses types – cytochromoe role, flowering – #photoperiodism – short day, long day and day neutral#, vernalization.

Unit IV: Stress physiology **18 Hrs**

Plant responses to abiotic and biotic stress, mechanism of abiotic and biotic stress tolerance, water stress, #heat stress and adaptation#, salt stress and osmotic adjustment, metal toxicity, chilling and freezing stress, oxygen deficiency and acclimation, free radicals and oxidative stress, antioxidative defense mechanism, stress proteins.

Unit V: Fruit ripening **18 Hrs**

Introduction, changes during ripening, controlled atmosphere storage, design of ripening rooms, #ethylene on ripening, sources of ethylene, alternative gases to ethylene, mechanism of ripening# – climatic rice, shelf life of tropical fruits, Biological clocks in plants – circadian rythms.

#----------# Self Study Portion

Text Books (T.B.):

1. Jain VK. Fundamentals of plant physiology, (14thRevised edition), S. Chand & Company Ltd., New Delhi, 2012.

Reference Books:

1. Leopold AC. Plant growth and development, Tata McGraw-Hill Co, 1973.
2. Nobel, PS. Introduction to Biophysical Plant Physiology. W. H. Freeman and Company, San Francico, 1970.
3. Salisbury FB and Ross CW. Plant Physiology (Third edition), CBS Publishers and Distributors, New Delhi, 1986.
4. Taiz L and Zeiger E. Plant physiology (Second edition). The Benjamin/Cummings publishing company, Inc., California, New York, 1998.

Unit I, II, III, IV, V: T.B.1, 2.

SEMESTER III : CORE X

BIOCHEMISTRY, BIOPHYSICS AND BIOINSTRUMENTATION

Course Code: 17PBO3C10 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

Objectives:

To enable the students to

- Appreciate the importance, classification and structure of major biomolecules and to understand the concepts of metabolic process
- Acquire knowledge of biophysical processes
- Learn the principle and applications of some common biological instruments and techniques

Unit I: Carbohydrates and Lipids **18 Hrs**

Importance, Nomenclature, Classification, Asymmetry, Isomerism, Optical Isomerism, Mutarotation, Formulation of Monosaccharides, Formula of Glucose - Linear Form, Ring Form, Haworth Perspective Formula, Conformation of Pyranose and Furanose Rings, Sucrose, Lactose, Maltose, Cellobiose, Homopolysaccharides - Starch, Glycogen, Inulin, Cellulose, Pectin, Chitin; Hemicelluloses - Xylan; Heteropolysaccharides, Mucopolysaccharide

Lipids and Fatty acids - Importance, Components; Fatty acids - saturated and unsaturated, #Lipids - simple, compound and derived lipids#.

Unit II:Enzymes **18 Hrs**

Importance, Nomenclature and Classification, Isolation and purification, Characteristics of enzymes, Energy Mechanics of enzymatic Reactions, Michaelis-Mentenhypothesis, Michaelis-Mentenequation, Lineweaver-Burk equation, Significance of Km and Vm values, Active site, Enzyme reaction rates, Enzyme inhibition - competitive, noncompetitive, uncompetive, allosteric.

Vitamins and coenzymes - General characteristics, #Classification and Structure of fat-soluble and water-soluble vitamins#.

Unit III: Metabolism **18 Hrs**

Definition, Terminology, Functions, Subdivisions of metabolism, Metabolic pathways - catabolic pathways, anabolic pathways; Central Pathways, Catabolism versus anabolism,

Anaplerotic pathways, Secondary pathways, Unifying themes of metabolic pathways, Regulation of metabolic pathways, #Evolution of metabolic pathways#.

Unit IV: Biophysics **18 Hrs**

Molecular interactions in biological systems - chemical behavior of atoms (orbit and orbital) – Thermodynamic processes - isothermal, adiabatic, isobasic, isochoric and cyclic processes – First, Second and third laws of thermodynamics - brief explanation, limitations and applications in biology – Gibbs free energy and its functions in biological system – application of biophysics of plant-water relations –#biophysics of photosynthesis# – redox potential.

