



**M. Sc.**  
**BIOTECHNOLOGY**  
**SYLLABUS (2007-2010)**

under  
**CHOICE BASED CREDIT SYSTEM**  
**(CBCS)**



**ST. JOSEPH'S COLLEGE (AUTONOMOUS)**

(Nationally Reaccredited with A+ Grade/  
College with Potential for Excellence)

**TIRUCHIRAPPALLI - 620 002**



## FEATURES OF CHOICE BASED CREDIT SYSTEM (PG COURSES)

The Autonomous St. Joseph's College (1978) Reaccredited with A+ Grade from NAAC (2007) has introduced the choice based credit system (CBCS) for UG and PG courses from the academic year 2001-2002.

### OBJECTIVES of Credit System:

- \* To provide mobility and flexibility for students within and outside the parent department
- \* 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. However, there could be some flexibility because of practicals, field visits and tutorials. The following Table shows the relation between credits and hours.

Hours in a week	Hours (2-3)	Hours (4)	Hours (5-6)
Theory Credits	1	3	4
Practicals Credits	1	2	3

For PG courses (2 years) a student must earn a minimum of 100 credits. For MCA course (3 years) the student must earn 140 credits to get a pass. For a two year PG degree course the minimum number of papers offered by a department is 18.

### COURSE PATTERN

The Postgraduate degree course consists of three major components. They are Core Course, Optional Course and Extra Department Course (EDC).

#### 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. All the students of the course must take the core courses.

#### Optional Course

The optional 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 optional. The optional is related to the major subject. The difference between core course and optional course is that there is choice for the student. The department is at liberty to offer optional course every semester or in any two semesters. It must be offered at least in two semesters. The staff too may experiment with diverse courses.

#### Extra Department Course (EDC)

EDC is an interdepartmental 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 EDCs must be taken by students.

**Day College student may also take an EDC from PG SFS Course and vice versa.** This provision enables students to earn extra credits. The EDCs are offered in the II and III semesters. For the day college student it is offered in the last hour and for the PG SFS course students in the first hour or zero hour. The EDCs are expected to be application oriented and inter-disciplinary.

**For Two Year Degree Programme**

	Credits
Core	- 84
Optionals	- 8 (2 semesters)
EDC	- 6
Shepherd	- 2
Total	- 100

**For Three Year MCA Programme**

	Credits
Core	- 121
Optionals	- 8 (2 semesters)
EDC	- 9
Shepherd	- 2
Total	- 140

**Credit System Codes:**

The various papers in the different courses are coded. The following code system is adopted.

Each code indicates the following particulars

- 1) The year of introduction/revision of syllabus (07)
- 2) Whether it is undergraduate or postgraduate course (U or P)
- 3) The discipline's name is indicated by two letters as shown below:

Sl. No.	Course	Subject Code
1.	Biochemistry	BI
2.	Biotechnology	BT
3.	Business Administration	BU
4.	Chemistry	CH
5.	Commerce	CO
6.	Computer Applications	CA
7.	Computer Science	CS
8.	Economics	EC
9.	English	EN
10.	English - General	GE
11.	Electronics	EL
12.	Foundation Course	FC
13.	French	FR
14.	Hindi	HI
15.	History	HS
16.	Human Resource Management	HR
17.	Information Technology	IT
18.	Mathematics	MA
19.	Physics	PH
20.	Plant Biology & Plant Biotechnology	PB
21.	Personnel Management & Industrial Relations	PM
22.	Sanskrit	SA
23.	Statistics	ST
24.	Tamil	TA
25.	Tamil - General	GT
26.	Transport Management	TM
27.	Journalism (EDC)	JO
28.	Law (EDC)	LA
29.	Short Hand (English) (EDC)	SH

- 4) The semester number (1 or 2 or 3 or 4 for 2-year course)
- 5) The paper number: The courses in the discipline fall into three categories

Core papers-numbers : 20 to 39

Optional papers - numbers : 41 to 49

EDC's : 61 to 70

For MCA course offered by Department of Computer Science, the following paper numbers used:

Core papers : 51 to 80

Optional Papers : 81 to 90

The following examples illustrate the above concept.

The first semester Core papers in Chemistry is given the code 07PCH121

The EDC offered by Chemistry department in Semester III is given the code 07PCH362

**Evaluation:**

For each course there is formative continuous internal assessment (CIA) and semester examinations (SE) in the weightage ratio 50:50. The following table illustrates how one evaluates the Overall Percentage Marks (OPM) for a student in Chemistry PG course in the all papers put together

$$\text{OPM} = (a_1b_1 + a_2b_2 + \dots + a_{23}b_{23}) / (b_1 + b_2 + \dots + b_{23})$$

Where  $a_1, a_2, \dots, a_{23}$  indicate the marks obtained in the 4 semesters for 23 papers and  $b_1, b_2, \dots, b_{23}$  indicate the corresponding credits for the 23 courses.

For example if total credit points in 23 papers is 6860 then the OPM is given by

$$\text{OPM} = 6860 / \text{total number of credits} = 6860.0 / 98 = 70.0$$

If OPM is between 50 and 60, the student gets II class. If OPM is 60 and more, then the student is placed in I class. If the OPM score is 75 and more the student gets first class with distinction.

The performance in shepherd programme is indicated by a pass and is not taken into account for computing OPM.

**Declaration of result**

\_\_\_\_\_ has successfully completed M. Sc. degree course with FIRST CLASS. The student's overall average percentage of marks is 70. The student has acquired 2 more credits in SHEPHERD programme.

**M.Sc. BIOTECHNOLOGY - COURSE PATTERN**

Sem	Subject code	Subject Title	Hrs/Week	Credits
I	07PBT121	Biochemistry	5	5
	07PBT122	Molecular Biology	5	5
	07PBT123	Cell and Developmental Biology	4	4
	07PBT124	Practical-I	8	5
	07PBT141	Biology of Cloning vectors / or		
	07PBT142	Pharmacology	4	3
		Library	4	
<b>TOTAL FOR SEMESTER-</b>			<b>30</b>	<b>22</b>
II	07PBT225	Enzyme technology	5	5
	07PBT226	rDNA Technology	5	5
	07PBT227	Microbial Biotechnology	4	4
	07PBT228	Practical-II	8	5
	07PBT243	Biophysics and Research Methodology / or		
	07PBT244	Intermediary Metabolism	4	3
			EDC-II	4
<b>TOTAL FOR SEMESTER-I</b>			<b>30</b>	<b>25</b>
III	07PBT329	Plant Biotechnology	5	5
	07PBT330	Animal Biotechnology	5	5
	07PBT331	Immunology	4	4
	07PBT332	Practical-III	8	5
	07PBT333	Review of literature		3
	07PBT345	Bioprocess Technology / or		
	07PBT346	Biosafety	4	3
			EDC-III	4
<b>TOTAL FOR SEMESTER-II</b>			<b>30</b>	<b>28</b>
IV	07PBT424	Bioinformatics	5	3
	07PBT425	Project & Viva-Voce	25	20
<b>TOTAL FOR SEMESTER-IV</b>				<b>23</b>
		EXTENSION		2
<b>TOTAL FOR ALL SEMESTER</b>			<b>120</b>	<b>100</b>

Sem-I  
07PBT121

Hours/week: 5  
Credits: 5

## BIOCHEMISTRY

### Objectives

- 1) To study about the biochemical aspects of life
- 2) To study about the macromolecules and their function

### UNIT-I AMINO ACIDS AND NUCLEIC ACIDS

Amino acids- structure, classification, characteristics and optical activity. Acid- base properties ; standard and non- standard amino acids. Glutathione – structure, synthesis and degradation; Function.

