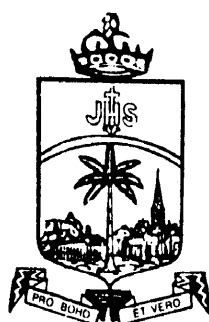




M.Sc. BOTANY

SYLLABUS : 2012

**CHOICE BASED CREDIT SYSTEM
(CBCS)**



St. JOSEPH'S COLLEGE (Autonomous)

Re-accredited with 'A' Grade (3rd Cycle) 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, accredited with Five Star status in 2001, Re-accredited with **A+ Grade** from NAAC (2006), Re-accredited with **A Grade** from NAAC (3rd cycle), 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 (TANSCHHE) 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	05
I - IV	3 - Core Electives	3	4	3 x 4	12
	1 - Soft Skill Course (Common) (IDC-1)				
	1 - Inter Dept. Courses (IDC-2)	2	4	2 x 4	08
I - IV	SHEPHERD - Extension Activity	~	70	5	05

Total Minimum Credits **100**

Other Additional Credits (Dept. Specific) **....**

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

For PG courses a student must earn a minimum of 100 credits. 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 Departmental 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 Discussions, Viva, Field Visits, 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 Departmental 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 IDCs must be taken by students which are offered in Semester II & III. In

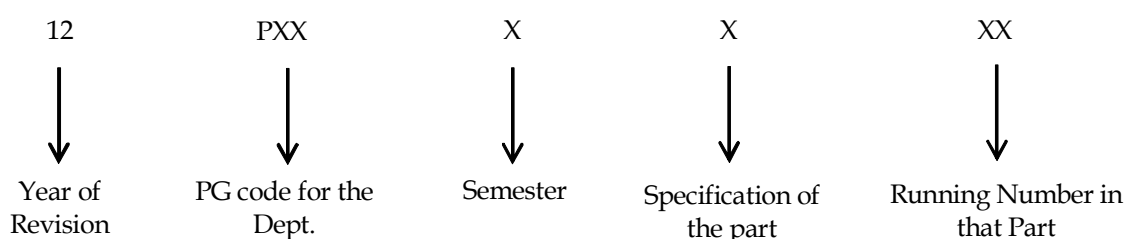
semester II, a common IDC, Soft Skills is to be offered by JASS (Joseph Academy of Soft Skills).

Day College (Shift-I) student may also take an IDC-2 from SFS (Shift-II) course and vice versa

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

06 – SHEPHERD

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 2 hours duration. The remaining 40% would comprise of any three 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, etc.

- * 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.

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:

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

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

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 100 credits. The student has also acquired _____ (if any) additional credits from courses offered by the parent department.

M.Sc. Botany - Course Pattern

Sem.	Code	Paper	Hrs	Cr
I	12PBO1101	Plant Diversity	6	5
	12PBO1102	Laboratory Course I (Pl. Diversity)	4	3
	12PBO1103	Molecular Genetics	6	5
	12PBO1104	Biodiversity & Climate Change	6	5
	12PBO1105	Laboratory Course II (Mol. Gen.& Biodiversity)	4	3
	12PBO1201A	Core Elective : Developmental Biology (OR)	4	4
	12PBO1201B	Forestry and Wood Science		
Total for Semester I			30	25
II	12PBO2106	Plant Physiology	5	4
	12PBO2107	Laboratory Course III (Pl. Physiology)	3	3
	12PBO2108	Recombinant DNA Technology	5	4
	12PBO2109	Research Methodology	5	4
	12PBO2110	Laboratory Course IV (rDNA Techn. & Res. Meth.)	4	3
	12PBO2202A	Core Elective : Cell Signalling & Communication (OR)	4	4
	12PBO2202B	Herbal Science		
	12PSK2401	IDC -I: Soft Skills	4	4
Total for Semester II			30	26
III	12PBO3111	Plant Systematics	6	5
	12PBO3112	Laboratory Course V (Pl. Systematics)	4	4
	12PBO3113	Plant Breeding and Evolution	4	2
	12PBO3114	Biochemistry	5	4
	12PBO3115	Laboratory Course VI (Biochemistry)	3	3
	12PBO3203A	Core Elective : Immunology (OR)	4	4
	12PBO3203B	Bioinformatics		
	12PBO3402	IDC - II: Horticulture & Landscaping	4	4
Total for Semester III			30	26
IV	12PBO4116	Microbiology	5	5
	12PBO4117	Biotechnology	5	5
	12PBO4118	Laboratory Course VII (Microbiol. & Biotechnol.)	4	3
	12PBO4501	Project Dissertation and <i>Viva Voce</i>	16	5
Total for Semester IV			30	18
General Credits				95
	12PBO4601	SHEPHERD		5
GRAND TOTAL FOR ALL SEMESTERS				100

PLANT DIVERSITY

Objectives

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

UNIT - I:

Algae (individual life cycles, developmental studies on sex 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.

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

UNIT - III:

Bryophytes - classification, 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 Type study 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.