UNIT V: Bioinstrumentation **18 Hrs**

pH meter - Principle, pH electrodes, Applications

Spectrophotometry– Principle, Spectrophotometer, Applications.

Electrophoresis – Principle, Types, SDSPAGE, Agarose gel electrophoresis; Applications.

#Centrifuge - Principle, Types of centrifuges, Applications of centrifugation#

Chromatography – Classification of chromatographic methods, Paper chromatography, Thin layer chromatography, Column chromatography; Isotopic tracer technique - Stable and radioactive isotopes, Geiger-Muller counter. Scintillation counting.Applications.

#----------# Self Study Portion

Text Books (T.B.):

1. Jain JL Jain S and Jain N. Fundamentals of Biochemistry, S. Chand Publishing, 2004.
2. Gurumani N. Research methodology, MJP publishers, Chennai, 2006.
3. Banerjee PK. Introduction to Biophysics, S Chand Publishing, New Delhi, 2008.

Reference Books:

1. Berg JM Tymoczko JL Stryer L. Biochemistry (Fifth edition), W H Freeman and Company
2. Nelson DL Cox MM. Lehninger Principles of Biochemistry (Fourth edition)

Unit I, II, III : T.B. 1

Unit IV : T.B. 3

Unit V : T.B. 1, 2

SEMESTER III : CORE XI

Plant Systematics and Ethnobotany

Course Code: 17PBO3C11 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objectives:

- To impart knowledge on plant systematics and its applications.
- To familiarise the students with plants having immense economic importance.

Unit I: Classification of Angiosperms **18 Hrs**

Historical account - classification of angiosperms (classification of Linnaeus, Bentham and Hooker, Engler and Prantl) – APG III classification - chemotaxonomy and #numerical taxonomy# – applications of DNA barcoding.

Unit II: Nomenclature and taxonomical techniques **18 Hrs**

Principles of ICBN – typification, Principles of priority and their limitations, author citation, #key for identification of plants (indended and bracket key)#, monographs, periodicals, floras and manuals, data banks, use of molecular tools in taxomomy, use of cladistics methodology in taxonomy.

Unit III: Families of Angiosperms **18 Hrs**

A detailed study of the following families: Ranunculaceae, Magnoliaceae, Menispermaceae, Caryophyllaceae, Portulacaceae, Rhamnaceae, Vitaceae, #Meliaceae#, Sapindaceae, Combretaceae and Aizoaceae.

UnitIV: Families of Angiosperms **18 Hrs**

Boraginaceae, Convolvulaceae, Scrophulariaceae, Bignoniaceae, Verbinaceae, Amaranthaceae, Nyctaginaceae, Polygonaceae, Orchidaceae, Commelinaceae, Typhaceae, #Cyperaceae# and Poaceae.

Unit V:Ethnobotany **18 Hrs**

Introduction - Ethnobotany as an emerging science and its scope - basic knowledge of tribes with special reference to Tamil Nadu (kanikkars, kurumbas, irulas, badagas, kothas and todas) – sources and forms of tribal medicines – #ethnoveterinary medicines#

#----------# Self Study Portion

Text Books and web links (T.B.):

1. Annie Ragland and Kumaresan. Angiosperms. Saras Publication, Nagercoil, 2013.
2. Pandey BP. Taxonomy of Angiosperms. Chand Publication, New Delhi, 2007.
3. Jain SK. Methods and approaches in Ethnobotany, Society of Ethnobotanists, Lucknow, 1989.
4. http://francescofiume.altervista.org/taxa/APG.pdf
5. https://www.researchgate.net/publication/285322603_DNA_barcoding_and_its_applications_-_A_critical_review

Reference Books:

1. Gamble, JS. Flora of the presidency of Madras . Vol. I,II & III. BishensinghMahendrapalsingh, India, 1956.
2. Lawrence, GHM. Taxonomy of Vascular plants, Oxford & IBH Publishing company (P) Ltd, New Delhi, 1964.
3. Sambamurty, AVSS. Taxonomy of Angiosperms, I.K. International Pvt. Ltd., 2005.
4. Sivarajan, V. Principles of plant taxonomy, Oxford and IBH, 1999.
5. Subramanium, NS. Modern Plant taxonomy. Vikas publishing house, New Delhi, 1995.

