



# M.Sc. PLANT BIOLOGY & PLANT BIOTECHNOLOGY



**SYLLABUS: 2010-2012**

**CHOICE BASED CREDIT SYSTEM  
(CBCS)**



**St. JOSEPH'S COLLEGE (Autonomous)**

*Re-accredited with A+ Grade by NAAC*

*College with Potential for Excellence by UGC*

**TIRUCHIRAPPALLI - 620 002, INDIA**





## FEATURES OF CHOICE BASED CREDIT SYSTEM PG COURSES

The Autonomous (1978) St. Joseph's College, Reaccredited with A+ Grade from NAAC (2006), had introduced the Choice Based Credit System (CBCS) for PG courses from the academic year 2001 – 2002. As per the guidelines of Tamil Nadu State Council of Higher Education (TANSCHE) and the Bharathidasan University, the College has reformulated the CBCS in 2008 – 2009 by incorporating the uniqueness and integrity of the college.

### OBJECTIVES OF THE CREDIT SYSTEM

- ✓ To provide mobility and flexibility for students within and outside the parent department as well as to migrate between institutions
- ✓ To provide broad-based education
- ✓ To help students learn at their own pace
- ✓ To provide students scope for acquiring extra credits
- ✓ To impart more job oriented skills to students
- ✓ To make any course multi-disciplinary in approach

### What is credit system?

Weightage to a course is given in relation to the hours assigned for the course. Generally one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours. The following Table shows the relation between credits and hours.

Sem.	Specification	No. of Papers	Hour	Credit	Total Credits
I – IV	Core Courses (Theory & Practical)	14	6	14 x 5	70
	Project	1	--	1 x 5	Additional
I – IV	3 – Core Electives	3	4	3 x 4	12
	2 – Inter Dept. Courses (IDC)	2	4	2 x 4	08
I – IV	SHEPHERD – Extension Activity	~	70	5	Additional

Total Minimum Credits	90
Total Additional Credits (Compulsory)	10
Other Additional Credits (Dept. Specific)	....

However, there could be some flexibility because of practical, field visits, tutorials and nature of project work.

For PG courses a student must earn a minimum of 90 credits and 10 compulsory credits as mentioned in the above table. The total number of courses offered by a department is 20. However within their working hours a few departments can offer extra credit courses.

### Course Pattern

The Post Graduate degree course consists of three major components. They are Core Course, Elective Course and Inter Department Course (IDC). Also 2 compulsory components namely Project / Project related items and Shepherd, the extension components are mandatory.

### Core Course

A core course is the course offered by the parent department, totally related to the major subject, components like Practical, Projects, Group Discussion, Viva, Field Visit, Library record form part of the core course.

### Elective Course

The course is also offered by the parent department. The objective is to provide choice and flexibility within the department. The student can choose his/her elective paper. Elective is related to the major subject. The difference between core course and elective course is that there is choice for the student. The department is at liberty to offer three elective courses any semester. It must be offered at least in two different semesters. The Staff too may experiment with diverse courses.

### Inter Department Course (IDC)

IDC is an inter departmental course offered by a department for the students belonging to other departments. The objective is to provide mobility and flexibility outside the parent department. This is introduced to make every course multi-disciplinary in nature. It is to be chosen from a list of courses offered by various departments. The list is given at the end of the syllabus copies. Two IDC s must be taken by students which are offered in Semester II & III.

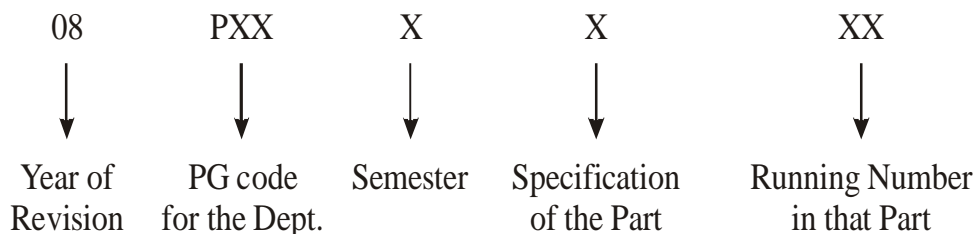
Day College (Shift-I) student may also take an IDC from SFS (Shift-II) course and vice versa

This provision enables students to earn extra credits. For the Shift – I students it is offered in their last hour and for the Shift-II

(Course) students in their first hour. The IDC are of application oriented and inter-disciplinary in nature.

### Subject Code Fixation

The following code system (9 characters) is adopted for Post Graduate courses:



01 – Core Courses: Theory & Practical

02 – Core electives

03 – Additional Core Papers (if any)

04 – Inter Departmental Courses

05 – Project (compulsory)

06 – Shepherd (compulsory)

### CIA Components

The CIA Components would comprise of two parts: (1) Test Components conducted by Controller of Examination (COE) and (2) Teacher specific component. The two centralized tests will be conducted by the COE (Mid-Semester Test & End-Semester Test) for 30% each administered for 1 hour and 30 minutes duration. The remaining 40% would comprise of any four components as listed below and will be carried out by the faculty concerned for that paper.

- ✓ Assignment, Quiz (Written / Objective), Snap test, Viva-Voce, Seminar, Listening Comprehension, Reading Comprehension, Problem Solving, Map Reading, Group Discussion, Panel Discussion, Field Visit, Creative Writing, Open Book Test, Library Record, Case Study.
- ✓ As a special consideration, students who publish papers in referred journals would be exempted from one of the teacher specific internal components in one of the papers. At the beginning of each semester, the four internal components would be informed to the students and the staff will administer those components on the date specified and the marks acquired for the same will be forwarded to the Office of COE.

### Question Pattern

Pattern	Mid & End Semester Test	Semester Exam
Part A : Objective	10 x 0.5 = 05	20 x 1 = 20
Part B : Either/or type	3 x 3 = 09	5 x 4 = 20
Part C : Comprehensive	(2/3) 2 x 8 = 16	(4/5) 4 x 15 = 60
	Total = <u>30</u>	Total = <u>100</u>

### Evaluation

For each course there are formative continuous internal assessment (CIA) and semester examinations (SE) in the weightage ratio 50:50. Once the marks of CIA and SE for each course are available, the Overall Percentage Mark (OPM) for a student in the programme will be calculated as shown below:

$$OPM = \frac{\sum C_i M_i}{\sum C_i} \text{ where } C_i \text{ is the credit earned for that course in any}$$

semester and  $M_i$  is the marks obtained in that course.

The Scheme of Over-all Results is as follows:

Class	PG	
	Arts (OPM)	Science (OPM)
SECOND	50 to 59.99	50 to 59.99
FIRST	60 to 74.99	60 to 79.99
DISTINCTION	75 & Above	80 & Above

The performance in Compulsory credits in Project and Project related items and in Shepherd programme is indicated by a pass and is not taken into account for computing OPM.

### Declaration of Result

Mr. /Ms. \_\_\_\_\_ has successfully completed M.Sc. / M.A. degree course in \_\_\_\_\_. The student's overall average percentage of marks is \_\_\_\_\_ and has completed the minimum 90 credits. The student has acquired 10 more compulsory credits from Project and Shepherd courses. The student has also acquired \_\_\_\_\_ (if any) extra credits from courses offered by the parent department.

## COURSE DETAIL

Sem	Code	Title of the Paper	Hrs	Cr
I	10PPB1101	Plant Diversity	6	4
	10PPB1102	Practical -I (Plant Diversity)	4	3
	10PPB1103	Molecular Genetics	6	4
	10PPB1104	Climate Change, Biodiversity and Conservation	6	4
	10PPB1105	Practical -II (Mol. Genetics. & Biodiv. and Conservation)	4	3
	10PPB1201A	Developmental Biology or	4	4
	10PPB1201B	Forestry and Wood Science		
<b>Total for Semester I</b>			<b>30</b>	<b>21</b>
II	10PPB2106	Plant Systematics	6	4
	10PPB2107	Practical -III ( Plant Systematics)	4	3
	10PPB2108	Recombinant DNA Technology	6	4
	10PPB2109	Research Methodology	6	5
	10PPB2110	Practical - IV (rDNA Technol. & Res. Methodol.)	4	3
	10PPB2401	IDC –Nanobiotechnology	4	4
<b>Total for Semester II</b>			<b>30</b>	<b>23</b>
III	10PPB3111	Plant Physiology	5	4
	10PPB3112	Practical -V ( Plant Physiology)	4	3
	10PPB3113	Biochemistry	5	4
	10PPB3114	Applied Biotechnology	4	4
	10PPB3115	Practical -VI (Biochem. & Appl. Biotechnol.)	4	3
	10PPB3202A	Cell Signalling and Communication or	4	4
	10PPB3202B	Remote Sensing		
	10PPB3115A	Self Study Paper: Plant Breeding and Evolution		2
10PPB3402	IDC – Remote Sensing and GIS	4	4	
<b>Total for Semester III</b>			<b>30</b>	<b>28</b>
IV	10PPB4116	Microbiology and Pathology	6	5
	10PPB4117	Pharmacognosy	6	5
	10PPB4118	Practical -VII (Microbial & Pharmacog.)	4	3
	10PPB4203A	Immunology or	4	4
	10PPB4203B	Bioinformatics		
10PPB4501	Project Dissertation and <i>Viva voce</i>	10	5	
<b>Total for Semester IV</b>			<b>30</b>	<b>23</b>
<b>Shepherd</b>				5
<b>Extra Credits</b>				
		Outstation Research	--	5
		Funded Student Project	---	5
		Publication in Journals with Impact Factor	---	5
<b>TOTAL – General (incl. SHPHERD)</b>				100
<b>TOTAL – Extra credit</b>				15
<b>GRAND TOTAL FOR ALL SEMESTERS</b>			<b>120</b>	<b>115</b>

Sem- I  
10PPB1101

Hours/week: 6  
Credits : 5

## PLANT DIVERSITY

### Objectives:

1. To understand the major groups of plants and their characteristics.
2. To trace their interrelationships and study their evolutionary trends.