Books

1. Venkataraman, *et al.*, 1974, *Algae-Form & Function*. Today and Tomorrow, Pub. Co.
2. Alexopoulos, C.J, *Introductory Mycology*. Wiley & Sons, C.W., Eastern Ltd., Delhi.
3. Prempuri, 1973. *Bryophytes - a broad perspective*. Atma Ram & Sons, New Delhi.
4. Foster & Gifford, 1959, *Comparative morphology of vascular plants*. COH, Freeman.

Reference

1. Delevoryas, T., 1977, *Plant Diversification*. Holt, Rinehart & Wintson, New York.
2. Chapman, V.J. & Chapman, D.J. *The Algae*. ELBS & MacMillan, London
3. Srivastava, H.N., 1999, *Fungi*. Pradeep Publications, Jalandhar
4. Hale, Jr. M.E., 1983, *Biology of Lichens*. Edward Arnold, Mayland.
5. Karl J. Nikias, 1981, *Paleobotany, Paleoecology & Evolution*, Praeger Pub. USA.

LABORATORY COURSE - 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 Report.

MOLECULAR GENETICS

Objectives

- * To understand the organization and functioning of genetic material.
- * 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, germinal vs 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 recombination, transposition and site-specific recombination. Extra-chromosomal (maternal) inheritance: inheritance of mitochondrial and chloroplast genes. DNA replication: rules, polymerases and molecular mechanism in linear and circular DNA. Replication of RNA genomes - replicase and reverse transcriptase.

UNIT III

Transcription mechanism in prokaryotes - RNA-P, initiation, elongation and termination in *E. coli*. Post transcriptional modifications. 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.

Book for Study

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.

BIODIVERSITY AND CLIMATE CHANGE

Objectives

- * To comprehend and appreciate the variety in living world.
- * To manage and conserve the biological resources.

UNIT I

Biodiversity: 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 II

Genetic Diversity. Plant genetic resources, megacentres 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 III

Conservation of biodiversity. 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 and ecotourism - its uses and misuses. Role of national, international organizations in conservation: IUCN, IBPGR, WWF, UNEP, FAO and WB.

UNIT IV

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 V

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.

Book for Study

Melchias, G., 2001, *Biodiversity and Conservation*, Science Publishers Inc. NH USA

Books for References

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. Sharma, P.D., 1999. *Ecology and Environment*, Rastogi Publishers, Meerut
6. Krishnamurthy K.V. 2003. *An advanced text book on Biodiversity Principle and Practice*. Oxford and IBH Publishing Co., New Delhi.

LABORATORY COURSE - II
MOLECULAR GENETICS & BIODIVERSITY

1. Problem solving: 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 on larva
6. Isolation of genomic DNA from plant and animal samples.
7. Determination of DNA and RNA
8. Enumeration of organisms in aquatic samples.
9. Chemical analysis of waters - Acidity, Alkalinity, Dissolved CO₂, Chlorides, Dissolved oxygen.
10. Vegetation Analysis.
11. Study of primary productivity (Winkler's method)
12. Field trip.

**DEVELOPMENTAL BIOLOGY
(CORE ELECTIVE)**

Objectives

- * To understand the pattern of embryo development among vertebrates.
- * To elucidate the fate and differentiation of early embryonic cells.

UNIT I

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 II

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*.

UNIT III

Introduction to embryology and development - basic concepts; potency, commitment, specification, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; and cytoplasmic determinants. Gametogenesis, fertilization and early development of embryo. Production of gametes, cell surface molecules in sperm-egg recognition in animals.

UNIT IV

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 V

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

Books for Study

1. Browder LW, Brickson CA and WR Jeffery. 1991. *Developmental Biology*, 3rd Ed. Saunders College Publishing, Philadelphia.
2. Bhojwani SS and SP Bhatragar. 1999. *The Embrology of Angiosperms*. Vikas Publishing House Pvt. Ltd. New Delhi.

Books for References

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 Harb. Lab. Press, USA.
3. Slack, JMW. 2005. *Essentials of Develop. Biol.* 2nd Ed. Wiley Blackwell, Germany
5. Larsen WJ. 1998. *Essentials of Human embryology*. Churchill Livingston Pub. Ltd. UK.
6. Soltis DE, Leebens JH and PS Soltis (eds.) 2006. *Developmental genetics of the flower*, *Advances in Botanical Research* Vol 44: 1-594.

**FORESTRY AND WOOD SCIENCE
(CORE ELECTIVE)**

Objectives

- * To prepare students for careers in the forest services and wood products industry.
- * 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; Forest products; people and Forest; Social and community forestry; Forest industries; Role of social forestry in cottage industry; Role of forestry in Indian economy. Biomass conversion strategies - energy plantations.

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.

Activities: Raising nursery for social forestry

Books for Study

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

Books for References

1. Negi, S.S., 1994, India's Forests, Forestry and Wildlife, Indus publishing Com., 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.

PLANT PHYSIOLOGY

Objectives

- * To study the recent aspects of various physiological processes in plants.
- * 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 and antitranspirants. Source -sink relationships in translocation of solutes. Mineral nutrition: Mineral ion uptake - passive and active uptake and transport, Nernst equation, Donnan's potential, role of H^+ ATPase as a carrier, co-transport (symport), counter transport (antiport) ionophores - Na^+ . K^+ - ATPase pump.