Unit I	:	T.B. 2
Unit II	:	T.B. 1
Unit III	:	T.B. 2
Unit IV	:	T.B. 1, T.B. 2
Unit V	:	T.B. 1

SEMESTER III : CORE XII

Laboratory Course for Core IX, X and XI

Course Code: 17PBO3C12P **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 20**

Credits: 4 **External Marks: 80**

Objectives:

To enable the students to

- Develop skills in design and performance of physiology and biochemical experiments, collection, analysis and interpretation of experimental data.
- To develop skills in taxonomicidentification of plants.

Plant Physiology:

1. Determination of water potential by gravimetric method.
2. Effect of various physical and chemical treatments on membrane permeability.
3. Determination of stomatal index
4. Estimation of chlorophyll, carotenoids and their absorption spectra in C3 and C4 plants.
5. Measurement of Photosynthesis - Hill Reaction.
6. Survey of C3, C4 and CAM plants.
7. Assay of nitrate reductase activity.
8. Extraction and estimation of leghaemoglobin from root nodules.
9. Estimation of phenols in plant tissues affected by abiotic/biotic stress.
10. Assay of peroxidase activity in plant tissues affected by biotic/abiotic stresses.

Biochemistry and Biophysics:

1. Preparation of molal, molar, normal and percentage solutions and their dilutions.
2. Extraction and estimation of proteins by Lowry's method
3. Extraction and estimation of lipids in seeds
4. Extraction and estimation of total carbohydrates
5. Extraction of amylase and determination of its activity
6. Determination of km-value, V-max, Michael's constant for amylase

Bioinstrumentation:

1. Determination of dissociation constant of weak acids
2. Verification of Beer's law
3. Separation and identification of amino acids/pigments by paper/thin layer chromatography and calculating the Rf values
4. Protein profile (SDS-PAGE).in plants under stress.

Plant Systematics:

1. Identification of binomial nomenclature for the available species from the local flora using Gamble's flora.
2. Detailed study of the plant families mentioned in the theory with two representative species from the local area.
3. Solving the taxonomical problems
4. Each student has to submit 25 herbarium specimens of local flora.
5. Field study to familiarize the angiosperm plants (3 days) and submission of field report.

Ethnobotany:

- Identification of family, genus, species, morphology of the useful parts and uses of following tribal medicinal plants.

  Abutilon indicum – Tuthi

  Achyranthusaspera – Nayuruvi

  Ficusbenghalensis – Aal

  Catharanthusroseus– Suddukattumalli

  Cissusquadrangularis– Perandai

  Cassia aricualta– Avarai

  Datura metal – Oomathai

  Boerhaaviadiffusa– Mookirattai

  Asparagus ravemosus– Shimaishadavari

  Erythroxylummonogynum- Sirinerinji

SEMESTER III : ELECTIVE III#

Bioinformatics and Biostatistics

Course Code: 17PBO3CE3A **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objectives:

To enable the students to

- Acquire knowledge on biological databases
- Appreciate the structure of proteins and nucleic acids
- Learn the principles of sequence analysis

Unit I: Biological databases **18 Hrs**

Bioinformatics - an overview, internet in bioinformatics; Biological databases: primary nucleotide sequence databases- GeneBank, EMBL, DDBJ; primary protein sequence databases – UniProt, PIR; secondary databases – Prosite, Prints, Pfam, CATH, SCOP, FSSP; structure database – PDB, Other relevant databases-KEGG, PQS; Literature database, file formats of genbank, Swissprot and PDB. Data retrievalusingEntrez and SRS.#Biodiversity database (brief account)#.

Unit II: Proteins and amino acids **18 Hrs**

Amino acids- structure, classification; Peptide bonds, Levels of protein structure - helix, sheet and turns - Ramachandran plot - Super secondary structures - Domains -Quaternary structure. DNA and RNA structure - Watson and Crick model - A, B and Z forms of DNA - #RNA secondary structure#.

Unit III: Biological Sequence analysis **18 Hrs**

Pair wise sequence comparison - Scoring matrix, Dynamics programming, Heuristic methods – FASTA, BLAST.Multiple sequence alignments –Phylogenetic alignment. #Protein structure visualization tools –RasMol#, SwissPDB Viewer.