### Unit - I

**Algae:** (Individual life cycles, developmental studies on reproductive organs and post fertilization changes need not be studied). General characteristics, thallus variations, reproduction, distribution and economic importance of major groups of algae. Criteria used in algal classification (Fritsch & De Silva) - Life cycles and mass culture of algae - Contributions of eminent Indian Algologists.

### Unit - II

**Fungi:** Classification (Ainsworth, 1973) general characteristics of major classes- morphology of somatic structures – Ecology of fungi - types of reproduction in fungi - fruit bodies and spore dispersal mechanisms - degeneration of sex, heterothallism and parasexuality in fungi - economic importance of fungi. Contributions of eminent Indian Mycologists.

**Lichens:** General account - classification - structure and reproduction -economic importance of lichens.

### Unit - III

**Bryophytes:** Classification (Watson) - general and reproductive characters of major classes (Hepaticopsida, Anthocerotopsida and Bryopsida) - distribution of bryophytes - comparative study of gametophytes and sporophytes of major classes - spore dispersal mechanisms and economic importance.



## Unit - IV

**Pteridophytes:** Characteristics - classification (Sporne, 1975) - life cycle patterns - stelar evolution - structure and reproduction of the major groups (individual life cycles need not be studied) - Psilophytopsida, Psilotopsida, Lycopsidea, Sphenopsida and Pteropsida - spore producing structures and soral evolution in ferns - heterospory and seed habit - telome concept and its significance - economic importance. Fossils, fossilization process and fossil diversity - geological era - study of the following fossil genera; *Rhynia*, *Lepidodendron*, *Lyginopteris*, *Calamites* and *Medullosa*.

## Unit - V

**Gymnosperms:** Classification (Sporne, 1975). - comparative study of vegetative, anatomical and reproductive characteristics of major divisions (Cycadophyta, Coniferophyta and Gnetophyta) - evolutionary trends and phylogenetic relationship among various groups of gymnosperms - Pteridospermales, Cycadeodales, Pentoxylales, Cordaitales, Coniferales, Ginkgoales and Gnetales - economic importance of gymnosperms.

## Text Books

1. Venkataraman, *et al.*, 1974, *Algae-Form & Function*. Today and Tomorrow, Pub. Co. (Unit - 1)
2. Alexopoulos, C.J, *Introductory Mycology*. Wiley & Sons, C.W., Eastern Ltd., Delhi. (Unit - 2)
3. Prempruri, 1973. *Bryophytes A Broad perspective*. Atma Ram & Sons, New Delhi. (Unit - 3)
4. Sporne, K.R., 1975. *The Morphology of Pteridophytes*. Hutchinson & Co., London. (Unit - 4)
5. Sporne, K.R., 1967. *The Morphology of Gymnosperms*. Hutch. & Co., London. (Unit - 5)

## Books for Reference

1. Foster & Gifford, 1959, Comparative Morphology of Vascular Plants. COH, Freeman & Co.
2. Delevoryas, T., 1977, Plant Diversification. Holt, Rinehart & Wintson, New York.
3. Chapman, V.J., & Chapman, D.J. The Algae. ELBS & MacMillan, London
4. S.Srivastava, H.N., 1999, Fungi. Pradeep Publications, Jalandhar
5. Burnet, J.H., 1971, The Fundamentals of Mycology. ELBS, Lond
6. Hale, Jr. M.E., 1983, Biology of Lichens. Edward Arnold, Mayland.
7. Bierhorst, 1971, Morphology of Vascular Plants.
8. Karl J. Nikias, 1981, Paleobotany, Paleoecology & Evolution, Praeger Pub. USA
9. Fritsch, F.E., 1976. Structure and reproduction of Algae, Vol. I & II. BI Publishers, New Delhi.
10. Bessey, E.A. 1971. Morphology and taxonomy of fungi. Hafner Publication Company, New York.
11. Chamberlain, C.J. 1986. Gymnosperms: Structure and Evolution. CBS Publishers & Distributors, Delhi.
12. Cavers, F. The interrelationship of the Bryophyta. Dawsons of Pall Mall, London.
13. Singh, Pande and Jain, 1998. A text book of Botany, Rastogi publications, Meerut.
14. Hale, M.E. (Jr.). 1983. The Biology of Lichens. Edward Arnold Ltd., London.
15. Dube, H.C. 1983. Introduction of Modern Mycology. Blackwell Science Publication. Oxford.

16. Watson, E.V. 1964. The structure and life of Bryophytes. Hutchinson & Co. London.
17. Campbell, D.H. 1970. The Evolution of land plants. Central Book Department, Allahabad.
18. Ian Morris. 1968. An introduction to algae. Hutchinson University Library Company, London.

Sem- I  
10PPB1102

Hours/week: 4  
Credits: 3

## PRACTICALS - I (PLANT DIVERSITY)

### Algae

*Ulva, Caulerpa, Padina, Sargassum, Batrachospermum, Gracilaria, Nostoc, Oscillatoria.*

### Fungi

*Plasmodiophora, Saprolegnia, Pilobolus, Claviceps, Xylaria, Phyllochora, Aspergillus, Penicillium, Alternaria & Fusarium.*

### Lichen

*Usnea.*

### Bryophytes

*Reboulia, Targionia, Aneura, Anthoceros, Pogonatum & Polytrichum*

### Pteridophytes

Comparative anatomy and sporangial organization in *Psilotum, Lycopodium, Selaginella, Equisetum, Angiopteris, Alsophila, Adiantum, Trichomanes* and *Azolla*.

### Fossils

*Lyginopteris, Calamites, Medullosa* and *Cordaites*, visits to fossil sites

### Gymnosperms

Comparative study of the wood and cone structures of *Pinus, Cupressus, Araucaria* and *Gnetum*.

Field trip.



Sem-I  
10PPB1103

Hours/week: 6  
Credits: 5

## MOLECULAR GENETICS

### Objectives:

1. To understand the organization and functioning of genetic material.
2. To comprehend the intricacy of regulation of genes.

### Unit - I

Organization of eukaryotic chromosome and bacterial genome. Special types of Chromosomes, 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, ploidy and their genetic implications. DNA repair mechanisms.

### Unit - II

Mobile genetic elements - IS elements and transposons in maize and bacteria. Transposition, phenotypic and genotypic effects - evolutionary significance. Homologous and non-homologous recombination, including transposition, site-specific recombination. Extra chromosomal (maternal) inheritance: Inheritance of mitochondrial and chloroplast genes. DNA replication. – Rules, Requirements, problems and molecular mechanism in linear and circular DNA. Polymerases, Replication of RNA genomes - replicase and reverse transcriptase.

### Unit - III

Transcription mechanism in prokaryotes – initiation, elongation and termination in *E. coli*. RNA-P. Post transcriptional modification. Differences in Eukaryotes – RNA polymerases, Classes of RNA molecules – antisense RNA, catalytic RNA and RNAi.

### Unit – IV

Translation - mRNA organization, the genetic code, translation

machinery, deciphering the code, translation in *E.coli* and differences in eukaryotes. Post translation processing - chaperones and protein targeting. Principles of gene regulation, the *lac* operon and *trp* operon.

### Unit - V

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sexduction, mapping genes by interrupted mating, fine structure analysis of genes. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

### Text Book

1. Gardner *et al.* 2004, Principles of genetics. John Wiley & Sons Inc. Singapore.

### Books for Reference

1. De Robertis and De Robertis, 1990, Cell and Molecular Biology, Saunders College, Philadelphia, USA
2. Weaver, R.F. and Hedrick, P.W., 1989, Genetics. Wm, C. Brown Pub, Dubuque
3. Freifelder D. 1987, Molecular Biology. Jones and Bartlett, Boston, USA
4. Watson J.D. *et. al.*, 2004, Molecular biology of the gene, Pearson education, Singapore.
5. Lodish *et. al.*, 2004, Molecular cell biology, COH freeman & Co. New York.
6. Miglani, G.S. 2002. Advanced Genetics. Narosa Publishing House.
7. Lewin, B. 1998. Genes VI. Oxford University Press.
8. Brown, T.A. 1999. Genomes. John Wiley & Sons.
9. Strickberger. 1985. Genetics. Mac Millan Company, New York.
10. Carlson, E.A., 1985. Human Genetics. Tata Mc Graw Hill, New Delhi.