UNIT II

Photosynthesis: Light reactions: Cyclic, non-cyclic and pseudocyclic photophosphorylation. Oxygen Evolving Complex (OEC) - Kok's model, photosynthetic carbon reduction cycles (PCR cycles): C_3 , C_4 and CAM pathway, Classification of C_4 plants and their significance, CO_2 concentration mechanisms, light activation of photosynthetic enzymes. Photorespiration and its regulation.

UNIT III

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.

UNIT V

Dormancy of seeds - causes and methods of breaking dormancy. Physiology of seed germination. Ageing and senescence - types and physiological/biochemical changes. Stress Physiology: definition, types and resistance mechanisms of water, drought, salt, ionizing and non ionizing radiation stresses.

Book for Study

Pandey, S.N. & Sinha, 2010, Plant Physiology, Vikas Publishing, New Delhi.

Books for References

1. Noggle, G.R. and Fritz, G.J. 2001, Introductory Plant Physiology, Prentice - Hall, India.
2. Devlin, R.M., 2000, Plant Physiology, Affiliated East West Press Pvt. Ltd.
3. Epstein, E., 2000, Mineral Nutrition in Plants-Principles and Perspectives, Wiley.

LABORATORY COURSE - III
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. Effect of CO₂ concentration on photosynthesis
7. Effect of quality of light on photosynthesis
8. Estimation of total free aminoacids and proline.
9. *In vivo* assay of NR & NiR.
10. Estimation of IAA.
11. Estimation of starch by perchloric method.
12. Estimation of nitrogen (Nessler's method).
13. Determination of activity of peroxidase and lipase.

RECOMBINANT DNA TECHNOLOGY

Objectives

- * To know the art of recombining genes and traits.
- * 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, sstrDNA 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: Ca²⁺-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 fingerprinting. IPR - the principles and rationale. Modalities of patenting of traits and DNA sequences and the issues. Hazards of RDT.

Books for Study

1. Old RN and Primrose S.B. 2004, Principles of gene manipulation - Blackwell Scientific Publications. USA.
2. Nicholl DST 2001 - An introduction to genetic engineering - Cambridge university press.

Books for References

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 B.R. and Pasternak J.J., 1998, Molecular Biotechnology, ASM Press, Washington.

RESEARCH METHODOLOGY

Objectives

- * To initiate the students into research activities.
- * 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.

UNIT II

Spectrophotometry: principles and instrumentation of 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 and measurements - autoradiography, X-ray crystallography and applications of isotopes.

UNIT III

Biostatistics: Measures of Location: Central values, Dispersions, skewness, kurtosis. Probability: binomial, poisson and normal distributions. Correlation: types, methods, regression analysis, Large sample (Z), small sample t, and chi-square. ANOVA - one and two way, Duncan Multiple Range Test. Principles of experimental design - randomization, replication, local control, size and shape of the plot, CRD, RBD.

UNIT IV

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, Page Rank, *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. The ISI and Thomson Reuter's Webmetric. Plagiarism, tailored research and retraction.

Books for Study

1. Kothari, C.R. 2000. Research Methodology - Methods & Techniques. Wishwa Prakashan.
2. Misra, R.P., 2000 Research Methodology - a handbook, Concept Publ Company, New Delhi.
3. Gupta, S.P., 1990, Statistical Methods, Sultan Chand & Sons, New Delhi.

Books for References

1. Hawkins, C and Sorgi, M. 2000 Research, Narosa Publishing House, New Delhi.
2. Willard, H.D., *et al.*, 1965, Instrumental Methods of Analysis, D Van Nostrand Co., New York.
3. Wilson, E. & Goulding, K.H. 2000 A Biologists' Guide to Principles and Techniques of Practical Biochemistry ELBS.
4. Daniel, W.W., 1983, Biostatistics: A Foundation for Analysis in the Health Science, John Wiley and Sons Inc., New York.

Reference for Bibliometrics

1. Ball, Philip. 2005. Index aims for fair ranking of scientists. *Nature* 436 (7053):900. <http://dx.doi.org/10.1038/436900a>.

2. Bornmann, Lutz, and Hans-Dieter Daniel. 2007. What do we know about the h index? *Journal of the American Society for Information Science and Technology* 58 (9):1381-1385. <http://dx.doi.org/10.1002/asi.20609>.
3. Bornmann, Lutz, Rüdiger Mutz, and Hans-Dieter Daniel. 2008. Are there better indices for evaluation purposes than the h index? A comparison of nine different variants of the h index using data from biomedicine. *Journal of the American Society for Information Science and Technology* (5):830-837.
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<http://www.sciencedirect.com/science/article/B83WV-4NCK2JT-1/1/ddf6c25f8810c462fb8c22ae3d5b5d28>
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<http://www.sciencedirect.com/science/article/B83WV-4P18BNV-1/1/0d60463e068ba604e67030229ce6d33b>
6. Eysenbach, G. 2006. Citation advantage of open access articles. *PLoS Biol* 4 (5):e157. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=16683865
7. Thomson Reuters. 2008. Using bibliometrics: a guide to evaluating research performance with citation data.
<http://scientific.thomsonreuters.com/news/newsletter/2008-07/8465001/>
8. Garfield, E 2006. The history and meaning of the journal impact factor. *JAMA* 295 (1):90-93. <http://jama.ama-assn.org/cgi/content/full/295/1/90>