Unit IV:Biostatistics **18 Hrs**

Brief history, definition, importance; Sampling techniques - Data – types, collection, classification, tabulation, presentation-diagrammatic and graphical; Measures of central tendencies - mean, median and mode; Measures of dispersion - range, mean deviation, variance, standard deviation and standard error; #Skewness and Kurtosis#.

Unit V:Probability and Probability distribution **18 Hrs**

Binomial, Poisson and normal distribution; #Correlation – types and methods of studying#; Regression (Simple and Linear) - Types, analysis and significance; Tests of significance – t-test, G-test, Chi-square test, F-test and ANOVA (one way and two way).

#----------# Self Study Portion

Text Books (T.B.):

1. Sundaralingam R and Kumaresan V. Bioinformatics, Saras publications, Nagercoil, 2015.
2. Lohar PS. Bioinformatics, MJP publishers, Chennai, 2009.
3. Jain JL Sunjay Jain and Nitin Jain. Fundamentals of Biochemistry, S. Chand Publishing 2004.
4. Attwood TK and Parry-Smith DJ. Introduction to Bioinformatics, Pearson Education Ltd., New Delhi, 2004.
5. Lesk AM. An introduction to Bioinformatics (Second edition), Oxford University Press. New Delhi, 2006.

Reference Books:

1. Jin Xiong, Essential Bioinformatics, Cambridge University Press, UK, 2006.
2. David W. Mount, Bioinformatics - Sequence and genome analysis, Cold Spring Harbor Laboratory Press, New York, 2001.

Unit I : T.B. 1

Unit II : T.B. 2, 3

Unit III : T.B. 1, 2

SEMESTER III : ELECTIVE III

Biodiversity and Conservation

Course Code: 17PBO3CE3B **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objectives:

To understand the principles and concepts of Biodiversity and conservation

Unit 1 - Biodiversity –Concept and definition **18 Hrs**

Scope and Constraints of Biodiversity Science, Composition and Scales of Biodiversity: Genetic Diversity, Species/Organismal Diversity, Ecological/Ecosystem Diversity, Landscape/Pattern Diversity, Agrobiodiversity, Bicultural Diversity and Urban Biodiversity

Unit 2 - Causes of Biodiversity **18 Hrs**

Origin of Species /Speciation: History of the Earth and Biodiversity patterns through Geological times; Current Centers of Biodiversity

Unit 3 - Values of Biodiversity **18 Hrs**

Instrumental/Utilitarian value and their categories, Direct use value; Indirect/ Non-consumptive use value, Introduction to Ecological Economics; Monetizing the value of Biodiversity; Intrinsic Value; Ethical and aesthetic values, Anthropocentrism, Biocentrism, Ecocentrism and Religions; Intellectual Value; Deep Ecology

Unit 4 - Threats to Biodiversity **18 Hrs**

Habitat Destruction, Fragmentation, Transformation, Degradation and Loss: Causes, Patterns and consequences on the Biodiversity of Major Land and Aquatic Systems Invasive Species: their introduction pathways, biological impacts of invasive species on terrestrial and aquatic systems

Unit V: Pollution **18 Hrs**

Impacts of Pesticide pollution, Water pollution and Air Pollution on biodiversity Overexploitation: Impacts of Exploitation on Target and Non-target Terrestrial and Aquatic species and Ecosystems Extinction: Types of Extinctions, Processes responsible for Species Extinction, Current and Future Extinction Rates, IUCN Threatened Categories, Sixth Extinction/Biological Crisis

Text Books (T.B.):

1. Krishnamurthy KV. Textbook of Biodiversity, Science Publication, 2003.
2. Primack R. Essentials of Conservation Biology, Sinauer Associates, Inc., USA, 2006.

SEMESTER III : EXTRA CREDIT - I

Organic Farming

Course Code: 17PBO3EC1 **Maximum Marks: 100**

Hours/Week: 00 **Internal Marks: 00**

Credits: 5 **External Marks: 100**

Objectives:

- To understand the concept of recycling biological waste into useful products.

