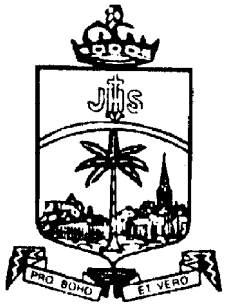
M SC BIOTECHNOLOGY

SYLLABUS: 2010-2012

CHOICE BASED CREDIT SYSTEM
(CBCS)



St. JOSEPH'S COLLEGE (Autonomous)

Re-accredited with A⁺ Grade by NAAC

College with Potential for Excellence by UGC

TIRUCHIRAPPALLI - 620 002, INDIA

FEATURES OF CHOICE BASED CREDIT SYSTEM

PG COURSES

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

OBJECTIVES OF THE CREDIT SYSTEM

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

What is credit system?

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

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

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

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

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

Course Pattern

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

Core Course

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

Elective Course

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

Inter Department Course (IDC)

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

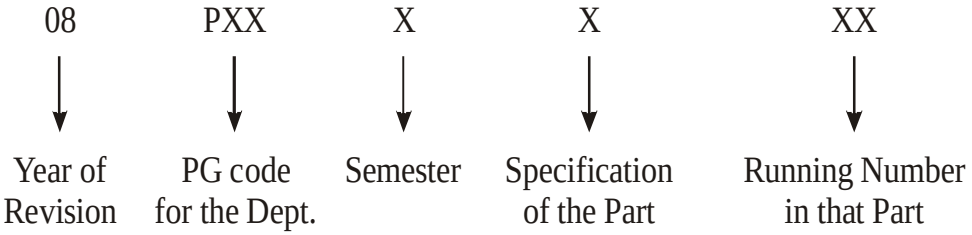
Day College (Shift-I) student may also take an IDC from SFS (Shift-II) course and vice versa

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

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

Subject Code Fixation

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



01 – Core Courses: Theory & Practical
02 – Core electives
03 – Additional Core Papers (if any)
04 – Inter Departmental Courses
05 – Project (compulsory)
06 – Shepherd (compulsory

CIA Components

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

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

Question Pattern

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

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:

$$OPM = \frac{\sum_i C_i M_i}{\sum_i C_i}$$ where Ci is the credit earned for that course in any semester and Mi is the marks obtained in that course.

The Scheme of Over-all Results is as follows:

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

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

Declaration of Result

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

COURSE DETAIL

Sem.	*Course*	*Course Title*	*Hours / Week*	*Cdts*
I	10PBT**1101**	Cell Biology and Genetics	6	5
	10PBT**1102**	Biochemistry	6	5
	10PBT**1103**	Developmental Biology	6	5
	10PBT**1104**	Laboratory Course - I	8	5
	10PBT**1201A**	Research Methodology (OR)	4	4
	10PBT**1201B**	Microbiology	-	-
		TOTAL FOR SEMESTER - I	30	**24**
II	10PBT**2105**	Recombinant DNA Technology	5	4
	10PBT**2106**	Immunology	5	4
	10PBT**2107**	Bioinformatics	4	3
	10PBT**2108**	Laboratory Course - II	8	5
	10PBT**2108A**	Self Study Report	-	4
	10PBT**2202A**	Stem Cells and Regenerative Medicine (OR)	4	4
	10PBT**2202B**	Artificial Cells Technology	-	-
	10PBT**2401**	IDC 1 Basic Bioinformatics	4	4
		TOTAL FOR SEMESTER - II	30	**28**
III	10PBT**3109**	Plant Biotechnology	4	4
	10PBT**3110**	Animal Biotechnology	4	4
	10PBT**3111**	Bioprocess Technology	4	4
	10PBT**3112**	Drug Dynamics & Design	4	4
	10PBT**3113**	Laboratory Course - III	6	4
	10PBT**3203A**	Genomics and Proteomics (OR)	4	4
	10PBT**3203B**	Biotechnology Management	-	-
	10PBT**3402**	IDC 2 Basic Genomics & Proteomics	4	4
		TOTAL FOR SEMESTER - III	30	**28**
IV	10PBT**4501**	Project Dissertation & *Viva Voce*	30	15
	10PBT**4601**	Outreach Activities		5
		TOTAL FOR ALL SEMESTERS		**100**