LABORATORY COURSE - IV
rDNA TECHNOLOGY & RESEARCH
METHODOLOGY

1. Preparation of molar solutions, buffers and reagents.
2. Monoprotic and polyprotic acid titration and pKa value determination.
3. Chromatographic separation of amino acids (paper) and lipids (TLC).
4. Spectrophotometry: Standard graphs for proteins (BSA), Glycine and Glucose.
5. Isolation and determination of human genomic DNA.
6. Spectrophotometric determination of DNA.
7. Determination of MW of macromolecules from electrophoresis profile.
8. Dialysis (purification of proteins).
9. Electrophoretic separation of proteins (PAGE).
10. Sampling technique and measures of locations.
11. Exercises with Tests of Significance.
12. Exercises in the calculation of Citation Index.
13. Determination of Impact Factor of Author, Article and Journal.

CELL SIGNALLING AND COMMUNICATION (CORE ELECTIVE)

Objectives

- * To understand the mechanism of cell communication.
- * To understand how cells are programmed and the mechanism of cancer and apoptosis.

UNIT I

Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell 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; Theories of Aging and senescence - gene regulation. Cellular senescence and whole organism aging.

Book for Study

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.

Books for References

1. Geoffery M Cooper and Robert E Hausman. 2009. The Cell and molecular approach. 5th Ed. ASM Press and Sinauer Associates Inc.
2. Gomperts, Basten D, Ljbrand M Kramer, Peter ER Tatham. 2009. Signal transduction. 2nd Ed. Academic Press.
3. Ernst JM Helmreich. 2001. The Biochemistry of cell signaling. Oxford Univ Press.
4. Krauss G. 2003. Biochemistry of signaling transduction and regulation. 3rd Ed. John Wiley and Sons.

**HERBAL SCIENCE
(CORE ELECTIVE)**

Objectives

- * This paper aims at introducing the students to the ancient traditional system of medicine in order to drive home the message of the advantages of working with local natural resources.

UNIT I

Traditional and alternative system of medicine – short history of herbal medicine, naturopathy, traditional Chinese, Iranian, African, Islamic, Native Americans medicine and folk medicine. Principle and practice of Ayurveda, Siddha, Unani, Homeopathy, Aromatherapy and acupuncture. A peep into approach to health care system of medicine - merits.

UNIT II

Classification of crude drugs - alphabetical, taxonomical, morphological, chemical, pharmacological (therapeutic). Cultivation-sexual and asexual method of propagation, fertilizer and manure, pest and its control. Collection, processing of herbal drugs - harvesting, drying, dressing, packing and storage.

UNIT III

Herbal preparations methods - bolus, capsules, compresses, creams, decoctions, extracts, infusions, herbal tea, ointments, massage oils, medicinal vinegar, poultice & plasters, powders, salves, syrups, tinctures, tonic, troches, maceration and compresses, baths and bathing remedies - teas and dry extract (pills or capsules). Method of administration.

UNIT IV

Pharmaceutical plant products - alkaloids, glycosides, terpenoids, tannins, flavonoids, lipids, proteins. Nutraceuticals,

cosmeceuticals, pharmaceuticals – fibre, sutures, surgical dressings, adaptogens, rasayana.

UNIT V

Drug adulteration - types, methods of evaluation - biological, anatomical, physical, Phytochemical investigation. Global trend in herbal market. Status of Indian medicinal plant trade, medicinal plants prohibited from export, leading companies in India in trade of medicinal plants. WHO regulation of herbal medicine. CHMP/ CVMP guidelines of the European Medicines Agency Inspections.

Books for Study

1. James Green, 2000 Herbal Medicine-Maker's Handbook, Crossing Press, U.S.
2. Weiss, Rudolf Fritz 2000 Herbal Medicine, 2nd Edition Thieme Medical Publishers.
3. Kokate CK, Purokit AP and Gokahale, 2006. Pharmacognosy, Nirali Prakashan.
4. Peter B. Kaufmann *et al.*, 1999, Natural Products from Plants, C.R.C. Press.

Online Resources

- <http://www.gallowglass.org/jadwiga/herbs/preparations.html>
- <http://shawnacohen.tripod.com/thetribaltraditions/id51.html>
- <http://www.vasundharaorissa.org/Research%20Reports/GlobalisationAndMedicinalplantsOfOrissa.pdf>
- http://www.emea.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003393.pdf

IDC-I: SOFT SKILLS

Unit 1: Effective Communication & Resume Writing 12 Hours

Effective Communication

Definition of communication, Process of Communication, Barriers of Communication, Non-verbal Communication, Johari Window, The Art of Listening, Kinesthetic, Production of Speech, Organization of Speech, Modes of delivery, Conversation Techniques, Dialogue, Good manners and Etiquettes.