Sem-I  
10PPB1104

Hours/week: 6  
Credits : 4

## **CLIMATE CHANGE, BIODIVERSITY AND CONSERVATION**

### Objectives:

1. To comprehend and appreciate the variety in living world.
2. To manage and conserve the biological resources.

### Unit – I Climate change

Introduction to weather and climate, the elements of the climate: the green house gases, global warming and climate change: climate of the past, natural causes of climate change, human activities, evidence of climate change and consequences – decimation of mountain peaks and rising ocean levels.

### Unit – II

Green house gas emissions, carbon credits, climate economics, adaptation and mitigation and CDMs. Politics and policy debate – Kyoto protocol, Bali Action Plan, UN conference on climate change (UNFCCC), IPCC, the Climate Summit and the Copenhagen Accord. Outlook for the future.

### Unit – III Biodiversity

Types – Genetic, species and ecosystem diversity. Estimation of global biodiversity. Importance and values – food, pharmaceuticals, resource and non resource uses. Plant diversity - crop plants and their relatives, trees and forests. Animal diversity – domesticated and other animals, fish and aquatic diversity. Human diversity and indigenous people.

### Unit – IV Genetic Diversity

Plant genetic resources, mega centres of origin of genetic diversity and cultivated crops. World's major plant gene banks and the commercial seed system. The genetic wealth of the South and the tangled genes. Animal gene banks and animal biodiversity loss. Control of gene banks and the genetic theft. Impact of modern agriculture on genetic diversity.



## Unit – V Conservation

Endangered flora and fauna – their identification and documentation Red Data Book. Conservation strategies; *In situ* approach, biosphere reserves, forest reserves, parks and sanctuaries. *Ex situ* approach – collection garden, seed storage, tissue culture and cryopreservation - Animal genetic resources conservation: *ex situ* gene bank, captive breeding, ecotourism – uses and misuses - Role of national, international organizations in conservation – CBD, GEF, NGRP, IUCN, IBPGR, NBPGR., PGRC, WWF, UNEP, UNDP, FAO, CITES and WB.

### Text Books:

1. Melchias, G., 2001, Biodiversity and Conservation, Science Publishers Inc. USA
2. Krishnamurthy KV. 2003, An Advanced text book on Biodiversity Principle and Practice. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

### Books for Reference

1. IUCN, 1985, The World Conservation Strategy, IUCN, Switzerland
2. Odum, E.P., 1970, Fundamentals of Ecology, 3rd edn, W.B.Saunders Ltd., UK
3. Querol, 1995, Conservation of Tropical Plant Resources, Third World Network, Malaysia
4. Simmons *et al.*, 1980, Conservation of Threatened Plants, NATO Scientific affairs, New York.
5. Sharma, P.D., 1999, Ecology and Environment, Rastogi Publishers, Meerut
6. Centre for Science and Environment. 2009. Climate Change- Politics and Facts. Centre For Science Environment., New Delhi.
7. Heywood V.H. (ed) 1995. *The Global Biodiversity Assessment*. United Nations Environment Programme.3.
8. Mc Neely, J.A., Miller, K.R., Reid, W.V., Mittermeier, R.A., and Werner, T.B. 1990. Conserving the world's biological diversity. IUCN, Gland, Switzerland.

Sem- I  
10PPB1105

Hours/week: 4  
Credits: 3

## PRACTICALS - II

### (MOL. GENETICS & CLIMATE CHANGE, BIODIV. AND CONSERVATION)

1. Problem solving in Mendelian and Non-Mendelian inheritance patterns.
2. Estimation of gene frequencies in natural populations
3. Linkage mapping.
4. Study of cell divisions and abnormal cell divisions
5. Chromosome banding technique
6. Isolation of genomic DNA from plant and animal samples.
7. Determination of DNA and RNA in samples.
8. Enumeration of organisms in aquatic samples.
9. Chemical analysis of soils and waters – total hardness, carbonates & bicarbonates, calcium magnesium, dissolved oxygen, chromium and mercury.
10. Vegetation Analysis.
11. Study of primary productivity (Winkler's method)
12. Field trip.



Sem-I  
10PPB1201A

Hours/week: 4  
Credits: 4

## DEVELOPMENTAL BIOLOGY

### Unit I

Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

### Unit II

Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

### Unit III

Morphogenesis and organogenesis in animals: Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, amphibia and chick; organogenesis – vulva formation in *Caenorhabditis elegans*.

### Unit IV

Eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development-larval formation, metamorphosis; environmental regulation of normal development; sex determination.

### Unit V

Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf

development and phyllotaxy; transition to flowering, floral meristems and floral development in *Arabidopsis* and *Antirrhinum*.

### Text Book

1. Browder LW, Erickson CA and WR Jeffery. 1991. *Developmental Biology*, 3rd Ed. Saunders College Publishing, Philadelphia. (Unit - I, II, III, IV)
2. Bhojwani SS and SP Bhatnagar. 1999. *The Embryology of Angiosperms*. Vikas Publishing House Pvt. Ltd. New Delhi. (Unit - I)
3. Sinnott EW. 1960. *Plant Morphogenesis*. McGraw-Hill Book Co., NY. (Unit - I, V)

### Books for Reference

1. Gilbert, Scott. F., 2000, *Developmental Biology*. 6th Ed. Sinauer Associates Inc. USA.
2. Bier Ethan., 2000, *The coiled spring: How life begins*. Cold Spring Harbour Laboratory Press, USA.
3. Slack, Jonathan MW, 2005, *Essentials of developmental biology*. 2nd Ed. Wiley Blackwell Pub. Ltd. Germany
4. Larsen WJ, 1998, *Essentials of Human embryology*. Churchill Livingstone Pub. Ltd. UK.
5. Soltis DE, Leebens JH and PS Soltis (eds.), 2006, *Developmental genetics of the flower*, *Advances in Botanical Research* Vol 44: 1-594.

Sem- I  
10PPB1201B

Hours/week: 4  
Credits : 4

**FORESTRY AND WOOD SCIENCE**  
(Core elective)

**Objectives:**

1. To prepare students for careers in the forest services and wood products industry.
2. To educate students to provide technical expertise to the wood industries.

**Unit – I**

World and Indian forest scenario; Forest types of India; Forest influences; forest protection; Rare and endangered species; Conservation strategies; Exotics and its significance; Silvicultural principles and practices; Genetic Engineering and its application in forestry; Remote sensing and GIS in forestry; Forest laws and policies.

**Unit – II**

Forest Resources and utilization; Major forest products; people and forest; Social and community forestry; Forest industries; Role of social forestry in cottage industry; Role of forestry in Indian economy.

**Unit – III**

Nature and properties of wood: physical, chemical, mechanical and anatomy of wood. Durability of wood. Defects and abnormalities of wood; Wood seasoning and preservation; Defects due to seasoning and machining; types of commercial wood species of India.

**Unit – IV**

Wood deterioration and protection; Wood deterioration by fungi, insects and other agents; Practical methods for preserving and protection in-service wood from deterioration; Chemical processing of wood.

## Unit – V

Composite wood: adhesives-manufacture, properties, uses, manufacture and uses of plywood, fiber boards and particle boards, present status of composite wood industry in India, pulp-paper and rayon, present position of supply of raw material to industries and wood substitution.

### Text Books:

1. De Vere Burton L., 2000, Introduction to Forestry Science, Delmar publishers, N Y
2. Brown *et al.*, 1981 – Text book of Wood Technology Mc Graw Hill.

### Books for Reference:

1. Negi, S.S., 1994, India's Forests, Forestry and Wildlife, Indus publishing Co., New Delhi.
2. Jha, L.K., 1996, Forestry for rural development, APH Publishing Corporation, New Delhi.
3. Lal, J.B., 1989, India's Forests Myth & Reality. Nataraj Publishers, Dehra Dun.
4. Tieuran, H.D., 1951, Wood Technology, Pituran publishing co. New York.
5. Champion, F W. & Seth, S K, 1968, A revised survey of the forest types of India.

Sem- II  
10PPB2106

Hours/week: 6  
Credits: 5

## PLANT SYSTEMATICS

### Objectives

1. To understand the relevance of molecular techniques in plant systematics.
2. To study the classical taxonomy with reference to different parameters.

### Unit – I

History of Indian Botany. Taxonomic hierarchy. Species concept. Taxonomic key (indented & bracketed). Specimen preparation and herbarium management. Taxonomic literature- flora monograph and revisions. Comprehensive view of various approaches to plant classification - natural, artificial, phylogenetic, general and special purpose.