Sem- I Hours / Week: 6
10PBT1101 Credits: 5

CELL BIOLOGY AND GENETICS

Objectives

1. *To study the structural and functional organization of cells.*
2. *To understand genetics of prokaryotes and eukaryotes.*

UNIT – I (15 Hrs)

Structural organization of Prokaryotes and Eukaryotes. Cell membranes and functions, Cellular trafficking – Receptors, ion channels, active transport, electrical properties of membranes, Microtubular organizing centers – microfilaments, actin and myosin. Cell cycle and its regulation. Structural organization and function of intracellular organelles: Nucleus, Mitochondria, Golgi bodies, Lysosomes, Endoplasmic reticulum, Peroxisomes, Plastids, Vacuoles, Chloroplast. Intra cellular trafficking – Nucleo-cytoplasmic interactions, Protein sorting and targeting.

UNIT – II (15 Hrs)

Chromosomal and genetic organization – Prokaryotes and Eukaryotes – chromatin, Binding proteins, genes, intergenic and nonfunctional DNA, Extra chromosomal DNA, Viral genome and Phage elements. DNA replication- Discontinuous and continuous replication of DNA. RNA replication.

UNIT – III (15 Hrs)

Transcription – RNA types and functions, RNA synthesis – initiation, elongation and termination in bacteria and differences in eukaryotes. Post transcriptional processing & antibiotic inhibitors. Translation- Genetic code & features, Machinery, Protein synthesis- Initiation, elongation and termination in bacteria and differences in eukaryotes, translational proof-reading, translational inhibitors, post-translational modification of proteins.

Unit IV (15 Hrs)

Mendelian principles – Dominance, segregation, independent assortment, deviation from Mendelian inheritance. Co dominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Inheritance of mitochondrial and chloroplast genes, maternal inheritance.

UNIT – V (15 Hrs)

Gene mapping methods: Linkage maps, tetrad analysis. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, Evolutionary genetics: Recombination – Homologous and non-homologous, Mutation- Types and causes, Chromosomal alterations and their genetic impacts.

BOOK

1. Cooper G M 2004 The Cell: A Molecular Approach, ASM Press. Washington. (Unit - I, II & III)
2. Tom Strachan and Andrew P Lead. 2003. Human Molecular Genetics 3, Garland Science/Taylor & Francis Group (Unit - IV & V)

REFERENCE

1. Darnell J *et al*., Molecular Cell Biology, Scientific American Books, USA.
2. Gerald Karp, 2005, John Wiley and Sons, Cell and Molecular Biology.
3. Jeoffrey M Cooper, 2000, The Cell: A Molecular Approach
4. De Robertis and De Robertis, 1990. Cell and Molecular Biology, Saunders College, Philadelphia.
5. Griffiths, Anthony J.F *et al.,* Introduction to Genetic Analysis, 1999 W. H. Freeman & Co. New York.

Sem – I Hours/ Week:6
10PBT1102 Credits: 5

BIOCHEMISTRY

Objectives

1. *To study the biochemical environment of life.*
2. *To study the macromolecular interplay of life.*

UNIT – I (15 Hrs)

Introduction to biomolecules- chemical composition and reactivity, macromolecules and their monomeric subunits. Nucleotides: structure and classification. Biosynthesis of purine and pyrimidine nucleotides: regulation of biosynthesis; salvage pathway, degradation of nucleotides, formation of deoxyribonucleotides and nucleotide coenzymes.

UNIT – II (15 Hrs)

Metabolism and Bioenergetics: glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Amino acids: structure, classification, characteristics, optical activity and biosynthesis. Structure of Proteins. Symmetry and functional properties of haemoglobin and collagen.

UNIT – III (15 Hrs)

Carbohydrates – chemical properties and classification. Stereo and optical isomerisms. Heteroglycans: N-linked glycans and O-linked glycans. Lipids- Chemical nature of fatty acids and acyl glycerols and phosphoglycerols. Derived lipids: steroids, prostaglandins and leukotrienes. Membrane lipids, lipid biosynthesis – fatty acids, triglycerols, cholesterol, phospholipids. Lipoproteins – types and biological role.