Biosynthesis of Purine and Pyrimidine ring nucleotides; Regulation of biosynthesis; Salvage pathways, Degradation of nucleotides, Formation of Deoxyribonucleotides and nucleotide coenzymes. Artificial synthesis of DNA.

### UNIT – II PROTEINS

Protein - Classification and types-characteristics. Protein structure- amino acid composition, cleavage of disulfide bonds, specific peptide cleavage reaction. Secondary structure- alpha helix and beta pleated structure. Tertiary and quaternary structure- subunit interaction , Symmetry and functional properties-haemoglobin and collagen. Protein folding- role of chaperones. Protein denaturation. Ramachandran plot. Isolation, fractionation and purification of proteins. Solid state synthesis of peptides, Sequence determination and peptide mapping. Methods of determining protein conformation- X-ray diffraction analysis. Amino acid biosynthesis.

### UNIT-III CARBOHYDRATES

Carbohydrates- occurrence, chemical properties and classification. Stereo isomerism and optical isomerism . Monosaccharides- structure, and their derivatives like phosphate esters, aminosugars , Deoxysugars and Inositols (A brief note on each). Polysaccharides – Glycogen, Cellulose, Dextrin and Inulin. Structure and properties of heteroglycons, agar, alginic acid (sea weed polysaccharides), Pectins, Glycoaminoglycans (mucopolysaccharides) and Glycocalyx oligosaccharides. Plant Secondary products – Alkaloids, Phenols and Terpenoids.

### UNIT-IV LIPIDS AND BIOMEMBRANES

Chemical nature of fatty acids and acyl glycerols. Triglycerides, Phosphoglycerols, derived lipids – steroids, prostaglandins and leukotrienes. Lipoproteins- Types and biological functions – Membrane lipids – their polar/apolar character; lipid alignment and membrane proteins; isolation of Membrane Proteins. Lipid biosynthesis – Fatty acids, Triacylglycerols, Cholesterol, Phospholipids.

### UNIT-V HORMONES

Hormones -definitions. Receptors - their structure and significance in hormone action. Signal transducers and second messengers; Adenylate cyclase system-cAMP, Adrenalin and glycogen degradation; G-protein as cellular transducer, Inositol triphosphate and calcium release; Glycogen phosphorylase kinase; DAG and Protein kinase C-pathway. Steroid hormone Receptors-Its structural organization. Steroid hormone action at cell level.

**TEXT**

1. Lehninger, A.L., 2002. Biochemistry, CBS Pub.
2. Donald Voet and J.G. Voet : Biochemistry
3. Stryer, L., 1988. Biochemistry, W.H. Freeman & Co
4. Zubey : Biochemistry

**REFERENCES**

1. Apps, *et al.*, 1992. Biochemistry, ELBS
2. Bohinsky, R.C., 1987. Modern Concepts in Biochemistry, Allyn & Bacon, USA.
3. Caret *et al.*, 1993. Inorganic, Organic and Biological Chemistry, WMC, Brown Pub., USA.
4. Candlisto, J.K. Lecture notes on Biochemistry.
5. Conn, E., *et al.*, 1976. Outline of Biochemistry, McGraw Hill, New York.
6. Goodwin & Mercer, 1986. Introduction to Plant Biochemistry, Pergamon Press.
7. Rawn, D., 1989. Biochemistry. Neil Patterson.
8. Royle, J.A., & Walsh, M. (Eds.) 1991. Watson's Medical Surgical Nursing
9. Devlin (1997): Text book of Biochemistry (with clinical correlation) John Wiley and Sons publications.
10. Martins, Mayes and Rodwell : Harper's review of Biochemistry

Sem-I  
07PBT122

Hours/week: 5  
Credits: 5

## MOLECULAR BIOLOGY

### Objectives

- 1) To study about the genetic material of the organisms.
- 2) To study about the cellular machinery.

### UNIT-I

Chromosomal organization – bacterial and eukaryotic-value paradox. Microbial genetics – transformation: competence, DNA uptake mechanism. Conjugation – *Hfr* transfer, chromosomal transfer and mediation by *F* plasmids, role of *rec* proteins. Transduction - mechanism of DNA transfer, cotransduction

### UNIT-II

DNA-the genetic material-the proofs, Properties of genetic material. DNA replication: Semiconservative replication of dsDNA. Discontinuous and bidirectional replication of circular and linear DNA. Replication of RNA genome – replicase and reverse transcriptase. Types of alteration and damage on DNA molecule, Repair mechanisms - Methylase, mismatch repair, excision, recombination and SOS repair.

### UNIT-III

Transcription - RNA types and functions, transcription signals, transcriptase, chemistry of RNA synthesis - initiation, elongation and termination in bacteria. Post- transcriptional processing in bacteria and eukaryotes. Regulation of transcription and antibiotic inhibitors.

### UNIT-IV

Genetic code - major features of genetic code, organization and deciphering of genetic code, elucidation of codons, mRNA, ribosomes, aminoacyl-tRNA synthetase. Initiation elongation and termination in bacteria. Post- translational processing of proteins.

### UNIT V

SNAPs and SNAREs. Bacterial signal sequences. Mitochondrial, Chloroplast and Nuclear protein targeting. TAG protein destruction. Gene expression and regulations - Molecular mechanisms. Prokaryotes: operon model - lac, trp and arabinose operons .Eukaryotes - gene dosage and gene amplification.

### TEXT

1. Lewin.B, 1993, Genes-V and VI, Oxford University Press, New York.
2. Freifelder.D, 1987, Molecular Biology, Jones and Bartlett Inc., USA.

### REFERENCE

1. Darnell.J *et al.* 1986. Molecular Cell Biology, Scientific American Books, USA.
2. Weaver.R.F. and Philip.P.W. 1989, Genetics, WMC Brown Publishing, USA.



Sem-I  
07PBT123

Hours/week: 4  
Credits: 4

## CELL AND DEVELOPMENTAL BIOLOGY

### Objectives

1. To study about the cellular development.
2. To study about cancer genetics.

### UNIT I

Cell cycle - cell deviation, cellular trafficking. The genetics of axis specification in *Drosophila*. Cellular differentiation and tissue maintenance. The Genetic core of development – Differential gene expression. Cell, Cell communication in development – Induction and Competence, Paracrine factors.