### Unit – II

Plant Nomenclature, Evolution of ICBN, Contents of ICBN- Author Citation- Type Method and different types – Publication of names – rule of priority – *nomina conservanda*- and definitions of nomenclatural terms Autonym, Homonym, Synonym, Basionym, Tautonym and *Nomen nudum*. Concept of characters. Morphology, comparative plant anatomy, karyology, embryology, palynology, paleobotany, ecology and physiology as taxonomic evidence

### Unit – III

Problems in evolutionary taxonomy – the concept of primitive and advanced, monophyly and polyphyly, parallelism and convergence, Homology and Analogy. Phytogeography. Speciation. Phenetic and numerical taxonomy - OTU, weighting, cluster analysis. Digital taxonomy - need and application and data base structure.



## Unit – IV

Detailed study - salient features, description, distribution and economic importance of the families Ranunculaceae, Magnoliaceae, Brassicaceae, Dipterocarpaceae, Meliaceae, Rosaceae, Apiaceae, Rubiaceae, Asteraceae, Asclepiadaceae, Convolvulaceae, Solanaceae, Verbenaceae, Lamiaceae. Euphorbiaceae, Hydrocharitaceae, Orchidaceae, Liliaceae, Arecaceae and Poaceae.

## Unit – V

Plant genome as source of taxonomic evidence - gene mapping, sequencing, base ratio, hybridization. Application of PCR, RFLP, RAPD in plant systematics. Proteins - amino acids sequencing, storage proteins, serology and isoenzymes.

Application of secondary metabolites as sources of taxonomic evidence - alkaloids, flavonoids, terpenoids, sugars, polysaccharides. Hydrocarbons, Fatty acids, lipids and pigments - betalains, anthocyanins and betacyanin.

### Text Books:

1. Singh, Gurcharan, 2004, Plant Systematics: Theory and Practices, 2nd Ed. Oxford & IBH, New Delhi. (Unit - I)
2. Harborne, J.B. & Turner, B.L, 1984, Plant Chemosystematics, Academic Press, London. (Unit - V)
3. Jude, W.S., C.S. Campbell, E.A. Kellogg, P.F. Stevens & M.J. Donoghue, 2007. Plant Systematics: A Phylogenetic approach, 3rd Ed. Sinauer Associates, Inc., Sunderland, USA. (Unit - V)
4. Lawrence, G.H.M., 1955, The Taxonomy of Vascular Plants, Central Book Depot., MacMillan, New York. (Unit - III, IV)

### Books for Reference:

1. Soltis, P.S., D.E. Soltis & J.J. Doyle (eds.), 1992, Molecular systematics of plants. Chapman and Hall, NY.
2. Soltis, D.E., P.S. Soltis & J.J. Doyle (eds.), 1998. Molecular systematics of Plants II-DNA sequencing, Kluwer Academic Publishers, Massachusetts, USA.

3. Grant, W.F., 1984, *Plant Biosystematics*, Acad Press Inc., Canada.
4. Young DA and Seiyler DS (eds.), *Photochemical and angiosperm phylogeny*. Praeger publications. NY.
5. Hillis, DM., Moritz, C & Mable, BK (eds)., 1996, *Molecular Systematics*, Sinauer Associates, Sunderland, USA
6. Jeffrey, C., 1982, *Introduction of Plant Taxonomy*, Cambridge Uni. Press, Cambridge.
7. Jain,S.K., 1981, *Glimpses of Indian Ethnobotany*, Oxford & IBH Publishing Co., New Delhi.
8. Burkill, IH, 1965, *Chapters on the history of botany in India*. Government of India Press,
9. Sivarajan, VV, 1999, *Principles of Plant Taxonomy*. Oxford & IBH Publishing CO.
10. Henry, A.N. & Chandrabose., 1980, *An aid to the International Code of Botanical Nomenclature*. BSI.

Sem- II  
10PPB2107

Hours/week: 4  
Credits: 3

**PRACTICALS-III  
(PLANT SYSTEMATICS)**

- I. Binomial identification using flora.
  
- II Study of the following families with reference to their South Indian representatives and a minimum of one member each to be dissected and sketched (to scale): Menispermaceae, Nymphaeaceae, Capparaceae, Caryophyllaceae, Meliaceae, Aizoaceae, Rubiaceae, Asteraceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Acanthaceae, Verbenaceae, Lamiaceae, Loranthaceae, Euphorbiaceae, Hydrocharitaceae, Commelinaceae, Araceae, Cyperaceae
  
- III. Technical description of plants, semi-permanent preparations of dissected floral parts; exercises in key-making; exercises in the important Articles of the Code.

Field trips

Sem-II  
10PPB2108

Hours/week: 6  
Credits: 5

## RECOMBINANT DNA TECHNOLOGY

### Objectives:

1. To know the art of recombining genes and traits.
2. To develop the skills in handling genetic material.

### Unit - I

Generation of foreign DNA molecules – Enzymes used in rDNA technology - restriction endonucleases and cDNA synthesis. Joining DNA molecules and the strategies - *E.coli* and T4 DNA ligases, linkers and homopolymers. Alterations - control circuits, reporters and selection markers.

### Unit - II

Cloning vectors: ideal cloning vehicles and plasmids. Natural vectors, *in vitro* vectors, ssrDNA vectors and shuttle vectors. Plant expression systems and animal expression systems.

### Unit - III

Recombinant screening and selection strategies - biochemical, genetic, immunological and hybridization methods. Expression of cloned genes - problems and solution. Cloning strategies - cDNA libraries and genomic libraries.

### Unit - IV

Methods of gene transfer to bacteria, plants and animals: Ca – mediated transfection, microinjection, lipofection, electroporation, nuclear transplantation and recombinant viruses. Gene knockouts and homologous recombination.

### Unit - V

Techniques in RDT: Hybridization techniques - Southern, Northern and Western. DNA amplification PCR, RFLP, RAPD and DNA fingerprinting. IPR - the principles and rationale. Modalities of

patenting of traits and DNA sequences and the issues. Hazards of RDT.

**Text Book:**

1. Old R.N and Primrose SB., 2004, Principles of gene manipulation - Blackwell Scientific Publications. USA. (Unit - I & II)
2. Nicholl DST, 2001, An introduction to genetic engineering - Cambridge university press. (Unit - III)
3. Brown, TA., 2006, Gene Cloning and DNA Analysis- An Introduction. Blackwell Scientific Publications, 5th edition. (Unit - IV & V)

**Books for Reference:**

1. Glover DM and BD Hames 1995 - DNA cloning I and II IRL press.
2. Glover DM 1984, Gene cloning, Chapman and Hall , New York.
3. Glick BR. and Pasternak JJ., 1998, Molecular Biotechnology, ASM Press, Washington.
4. Sambrook, J. et al., 2001, Molecular Cloning – A Laboratory Manual. Spring Harbor Laboratory Press, New York.
5. Watson et al., 1992, Recombinant DNA. Scientific American Books, New York.

Sem- II  
10PPB2109

Hours/week:6  
Credits: 5

## RESEARCH METHODOLOGY

### Objectives:

1. To initiate the students into research activities.
2. To learn to handle various instruments, their principles and procedures.

### Unit - I

**Buffers:** Characteristics and preparation. pH meter - principle, measurement of pH and pka. Electrometric determination, glass and reference electrodes. **Chromatography** - basic principles and detailed study of TLC, HPTLC, HPLC, Ion exchange, molecular sieve, and affinity chromatography. **Electrophoresis** - basic principles - types, electrophoretic mobility and factors. Isoelectric focusing PAGE and AGE.

### Unit - II

**Spectrophotometry** - principles, instrumentation - UV/Vis. Flame photometer - general principles and Instrumentation. Atomic absorption spectrophotometer, NMR, ESR. **Tracer techniques** - nature of radioactivity, patterns of decay, half life - detection of radiation, measurements - GM Counter, Scintillation counter, autoradiography and applications of isotopes. X-ray crystallography.

### Unit - III

**Measures of Location:** Central values, Dispersions, skewness, kurtosis. **Probability:** definition, binomial, poisson, normal distributions. **Correlation:** definition, types, methods, regression analysis (for simple, linear) **Testing:** Large sample (Z), small sample t, chi-square, ANOVA - one and two way, Duncan's Multiple Range Test. Principles of experimental design - randomization, replication, local control, size and shape of the plot, CRD, RBD.

## Unit – IV Biostatistics

Research - types, objectives and approaches. Sample - types; Sampling Techniques. Hypothesis: definition, characteristics, types, significance. Literature collection: web browsing. Writing Review and Journal article. Structure of thesis. Manuscript for publication and proof correction.

## Unit - V

Bibliometrics: definition and relevance; Laws – Lotka's Law, Bradford's Law, Zipf's Law. Bibliometrics databases, indexes, and evaluation tools –h-index, PageRank, *Impact Factor* and other indices. Evaluation of the Impact Factor. Sharing of resources; Collective platforms with Free Access. The use of bibliometrics in research. Citation Research, Citation Indexing, the SCI, Co-citation Coupling. Co-Citation Clustering, Bibliographic Coupling. The ISI and Thomson Reuter's Webmetrics/ Cybermetrics. Plagiarism, Tailored Research and Retraction.