Resume Writing

What is Resume? Types of Resume? Chronological, Functional and Mixed Resume, Steps in preparation of Resume.

Unit II: Group Discussion, Interview Skills & Team Building

18 hours

Group Discussion (GD)

Group Discussion Basics, GD Topics for Practice, Points for GD Topics, Case-Based and Article based Group Discussions, Points for Case Studies, and Notes on Current Issues for GD.

Interview Skills

Common interview questions, Attitude, Body Language, The mock interviews, Phone interviews, Behavioral interviews.

Team Building

Team Vs Group - synergy, Stages of Team Formation, Dabbawala-Case Study-PPT, Broken Square-Exercise, Group dynamics, Win as much as you win- Exercise, Leadership - Styles, Work ethics.

Unit III: Personality Development, Attitude & Motivation 18 hours

Personality Development

Self awareness, Assertiveness, Goal setting, Problem-solving, Conflict and Stress Management, Decision-making skills, Positive and Creative thinking, Lateral thinking, Time management.

Attitude

Concept, Significance, Factors affecting attitudes, Positive attitude, Advantages, Negative attitude, Disadvantages, Ways to develop positive attitude, Difference between Personalities having positive and negative attitude.

Motivation

Concept of motivation, Significance, Internal and external motives, Importance of self-motivation, Factors leading to demotivation.

Unit IV: Numerical Ability

8 hours

- * Average, Percentage
- * Profit and Loss, Simple Interest, Compound Interest
- * Time and Work, Pipes and Cisterns
- * Time and Distance, Problems on Trains, Boats and Streams
- * Calendar, Ratios and Proportions.

Unit- V: Test of Reasoning

8 hours

Verbal Reasoning

- * Series Completion, Analogy
- * Data Sufficiency, Assertion and Reasoning
- * Logical Deduction

Non-Verbal Reasoning

- * Series
- * Classification

References

- * Aggarwal, R.S. *Quantitative Aptitude*, S.Chand & Sons.
- * Aggarwal, R.S. (2010). *A Modern Approach to Verbal and Non Verbal Reasoning*, S.Chand & Co., Revised Edition.
- * Alex, K. (2009). *Soft Skills*, New Delhi, S. Chand & Company Ltd.

- * Covey, Stephen. (2004). *7 Habits of Highly effective people*, Free Press.
- * Egan, Gerard. (1994). *The Skilled Helper* (5th Ed), Pacific Grove, Brooks/Cole.
- * Khera, Shiv (2003). *You Can Win*. Macmillan Books, Revised Edition.
- * Murphy, Raymond. (1998). *Essential English Grammar*, 2nd ed., Cambridge University Press.
- * Prasad, L. M. (2000). *Organizational Behaviour*, S.Chand & Sons.
- * Ravindran, G., Elango, S.P.B., Arockiam, L. (2009). *Success through Soft skills*, IFCOT Publications.
- * Sankaran, K. & Kumar, M. *Group Discussion and Public Speaking*, M.I. Pub, Agra, 5th ed., Adams Media.
- * Schuller, Robert. (2010). *Positive Attitudes*, Jaico Books.
- * Thamburaj, Francis (2009). *Communication Soft skills*, Grace Publications.
- * Trishna's (2006). *How to do well in GDs & Interviews*, Trishna Knowledge Systems.
- ** Yate, Martin. (2005). *Hiring the Best: A Manager's Guide to Effective Interviewing and Recruiting**

PLANT SYSTEMATICS

Objectives

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

UNIT I:

History of Indian Botany. Taxonomic hierarchy. Plant nomenclature - basis, rules and typification. Taxonomic key. Specimen preparation and herbarium management. Taxonomic literature - flora and monograph. Comprehensive view of various approaches to plant classification - natural, artificial, phylogenetic, general and special purpose.

UNIT II:

Detailed study - salient features, description, distribution and economic importance of the families Menispermaceae, Nymphaeaceae, Capparaceae, Caryophyllaceae, Meliaceae, Aizoaceae, Rubiaceae, Asteraceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Acanthaceae, Verbenaceae, Lamiaceae.

UNIT III:

Loranthaceae, Euphorbiaceae, Hydrocharitaceae, Commelinaceae, Araceae and Cyperaceae. Phenetic and numerical taxonomy - OTU, weighting, cluster analysis. Digital taxonomy - need and application and data base structure.

UNIT IV:

Concept of characters. Morphology, comparative plant anatomy, karyology, embryology, palynology, paleobotany, ecology and physiology as taxonomic evidence. Phytogeography. Speciation.

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.

Books for Study

1. Davis, P.H. & Heywood, V.M 1963, Principles of Angiosperm Taxonomy, Oliver & Boyd.
2. Harborne, J.B. & Turner, B.L, 1984, Plant Chemosystematics, Acad. Press, London.
3. Heywood, V.K & Moore, D.M., 1984, Current Concepts in Plant Taxonomy, AP, London.
4. Lawrence, G.H.M., 1955, The Taxonomy of Vascular Plants, Central Book Depot., MacMillan, New York.