### UNIT II

Morphogenesis and Cell adhesion- adhesion of cells to non-cellular substrates; cell-to-cell adhesion ; Integrins, selectins and cadherins. Adhesion junctions and desmosomes: Tight junctions. Cell aging and death. Apoptosis and its significance. Free radicals and their role. Antioxidants and antioxidant enzymes in cells

### UNIT III

Recognition of sperm and egg, From fertilization to cleavage, Patterns of embryonic cleavage, Blastulation, Invagination and involution, Gastrulation, Axis formation. Cell motility- molecular motors-microtubules. Structure and composition. Micro tubular associated proteins-Role in intracellular motility. Microtubule organizing centers (MTOC). Factors influencing assembly and disassembly. Microfilaments assembly and disassembly : Actin and Myosin.

### UNIT IV

Early mammalian development – Cleavage in mammals, Gastrulation in mammals, mammalian anterior – posterior axis formation .Central nervous system and the epidermis, Neural crest cells and axonal specificity, paraxial and intermediate mesoderm, Lateral plate mesoderm and endoderm. Development of the tetrapod limb. Cellular organelles-Structure and function organization. Nuclear- cytoplasmic interactions. Histopathological studies-organ specific morphohistological examination; Identification of morphological changes related to pathology. Sex determination- Chromosomal sex determination and Environmental sex determination

### UNIT V

Cancer genetics - Role of proto-oncogenes - function and loss of control. Oncogene induction and introduction. *c-src* product - Tyrosine protein kinases. Tumor suppression kinases. Tumor suppression genes. Telomerase expression - role in cell immortalization

### TEXT

1. Scott F. Gilbert: Developmental Biology; Sinauer Associates Inc. Publishers, Sunderland, Massachusetts.
2. Harvey Lodish et al, (2000): Molecular Cell Biology - 4<sup>th</sup> ed. W.H. Freeman and Co., New York.

### REFERENCE

1. Gerald Karp,(1966): Cell and Molecular Biology- Concepts and Experiments (John Willey and Sons Inc.
2. Jean Brachet and Alfred E. Mirsky: The Cell -biochemistry, Physiology and Morphology, Academic Press, New York

Sem-I  
07PBT124

Hours/week: 8  
Credits: 5

### **PRACTICAL-I**

1. Units and measurements, Preparation of buffers, pH and pka determination.
2. Qualitative quantitative determination of carbohydrates and amino acids.
3. Determination of protein (Bradford and Lowry et al.)
4. Estimation of free fatty acids, saponification value and cholesterol value.
5. Estimation of total lipids (Folch *et al.*, 1951) and TLC of lipids.
6. Isolation and estimation of DNA (plant, animal and bacterial samples).
7. Isolation and estimation of RNA.
8. Native gel
9. SDS PAGE.
10. Staining procedures – Coomassie blue and silver staining.
11. Agarose Gel electrophoresis
12. Ethidium bromide and Methylene blue staining.

Sem-I  
07PBT141

Hours/week: 4  
Credits: 3

## BIOLOGY OF CLONING VECTORS

### Objectives

- 1) To study about the prokaryotic and eukaryotic vectors used in the cloning works.
- 2) To study about the use of cloning vectors in Bio - industrial field.

### UNIT-I

Salient features of cloning vectors, restriction enzymes, their classification, mode of action and target sites. Types of cloning vectors: plasmids, cosmids, transposons, binary vectors, phasmids, PAC.

### UNIT-II

Plasmid features and biology - structural and functional organization, plasmid replication and copy-number - stringent and relaxed plasmids, incompatibility of plasmid maintenance. Construction of an ideal vector, cointegrate vectors

### UNIT-III

Lambda phage: *in vitro* construction of lambda-vector, classes of lambda vectors –cosmids and their uses. Organization, construction and use of pBR322-based and pUC-based vectors. Chromosome walking, Retrofit.

### UNIT-IV

M13 vectors and their use in DNA sequencing. Animal viruses (SV 40, Papilloma, Baculovirus) in gene cloning. Cloning in Gram – ve bacteria. Plant viruses as vectors (Caulimo virus and Gemini virus).

### UNIT-V

Specialized vectors - expression vectors, orf vectors, gene fusion vectors and shuttle vectors. BAC and YAC. Vectors for *Saccharomyces*, *Streptomyces* and *Bacillus*.

### TEXT

1. Old and Primrose : Principles of Gene Manipulation
2. Winnacker, 1998 : Genes to Clone.

### REFERENCE

1. Broda, P. : Bacterial Plasmids
2. Williamson (Ed) : Genetic Engineering Vol. I-IV
3. Setlow and Hollander (Ed.) : Genetic Engineering Vol. I-VII
4. Glover, 1984 : Gene Cloning – Vol. I-IV.
5. Watson *et al.*, 1983 : Recombinant DNA
6. Hendrix *et al* : Lambda II
7. Ray, D.S. : Single Stranded DNA Phages
8. Rodringnes *et al.*, 1995 : Vectors.

Sem-I  
07PBT142

Hours/week: 4  
Credits: 3

## PHARMACOLOGY

### Objectives

1. To study about the pharmacological aspects of drugs.
2. To study about the therapeutics of drugs.

### UNIT-I

Drug-definition; classification of drugs – based on their source – plant, animal, mineral and synthetic; based on action. Absorption of drugs, importance of drugs; drug distribution – role of drugs – drug – protein interaction; Drug elimination – role of kidney. Pharmacological activities ; Consequences of non-specific interaction.

### UNIT-II

Drug metabolism – Chemical pathways of drug metabolism – Phase-I and Phase-II reactions; Biotransformation reactions – Microsomal and non-microsomal metabolism of drugs – role of cytochrome P450. Introduction to drug metabolizing enzymes, enzyme inductions and pharmacological activities.

### UNIT-III

Receptors – types and biological roles; factors and forces involved in drug receptor interactions. Receptor theories. Drug structure and activity relationship. Chemotherapy – definition. Antimalarial, antiviral and anticancer chemotherapy – mechanism of action. Mode of action of sulfonamides. Psychiatric chemotherapy – anxiety and Parkinsonism;; Anaesthetics–mode of action and application.Immunopharmacology – Immunostimulants and immunosuppressants.

### UNIT-IV

Clinical Toxicology – definition – classification of toxicity – occupational, environmental and pharmaceutical. Factors affecting toxicity. Specific drug toxicity – salicylates, analgesics, antihistamines, antidepressants and narcotics. Methods of detection. Dermatologic pharmacology . Therapeutics for GI tract diseases. Rational prescribing of drugs.

### UNIT-V

Neurotoxins – mechanism of action. Management of toxified patients – screening, decontamination and supportive care. Evaluation of new drugs – screening and toxicological trials. Drug abuse – commonly abused drugs and their biological effect. Drug tolerance, intolerance and allergy.

### TEXT

1. Prasun K. Das, Salil K.Bhattacharya and Parantap Sen: Pharmacology, BI Churchill Livingstone.
2. Munson, P. (1995); Principles of Pharmacology, Chapman and Hall.

### REFERENCE

1. Herfuidal and Gourley (1996): A Textbook of Therapeutics (Williams and Wilkins)
2. Leanord S. Jacob (1992): Pharmacology, National Medical Series for Independent Study.
3. Mant Timothy, G.K., Ritter, James, M and Lewis Lionel, D: A text Book of Clinical – Pharmacology.

Sem-II  
07PBT225

Hours/week: 5  
Credits: 5

## ENZYME TECHNOLOGY

### Objective

- 1) To study about the enzyme action.
- 2) To study about the recent techniques and purification of enzymes.