### Text Books:

1. Kothari, CR, Research Methodology – Methods & Techniques. Wishwa Prakashan. (Unit - IV)
2. Misra, RP, Research Methodology a hand Book, Concept Publishing Company, New Delhi. (Unit - V)
3. Jayaraman, J., 1985, Laboratory Manual in Biochemistry, Wiley Eastern Ltd., Delhi. (Unit - I, II)
4. Gupta, S.P., 1990, Statistical Methods, Sultan Chand & Sons., (Unit - III)
5. Veerakumari. 2006. Bioinstrumentation. MJP Publishers, Chennai (Unit - I)

### Books for Reference:

1. Dominic Fernandez, Metrology of Study and Scientific Work.
2. Hawkins, C and Sorgi, M, Research, Narosa Publishing House.

3. Anbalagan, K., 1985, Electrophoresis a Practical Approach, Life Sci.BH, Madurai.
4. Block, R.J., Durrum, E.L. and Zweign, G., 1958, A Manual of Paper Chromatography and Paper Electrophoresis, Academic Press Inc., New York.
5. Clark, J.N., 1964, Handbook of Basic Microtechnique, McGraw Hill Book Co., London.
6. Jayaraman, J., 1972. Techniques in Biology, Higginbothams Pvt.Ltd, Madras.
7. Plummer, D.T., 1978, An Introduction to Practical Biochemistry, Tata McGraw- Hill Publishing Co. Ltd., New Delhi.
8. Stock, R., & Rice, CBE, 1977, Chromatographic Methods, Chapman and Hall Ltd., London.
9. Umbreit, W.W., 1972, Manometric and Biochemical Techniques Burgess Publishing Co., Minnesota.
10. Willard, H.D., *et al.*, 1965, Instrumental Methods of Analysis, D Van Nostrand Co., New York.
11. Wilson, E. & Goulding, K.H., 1987, A Biologists' Guide to Principles and Techniques of Practical Biochemistry ELBS.
12. Ragava Rao, D., 1983, Statistical Techniques in Agricultural and Biological Research, Oxford & IBH Publishing Co., New Delhi.
13. Jain, J.P., 1982, Statistical Techniques in Quantitative Genetics, McGraw Hill, New Delhi.
14. Daniel, W.W., 1983, Biostatistics; A Foundation for Analysis in the Health Science, John Wiley and Sons Inc., New York.
15. Wilson, K. and Walker J. 1997. Practical Biochemistry: Principles and Techniques. Cambridge University.
16. Snedecor GW and Cochran WG., 1967, Statistical Methods. Oxford & IBH Pub. New Delhi.



Sem- II  
10PPB2110

Hours/week: 4  
Credits: 3

## PRACTICALS IV

### **(rDNA TECHNOLOGY & RESEARCH METHODOLOGY)**

1. Small-scale preparation of plasmid DNA.
2. Large-scale preparation of plasmid DNA.
3. Restriction digestion and ligation.
4. Isolation and identification of cloned genes by agarose gel electrophoresis and Southern, Northern and Western blotting techniques.
5. Preparation of buffers and solutions.
6. Monoprotic and polyprotic acid titration and pKa value determination.
7. Chromatographic separation of amino acids (paper) and lipids (TLC).
8. Spectrophotometry: Standard graphs for proteins. (BSA), Glycine and Glucose.
9. Dialysis (purification of proteins).
10. Electrophoretic separation of proteins (PAGE).
11. Sampling technique and measures of locations.

Sem- II  
10PPB2401

Hours/week: 4  
Credits: 2

## **NANOBIOTECHNOLOGY (EDC)**

### **Objectives:**

1. To study the therapeutic applications of nanomedicine.
2. To know the social implications of nanotechnology.

### **Unit – I: Nanoscience and Nanotechnology**

Introduction – Interaction between Biomolecules and Nanoparticle Surfaces, Different types of Inorganic materials used for the Synthesis of Hybrid Nano – Bio Assemblies. Applications of Nano in Biology, Nanoprobes for Analytical Applications – A New Methodology in Medical Diagnosis and Biotechnology – Current Status of Nanobiotechnology.

### **Unit – II: Bionanomaterials**

Bionanomaterials – Synthetic and Natural bionanomaterials, Basic concepts of Cell and Molecular Biology – Designing Nanostructures, Biosensors and their Applications, Nanoarrays, DNA double Nanowire, Biological Nanostructures – Applications of bionanoscience to materials research.

### **Unit – III: Food Nanotechnology**

Functional Materials in Food Nanotechnology – Potential Food Applications, Nanodispersions and Nanocapsules, Association Colloids, Nano-emulsions, Nanostructured multiple emulsions, Nanostructured multilayer emulsions, Biopolymeric Nanoparticles, Nanolaminates, Nanocomposites, Polysaccharide / clay nanocomposites, Nanofibers, Nanotubes, Food Product Innovation.

### **Unit – IV: Nanomedicine**

Approach to developing nanomedicines, various kinds of Nanosystems in use, Protocols for Nanodrug administration, Nanotechnology in diagnostic applications, Materials for use in

Diagnostic and Therapeutic Applications, Biomaterials and Nanotechnology for Tissue Engineering.

### Unit – V: Social Implications of Nanoscience and Nanotechnology

Implications of Nanoscience and Nanotechnology on Society, Issues – An outlook – Nano Policies and Institutions, Nanotech and War – Nano Arms Race, Public perception and public involvement in the Nano Discourse, Harnessing Nanotechnology for Economic and Social Development.

#### Text Books:

1. Pradeep T, 2007, NANO : The Essentials – Understanding Nanoscience and Nanotechnology, TATA McGraw – Hill Education.

#### Books for Reference:

1. Charles PP and Frank JO, 2006, Introduction to Nanotechnology, Wiley India Ed.
2. Abdelhamid Elaissari, 2008, Colloidal Nanoparticles in Biotechnology, John Wiley & Sons, Inc., Hoboken, New Jersey.
3. Brechignac C, Houdy P and Lahmani M, 2007, Nanomaterials and Nanochemistry, Springer, New York.
4. Robert A, Freitas Jr, 1999, Nanomedicine, Volume I : Basic Capabilities, Landes Bioscience, USA.
5. Kewal K. Jain MD, 2008, The Handbook of Nanomedicine, Humana Press, USA

Sem-III  
10PPB3111

Hours/week : 5  
Credits : 4

## PLANT PHYSIOLOGY

### Objectives:

1. To study the recent aspects of various physiological processes in plants.
2. To understand the application of physiology in agriculture.

### Unit - I

Water relations of plants: Water potential, osmotic potential and pressure potential - their relationships. Stomatal physiology, transpiration flux, antitranspirants. Source-sink relationships in translocation of solutes. Mineral nutrition: Hydroponics - prospects and problems, nutrient solutions, chelating agents. Mineral ion uptake - passive and active uptake and transport, Nernst equation, Donnan's potential, role of H<sup>+</sup>ATPase as a carrier, cotransport (symport), counter transport (antiport) ionophores - Na<sup>+</sup>. K<sup>+</sup>-ATPase pump.

### Unit - II

Photosynthesis: recent concepts in photosynthetic electron transport, redox systems of chloroplast, cyclic, non-cyclic and pseudocyclic photophosphorylation. Oxygen Evolving Complex (OEC) Kok's model, photosynthetic carbon reduction cycles (PCR cycles): C<sub>3</sub>, C<sub>4</sub> and CAM pathway, Classification of C<sub>4</sub> plants and their significance, CO<sub>2</sub> concentration mechanisms, light activation of photosynthetic enzymes. Photorespiration (PCO cycle) and its regulation.

### Unit - III

Bioenergetics: Concepts of free energy, entropy, high-energy compounds, bioenergetics of ATP. Aerobic and anaerobic respiration, Glycolysis, TCA cycle Pasteur effect, anaplerotic reactions, amphibolic nature of the citric acid cycle. Mitochondrial electron

transport and oxidative phosphorylation, mechanism of ATP synthesis, electron transport inhibitors and uncouplers, gluconeogenesis, glyoxylate cycle, cyanide resistant respiration, Pentose phosphate pathway.

#### Unit – IV

Biological nitrogen fixation, nif gene, nitrate assimilation, GDH and GS/GOGAT pathways. Integration of nitrogen and carbohydrate metabolisms. Applications of auxins, gibberellins, cytokinins in agriculture and horticulture, Physiology of growth retardants - ethylene and abscisic acid, phytochrome mediated processes. Physiology of flowering & fruit ripening. dormancy of seeds, causes and methods of breaking dormancy. Ageing and senescence - types, physiological and biochemical changes. Physiology of seed germination.

#### Unit – V

Stress Physiology: definition, types and resistance mechanisms of water, drought, salt, ionizing and non ionizing radiation stresses.

Secondary metabolites: Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

#### Text Books:

1. Noggle, GR. and Fritz, GJ., 1976, Introductory Plant Physiology, Prentice - Hall, India.
2. Pandey, SN. & Sinha, 1972, Plant Physiology, Vikas Publishing, New Delhi.

#### Books for Reference:

1. Beevers, L. 1976, Nitrogen metabolism in plants. William & Sons Ltd. London.
2. Bray, CM., 1983, Nitrogen Metabolism in Plants, Longman.
3. Devlin, RM., 1974, Plant Physiology, Affiliated East West Press Pvt. Ltd.