Books for References

1. Burkill, I.H., 1965, Chapters of the history of Botany in India, Government of India Press, Nasik, The Manager of Publications.
2. Grant, W.F., 1984, Plant Biosystematics, Acad Press Inc., Canada.
3. Young DA and Seiyler DS (eds.) Phytochemical and angiosperm phylogeny. Praeger publications. NY.
4. Heywood, V.H., 1967, Plant Taxonomy. English Language Book Society, London.
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 Publ. Co., New Delhi.

LABORATORY COURSE - V
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 Trip Report

PLANT BREEDING AND EVOLUTION

Objectives

This course is intended to provide an understanding as to 1) why and how crops are improved; and 2) how crop improvement is affected by genetics and the environment.

UNIT I

Genes & their actions; genotypes & phenotypes; homozygosity & heterozygosity; and importance of variation. Mendel's laws of heredity, chromosome basis of heredity, multiple alleles, linkage and crossing over. Population genetics: gene frequency, gene pool, Hardy - Weinberg equilibrium.

UNIT II

Objectives of plant breeding. Stages in the plant breeding process: introduction, selection, hybridization, domestication and acclimatization. Selection methods: mass, pure and clonal. Goal of hybridization and criteria for selecting parents; hybridization techniques and types. Seed purity standards and UPOV Convention.

UNIT III

Breeding methods: self pollinated species and cross pollinated species. Concept of heterosis, development of hybrid and genetic basis of heterosis. Inbreeding - bulk method. Mass and pure-line selection in self-pollinating and cross - pollinating populations. Pedigree Method; Single - Seed Descent Method; Backcross Method; and inbreeding depression. Release and registration of new varieties.

UNIT IV

Breeding for disease resistance and drought tolerance. Biotechnology and crop improvement. Mutation breeding and marker-assisted selection - breeding. Methods of breeding self-pollinated, cross - pollinated and asexually propagated crops. Plant genetic resources: collection, evaluation and conservation of germplasm.

UNIT V

Evolution – definition and history of evolutionary thoughts. Mechanisms of evolution: (natural selection, gene flow, mutation, genetic drift, and factors that influence population genetic structure). Origin and evolution of life - theories of evolution: Lamarkism, Darwinism and principles of Hugo de Vries. Adaptation, co-evolution, speciation and extinction. Evidences for evolution. Speciation and modes of speciation - sympatric vs allopatric. Human evolution.

Book for Study

Sinha, U and S. Sinha 1980 Cytogenetics, Plant Breeding and Evolution Vikas Publishing House Pvt. Ltd.; 2nd Revised ed.

Books for References

1. Gardner *et al.* 1991. Principles of Genetics, John Wiley & Sons Inc., 8th Edn., New York.
2. Chahal GS & Gosal SS 2002 Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches. CRC Press.
3. Jack Brown and Peter Caligari, 2008. Introduction to Plant Breeding. Blackwell Publ. UK.
4. George Acquah 2006 Principles of Plant Genetics and Breeding. Blackwell Publ. UK.

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: structure, metabolism and function. Biology of cyclosporin. Metabolism of phenylalanine and tyrosine; glycine, cysteine and methionine. Coenzyme A from valine, aspartate and cysteine; and 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. Quaternary structure of haemoglobin and its regulatory features. Ligand binding and cooperative effect.

UNIT III

Carbohydrates. Homoglycans: chemical structure and properties of starch, glycogen, cellulose, dextrin and inulin. Heteroglycan: chemical 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.

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; and role of cofactors/vitamins. Enzyme regulation: pH, temperature and [S]. Inhibitions and regulation of glutamine synthetase.

Book for Study

Stryer Lubert, 2005, Biochemistry, W.H. Freeman & Co., NY.

Books for References

1. Apps *et al.*, 1992, Biochemistry, ELBS.
2. Caret *et al.*, 1993, Inorganic, Organic and Biological Chemistry, WMC Brown, USA.
3. Rawn, David, 1989, Biochemistry, Neil Patterson USA.

LABORATORY COURSE - VI
BIOCHEMISTRY

1. Estimation of glycogen / total polysaccharides
2. Estimation of hexosamine
3. Estimation of total proteins [Bradford's / Lowry's]
4. Study of Enzyme Kinetics (experiments with acid phosphatase)
5. Effect of temperature on enzyme activity.
6. Effect of pH on enzyme activity.
7. Effect of [E] on enzyme activity.
8. Effect of [S] on enzyme activity; measurement of V_{max} and K_m .
9. Estimation of Ascorbic acid [Calorimetric / volumetric]
10. Estimation of Riboflavin
11. Estimation of Phenolics [Folin - Ciocalteu]
12. Estimation of Tannins [Folin - Denis / Vanillin hydrochloride]
13. Estimation of total lipids and cholesterol

**IMMUNOLOGY
(CORE ELECTIVE)**

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.