### UNIT-I

Classification – Nomenclature & general properties of the enzyme. Factors affecting enzyme action: pH, temp. ions, substrate concentration, enzyme concentration, inhibitors. Extraction, assay and purification of enzymes – units of activity .

### UNIT-II

Steady state kinetics – Bisubstrate and Multisubstrate reaction – enzyme catalysed reaction – different types of inhibitors and activators – Michaelis Menton, Line – Weaver and Burke's equations; Km Value, K Cat Value – Enzyme Specificity; Nucleophilic & electrophilic attack.

### UNIT-III

Role of Co-enzyme in enzyme catalysis. Co-enzyme regeneration; Mechanism of enzyme action - Lysozyme, Chymotrypsin, DNA polymerase, Ribonuclease & LDH, Zymogen & Enzyme activation, Allosteric enzymes & Metabolic regulations. Catalytic antibodies and RNA.

### UNIT-IV

Techniques of enzyme immobilization & their applications - Medical, food industry, leather industry, textile and paper industries. A brief account of modification of enzymes (enzyme engineering) and its products through r-DNA technology – Biosensors. Mechanism of light activation of enzymes. Clinical application of enzymes.

### UNIT-V

Practical aspects of large scale protein purification; Large scale application of microbial enzymes in food and allied industries; leather industry, textiles, paper industries and antibiotics production; medical application of enzymes in reverse glycosidase in synthetic reaction; Interesterification of lipids. .

### TEXT

1. William, B Jakoby, 1984. : Methods in Enzymology, Vol.107, Enzyme purification and related techniques.
2. Terrance, G. Cooper, 1977 : The tools of Biochemistry, John Wiley & Son
3. Rehm, H.J., and Reed, G. 1988 : Biotechnology, Vol:7a, Enzyme Technology, Elsevier.

### REFERENCE

1. Blazej, A., & Zemek, J., 1987 : Interbiotech, 87, Enzyme Technologies, Elsevier.
2. Murray Moo – Young, 1988 : Bioreactor immobilized enzyme and cells; Fundamentals, and applications, Elsevier, Applied Science.

Sem-II  
07PBT226

Hours/week: 5  
Credits: 5

### **rDNA TECHNOLOGY**

#### **Objective**

1. To study about the techniques involved in the transformation of cell.
2. To study about the safety aspects of rDNA technology

#### **UNIT-I**

Cloning strategies – c-DNA cloning and gene libraries. Recombinant selection and screening methods. Expression of cloned genes – problems and solutions. DNA hybridization techniques – Southern, Northern, Western and Southern blotting.

#### **UNIT-II**

Methods of introducing recombinant DNA in to bacteria, plants and animals - Ca-mediated transfection, particle bombardment, microinjection, electroporation and lipofection. Transgenic plants, gene knockout/ knock in, HR and production of transgenic animals: biopharming, and xenografting – animal organ donors to humans.

#### **UNIT-III**

Assembling a physical map of the Genome, Sequencing methods and strategies, DNA and cDNA Microarrays, Global expression profiling, Mapping protein interaction Gene silencing, Gene tagging, RNA i, Molecular marker technology. Biochips.

#### **UNIT-IV**

Applications of biotechnology: Potential hazards - safety aspects of RDT, biological weapons and biosafety of GM foods and GMOs - substantial equivalence and safety testing. Human genetics - decline of human genome, eugenics, approaches - overriding expression, directed recombination and RDT.

#### **UNIT-V**

Targeted mutagenesis. Human genome research - the objectives and approaches. Genomics and genome prospecting - the controversies. Issues of biotechnology - social and scientific. IPR and patenting - reasons against patenting living systems. Technology protecting systems and the terminator; Delebrate release of GMOs.

#### **TEXT**

- |                        |   |                                 |
|------------------------|---|---------------------------------|
| 1. Old & Primrose      | : | Principles of Gene Manipulation |
| 2. Watson              | : | Recombinant DNA                 |
| 3. Ernst L. Winnaccker | : | From Genes to Clones            |
| 4. Lewin               | : | Genes-VI                        |

#### **REFERENCE**

- |                         |   |   |
|-------------------------|---|---|
| 1. Biotol Series        | : | Techniques for Engineering genes Strategies for Engineering Organisms |
| 2. Glick and Pasternark | : | Molecular Biotechnology   |
| 3. Maniatis             | : | Molecular Cloning – A Lab Manual<br>Vol. I, II & III                  |
| 4. Primrose and Twyman  | : | Principles of Genome analysis and Genomics,<br>Third edition          |
| 5. David M. Glover      | : | The mechanisms of DNA manipulation                                    |

Sem-II  
07PBT227

## MICROBIAL BIOTECHNOLOGY

Hours/week: 4  
Credits: 4

### Objective

1. To study about biodegradation by microbes.
2. To study about the industrial uses of microbes.

### UNIT-I

The characterization, classification and identification of micro organisms, morphology and fine structure of bacteria, Culture of bacteria, Microbial metabolism, bacterial genetics growth and reproduction, Pure culture, Control of micro organisms – physical, chemical and chemotherapeutic agents, Microbial resistance to drugs.

### UNIT-II

Biological pest control – Advantages & Disadvantages of chemical and Bio pesticides – *Bacillus thuringiensis* – mode of action of Bt toxin ; Development of Bt resistance; Species other than *thuringiensis* - *B. popilliae* – *B. lentimorbus*- *B. sphaericus* – mode of action; Baculoviruses – Nuclear Polyhedrosis virus (NPV) advantages – mode of action. Mycoinsecticides – mode of action and advantages.

### UNIT-III

Biodegradation – significance – factors affecting general reactions involved in biodegradation – Degradation of textiles, leather, and paper effluents, cellulose, hemicellulose and lignin, Alkanes – Benzene – Toluene Catechol – ortho & metapathways – TOL plasmid. Ore leaching by microbes – Bioleaching – advantages chemical reactions involved in leaching of Copper – *Thiobacillus ferro oxidans*.

### UNIT-IV

Selection of industrially useful organisms, fermentation process, recovery of end products. Production of insulin, lactic acid, vinegar, hydrocarbons, single cell oil, Amino acid fermentation – Strategies to improve amino acid production – production of lysine, proline and glutamic acid ; Preservation of milk and dairy products: yogurt and cheese. Industrial production of Penicillin, acetone, ethanol.

### UNIT-V

Biodeterioration and Bioremediation: Treatment of solid wastes and liquid wastes and their types. Microbial interaction with xenobiotics . Biopolymers, biosurfactants. Production of single cell protein and mycoprotein. Bioventing, biosparging, phytoremediation, biofuel production, gasohol and gobar gas.

### TEXT

1. Pelczar, Chan and Kreiz . Microbiology
2. Stanbury, P.F., and Whitakar, A., 1984. Principles of Fermentation Technology, Aditya Books Pvt., Ltd., New Delhi.
3. Baily and Ollis, 1986, Biochemical Engineering Fundamentals, McGraw Hill, Yew York.