UNIT – IV (15 Hrs)

Chemical signal molecules: definition and types – Signal transduction across membranes – adenylate cyclase system – adrenalin, G-proteins, Camp. Inositol triphosphate and calmodulin, DAG and

Protein kinase C – pathway. Steroid hormone – receptors – their structural and functional significance in hormone action.

UNIT – V (15 Hrs)

Enzymes- Classification, Nomenclature, Principles of enzyme catalysis. MM equation, Rate constants, LB plots. Inhibitors and activators. Allosteric enzymes & metabolic regulations. Abzymes and ribozymes. Enzyme immobilization, their applications in clinical, food and allied industries. Zymogens- activation and their role in biological system.

BOOK

1. Stryer, L., 2005. Biochemistry, W.H.Freeman & Co. NY (Unit: I & IV)
2. Trevor Palmer, 2001 Enzymes: Biochemistry, Biotechnology & Clinical Aspects Chichester, Horwood Pub. West Sussex, England (Unit - V)

REFERENCE

1. Lehninger A.L., 2002, Biochemistry, CBS Pub
2. Apps *et al*., 1992, Biochemistry, ELBS
3. Rawn, D., 1989, Biochemistry. Neil Patterson, USA
4. Martins *et al*., 2003 Harper's Review of Biochemistry, McGraw Hill Edu. Asia
5. Donald Voet and J.G. Voet 1990 Biochemistry, John Wiley & Sons Inc.

Sem – I Hours / Week: 6
10PBT1103 Credits: 5

DEVELOPMENTAL BIOLOGY

Objectives

1. *To study the cellular basis of development.*
2. *To elucidate the early development process of humans.*

UNIT – I (15 Hrs)

Morphogenesis and cell adhesion; cell to cell communication in development. Induction and competence. Paracrine factors and their importance. Adhesion of cells to non-cellular substrates;

UNIT – II (15 Hrs)

Fertilization – Recognition of sperm and egg. From fertilization to cleavage. Patterns of embryonic cleavage – blastulation, gastrulation, axis formation –anterior and posterior. Sex determination – chromosomes and environment.

UNIT –III (15 Hrs)

Organogenesis: Central nervous system and the epidermis – Formation of neural tube, Differentiation of the neural tube, tissue architecture of the central nervous system, origin of cutaneous structures. Neural crest cells and axonal specificity – Specification, Trunk Neural Crest, Pattern generation in the nervous system. Paraxial and intermediate mesoderm – Somites formation, Osteogenesis, Urogenital system. Lateral plate mesoderm and endoderm – Heart formation, digestive tube and its derivatives.

UNIT – IV (15 Hrs)

Cancer – Genetic predisposition, Epigenetic nature of neoplastic transformation, Physiopathological role of oncogenes in development and neoplasia, Dysfunction of regulatory tissue interactions. Oncogenes and Tumor suppressor genes. Telomerase expression – role in cell immortalization. Genetic ageing program – Age related factors in carcinogenesis.

UNIT – V (15 Hrs)

Medical implications of developmental biology – genetic disorders in human development, environmental assaults on human development, Future therapies and Developmental biology, Environmental regulation of animal development – Environment as a part of normal development, Polyphenisms and plasticity, Learning system. Mechanisms of Macroevolutionary change – Heterotropy, Heterochrony, Heterometry, Heterotrypy and Recruitment.

BOOK

1. Scott F. Gilbert, 2003 Developmental Biology; Sinauer Associates Inc. Pub., Sunderland, Massachusetts. (Unit - 1 & V)

REFERENCE

1. Alberts, Bruce; Johnson, Alexander; Lewis, Julian; Raff, Martin; Roberts, Keith; Walter, Peter. 2002 Molecular Biology of the Cell. Garland Science.
2. Harvey Lodish *et al*., 2000, Molecular Cell Biology – 4th ed. W H Freeman, NY.