Book for Study

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

Books for References

1. Nandini Shetty 1996, Immunology - An introductory Text Book, New Age International (P) Ltd.
2. Roitt *et al.*, 1998, Immunology 5th edition, Mosby International Ltd. London. UK.

**BIOINFORMATICS
(CORE ELECTIVE)**

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.

Book for Study

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

Books for References

1. Baxovans A.D. and Francis Ouellette B.P. 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 ananalysis and Genomics.
3. Balagurusamy, E., 1985, Programming in BASIC. Tata McGraw Hill Publication Co. Ltd., New Delhi.
4. Smith, D.W., 1994, Biocomputing - informatics and Genome Project Academic press, Inc., New York.

HORTICULTURE AND LANDSCAPING (INTERDISCIPLINARY COURSE 2)

Objectives

The paper aims at introducing the students to the emerging art of greening campus and homes for aesthetics; and at making gardening a hobby as well as a means of maintenance and opportunity for employment.

UNIT I

Importance and scope of horticulture; divisions of horticulture; climate, soil and nutritional needs. Water irrigation; plant propagation methods - cutting, layering, grafting, and budding. Stock - scion relationship, micropropagation by root induction.

UNIT II

Indoor gardening - foliage plants, flowering plants and hanging basket. Bonsai plants - training and pruning. Floriculture - cultivation of commercial flower crops; rose, jasmine and chrysanthemum. Flower decoration - dry and wet decoration.

UNIT III

Fruit crops - induction of flowering, flower thinning, fruit setting, fruit development. Cultivation of important fruit crops - mango, grapes and guava.

UNIT IV

Landscaping principles - planning designs for house gardens, institutional and industrial gardens - bioaesthetic planning for rural gardens, recreational grounds, avenue planting, highway planting, railway planting - trees, shrubs, climbers, herbs and ground covers suited for different situations their culture, training and pruning - tree transplantation.

UNIT V

Lawns: different grasses, maintenance of lawns and turf in play grounds, gardens and golf courses; special types of gardens: traffic islands, vertical garden, roof /terrace garden, bog garden, water garden, planning parks and public garden; beautification of urban areas.

Books for Study

1. Arora JS. 1992. Introductory ornamental horticulture, Kalyani Publishers, New Delhi.
2. George Acquah. 2002. Horticulture principles and practices, 2nd Edn. Pearson Edn, Delhi.
3. Manibushan Rao K. 1991. Text book of horticulture. MacMillan Publishing Co., New York.
4. Edmond JB et al., 1977. Fundamentals of horticulture. Tata McGraw Hill Ltd., New Delhi.
5. Rao KM. 2000. Text Book of Horticulture, MacMillan India Ltd., New Delhi.
6. Gopalswamy Iyyangar, 1970. Complete gardening in India, Kalyan Printers, Bangalore.

MICROBIOLOGY

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; food poisoning, food-borne infections and food preservation. Microbial contamination of milk, milk-borne infection and intoxication; preservation of milk and dairy products. Yogurt and cheese. Aquatic microbiology - fresh water and marine microbes. Treatment and disposal of contaminated waters and sewage. 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 flu 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, hypertrophy and hyperplasia. Mode of infection and dissemination. Role of enzymes and toxins in disease development. Molecular basis of infection and defence mechanisms. Control measures: cultural, chemical and biological methods.

Book for Study

1. Prescott *et al.*, 2009 7e, Microbiology. Wm. C. Brown Publishers.

Books for References

1. Pelczar *et al.* 1998, Microbiology - Concepts & Applications. Tata McGraw Hill New Delhi.
2. Adams MR and Moss MO, 1995, Food Microbiology. Royal Soc. Chem., Cambridge, UK.
3. Dickinson M. 2003. Molecular Plant Pathology. BIOS Scientific Publishers, London.

BIOTECHNOLOGY

Objectives

1. Applying genetic concepts into manipulating living things for human welfare.
2. Understanding the revolutions that unfold in biotechnology

UNIT I

Agrobacterium based plant transformation. Marker-free plant transformation. Strategies and methodologies employed in Golden rice technology, Bt crops, Plantibodies, and Blue roses. Strategies for crop improvement: engineering for tolerance against herbicide, resistance to drought, salt and disease.

UNIT II

Engineering microbes: bioremediation of oil spills: oil-eating super bugs - genes from *Pseudomonas putida*, *Bacillus megaterium*, and *Alcanivorax borkumensis*. IPM and juvenile hormone analogues. Biotechnology in aquaculture - ploidy induction, gynogenesis, androgenesis and transgenic fish. Transgenic animals and genetic pharming. Animal husbandry - AI, IVF and embryo manipulation.

UNIT III

Gene therapy: principles, method and gene delivery systems. Immunotoxins, recombinant vaccines and edible vaccines. Assisted reproductive technologies in mammals - IVF, AI, and cloning (reproductive and therapeutic). Stem cell technology and xenografting.

UNIT IV

Technology protection systems (GURT) - the terminator. GMOs and environment - biosafety aspects of GMOs and GM foods; principles of biosafety; potential risks; environmental impacts; safety of food & animal feed derived from GM crops; and patterns of gene flow. Issues concerning release of Bt brinjal.