4. Epstein, E., 1978, Mineral Nutrition in Plants-Principles and Perspectives, Wiley.
5. Kramer, P.J., 1969, Plant and soil water relationship, A Modern Synthesis.
6. Salisbury, FB.& Ross, S., 1974, Plant Physiology, Prentice Hall India (Pvt.) Ltd. New Delhi.
7. Levitt, 1972, Responses of plants to environmental stress, Academic press, New York.
8. Bidwell RGS., 1979, Plant Physiology, Mac Millan Publishing Company. New Delhi.

Sem-III  
10PPB3112

Hours/week : 4  
Credits : 3

PRACTICALS-V  
**(PLANT PHYSIOLOGY)**

1. Determination of water potential (Shardakov's method).
2. Determination of solute potential.
3. Hill reaction.
4. Estimation of total acidity in CAM plants.
5. Apparent photosynthesis.
6. Estimation of total free aminoacids.
7. Estimation of proline.
8. *In vivo* assay of NR, NiR.
9. Estimation of IAA.
10. Estimation of sucrose.
11. Estimation of starch by perchloric method.
12. Estimation of nitrogen by Nessler's method.

Sem-III  
10PPB3113

Hours/week : 5  
Credits : 4

## BIOCHEMISTRY

### Objectives:

1. To fathom the chemical environment of cell.
2. To elucidate the interrelationships of the cellular components.

### Unit - I Amino Acids and Peptides

Amino acids: general structure and classification. Glutathione: synthesis and function. Neurotransmitter peptides, peptide hormones and growth hormones. Immunosuppressant peptide - cyclosporin. Phenylalanine and tyrosine metabolism, Tetrapyrrole from glycine, Cysteine and methionine metabolism, Coenzyme A from valine, aspartate and cysteine. Polyamines from methionine and arginine.

### Unit - II Proteins

The peptide bond and primary structure. Protein sequencing strategies chemical and enzymic. Secondary structure and backbone folding. Tertiary structure and stabilizing forces in collagen. Quarternary structure of haemoglobin and its regulatory features. Ligand binding and cooperative effect.

### Unit - III Carbohydrates

Homoglycans: structure and properties of starch, glycogen, cellulose, dextrin and inulin. Heteroglycan: structure and properties of agar, alginic acid (sea weed polysaccharide), glycosaminoglycans and pectins. Glycocalyx oligosaccharide.

### Unit - IV Lipids and Biomembranes

Triglycerides, phosphoglycerols, derived lipids - steroids, prostaglandins and leukotrienes. Membrane lipids and their alignment in membrane. Membrane proteins and membrane receptors: adrenalin receptors, acetylcholine receptors and insulin receptors. Transduction of signals across membranes. Receptor



controlled adenylate cyclase system: calcium (calmodulin) system and phosphatidylinositol system.

### Unit - V Enzymes

Principles of catalysis, activation barrier and energy changes in reaction profile, initial velocity and principles of enzyme kinetics: Michaelis - Menten Equation,  $K_m$  and  $V_{max}$  measurements - LB blot. Active site organization, role of cofactors and vitamins. Enzyme regulation: pH, temperature and substrate concentration. Inhibitions and covalent modifications.

#### Text Book:

1. Stryer, L., 1988, Biochemistry, WHFreeman & Co., NY.

#### Books for Reference:

1. Apps *et al.*, 1992, Biochemistry, ELBS.
2. Caret *et al.*, 1993, Inorganic, Organic and Biological Chemistry, WMC Brown Pub. USA.
3. Lehninger, AL., 1987, Biochemistry, CBS Pub.
4. Rawn, D., 1989, Biochemistry, Neil Patterson.
5. Jeffrey M Cooper, 2002, The cell: A molecular approach.
6. Zuley G.L., 1998, Biochemistry, Wm.C.Brown Publishers USA.
7. Mathews CK, *et al.*, 2005, Biochemistry, Pearson Education, Singapore.

Sem-III  
10PPB3114

Hours/week : 4  
Credits : 4

## APPLIED BIOTECHNOLOGY

### Objectives:

1. To apply the genetic concepts into manipulating living things.
2. To exploit living things for human benefit.

### Unit I

Plant tissue culture - organogenesis and somatic embryogenesis. Micropropagation – Meristem culture. Culturing of ornamental plants and orchids. Protoplast fusion and regeneration. Microspore culture and haploids. Synthetic seeds.

### Unit II

*Agrobacterium* and crown gall tumour. Mechanism of T DNA transfer to plants. Ti plasmid vector for plant transformation. Strategies for crop improvement - Bt, chitinase. Engineering for tolerance against herbicide, drought, salt and disease resistance. Plantibodies and edible vaccines. Bioplastics.

### Unit III

Animal cell culture and applications. IPM and juvenile hormone analogues. Transgenic animals - improving important genes, genetic pharming and recombinant proteins. Cryobiology and germplasm conservation. Animal husbandry - AI, IVF and embryo manipulation. Biotechnology in aquaculture - ploidy induction, gynogenesis, androgenesis and transgenic fishes.

### Unit IV

Gene therapy and gene delivery systems. Immunotoxins and recombinant vaccines. Cloning - reproductive and therapeutic. Stem cell technology and its revolutions. Xenografting, animal organ donors and the controversies.

## Unit V

Technology protection systems - the terminator. GMOs and the environment – Cartagena Protocol biosafety aspects of transgenics and GM foods - principles: advance informed consent, precaution, safety testing, labeling, containments, biosafety cabinets and substantial equivalence. Issues - biological weapons, genetic erosion, loss of biodiversity, gene drain and gene escapes.

### Text Books:

1. George, EF. and Sherrington, PD., 1984, Plant propagation by tissue culture. Exegetics Limited, London. (Unit - I, II)
2. Watson JD *et al.*, 2005, Recombinant DNA. Blackwell Science publ. USA. (Unit - III, IV & V)

### Books for Reference:

1. Adrian Slater *et. al.*, 2003, Plant Biotechnology , Oxford University press, U.K.
2. Glick BJ and Pasternack JJ, 2004, Molecular biotechnology. Panima Publ. Bangalore.
3. Old R W and Primrose SB, 1994, Principles of Gene Manipulation, Blackwell, Science Ltd., London.
4. Hedin, PA., Menn, JJ and Hollingworth, RM, 1988, Biotechnology for Crop Protection, American Chemical Society, Washington.
5. Marx, JL, 1989, A Revolution in Biotechnology, Cambridge University Press, Cambridge.
6. Razdan, MK, 1993, An introduction to Plant Tissue Culture. Mac Millan Co., Bombay.
7. Gamborg, OL, Phillips, GC, 1998, Plant Cell, Tissue & Organ Culture. Fundamental Methods. Narosa Publishing house, New Delhi.
8. Hammond, J. McGarvey., P. Yusibov, 2004, Plant Biotechnology, Springer Verlag.

Sem-III  
10PPB3115

Hours/week: 4  
Credits : 3

## PRACTICALS-VI

### **(BIOCHEMISTRY & APPLIED BIOTECHNOLOGY)**

1. Estimation of total Lipids and triglycerides.
2. Estimation of hexosamine (mucopolysaccharide).
3. Estimation of glycogen (anthrone method).
4. Estimation of total polysaccharides.
5. Estimation of cholesterol.
6. Study of enzyme kinetics (phosphatase) and activity.
  - Effect of change of temperature.
  - Effect of change of pH.
  - Effect of change of enzyme concentration.
  - Effect of change of substrate concentration and measurement of  $V_{max}$  and  $K_m$ .
7. Callus induction and regeneration.
8. Clonal propagation.
9. Electrophoretic separation of DNA, protein and restriction digestion.
10. Isolation of protoplasts by enzymes.



Sem - III  
10PPB3202A

Hours/week: 4  
Credits: 3

## **CELL SIGNALING AND COMMUNICATION**

Objectives:

### Unit I

**Host parasite interaction:** Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of hostcell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

### Unit II

**Cell signaling:** Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component signaling systems, bacterial chemotaxis and quorum sensing.

### Unit III

**Cellular communication:** Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extra cellular matrix, integrins, neurotransmission and its regulation.

### Unit IV

**Cancer:** Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

## Unit V

Programmed cell death Apoptosis—genes involved, Functions: Cell termination—Homeostasis—development—lymphocyte interaction. Process of Apoptosis: mitochondrial regulation—direct signal transduction—excretion and removal of dead cells. Apoptosis in plants. Theories of Aging and senescence—gene regulation. Cellular senescence and whole organism aging.

### Text Book

1. Michel Friedman and Brett Friedman, 2004, Cell communication: Understanding how information is stored and used in cells. (The Library of cells- Series), Ingram International Inc.