Sem – I Hours / Week: 8
10PBT1104 Credits: 5

LABORATORY COURSE – I

[120 Hrs]

1. Acid base equilibrium, pH and pKa
2. Determination of protein (Bradford method)
3. Thin layer chromatography – separation of compound lipids
4. Native gel electrophoresis
5. SDS-PAGE for proteins
6. Silver staining of proteins separated by PAGE
7. Staining with coomassie brilliant blue
8. Isolation of genomic DNA and Plasmid DNA from bacteria
9. Isolation of total RNA (Guanidinium thiocyanate – Phenol chloroform extraction method)
10. Agarose gel Electrophoresis for DNA and staining
11. Pure culture of microorganisms.
12. Staining techniques (simple, Grams, Spore and Capsular staining techniques).
13. Biochemical test for identification of microorganisms.
14. Antimicrobial susceptibility testing of microorganisms (Kirby – Baur method)
15. Quantification of microorganisms (Turbidimetry method)
16. Bacterial growth kinetics
17. Assay of enzyme activity: Phosphatase.
18. Determination and optimization of physical factors for enzyme activity.
19. Determination of kinetic constants for enzyme: Kcat, Vmax and Km.
20. Determination of enzyme stability.
21. Most Probable Number of Micro-organisms.

Sem- I Hours / Week: 4
10PBT1201A Credits:4

RESEARCH METHODOLOGY

Objectives

1. Elucidation of the methods relevant to research; and application of experimentation and statistics in biological research.

Unit-I (12 Hrs)

Buffers, pH and pKa. Electron Microscopy – TEM & SEM and Fluorescence Microscope. Electrophoresis – Principles and types; Capillary electrophoresis, SDS-PAGE, IEF, 2D PAGE and AGE. Chromatography – Basic principles and types- HPLC, Gel filtration, Adsorption and Partition, Ion exchange, Affinity, HIC, IMAC, GLC and TLC.

Unit II (12 Hrs)

Radioisotopes – nature of radioactivity, pattern of decay and half life. Detection and measurement of radioactivity: Autoradiography. Applications of isotopes. Spectroscopy – UV/Vis, Spectrofluorimetry, IR, NMR, X-ray Crystallography, Mass spectrometry and MALDI-TOF, LC-MS/MS.

Unit III (12 Hrs)

Research – types, objectives and approaches, research designs. Sampling techniques. Hypothesis – meaning, types and characteristics. Literature collection – web browsing. Writing Reviews and Manuscript for publication – proof correction, structure of thesis.

Unit IV (12 Hrs)

Measures of Central tendency- Mean, Mode, median, Quartiles & Percentiles. Measures of Dispersion: Range, Quartile deviation, Mean deviation & Standard deviation. Measures of Relation – Correlation and Regression analysis. Probability distributions: Normal, Binomial, Exponential, Gaussian and Poisson distribution. Tests of hypothesis- student's T test, Chi square test, F test, ANOVA.

Unit V (12 Hrs)

Bibliometrics: definition, relevance and laws. Bibliometrics databases and indexes – evaluation tools: Impact Factor, *H-index,* Y factor, *Impact Factor*, and PageRank. Sharing of resources; Collective platforms with free access. Bibliometrics of e-journals. Citation Research: meaning, history. Strategies in linking Literatures; exploratory process and exclusionary process. The SCI, Search Strategies, Co-citation Coupling. Co-Citation Clustering and Co-World Clustering. Bibliographic Coupling, Thomson Reuters' Webmetrics/ Cybermetrics.

Books

1. Wilson, K and Walker, J (2000) Practical biochemistry: Principles and techniques, 5th Edn. Oxford University press, UK. (Unit - I & II)
2. Petter Laake *et al.,* (2007) Research methodology in Medical and Biological Sciences, First Edn. Elsevier Ltd. Amsterdam (Unit - III & V)

Sem – I Hours/ Week:4
10PBT1201B Credits: 4

MICROBIOLOGY

Objectives

1. *To understand the microbial world and their dynamics.*
2. *To know the importance of microbes in day-to-day life.*

UNIT – I (12 Hrs)

Brief history of microbiology: spontaneous generation, germ theory of disease, methods of microbiology – Culturing microorganisms, counting microorganisms, obtaining a pure culture. Uncultivable microorganisms and their study. The Viruses: classification of viruses, bacteriophages, animal and plant viruses.

UNIT – II (12 Hrs)

Prokaryotic and Eukaryotic cells: structure and functions. Metabolism of microorganisms – an overview, aerobic and anaerobic metabolism. Nutritional classes of microorganisms. Regulation of metabolism.