UNIT V

Synthetic biology - the art of extreme genetic engineering and creation of new life in lab. Artificial DNA and synthetic genome. The pioneering work of JC Venter *et al.* Minimal genome, Modular components and expanded gene pool. Creation of synthetic organisms: top-down and bottom-up approaches. Potentials and applications; implications risks and ethical questions. Areas of research and future directions.

Book for Study

1. Watson JD *et al.*, 2005. Recombinant DNA. Blackwell Science Publ. USA.

Books for References

1. Adrian Slater *et. al.*, 2003, Plant Biotechnology, Oxford University press, U.K.
2. Glick BJ & Pasternack JJ. 2004. Molecular biotechnology. Panima Publ. Bangalore.
3. European Commission Report of a NEST High-Level Expert Group, 2005.
4. Synthetic Biology: Applying Engineering to Biology.
5. Ernesto Andrianantoandro *et al.* 2006. Synthetic Biology: - A Review.
6. Presidential Commission for the Study of Bioethical Issues, 2010. (www.bioethics.gov)
7. ETC Group, Canada, 2010. Extreme Genetic Engg - an introduction to synthetic biology.
8. Young, E and Alper, H, 2010. Synthetic Biology: A Review. *J Biomedicine and Biotechnology*.
9. Benner SA. & Sismour AM, 2005. Synthetic Biology, *Nature Reviews, Genetics*, 6: 533
10. Creation of a bacterial cell by Craig Venter *et al.*, 2010. Research paper: (www.guardian.co.uk)

LABORATORY COURSE - VII
MICROBIOLOGY & BIOTECHNOLOGY

1. Isolation and enumeration (CFU) of microorganisms in soil by serial dilution.
2. Bacterial staining - Simple, Gram's and Capsular staining.
3. Test for activity of amylase and protease.
4. Isolation of bacteria from skin, mouth and urine.
5. Potability test of water - presumptive, confirmative and completed tests.
6. Quantitative estimation of bacteria in milk.
7. Testing quality of milk by methylene blue reductase and phosphatase test.
8. Morphological and biochemical identification of bacteria - indole test, methyl red test, Voges-Proskaur test, Citrate utilization test, TSI agar test.
9. Cellulolytic fungi - isolation and application of wood rots.
10. WIDAL test.
11. ABO blood grouping, Rh factor.
12. Identification of local crop diseases (sugar cane, paddy, banana, brinjal and citrus).
13. Callus induction and regeneration.
14. Clonal propagation.
15. Electrophoretic separation of DNA, protein and restriction digestion.
16. Isolation of protoplasts by enzymes and synthetic seeds.

PROJECT DISSERTATION AND VIVA VOCE

INTER DEPARTMENTAL COURSE – IDC

BIOCHEMISTRY

12PSK2401	SOFT SKILLS
12PBI3402	FIRST AID MANAGEMENT

BIOTECHNOLOGY

12PSK2401	SOFT SKILLS
12PBT3402	APPLIED BIOTECHNOLOGY

BOTANY

12PSK2401	SOFT SKILLS
12PBO3402	HORTICULTURE & LANDSCAPING

CHEMISTRY

12PSK2401	SOFT SKILLS
12PCH3402	HEALTH CHEMISTRY

COMMERCE

12PSK2401	SOFT SKILLS
12PCO3402	FINANCIAL ACCOUNTING FOR MANAGERS

COMMERCE (CA)

12PSK2401	SOFT SKILLS
12PCC3402	CAREER PLANNING AND MANAGEMENT

COMPUTER APPLICATIONS

12PSK2401	SOFT SKILLS
12PCA3402	COMPUTER APPLICATIONS FOR SOCIAL SCIENCES
12PCA3403	FUNDAMENTALS OF PROGRAMMING

COMPUTER SCIENCE

12PSK2401	SOFT SKILLS
12PCS3402A	FLASH
12PCS3402B	WEB DESIGN

ECONOMICS

12PSK2401	SOFT SKILLS
12PEC3402	INDIAN ECONOMY

ELECTRONICS

12PSK2401	SOFT SKILLS
12PEL3402	COMPUTER HARDWARE

ENGLISH

12PSK2401	SOFT SKILLS
12PEN3402	ENGLISH FOR MEDIA STUDIES

HISTORY

12PSK2401	SOFT SKILLS
12PHI3402	INDIAN CONSTITUTION

HUMAN RESOURCE MANAGEMENT

12PSK2401	SOFT SKILLS
12PHR3402	FUNDAMENTALS OF HRM

INFORMATION TECHNOLOGY

12PSK2401	SOFT SKILLS
12PIT3402A	FLASH
12PIT3402B	WEB DESIGN

MATHEMATICS

12PSK2401	SOFT SKILLS
12PMA3402	OPERATIONS RESEARCH

PHYSICS

12PSK2401	SOFT SKILLS
12PPH3402	MODERN PHOTOGRAPHY

TAMIL

12PSK2401	நுண்வகைகமைத்திறன்கள்
12PTA3402	அரசுப்பணித்தேர்வுத் தமிழ் - I