### REFERENCE

1. Alexander, M., 1961. Soil Microbiology, John Wiley & Sons, New York.
2. Atlas, R.M. and Bartha, R., 1988. Microbial Ecology – Fundamentals and Applications, Benjamin/Cummings Publishing Company, Inc., Menlo Park., California.
3. Balasubramanian, D., Bryce, C.F.A., Dharmalingam, K., Green, J., and Kunthala, J. (Eds.), 1996. Concepts in Biotechnology, COSTED – IBN, University Press, Hyderabad.
4. Flickinger, M.C., and Drew, S.W., 1999. Encyclopedia of Bioprocess Technology – Fermentation Biocatalysis & Bioseparation, (Vol I–V), John Wiley and Sons, New York

Sem-II  
07PBT228

Hours/week: 8  
Credits: 5

### PRACTICAL-II

1. Assay of catalase.
2. Assay of acid and alkaline phosphatases.
3. Assay of salivary amylase.
4. Assay of urease.
5. Assay of lipase.
6. Assay of peroxidase.
7. Protein purification by dialysis.
8. Immobilization technology.
9. Protein purification by molecular sieve chromatography.
10. Preparation of total DNA and Agarose gel electrophoresis  
Preparation of RNA.  
Preparation of cell pellet.  
Preparation of cytoplasmic RNA.
11. Agarose gel analysis.
12. Preparation of plasmid DNA.  
Mini prep : Small scale preparation of plasmid DNA.  
Maxi prep : Large scale preparation of plasmid DNA.
13. Restriction digestion and ligation.
14. Isolation and identification of cloned genes by agarose gel electrophoresis and southern blotting.
15. PCR
16. Preparation of culture media.
  - a. Preparation of solid media.
  - b. Preparation of liquid media.
17. Pure Culture of microorganisms.
  - a. Streak plate method.
  - b. Pour plate method.
  - c. Spread plate method.
  - d. Slant preparation.
18. Staining techniques ( Simple, Grams, Spore and Capsular staining techniques).
19. Biochemical test for identification of microorganisms.
20. Antimicrobial susceptibility testing of microorganisms ( Kirby – Baur method).
21. Quantification of microorganisms by Turbidimetry method.
  - a. Isolation of soil sample ,water and beverages.
  - b. Bacteriological examination of milk sample.
  - c. Preservation of bacterial cultures.



Sem-II  
07PBT243

Hours/week: 4  
Credits: 3

## **BIOPHYSICS AND RESEARCH METHODOLOGY**

### **Objectives**

- 1) To study about the nature of bonds, thermodynamics and the applications.
- 2) To study about the methodology of publish a research paper.

### **Unit – I**

Types and nature of bonds, Sub atomic configuration, Radiation and patterns of decay -  $\alpha$ ,  $\beta$ ,  $\gamma$ , UV light and biological systems.

Thermodynamics of biological systems - importance of Gibbs free energy, G - free energy in terms of enthalpy and entropy - dependence of G on temperature and pressure - Raoult's Law and Henry's Law - chemical potential - chemical equilibria - equilibrium coefficient K - effect on K of temperature and van't Hoff equation - the role of ATP. The Nernst potential and the Donnan effect.

### **Unit - II**

Protein crystallography - the phase problem - Patterson function - isomorphous replacement - anomalous scattering - refinement - comparison between X ray and neutron diffraction. Protein elutor : principle and its applications. NMR, X-ray crystallography, IR, ESR, MALDI, TOF, ESI.

DNA structural dynamics- DNA bending. Protein-DNA, DNA-DNA, DNA-RNA interactions.

### **Unit – III**

Chromatography- Principles and applications of GLC, HPLC, Affinity, Ion exchange, Gel permeation, Adsorption chromatography

Electrophoresis- GEL electrophoresis, Isoelectric focusing, electrophoretic mobility, 2D-PAGE-SAGE-DNA sequencer

Spectrophotometer- absorption and emission spectrum.

Autoradiography and its applications

### **Unit – IV**

Research- meaning, types, objectives, and approaches: Literature collection : Different sources, Biological online databases, Determining sample design, collecting data, analysis and hypothesis testing, generalization and interpretation, writing reviews and journal articles, . Structure of thesis; Manuscript and proof correction.

### **Unit – V**

Introduction of Scanning Probe Microscopy (SPM) – Scanning tunneling mode (STM), Atomic force microscopy (AFM). Molecular manipulation; Nanoscale materials chemistry (Synthesis, Functionality, applications), Introduction to biological applications : Quantum dots, Nanotubes, Nanoparticles, DNA nanomotors, Actuators, Bio micro electro mechanical systems, Nanocomposites. Protein and DNA interaction with Nanotubes. Nanomedicines Biomolecular motors : ATPase, Myosin, Kinesin. Futures of Nanobiotechnology : Clotocytes, Respirocytes, Microbivores, Biocomputers. Ethical issues in Nanotechnology

**TEXT**

1. Braun,R.P.,1987 : Introduction to instrumental analysis(Mc Graw Hill)
2. Upadhyay, Nath : Biophysical chemistry
3. Engines of creation – The coming era of Nanotechnology : Eric drexler
4. Ram Ahuja, 2003 : Research methods

**REFERENCE**

1. Palanisamy, S and Shanmugavelu, M : Principles of Biophysics
2. West,E.S and Todd,W.R., Mason,H.S and Van Brugan,J.T.: Text book of Biochemistry..
3. Physical Chemistry, Fifth edition : Ira N.Levine
4. Biophysics Concepts and Mechanisms : E.J.Carey.
5. Nanotechnology, 2002 - Recent advances and issues in Molecular Nanotechnology : David. E. Newton.

Sem-II  
07PBT244

Hours/week: 4  
Credits: 3

## INTERMEDIARY METABOLISM

### Objectives

- 1) To study about the various metabolic pathways
- 2) To study about the various metabolic diseases

### UNIT-I

Approaches to biochemical investigations : whole organism studies, whole animal studies, whole plant studies; perfusion of isolated organs - liver, kidney and pancreas; organ and tissue slice techniques; isolation of individual cells; tissue and cell cultural techniques; ;Methods for disrupting tissues and cells; Preparation of tissues and cell homogenates. Metabolic pathways - anabolic, catabolic and central pathways; overview of intermediary metabolism.

### UNIT-II

Metabolism of Carbohydrates : Glycolysis: Alcohol and lactic acid fermentation - Pasteur effect; Glycogenolysis, HMP pathway, glucuronic acid cycle, Citric acid cycle and its regulation; A detailed study of enzymes of Glycolysis and citric acid cycle highlighting the following key enzymes Phosphofructokinase, Hexokinase, pyruvate dehydrogenase complex. Glyoxylate cycle; glycogenesis; glyconeogenesis; metabolism of amino sugars, sialic acids and mucopolysaccharids; structure, function and metabolism of glycoproteins.

### UNIT-III

Metabolism of proteins : enzymatic cleavage of proteins, degradation of amino acids, oxidative and non-oxidative deamination, transamination and decarboxylation, detoxification of ammonia(urea cycle), catabolism of amino acids, ketogenic and glycogenic amino acids; biosynthesis of amino acids, essential and non-essential amino acids. Inborn errors of metabolism; Phenylketonuria, alkaptonuria, tyrosinosis, albinism, galactosemia, Hartnup disease, Tay-Sach's disease, Nieman-Pick's disease.