UNIT – III (12 Hrs)

Microbial genetics – the genetics of antibiotic resistance, Integrons, Transposons. Genetic exchange among eukaryotic microbes. Growth of microorganisms: doubling time and growth rate, exponential growth, phases of growth, continuous cultures, growth of a colony, nutrition. Measuring microbial growth.

UNIT – IV (12 Hrs)

Controlling microorganisms – death rate, sterilization. Physical controls on microorganisms – radiation, filtration, drying and osmotic strength. Chemical controls on microorganisms. Preserving food – temperature, Ph, water and chemicals.

UNIT – V (12 Hrs)

Microorganisms and human health – normal biota, symbiosis, Microorganisms and human disease. The immune system – the

body's three lines of defense against infection. Microorganisms and the environment: the cycles of matter, treatment of waste water, treatment of drinking water.

BOOK

1. John L Ingraham and Catherine A Ingraham 2004. Introduction to Microbiology – A Case History Approach, Thomson Asia Pvt. Ltd. (Unit - I & V)

REFERENCES

1. Larry McKane and Judy kandel, 1996, Microbiology – Essentials and Applications, McGraw Hill Inc. NY

2. Pelczar *et al*., 1986 Microbiology McGraw Hill Inc. NY

Sem – II Hours/ Week:5
10PBT2105 Credits: 4

RECOMBINANT DNA TECHNOLOGY

Objectives

1. *To study the techniques involved in genetic manipulation.*
2. *To study the safety aspects of rDNA technology.*

UNIT – I (15 Hrs)

Organization of genomes – Prokaryotes, Eukaryotes and Virus. Restriction and Linkage of DNA – Concepts, Components and Strategies. Vectors: Types, Characteristics & Applications – Plasmids, Phages, Cosmids, Phagemids, Shuttle vectors, Large insert vectors: BAC, YAC and HAC. Transposons and their role.

UNIT – II (15 Hrs)

Expression systems – Bacteria, Fungi, Plants and Animals. Expression cassette – promoters, reporters and markers. Recombinant selection and screening: genetic screening – PCR, sequencing strategies, Biochemical screening – Immunological screening- Western blotting, Phage display, Yeast two-hybrid & three-hybrid systems, Reverse two-hybrids and Hybridizations- Southern, Northern. Expression of cloned genes – problems and solutions.

UNIT – III (15 Hrs)

Methods of introducing recombinant vector into bacteria, plants and animals: Ca-mediated transfection, particle bombardment, microinjection, electroporation and lipofection. Gene knockouts and homologous recombination.

UNIT – IV (15 Hrs)

Recombinant libraries: Generation and applications – Genomic libraries, Cdna libraries, Fractionating libraries- Methyl filtration libraries, Methylation restriction libraries, COT fractionation based libraries. Assembling a physical map of the genome – RFLP. Global

gene expression profiling: Microarray – DNA and Non-DNA arrays, ChIPs, SAGE, MPSS. Mapping protein interaction, gene silencing, gene tagging, RNAi. Biochips.

UNIT – V (15 Hrs)

Applications and potential hazards of RDT. Safety aspects and regulation of RDT. Human genetics – decline of human genome and eugenics. Issues of RDT – social and scientific. IPR and patenting genes.

BOOKS

1. Bernard R Glick and Jack J Pasternak 2001 Molecular Biotechnology principles and applications of Recombinant DNA (2nd edition) ASM Press, Washington, D.C. (Unit-I & III)
2. James D Watson *et al* 1992 Recombinant DNA (2nd edition) W H Freeman and Co. NY. (Unit - IV & V)

REFERENCES

1. Ernst L Winnacker, 2002, From Genes to Clones – Introduction to Gene Technology, VCR Pub., Weinheim.
2. Maniatis and Sambrook, 2003 Molecular Cloning – A Lab Manual Vol. I, II & III.
3. Primrose, S B and Twyman R M. 2003. Principles of genome analysis and Genomics, Blackwell Publishers. Australia.
4. David M Glove 1984 Gene Cloning: The Mechanisms of DNA manipulations, Chapman& Hall, NY.