Unit I: Sustainable agriculture system

History of organic farming – Adverse effects of modern agricultural practices – Socio economic values - Alternative agriculture – integrated intensive farming system – Components of organic farming system – Methods in organic farming.

Unit II: Pollution

Agricultural pollution –Soil pollution - soil as a pollutant – plant nutrients - soil as air pollutant – polluted soil–Fertilizer pollution – inorganic fertilizers – biological transformation – Adverse impact of agro-chemicals in soil quality – Pesticidal pollution.

Unit III: Manuring

Traditional additives for organic farming – Bulky organic manures – Green manuring – Agronomic importance of organic manures – Non-traditional additives for organic farming – Types of biofertilizers – Soil conditioners – aquatic weeds.

Unit IV: Waste Management

Biogas technologies for organic farming waste – Waste water treatment – Recycled use of water in organic farming – Domestic and industrial wastes for organic farming – organic certification.

Unit V: Future trends in organic farming

Natural resources – Soil conservation – Water availability - Energy - General rules and regulation for commercialization of organic products – Research and development needs under organic farming.

Text Book (T.B.):

1. Dahama AK. Organic farming for sustainable agriculture (Second enlarged edition), Jodhpur, 1997.

Reference Book:

1. Veeresh GK. Organic Farming, Foundation books Pvt. Ltd, New Delhi, 2006.

Unit I, II, III, IV, V : T.B. 1

SEMESTER IV : CORE XIII

Plant Biotechnology

Course Code: 17PBO4C13 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

Objectives:

To understand the basic aspects of biotechnology.

To understand the advances in plant tissue culture and genetic engineering.

Unit 1: In vitro culture technique of plants: 18 Hrs

History and Scope, Plant tissue culture general aspects, Plant tissue culture media, Protoplast culture and somatic hybridization. Selection and identification of haploid cells (Plants), Cybrids – Hybrids and somatic incompatibility, methodology of cybridization, #Applications of cybrids and somatic hybridization in plant tissue culture.#

Unit 2: Molecular tools of genetic engineering: 18 Hrs

Restriction enzymes - Nomenclature, Restriction endonucleases, DNA Ligases, Polymerases. Vectors – The cloning vehicles – Plasmid types, Phage vectors, Cosmids, Phasmid vectors. Artificial chromosome vectors – Human artificial chromosome (HAC), Yeast artificial chromosomes (YACs), Bacterial artificial chromosomes (BACs). #Shuttle vectors#.

Unit 3: Techniques in plant genetic engineering: 18 Hrs

PCR and its applications, DNA markers and its applications – RAPD, RFLP, SSR, ISSR and AFLP. Basic steps in gene cloning , Nucleic acid blotting techniques – Sourthern blotting, Northern blotting, Western blotting, Dot blotting, Autoradiography, #Colony and Plaque blotting#. DNA sequencing – Maxam and Gilbert technique.

Unit 4: Genetic Engineering: 18 Hrs

Genetic engineering of plants: Gene transfer methods - vector mediated (Bacterial and Plant virus mediated) and vector less DNA transfer – Physical gene transfer methods, electroporation, Biolistics, microinjection, liposome mediated, chemical gene transfer methods and DNA imbibitions by cells/tissues, Applications of plant transformation - resistance to biotic and abiotic stresses, #Plants with improved nutrition's.#

Unit 5: Transgenic plants: **18 Hrs**

Transgenic plants as bioreactors: Metabolic engineering of carbohydrates – Starch, Cyclodextrins, fructans and Trehalose. Metabolic engineering of Lipids – Production of biodegradable plastics.Genetically engineered plants as protein factories and molecular farming – Approaches for protein production - #Industrialand lysosomal enzymes in plants, antibodies, vaccines and therapeutic proteins in plants#.

#----------# Self Study Portion

Text Books (T.B.):

1. Satyanarayana U. Biotechnology, Books and Allied Pvt. Ltd**.,** 2007.
2. Dubey RC. A text book of Biotechnology, S. Chand Publishing House, 2010.
3. Adrian Slatter, Nigel Scott and Mark Fowler, Plant Biotechnology, Oxford University Press, I Pub, 2004.