### UNIT-IV

Metabolism of lipids: oxidation of fatty acids; degradation of complex lipids; Biosynthesis of fatty acids, essential fattyacids, triglycerides, steroids, phospholipids and prostaglandins; metabolism and functions of cholesterol and bile acids; Types of lipoproteins, their biosynthesis, metabolism and function; structure of glycolipids and their function. Plasma lipoproteins, cholesterol, triglycerides and phospholipids in health and diseases (fatty liver). Metabolism of nucleic acids: Biosynthesis of purine and pyrimidine ring nucleotides; Regulation of biosynthesis; Salvage pathways, degradation of nucleotides, formation of Deoxyribonucleotides and nucleotide coenzymes.

### UNIT-V

Mineral metabolism - Macro and trace elements.

Minerals and Bone : Cells of bone and their biochemical characterization; Synthesis and secretion of collagen and other matrix components; elastin and other fibres. Deposition of calcium phosphate. Disorders of bone - osteoporosis and osteomalacia. Interrelationship of Ca, Vit.D, CT & PTH.

**TEXT**

1. Intermediary Metabolism and its regulation : Larnes
2. Biochemistry : Lehninger
3. Biochemistry : L. Stryer
4. Biochemistry : Donald Voet and J.G. Voet

**REFERENCE**

1. Harper's Review of Biochemisty : Martins, Mayes and Rodwell
2. Nutrition and Dietetics : Davidson et al.
3. Trace Elements : Eric

Sem-III  
07PBT329

Hours/week: 5  
Credits: 5

## **PLANT MOLECULAR BIOLOGY AND BIOTECHNOLOGY**

### **Objectives**

- 1) To study about the basics of tissue culture and its applications.
- 2) To know about the molecular aspects of genes in various responses and the techniques used to analyse the foreign gene in transgenic plant.

### **UNIT-I**

Establishment of plant tissue culture: various explants, Establishment of callus, suspension cultures, organogenesis and embryogenesis, Meristem tip culture, Hardening of plants, Techniques of anther, embryo and ovule culture. Protoplast isolation, culture and fusion. Artificial seed (synthetic seed), Cryopreservation.

### **UNIT-II**

Agrobacterium mediated gene transformation. Crown gall tumours. Mechanism of T-DNA transfer . Ti plasmid vector for plant gene transformaton. Culture of hairy roots using Agrobacterium rhizogenes, Ri plasmid and its role. Molecular breeding-Constructing molecular maps-Molecular tagging of genes/traits-Marker-assisted selection of qualitative and quantitative traits

### **UNIT-III**

Molecular genetics of photosynthesis, nitrogen fixation – ( nif gene, nod gene, hup gene) stress.

Biotechnology for crop improvement – BT technology, Chitinase, and scorpion. Genetic engineering for drought, salt stress tolerance, disease resistance.

Genetic engineering for quality improvement :

Protein, carbohydrates, vitamins. Chloroplast and mitochondria genome

Somatic embryogenesis and somaclonal variation. The concept of gene synteny

The concept of map-based cloning and their use in transgenics

### **UNIT-IV**

Plant metabolite engineering – Control mechanism and manipulation of phenylpropanoid pathway, Shikimate pathway, Food vaccines, Bioplastics, Plantibodies, Plantigens. Antisense RNA technology and its applications. Golden rice technology. Applications of Tissue culture in Agriculture and Forestry.

### **UNIT V**

RFLP and RAPD in plant breeding, STS Micro satellites, SCAR (Sequence characterized amplified regions), SSCP (Single strand conformational polymorphism), PCR Technology- Applications of PCR in cloning genes, promoters and flanking sequences. Plant Genomics: Arabidopsis, Rice and Marchantia.

### **TEXT**

1. Old, R.W., and Primrose, S.B., 1996. Principles of Gene Manipulation - An Introduction to Genetic Engineering, Black Well Sciencers Ltd., New York.
2. Winnacker, E.L., 1987. From Genes to Clones – Introduction to Gene Technology, VCH Publisher, Weinheim

3. Yury E.Khudyakov and Howard A .Fields .Artificial DNA: Methods and applications.
4. Srivastava, P.S., 1998. Plant Tissue culture and Molecular Biology – Application and prospects, Narosa Publishing House, New Delhi.

#### **REFERENCE**

1. Gamborg, O.L. and Phillips, G.C., 1995: Plant Cell, Tissue and Organ Culture Fundamental Methods, Narosa Publishing House, New Delhi.
2. George, E.F. and Sherrington, P.D., 1984, Plant Propagation by Tissue culture, Exegetics Limited, London.
3. Ghosh, S.P., 1999. Biotechnology and its Application in Horticulture, Narosa, Publishing House, New Delhi.
4. Hedin, P.A., Menn, J.J., and Hollingworth, R.M., 1988. Biotechnology for Crop Protection, American Chemical Society, Washington.
5. Khan, I.A., and Khanum, A., 1998. Role of Biotechnology in Medicinal and Aromatic Plants, Ukaaz Publications, Hyderabad.
6. Marx, J.L., 1989. A Revolution in Biotechnology, Cambridge University Press, Cambridge.
7. Reinert, J. and Bajaj, Y.P.S., 1997. Plant Cell, Tissue, and Organ Culture, Narosa Publishing House, New Delhi.

Sem-III  
07PBT330

Hours/week: 5  
Credits: 5

### **ANIMAL BIOTECHNOLOGY**

#### **Objectives**

- 1) To know about the basic techniques in Animal tissue culture.
- 2) To know about transgenic animals and their applications.

#### **UNIT-I**

Introduction to animal biotechnology. Animal cell: production and culture of animal cells Development and maintenance of cell lines, continuous cell lines, culture media, preparation of various culture media and sterilization, storage. Suspension culture, Embryo culture, Teratogenesis, Teratomas. Cell culture in laboratory: large scale culture, applications of animal cell culture.

#### **UNIT-II**

Genetic engineering in animals – transformation of animal cells, cloning vectors and expression vectors and animal viral vectors. Transgenic animals – improving important genes, production of recombinant proteins, immunotoxins, vaccines, Hybridoma and monoclonal antibody production. Molecular and cellular biology of fertilization.

#### **UNIT-III**

Integrated Pest Management – pest management using juvenile hormone analogues. Pheromones and genetic manipulations – Silk worm and Fish as bioreactors. Baculo viruses in biocontrol and foreign gene expression. Therapeutic and Reproductive cloning. Neurobiotechnology.

#### **UNIT-IV**

Biotechnology in aquaculture (Ploidy induction, Gynogenesis, Androgenesis and Transgenic fishes); Animal husbandry ( In vitro fertilization, Gamete selection, Embryonic sex selection , Embryo manipulation, Demi embryos and Embryo transfer);Animal cloning; Cryobiology. Stem cell – Isolation, culture and its applications

#### **UNIT-V**

Mammalian Embryo fusion – Allopheny. Use of nucleic acid probes and antibodies in clinical diagnosis and tissue typing. Mapping of human genome. Role of RFLP, DNA finger printing and PCR in Forensic science. Gene therapy: types and their applications. Social, Ethical and legal issues in Animal Biotechnology(Human cloning, Foeticide, Sex determination).