Sem – II Hours / Week: 5
10PBT2106 Credits: 4

IMMUNOLOGY

Objectives

1. *To elucidate the immune responses of humans to foreign substances / organisms.*
2. *To study the modern techniques that help determine human protection.*

UNIT – I (15 Hrs)

Immune system: definition and properties. Cells of the immune system. Lymphoid organs-primary and secondary; structure and function. Types of immunity-innate and acquired, humoral immunity and cell mediated immunity. Antigen; definition, types and properties-antigenicity and immunogenicity, antigenic determinants and haptens.

UNIT – II (15 Hrs)

Humoral Immunity: Immunoglobulins; structure, classes and distribution of antibodies. Theories of antibody formation. Antigen-antibody interactions; strength of antigen- antibody interactions. Organization and expression of immunoglobulin genes- generation of antibody diversity. B cell activation, proliferation and differentiation. Generation of humoral immune response- primary and secondary. Complement system – alternate and classical pathways, initiators and MAC.

UNIT – III (15 Hrs)

Cell mediated immunity: cells and molecules involved. 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. Mechanism of antigen recognition by T lymphocytes. Primary and secondary immune response. Regulation of immune response, cytokines- types, role in immunity.

UNIT – IV (15 Hrs)

Immunoregulation – helper and suppressor cells, mechanism in immunity. 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 (15 Hrs)

Immunological Techniques: production of monoclonal antibodies and Polyclonal antibodies. Principle and applications of immunoassays: RIA, ELISA, IRMA, EIA, ELFIA, ECLIA, DELFIA, TRIFMA, SLFIA, and western blot. Precipitation reaction – immunodiffusion, immunoelectrophoresis, precipitin ring test. Agglutination tests – heamagglutination, febrile and latex agglutination- applications. Immunohistochemistry – Flow cytometry and FACS. Immunoelectronmicroscopy.

BOOKS

1. Ivan M. Roit *et al* 1998 Immunology-5th Edition. Churchill Livingstone publishers (Unit - I & IV)
2. Janis Kuby 1998 Immunology – 3rd and 4th edition W.H. Freeman and Co. NY (Unit - V)

REFERENCES

1. Murphy *et al.,* 2008. Janeway's Immunobiology the immune system in health and disease. Seventh edition. Garland Science Publisher
2. Wilson K and Walker J 2005 Practical Biochemistry Cambridge University Press, London.
3. Weir, D.N (1997): Immunology 8th edition, Churchill Livingstone publishers.
4. Richardo coico *et al.,* 2003. Immunology A short course. Fifth edition. John Wiley & sons Inc. New Jersy.

Sem – II Hours / Week: 4
10PBT2107 Credits: 3

BIOINFORMATICS

Objectives

1. *To analyse the various databases available for protein and nucleic acids.*
2. *To learn sequence analysis and to compare between species and individuals.*

UNIT – I (12 Hrs)

Computer concepts – structural organization of computer- evolution of computer-operating system-computer application in biology – bioinformatics and its applications. Web browsing. Information networks- NCBI, EMBL, DDBJ. Databases- primary nucleic acid databases-structure of Genbank entries.

UNIT – II (12 Hrs)

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. Protein structural databases: PDB, MMDB.

UNIT – III (12 Hrs)

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 alignment

UNIT – IV (12 Hrs)

Dotplot, pairwise database searching – FASTA & BLAST, building sequence search protocol. Phylogenetic analysis-methods of

UNIT – V (12 Hrs)

Comparative and functional genomics: Genome annotation – genome maps, types & uses. Human genome physical map. Secondary & tertiary structure prediction, homology modelling & model structure refinement using SPDBV.

BOOKS

1. Andreas D. Baxevanis and B.F. Francis Ouellette. Bioinformatics. A Laboratory Course guide to the analysis of Genes and Proteins. 2002 Edn. A. John Wiley & Sons, Inc., Publications (Unit - I & V)

REFERENCES

1. Primrose, S B and Twyman R M. 2005. Principles of genome analysis and Genomics. Blackwell Publishers. Australia.
2. Arthur M Lesk. 2002. Introduction to Bioinformatics. Oxford university press. New York.
3. David W Mount. 2001. Bioinformatics Sequence and Genome analysis. Cold Spring harbor laboratory.
4. Shui Qing Ye. 2008. Chapman & Hall/CRC series. Bioinformatics A practical approach. Taylor and Francis group.