Reference Books:

1. Glick BR and Pasternak JK. Molecular Biotechnology: Principles and Applications of Recombinant DNA (4th edition), American Society for Microbiology, 2010.
2. Thieman W. Introduction to Biotechnology Paper back (3rd edition), Pearson Benjamin Cummings, 2012.
3. John E. Smith. Biotechnology (Studies in Biology) Kindle Edition (4th edition), Cambridge University Press, 2004.

Unit I	:	T.B.1, 2
Unit II, III	:	T.B.1, 3
Unit IV, V	:	T.B.1, 2

SEMESTER IV : CORE XIV

Plant Ecology and Conservation Biology

Course Code: 17PBO4C14 **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 5 **External Marks: 75**

Objectives:

- To impart knowledge on ecosystem.
- To acquire knowledge on various pollutions and its control.
- To understand the conservation aspects of bioresources.

Unit 1: Ecology **18 Hrs**

Concept and dynamics of ecosystem: Ecosystem – types, components, energy flow. Productivity.Ecological genetics of population or Gene Ecology – Ecotypes and Its characteristics, Formation and origin of new ecotypes, Delimitation and Significance, Ecoclines. #Raunkiaer's life forms#. Energy resources – non renewable and renewable energy.

Unit 2: Environmental pollution **18 Hrs**

Air, Water, Soil, Thermal, Radiation, Noise pollution and marine sources and control strategies.Cumulative effects of pollution on global environment – greenhouse effect, depletion of ozone layer, climate change, its causes and consequences.#Pollution abatement strategies and methodologies#.

Unit 3: Conservation application **18 Hrs**

Afforestation programmes – social forestry, Appiko, chipko movement, forestry – wildlife management and its impact – environmental monitoring and impact assessment , forest and land restoration – principles, methods and applications, Designing networks of protected areas, Managing protected areas, Restoration ecology. Convention on Biological Diversity targets, Earth summit - Rio, Kyoto-Nagayo protocol, #Ganga action plan#

Unit 4: Bioresources and Conservation **18 Hrs**

Definitions and types.Endangered flora and fauna – their identification and documentation – conservation of genetic resources – NGRP – Role of IUCN, IBPGR, PGRC of FAO, Red Data Book. Conservation strategies – In situ approach: Biosphere reserves, forest reserves, Narional parks, Sanctuaries, Sacred groves. Exsitu approach: Botanical garden, germ plasm and gene banks, tissue culture, Cryopreservation.

Environmental education, Ecotourism.#Role of International organization# – WWF, UNEP, UNDP, FAO and WB.

Unit 5: Remote sensing **18 Hrs**

The eye in the sky - Sensors and Satellites: electromagnetic spectrum (EMS), Mapping waste lands through remote sensing. GIS – Fundamentals of GIS, Map projections, Coordinate system, Spatial and non – spatial data types, Georeferencing, Digitization, GNSS – GPS, GLONASS/ Galileo – Principles of GPS, DGPS and application of Remote sensing in Natural resources management. Types of satellites: #Indian Remote sensing satellites#.

#----------# Self Study Portion

Text Books (T.B.):

1. Shukla RS Chandal PS. A Text Book of Plant Ecology, S.Chand Publishers, 2009.
2. Primack RB. Essentials of Conservation Biology, Sinauer Associates, Inc., Publishers, USA, 2014.
3. Narayan LR. Remote Sensing and its applications, Universities press(India)Pvt. Ltd**.** 2012.

Reference Book:

1. Odum EP Barrett Gary W. Fundamentals of Ecology, Brooks/Cole, 2004.

Unit I, II	:	T.B.1
Unit III, IV	:	T.B. 2
Unit V	:	T.B. 3

SEMESTER IV : CORE XV

Laboratory Course for Core XIII & XIV

Course Code: 17PBO4C15P **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 20**

Credits: 5 **External Marks: 80**

Objectives:

- To develop skill in plant tissue culture.
- To understand methods of vegetation analysis and develop skills in chemical analysis of water.