### Reference Books:

1. Geoffery M Cooper and Robert E Hausman, 2009, The Cell and molecular approach. 5t Ed. ASM Press and Sinauer Associates Inc.
2. Fairweather I, 2003, Cell signaling in prokaryotes and lower metazoan. Springer Neatherlands.
3. Gomperts, Basten D, Ijbrand M Kramer, Peter ER Tatham, 2009, Signal transduction. 2nd Ed. Academic Press.
4. Unsicker, Klaus, 2005, Cell signaling and growth factors in development: from molecules to organogenesis. 1st Ed. Wiley-VCH Pub.
5. Ernst JM Helmreich, 2001, The Biochemistry of cell signaling. Oxford Univ Press.
6. Krauss G, 2003, Biochemistry of signaling transduction and regulation. 3rd Ed. John Wiley and Sons.
7. Brian Henderson, A. Graham Pockley. 2005. Molecular Chaperones and Cell signaling . Cambridge University Press.

Sem- III  
10PPB3202B

Hours/week: 4  
Credits: 3

## REMOTE SENSING AND GIS

### Objectives:

1. To know the principles of RS and the process of obtaining RS data.
2. To know the concept, method and use of GIS.

### Unit – I

Remote Sensing - Introduction, definition, history, Indian space program, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, interaction with earth surface, major components of remote sensing, image acquisition.

### Unit – II

Satellite Image: Introduction, definition, types of image, hard copy, soft copy, pixel. Image resolutions - spectral, spatial, temporal and radiometric. Image stations, image interpretation elements, digital classification: supervised, unsupervised and hybrid classification, advantages and disadvantages.

### Unit – III

Aerial photography: Introduction to aerial photos, aerial camera, B/W aerial photos, infrared photos, aerial photo interpretation, applications of aerial photos, GPS - principles and application. Applications of Remote Sensing.

### Unit - IV

Geographic Information System - history, definition. Georeference - latitude, longitude. Spatial features - point, line and polygon. Manual GIS, Computer assisted GIS. Components of GIS. Data structure. Raster data format, vector data format. Digitization. Data input, correction, storage and output. Errors - sources and types.



## Unit - V

Map – definition, features, projection, thematic maps. Map composition. Map overlay analysis. Application of GIS - spatial analysis, decision making and environmental impact assessment.

### Text Books:

1. Lillesand, TM and Kiefer, RW, 1994, Remote Sensing and Image Interpretation, 3rd Edition, John Wiley and Sons. (Units I, III)
2. Burrough, PA , Principles of Geographical Information Systems for Land Resources Assessment, Clarendon Press, Oxford. (Units - IV, V)

### Books for Reference:

1. Hord, R. Michael, 1986, Remote Sensing: Methods and Applications, John Wiley & Sons.
2. Jensen, J R, 1986, Introductory Digital Image processing: A Remote Sensing perspective, prentice - Hall, New Jersey.
3. Sharma, MK, 1986, Remote Sensing and Forest surveys, International Book Distributors, Dehra Dun.
4. Johnson, PI, 1969, Remote Sensing in Ecology, University of Georgia press, Athens.
5. Barrett, EC, 1982, Introduction to Environmental Remote Sensing, Chapman & Hall.
6. Campbell, J, 1984, Introductory cartography, Prentice-Hall Englewood Cliffs, N.J.
7. Floyd, F. Sabins, JJ, 1987, Remote Sensing: Principles and Interpretation II Edition, W.H. Freeman and Co., New. York.
8. Cliff, AD and Ord, JK ,1981, Spatial process: Models and application, Pion, London,

Sem- III  
10PPB3315A

Hours/week:  
Credits: 2

**SELF STUDIES-PLANT BREEDING AND EVOLUTION**

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*Syllabus : 2010*

Sem- III  
10PPB3402

Hours/week: 4  
Credits: 2

**REMOTE SENSING AND GIS  
(Refer IDC Syllabus Book)**

Sem-IV  
10PPB4116

Hours/week: 6  
Credits: 5

## **MICROBIOLOGY AND PATHOLOGY**

### Objectives

1. To study the different types of microorganisms and their activities.
2. To understand and exploit their potentialities in agriculture, industry and other environmental aspects.

### Unit - I General Microbiology

Microbiology - scope, branches and history. Structure and organization of Spirochetes, Rickettsias, Chlamydias, Mycoplasmas, Viruses - Viroids and prions. Culture of microorganisms, synchronous, batch and continuous culture. chemostat and turbidostat, preservation of microbes.

### Unit - II Food, Dairy and Aquatic Microbiology

Microbial contamination of food; sources and factors, food poisoning, food-borne infections, food preservation. Microbial contamination of milk, milk-borne infection and intoxication; preservation of milk and dairy products. Yogurt and cheese. Aquatic microbiology - fresh water, marine microbes; factors influencing aquatic microbiology. Treatment of contaminated water and sewage; microbes involved in biogeochemical cycling. Biodegradation of solid wastes and heavy metals.

### Unit - III Industrial Microbiology

Selection of industrially useful microbes, fermentation processes, recovery of end products; production of alcohol, insulin, lactic acid, vinegar, hydrocarbons, single cell oil and single cell protein. Common immunizations, antibiotics and other chemotherapeutic agents and their mode of action. Microbial resistance to drugs.

### Unit - IV Clinical Microbiology

The epidemiology and control of the following diseases: bacterial

diseases of human beings; diphtheria, tuberculosis, pertussis and meningitis, viral diseases of humans (diseases caused by Adeno, Herpes, Varicellazoster (VZV), Rhabdo and Retroviruses). Opportunistic (nosacomial) infection; Mycoplasmal, Rickettsial Chlamydial; fungal and protozoan diseases of human beings. Avian flue and SARS.

### Unit - V Plant Pathology

Introduction-scope, significance and terminology of plant pathology. Diseases – concepts, components and causes. Classification of diseases, general symptoms of plant diseases: necrosis, chlorosis, hyper trophy and hyperplasia. Mode of infection and dissemination. Role of enzymes and toxins in disease development. Molecular basis of infection and defence mechanisms. Control measures: biological, cultural and chemical methods.

#### Text Book:

1. Prescott *et al.*, 2009, 7e, Microbiology. Wm. C. Brown Publishers. (Unit - 1, 4)
2. Mehrotra RS, 1994, Plant pathology, Tata Mc Graw Publishing Company Ltd. New Delhi. (Unit - 5)

#### Books for Reference:

1. Pelczar *et al.*, 1998, Microbiology - Concepts & Applications. Tata McGraw Hill Publishing co Ltd., New Delhi.
2. Sullia SB and Santharam S, 2005, General Microbiology, Oxford & IBH Publishing company, P. Ltd. New Delhi.
3. Adams MR and Moss MO, 1995, Food Microbiology. Royal Society of Chemistry, Cambridge, UK.
4. Rangasamy G, 1988, Diseases of crop plants in India. Prentice-Hall of India P. Lit. New Delhi.
5. Dickinson M, 2003, Molecular Plant Pathology. BIOS Scientific Publishers, London.
6. Brige, EA, 1992, Modern Microbiology. Principles and applications, WMC Brown Publishers, USA.
7. Phillip A Thomas, 2007, Clinical Microbiology. Orient Longman.

Sem-IV  
10PPB4117

Hours/week: 6  
Credits: 5

## PHARMACOGNOSY

### Objectives:

1. To study various extraction procedures of active compounds.
2. To study various secondary products of plant as anti-microbial agents.

### Unit - I

Traditional and alternative systems of medicine, classification of crude drugs, scheme for pharmacognostic studies of a crude drug. Collection, processing and preparation of crude drugs.

### Unit - II

Medicinal plant Biotechnology - medicinal herbs and transgenic plants. Plant tissue culture as source of biomedicinals - introduction to biogenesis of phytopharmaceuticals - Indian trade in medicinal and aromatic plants.

### Unit - III

Analytical pharmacognosy - Drug adulteration, methods of drug evaluation - biological testing of herbal drugs. Phytochemical investigations: phytopharmaceuticals - retrospects and prospects, Ayurvedic pharmacy.

### Unit - IV

Pharmaceutical plant products: carbohydrates and derived products. Drugs containing glycosides, tannins, lipids, terpenoids, Enzymes and protein drugs, alkaloidal drugs.

### Unit - V

Nutraceuticals and cosmeceuticals - fibres, sutures and surgical dressings – Natural pesticides, antibiotics and allergenic extracts – Immunomodulators – adaptogens and rasayana.

**Text Book:**

1. Kokate, C.K., Purohit A.P and Gokahale, 2002, Pharmacognosy, Nirali Prakashan.
2. Gary Walsh 1998, Biopharmaceutical, John Wiley and Sons, NY

**Books for Reference:**

1. Peter B. Kaufmann *et al.*, 1999, Natural Products from Plants, C.R.C. Press.
2. Munson, P., 1995, Principles of Pharmacology.
3. Nadkarni, AK, 1989, *Indian Materia Medica* Vol: 1 Publisher: Popular Prakash, Mumbai, India.
4. Warriar P.K *et al.*, 1995, A compendium of Indian medicinal plants vol 1,2 & 3, Orient Longman publication.