#### **TEXT**

1. Spier, R.E. and Griffiths, J.B., 1988, Animal Cell Biotechnology, Academic Press, New York.
2. Butler, M., 1987. Animal Cell Technology, Principles and Products, Open University Press, New York.
3. Strachan, T. and Read, A.P., 1999. Human Molecular Genetics, John Wiley & Sons, Pvt. Ltd., Singapore.

#### **REFERENCE**

1. Anon, 1988. Animal Cell Biotechnology, Academic Press, New York.
2. Biotol Series, 1992. *In vitro* cultivation of Animal cells, Butterworth, Oxford.
3. Epplen, J.T., and Lubjuhn, T., 1999. DNA Profiling and DNA Fingerprinting, Birkhauser Verlag, Basel.
4. Marx, J.L. 1989. A Revolution in Biotechnology, Cambridge Uni. Press, Cambridge.
5. Pandian, T.J. and Muthukrishnan, J. 1988. Chromosome Manipulation in Fish, M.K.University, Madurai.

Sem-III  
07PBT331

Hours/week: 4  
Credits: 4

## IMMUNOTECHNOLOGY

### Objective

- 1) To study about the immune response of an organism.
- 2) To study about the advanced techniques in Immunology for the betterment of Humans

### UNIT-I

Immune system- Definition and properties. Lymphoid organs-primary and secondary; structure and functions. Types of Immunity- Innate and acquired, humoral immunity and cell-mediated immunity. Antigen: definition, properties- antigenicity and immunogenicity, antigenic determinants and haptens. Types of antigens.

### UNIT –II

Immunoglobulins; structure, classes and distribution of antibodies. Theories of antibody formation. Antigen - antibody interactions; strength of antigen - antibody interactions, cross reactivity, precipitation reactions and agglutination reactions. Organization and expression of Immunoglobulin genes - generation of antibody diversity. Complement system - alternate and classical pathways, initiators and MAC.

### UNIT-III

Mechanism of antigen recognition by T and B - lymphocytes. Major histocompatibility complex (MHC) - General organization and inheritance of the MHC, MHC molecules and genes - cellular distribution and regulation of MHC molecules. Antigen processing and presentation - role of antigen - presenting cells. Primary and Secondary immune response. Cell immunity - components of T lymphocytes and CD molecules, Regulation of immune response, cytokines, types, role in immunity.

### UNIT-IV

Immunoregulation - helper and suppressor cells, mechanism in immunity. Antigen recognition - T and B cell receptors. Inflammation - mechanism and significance. Transplantation immunology - graft rejection and HLA antigens. Role of MHC and T cells. Prevention of graft rejection. Hypersensitivity - immediate and delayed types; mechanism and reactions. Vaccines - types production and uses. Immunity to virus, bacteria and parasites - Genetic control of Immune response. Immunosuppression.

### UNIT-V

Immunological Techniques: Polyclonal antibodies - principle and production of antisera. Monoclonal antibodies. Recombinant antibodies. Principle and applications of RIA, ELISA, FISH and Western blot. Precipitation reaction - Immunodiffusion, immunoelectrophoresis, precipitin ring test. Agglutination tests - Hemagglutination, Febrile and Latex agglutination. Widal, VDRL, Pregnancy and Rheumatoid factor tests.

### TEXT

1. Ivan, M. Roit, Jonathan and Brostoff and David Male (1998): Immunology-5<sup>th</sup> Edition. (Churchil Livingstone Publishers)
2. Janis Kuby (1998) : Immunology - 3<sup>rd</sup> and 4<sup>th</sup> Edition (W.H. Freeman)

### REFERENCE

1. Weir, D.N (1997): Immunology (8<sup>th</sup> edition, Churchil Livingstone Publishers)
2. Nandini Shetti : Immunology Introductory Text Books
3. Gladwin and Trattler : Clinical Microbiology
4. Male *et al* : Advanced Immunology



Sem-III  
07PBT332

Hours/week: 8  
Credits: 5

### PRACTICAL-III

1. Invitro studies of plants.
2. Determination of A,B.O & Rh blood groups in human beings.
3. Preparation of antigens
4. Techniques of immunization and bleeding
5. Preparation of Ouchterlony double immuno diffusion
6. Radial immuno diffusion
7. ELISA
8. Dissection & identification of thymus, spleen and lymph nodes in mouse and chick
9. Immuno precipitation & precipitin curve.
10. VDRL test
11. Pregnancy test.
12. Immuno electrophoresis
13. Rocket immuno electrophoresis
14. T & B lymphocytes separation.
15. Mutant isolation by Gradient Plate Method.
16. Mutant isolation by Replica Plating
17. Isolation of plasmids from bacterial strains
18. Isolation of genomic DNA from bacterial culture
19. Fermenter parts, function and operation
20. Fermentation kinetics – determination of the product, yield, and productivity, Cell mass as the product (fungal/yeast system)
21. Ethanol production by Yeast, (Substrate – Molasses/Starch)
22. Antibiotic production by fungal system (Penicillin/Streptomycin)
23. Immobilised cells for enzyme production (Amylase/Cellulose production)
24. Immobilization of enzyme (Urease/Phosphatase)
25. Hairy roots induction through A.rhizogenes in carrot.
26. Gene clean.
27. DNA elution.
28. Calcium chloride transfection.
29. Western blotting by non radioactive probe

Sem-III  
07PBT345

Hours/week: 4  
Credits: 3

## **BIOPROCESS TECHNOLOGY**

### **Objectives**

- 1) To study about the growth factors necessary for the fermentation process.
- 2) To study about the down stream process for product removal and purification

### **UNIT-I**

Introduction to Fermentation process, Basic concepts-batch, continuous and fed batch culture, isolation methods for industrially important microorganisms. Preservation, properties of industrial strains.

### **UNIT-II**

Media formulation-growth factors, buffers, O<sub>2</sub>, antifoams, media optimization. Properties for yeast, bacteria and fungal cultures. Bioreactor design, Parts and their functions, sterilization.

### **UNIT-III**

Bioprocess control and monitoring variables –Aeration,agitation, pressure and pH. Flow measurement and control, control system-manual and automatic.PID control. Application and the role of Computers in bioprocess.

### **UNIT-IV**

Oxygen requirement of microbial cultures, Oxygen uptake rate, Types of impellers, baffles and Sparger. Types of reactor –Submerged reactor-mechanically stirred draught-tube reactor-Continuous flow stir type reactor-air lift reactor-jet loop reactor, Surface reactor, Packed bed reactor.

### **UNIT-V**

Down stream processing: Introduction, removal of microbial cells precipitation, filtration. Centrifugation - The range of centrifuges, Cell disruption-physical and chemical. Chromatography - types. Membrane process, drying and crystallization.

### **TEXT**

1. Stanbury,P.F., & Whitakar, A., 1984. Principles of Fermentation Technology, Pergamon Press.
2. E.MT.El-Mansi .,& C.F.A.Bryce Fermentation Microbiology and Biotechnology
3. Bailley and Ollis,1986,Biochemical Engineering Fundamentals,McGraw Hill,New york.