Plant Biotechnology:

1. Plant tissue culture media preparation.
2. Explant selection and culture.
3. Isolation of total genomic DNA from leaf tissues
4. Isolation of plasmid DNA from *E.coli*

Plant Ecology and Conservation Biology:

1. Analysis of vegetation – Quadrat, Line transect methods, Point frame method, Belt transect method to analyse species frequency, Abundance, density and dominance.
2. Species area curve index
3. Practical application of Raunkier's frequency formula.
4. Estimation of Dissolved oxygen content
5. Estimation of carbonate and Bicarbonate
6. Estimation of Chloride content
7. Estimation of Total dissolved solids and Total solids
8. Estimation of Total hardness

SEMESTER IV : ELECTIVE – IV#

Plant Tissue Culture

Course Code: 17PBO4CE4A **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objective:

- Exposure to plant tissue culture techniques and its important applications

Unit I: Basic plant tissue culture **18Hrs**

Concept, Technique, applications: of plant tissue culture-plant culture media, methods of plant regeneration in vitro: organogenesis and somatic embryogenesis. #Callus culture#, single cell and cell suspension culture. Micropropagation-methods and importance

Unit II: Protoplast culture, somatic hybridization and cryopreservation **18Hrs**

Protoplast isolation & culture-somatic hybridization and #cybridization#-Production of haploids. Role of haploids in Plant breeding-cryopreservation technology-steps involved in cryopreservation of plant materials-uses of cryopreservation of plant stock

Unit III: Genetic transformation **18Hrs**

Transformation techniques in plants-plant vectors for genetic transformation. *Agrobacterium* mediated gene transfer in plants. Physical methods of gene transfer – microinjection, particle bombardment, PEG and liposome mediated-generation and maintenance of transgenic plants, #Bt cotton & Golden rice#.

Unit IV: Fundamentals of metabolic engineering **18Hrs**

Application of cell culture systems in metabolic engineering-advantages of cell, tissue and organ culture as a source of secondary metabolites-hairy root culture-#screening of high yielding cell lines#-procedures for extraction of high value industrial products.

Unit V:Bioteactors and biotransforamtion **18Hrs**

Scale-up procedure in bioreactors, types of bioreactors for plant cell cultures-manipulation in production profile by biotic and abiotic elicitation-#biotransformation#.

#----------# Self Study Portion

Text Books (T.B.):

1. Razdan MK. Introduction to plant tissue culture. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, 2003.
2. Dubey RC. A Textbook of Biotechnology, S.Chand& Company Ltd., New Delhi, 2006.
3. Karthikeyan K Chandran C Kulothungan S. Plant biotechnology. KR Printers, Thanjavur, 2009.
4. Kumaresan V. Biotechnology,Saras Publication, Nagercoil, 2013.

Reference Books:

1. Nirmala CB Rajalaksmi G and Chandra Karthick. Plant Biotechnology, MJP Publishers, Chennai, India, 2009.
2. Bhojwani SS Razdan MK. Plant tissue culture theory and practice, a revised edition. Elsevier, Amsterdam, 1996.
3. Loyola-Vargas VM Ochoa-Alejo N. Somatic embryogenesis: Fundamental aspects and applications, Springer international publishing, Switzerland, 2016.

Unit I	:	TB 1
Unit II	:	TB 1, 2, 3
Unit III	:	TB 1
Unit IV, V	:	TB 3

SEMESTER IV : ELECTIVE – IV#

Marine Ecology

Course Code: 17PBO4CE4B **Maximum Marks: 100**

Hours/Week: 6 **Internal Marks: 25**

Credits: 4 **External Marks: 75**

Objective:

- To understand the physical, chemical and biological aspects of marine environment

Unit I: Physical Oceanography and Biotic Factors **18 Hrs**

Physical Oceanography : The role and observations in oceanography – oceans and seas, their dimension, physical properties of sea water – salinity, temperature-density in space and time, O2, CO2, nutrients, oceanic mixed layer and thermocline. Ocean currents and their movement, equatorial processes- El Nino, Indian ocean circulation. • Biotic factors- floral and faunal components. Role of phytoplanktons, water blooms and red tide phenomenon.