Sem-IV  
10PPB4118

Hours/week: 4  
Credits: 3

### PRACTICALS-VII

#### (MICROBIOLOGY & PATHOLOGY AND 'PHARMACOGNOSY)

1. Identification and uses of locally available medicinal plants (*Cissus quadrangularis*, *Cardiospermum halicacabum*, *Aegle marmelos*, *Tribulus terrestris*, *Phyllanthus niruri*, *Acorus calamus*, *Centella asiatica*, *Solanum xanthocarpum*, *Wedelia calendulacea*, *Vitex negundo*, *Vetiveria zizanoides*).
2. Preparation of aqueous, methanolic and ethanolic extracts of medicinal plants using soxhlet apparatus.
3. Qualitative tests for phenols, terpenoids, alkaloids, glycosides, steroids and saponin.
4. Quantitative estimation of anthocyanin, flavonoids and total phenols.
5. TLC separation of phenols, terpenoids and alkaloids.
6. Antimicrobial screening of bioactive principles of medicinal plants.
7. Preparation of tonics and syrups (*Aegle marmelos* and *Vetiver*)
8. Screening for antioxidants.
9. Simple screening for leaf lectins.
10. Preparation of media, stains and sterilization techniques.
11. Isolation of microorganisms from soil - bacteria, fungi and actinomycetes staining techniques.
12. Bacterial staining - Simple, Gram's and Capsular staining.
13. Test for activity of amylase and protease.
14. Isolation of bacteria from skin, mouth and urine.



15. Potability test of water - presumptive, confirmative and completed tests.
16. Quantitative estimation of bacteria in milk.
17. Testing quality of milk by methylene blue reductase and phosphatase test.
18. Morphological and biochemical identification of bacteria - indole test, methyl red test, Voges-Proskaur test, Citrate utilization test, TSI agar test.
19. Cellulolytic fungi – isolation and application of wood rots.
20. WIDAL test.
21. ABO blood grouping, Rh factor.

Sem-III  
10PPB4203A

Hours/week: 4  
Credits : 4

**IMMUNOLOGY**  
**(Optional paper)**

**Objectives:**

1. To know the basic concepts of the immune system.
2. To understand the mechanism of immune action.

**Unit – I**

Immunology – introduction - immune system - organs - immune cells - haemopoiesis -detailed study of T and B cells. General structure of antibodies - classes - cloning and expression of immunoglobulin genes.

**Unit - II**

Antigens – types, properties, antigen-antibody interaction. Types of immunity - innate and adaptive - emphasis on cell mediated and humoral immune reactions - Vaccines -Immunization schedule.

**Unit – III**

Major histocompatibility complex - Class I and II MHC molecules - Antigen processing and presentation. HLA complex - genes involved. Immune dysfunction, clinical importance.

**Unit - IV** Cytokines and interferons - types - mechanism of action and therapeutic uses. Transplantation immunology and tumor immunology. Monoclonal antibodies - Bispecific monoclonal antibodies, conjugated monoclonal antibodies - production and clinical importance.

**Unit - V**

Application of Immunotechniques-Agglutination assays - Precipitation assays- Antibody inhibition assay - ELISA - RIA - Western Blotting - Immunoelectrophoresis - Flow Cytometry and HLA Typing - Principle and clinical applications.

**Text Book:**

1. Kuby J, 2000, Immunology, 4th edition, W H Freeman.

**Books for Reference:**

1. Janeway and Travers, Immunobiology, 3rd edition Garland Pub. Inc. NY.
2. Nandini Shetty 1996, Immunology - An introductory Text Book, New Age International (P) Ltd.,
3. Roitt I et al., 1998, Immunology 5th edition, Mosby International Ltd. London. UK.
4. Sell, S. Basic Immunology. North Holland, London.
5. Paul, WE, 1999, Fundamentals of Immunology. 2nd Edition.

Sem-III  
10PPB4203B

Hours/week: 4  
Credits : 4

**BIOINFORMATICS**  
(Optional paper)

**Objectives:**

1. To know the various databases available.
2. To learn sequence analysis.

**Unit-I**

Computer concepts - Structural organization of Computer - evolution of Computer -operating system - computer applications in Biology. Bioinformatics and its applications, Information networks - EMB net and NCBI. Databases; Primary Nucleic acid databases - EMBL; Gene Bank and DDBJ.

**Unit-II**

Gene structure and DNA sequences, CDS - open reading frames - The EST alphabet - The expression profile of a cell, cDNA libraries and ESTs. EST analysis tools - sequences similarity search tools, sequence assembly and sequence clustering tools. Alignment techniques; use of gap characters. Identity and similarity.

**Unit-III**

Protein sequences databases; primary databases PIR, MIPS, SWISS - PROT, TrEMBL, NRL-3D. Structure of SWISS - PROT entries. Secondary Databases; PROSITE, PROFILES, PRINTS, Pfam, BLOCKS and IDENTIFY. Composite protein Databases.

**Unit-IV**

Dotplot, Pairwise database searching Global alignment, FASTA and BLAST Building a sequence search protocol. Phylogenetic analysis - Parsimony, Distance Matrix, Distance maximum Likelihood. Construction of phylogenetic tree with reference to DNA, RNA and protein sequences. Biological importance of computerized phylogenetic analysis. Web browsing.

## Unit-V

Genome annotation, Protein structural genomics, Comparative genomics, Computational identification of Genes, Hawaii biological survey. The role of EBI and USGS.

### Text Book:

1. Attwood T K and Parry Smith D J, 1999, Introduction to Bioinformatics Addison Wesley Longman Limited, England.

### Books for Reference:

1. Baxovans A. D., and Francis Ouellette BP 1998, Bioinformatics a practical guide o the analysis of gene and proteins, Wiley – Interscience publication, New York.
2. Primrose, S. B., and Twyman R. M., 2003, Principles of Genome analysis and Genomics.
3. Balagurusamy, E., 1985, Programming in BASIC. Tata McGraw Hill Publication Co. Ltd., New Delhi.
4. Dheenadayalu, R., 1987, Computer Science. Tata McGraw Hill Publication Co. Ltd., New Delhi.
5. Smith, D.W., 1994, Biocomputing – informatics and Genome Project Academic press, Inc., New York.

Sem-IV  
10PPB4501

Hours/week:10  
Credits: 5

**PROJECT DISSERTATION AND  
VIVA VOCE EXAMINATION**

**INTER DEPARTMENTAL COURSE - IDC****BIOCHEMISTRY**

- 10PBC2401 APPLIED NUTRITION  
10PBC3402 FIRST AID MANAGEMENT

**BIOTECHNOLOGY**

- 10PBT2401 BASIC BIOINFORMATICS  
10PBT3402 BASIC GENOMICS & PROTEOMICS

**CHEMISTRY**

- 10PCH2401 HEALTH CHEMISTRY  
10PCH3402 INDUSTRIAL CHEMISTRY

**COMMERCE**

- 10PCO2401 FINANCIAL ACCOUNTING FOR MANAGERS  
10PCO3402 MANAGEMENT CONCEPTS & ORGANIZATIONAL BEHAVIOR

**COMPUTER APPLICATIONS**

- 10PCA2401 INTERNET CONCEPTS  
10PCA2402 FOUNDATION OF COMPUTER SCIENCE  
10PCA3403 COMPUTER APPLICATIONS FOR SOCIAL SCIENCES  
10PCA3404 FUNDAMENTALS OF PROGRAMMING

**COMPUTER SCIENCE**

- 10PCS2401A FUNDAMENTALS OF IT  
10PCS2401B WEB DESIGN  
10PCS3402A FLASH  
10PCS3402B DREAM WEAVER

**ECONOMICS**

- 10PEC2401 ECONOMICS FOR MANAGERS  
10PEC3402 INDIAN ECONOMY

**ELECTRONICS**

- 10PEL2401 ELECTRONICS IN COMMUNICATION  
10PEL3402 COMPUTER HARDWARE

**ENGLISH**

- 10PEN2401 BUSINESS ENGLISH  
10PEN3402 INTERVIEW SKILLS AND GROUP DYNAMICS

**HISTORY**

- 10PHS2401 PUBLIC ADMINISTRATION  
10PHS3402 APPLIED TOURISM

**HUMAN RESOURCE MANAGEMENT**

- 10PHR2401 FUNDAMENTALS OF HRM  
10PHR3402 PERSONALITY AND SOFT SKILLS DEVELOPMENT

**INFORMATION TECHNOLOGY**

- 10PIT2401A FUNDAMENTALS OF IT  
10PIT2401B WEB DESIGN  
10PIT3402A FLASH  
10PIT3402B DREAM WEAVER

**MATHEMATICS**

- 10PMA2401 OPERATIONS RESEARCH  
10PMA3402 NUMERICAL METHODS

**PHYSICS**

- 10PPH2401 MODERN PHOTOGRAPHY  
10PPH3402 MEDICAL PHYSICS

**PLANT BIOLOGY & PLANT BIOTECHNOLOGY**

- 10PPB2401 NANOBIO TECHNOLOGY  
10PPB3402 REMOTE SENSING AND GIS

**TAMIL**

- 10PTA2401 முருகு; கழிப்பு; நியூட்ரிஷன்; கல்வி; - 1  
10PTA3402 முருகு; கழிப்பு; நியூட்ரிஷன்; கல்வி; - 2