### **REFERENCE**

1. Coulson, J.M., & Richardson,S.F., 1984. Chemical Engineering, Pergamon Press.
2. Mooyoung (ed.) 1985. Comprehensive Biotechnology, Vol.I, II, III & IV Pergamon Press.

Sem-III  
07PBT346

Hours/week: 4  
Credits: 3

## BIOSAFETY

### Objectives

- 1) To study about the risk of Genetically modified organisms.
- 2) To know about the security response and control.

### Unit I

Introduction to biosafety: meaning, precautionary principle, advanced informed consent, access to information, deliberate release of engineered organisms .Risks : pathogenicity, transmission, stability, inoculum potential-infectious dose and concentration, origin, surveillance and evaluation.

### Unit II

Classification of biological risk material. Major risks from GMOs.Engineered microbes : Baculoviruses. Biological weapons and bioterror - the Anthrox menace. Laboratory biosafety level criteria – the four levels.Transgenic plants : GURTs - Terminator and Bt technology - the protocol and biology.

### Unit III

GM foods : Substantial equivalence and safety testing - Labelling.Research animals : Biosafety level criteria. Working with human and primates. Infectious risks, in using baboons and bigs. Issues of biosafety in xenografting – animal organ donors to humans.

### Unit IV

Containment : Primary containment, biosafety cabinets and their classification.Measures : Transportation and transfer of biological agents. Laboratory security and emergency response - detection and control.Risks and risk-reduction: Strategies. Handling biotoxins - general and standard protocolsDeliberate release of GMOs into the environment - the perils and risks.

### Unit V

International protocols on biosafety : the UNIDO, IPPC, CBD and the *Cartagena* protocol (2000) – essential elements. Modalities of an ideal protocol. International organizations on biosafety.

Sem-IV  
07PBT424

Hours/week: 5  
Credits: 3

### BIOINFORMATICS

#### 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; Gen Bank and DDBJ. Structure of Gene bank entries.

#### UNIT-II

Protein sequence 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-III

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 – sequence similarity search tools, sequence assembly tools and sequence clustering tools. Alignment techniques; multiple alignments.

#### UNIT-IV

Dotplot, Pairwise database searching; FASTA and BLAST Building a sequence search protocol. Phylogenetic analysis - methods of phylogenetic analysis – Parsimony, Distance matrix, Distance Maximum Likelihood. Constructions of phylogenetic tree with referenc to DNA, RNA and protein sequences. Biological importance of computerized phylogenetic analysis. Web browsing.

#### UNIT –V

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

#### TEXT

1. Attwood, T.K. and Parry Smith,D.J., 1999. Introduction to Bioinformatics, Longman Publication, Sussex.
2. Baxevanis, A.D., and Francis Ouellette, B.P., 1998. Bioinformatics A Practical Guide to the Analysis of Genes and Proteins, Wiley – Interscience Publication, New York.
3. Primrose,S.B. and Twyman,R.M.,2003.Principles of Genome analysis and Genomics

#### REFERENCE

1. Balagurusamy,E., 1985. Programming in BASIC. Tata McGraw Hill Publication Co.Ltd., New Delhi.
2. Dheenadayalu, R., 1987. Computer Science, Tata McGraw Hill Publications & Co., Ltd., New Delhi.
3. Smith, D.W., 1994. Biocomputing – Informatics and Genome Project Academic Press Inc., New York.

Sem-IV  
07PBT425

Hours/week: 4  
Credits: 3

### PROJECT & VIVA-VOCE

**EXTRA DEPARTMENT COURSES (EDC)  
OFFERED BY THE VARIOUS DISCIPLINES DURING II AND III SEMESTERS**

Sem	Code No.	Title of the Paper	Hr	Cr
<b>Department of Biochemistry</b>				
II	07PBI261	Applied Nutrition*	4	3
III	07PBI362	First Aid Management*	4	3
<b>Department of Biotechnology</b>				
II	07PBT261	Basics of Bioinformatics*	4	3
III	07PBT362		4	3
<b>Department of Botany</b>				
II	07PBO261	General Microbiology	4	3
III	07PBO582	Remote Sensing and Geographical Information System	4	3
<b>Department of Chemistry</b>				
II	07PCH261	Environmental Chemistry	4	3
III	07PCH362	Industrial Chemistry	4	3
<b>Department of Commerce</b>				
II	07PCO261	Fundamentals of Accounting for Managers	4	3
III	07PCO362	Principles of Management	4	3
<b>Department of Computer Science</b>				
II	07PCS261	Internet Concepts*	4	3
II	07PCS261	Internet Concepts	4	3
III	07PCS362	Computer Applications for Social Sciences*	4	3
III	07PCS362	Computer Applications for Social Sciences	4	3
<b>Department of Economics</b>				
II	07PEC261	General Economics	4	3
III	07PEC362	Indian Economy	4	3
<b>Department of Electronics</b>				
II	07PEL261	Electronics in Communication*	4	3
III	07PEL362	Computer Hardware*	4	3
<b>Department of English</b>				
II	07PEN261	English for Specific Purposes	4	3
III	07PEN362	Interviews and Group Dynamics	4	3
<b>Department of French</b>				
II	07PFR261	Beginners Course in French	4	3
III	07PFR362	Advanced Course in French	4	3

**Department of Hindi**

II	07PHI261	Beginners Course in Hindi	4	3
III	07PHI362	Advanced Course in Hindi	4	3

**Department of History**

II	07PHS261	Public Administration*	4	3
III	07PHS362	Applied Tourism*	4	3

**Department of Human Resource Management**

II	07PHR261	Sociology for Competitive Examinations	4	3
III	07PHR362	Human Resource Management	4	3

**Department of Mathematics**

II	07PMA261	Operations Research	4	3
III	07PMA362	Numerical Methods	4	3

**Department of Physics**

II	07PPH261	Physics for Rural Development	4	3
III	07PPH362	Medical Physics	4	3

**Department of Sanskrit**

II	07PSA261	Beginners Course in Sanskrit	4	3
III	07PSA362	Advanced Course in Sanskrit	4	3

**Department of Statistics**

II	07PST261	Statistics for Biomedical Sciences*	4	3
III	07PST362	Data Analysis*	4	3

**Department of Tamil**

II	07PTA261	Beginners Course in Tamil	4	3
II	07PTA261	அரசுப் பணித்தேர்வுத் தமிழ் - I*		
III	07PTA362	Advanced Course in Tamil	4	3
III	07PTA683	அரசுப் பணித்தேர்வுத் தமிழ் - II*	4	3

**Non-Departmental Courses****Journalism**

II	07PJO261	Beginners Course in Journalism	4	3
III	07PJO362	Advanced Course in Journalism	4	3

**Law**

II	07PLA261	Beginners Course in Law	4	3
III	07PLA362	Advanced Course in Law	4	3

**Shorthand**

II	07PSH261	English Shorthand-I	4	3
III	07PSH362	English Shorthand-II	4	3

(\* Offered by Self Financing Section)