Unit II: Marine Chemistry **18 Hrs**

Major and minor elements in sea water, chlorinity, salinity – Definition, significance and measurement. Solubility of gases in sea water – dissolved O2, CO2, pH, alkalinity, percentage composition of inorganic carbon, calcium carbonate precipitation. • Micronutrient elements in sea water (P,N,Si), N:P ratios, stoichiometry and uptake and regeneration of nutrient elements.

Unit III: Microbial Ecology **18 Hrs**

Microbial Ecology of Coastal Ecosystem – Mycorrhizal relations, coastal vegetation and nitrogen fixation, detritus based food chain. • Microbial Ecology of Coral Reefs – occurrence, distribution and types. Calcification, reef algae, natural and anthropogenic stress, restoration and conservation of coral ecosystem, concept of marine park.

Unit IV: Biodiversity of Mangroves **18 Hrs**

Brief introduction to creek, estuary, lagoon and delta formations. Definition of 'Mangrove", distribution- biogeography of Indian Mangroves, east and west coast mangroves, Mangrove forests. • Salient features of important mangrove families such as Rhizophoraceae,

Sonneratiaceae, Avicenniaceae, Myrsinaceae, Acanthaceae. • Salt marshes, sea grasses and sand dune vegetation.

Unit V: Marine Pollution and Conservation of Mangrove Ecosystem 18 Hrs

Marine Pollution; types, sources and impact. Toxic metal pollution, oil, sewage, pesticide, radioactive pollution and effect of waste disposal on marine ecosystem. Biomagnification. • Conservation of mangrove ecosystem; need for conservation, human impact, role of global institutions and NGO's in India.

Text Books (T.B.):

1. Svedrup HU. Johnson MW and Flemming RH. The Ocean: Their Physics, Chemistry and Biology, Asia Publ.House, New Delhi (1962).
2. Pierson WJ and Newmann GS. Principles of Physical Oceanography, Prentice Hall, Inc., New Jersey, 1966.
3. Naskar, Kumundrajan and Rathindranath Mandal, Ecology and Biodiversity of Indian Mangroves, 1999.
4. Current Trends in Life Sciences, Vol23: Agromicrobes, Today and Tomorrow. New Delhi.

SEMESTER IV : PROJECT WORK

Dissertation

Course Code: 17PBO4PW	**Maximum Marks: 100**
Hours/Week: 6	**Internal Marks: 00**
Credits: 5	**External Marks: 100**

SEMESTER IV : EXTRA CREDIT COURSE - II

Botanical Pharmacy

Course Code: 17PBO4EC2 **Maximum Marks: 100**

Hours/Week: 0 **Internal Marks: 00**

Credits: 5 **External Marks: 100**

Objectives:

- Exposure to basic knowledge on plant pharmacognocy.
- Familiarizing with common medicinal plants and their utilization.

Unit I: Cultivation and collection of medicinal plants

Introduction-Parts of medicinal plants-Cultivation collection and processing of Herbal drugs.Utilization of medicinal and aromatic plants in India.

Unit II: Drug evaluation

Analytical pharmacognosy – Drug adulteration- morphological - organoleptic evaluation- Microscopic evaluation- Chemical evaluation – Physical evaluation – Biological Evaluation – Quality control of Herbal drugs.

Unit III: Pharmaceutical plant products

Carbohydrates derived plant products. Glycosides-Tannin- Amla Black catechu. Lipids- Arachis oil, Castor oil, Rice bran oil and corn oil. Terpenoids- Lemon Grass oil, cinnamon, Garlic and tulsi. Alkaloidal drugs- isolation and extraction of alkaloids- Vinca and Cinchona.

Unit IV: Plant secondary metabolites

Products of commercial interest obtained through tissue culture. Morphine alkaloids, tropane alkaloids, quinoline alkaloids, antitumerous compounds, vanillin and vanilla aroma- colors and flavors-production of natural sweeteners**.**

Unit V: Neutraceuticals, cosmoceuticals and immunomodulators

Neutraceuticals, cosmoceuticals and immune modulators.Marine drugs. Natural pesticides- immobilization of plant cells adaptogens and Rasayana.

Text Book (T.B.):

1. Kokate CK, Purohit AP, and Gokahale. Phamacognosy. NiraliPrakasan, 2002.

Unit I, II, III, IV, V : T.B. 1