Sem – II Hours/ Week:8
10PBT2108 Credits: 5

LABORATORY COURSE – II

[120 Hrs]

1. Preparation of antigen for immunization.
2. Techniques of immunization and bleeding.
3. Immunodiffusion: Ouchterlony double and single radial immunodiffusion.
4. Dissection and identification of thymus, spleen and lymph nodes in mouse
5. Pregnancy test
6. Rocket immunoelectrophoresis
7. Separation of Peripheral blood mononuclear cells.
8. Isolation of rat peritoneal macrophage.
9. Generation and purification of chicken egg yolk antibodies.
10. Western Blotting.
11. Isolation of DNA from leukocytes.
12. Polymerase Chain Reaction (Integrons, 16SrRNA Bacterial identification and ITS Fungal identification).
13. Restriction Digestion and Ligation.
14. Cloning and Transformation (PEG method)
15. Bioinformatics Tools and Protocols

    Sequence analysis: Pairwise alignment (BLAST)

    Sequence analysis: Multiple alignment (Clustal W)

    Phylogenetic Analysis.

    Six frame translation.

    Primer designing.

17. Environmental tolerance studies of Micro-organisms

a) Organic solvent tolerance

b) Antibiotic, Heavy metals, detergents and dye resistance – Planktonic cells and Biofilm.

c) Efflux pumps

Sem – II
10PBT2108A (Applied Intra) Credits: 4

SELF STUDY REPORT

Objective

To familiarize with the art of literature search and survey, abstraction, compiling and editing; citation of authors and acknowledgement for a scientific review writing.

Sem – II Hours/ Week:4
10PBT2202A Credits: 4

STEM CELLS AND REGENERATIVE MEDICINE

Objectives

1. To understand nature's way of cell perpetuation; and

2. To realize and appreciate the inherent trait of regenerative therapy.

Unit I (12 Hrs)

Stem cells – definition; unique properties – proliferation and differentiation; Potency definitions: totipotent, pluripotent, multipotent and unipotent; basics of early human embryology; History and key stem cell research events

Unit II (12 Hrs)

Isolation, culture, identification and assays. Types: unlimited and limited; Embryonic and adult stem cells – bone marrow, cord blood, neural, endothelial, hematopoietic, epithelial, pancreatic, hepatic, glandular, cardiac and gastrointestinal, leukemia and cancer stem cells.

Unit III (12 Hrs)

Stem cells and cloning; germ line stem cells; Recruiting Donors and Banking Hes Cells; IPRs and Hes Cells. Fate mapping of stem cells in experimental systems.

Unit IV (12 Hrs)

Genetically engineered stem cells and experimental therapies. Stem cell based therapies: stem cells and repair of heart and nervous system; regeneration strategies. Skin replacement, brain cell transplantation and stem cells in aging

Unit V (12 Hrs)

Controversies and Guidelines for Hes cell research – Scientific background of Hesc research; Ethical and scientific concerns; Current Regulation of Human Embryonic Stem Cell Research. Future of SC research.

Books

1. Stewart Sell 2003 (Ed) Stem Cells Handbook, Humana Press, NY (Unit - I)
2. Verma IM and Gage FH 2002 (Ed) Regenerative Medicine, Natl Acad Sci & Engg, USA (Unit - IV)
3. The Natl Academies, USA 2007 Understanding Stem Cells (Unit - II)
4. The Natl Academies, USA 2002 Stem Cells and the Future of Regenerative Medicine (Unit - IV & V)
5. Stem Cells Info 2008, NIH USA
6. Terese Winslow 2006 Regenerative Medicine, Natl Acad Sci & Engg, USA
7. Marshak *et al.,* 2000 Stem Cell Biology, CSHL press, USA. (Unit - III)
8. Regenerative Medicine (2006) NIH, Bethesda, USA.

Online Resources

Stem Cells and the Future of Regenerative Medicine (2001) National Academies Press, USA. http://www.nap.edu/catalog/10195.html

Scientific and Medical Aspects of Human Reproductive Cloning (2002) National Academies Press, USA. http://www.nap.edu/catalog/10285.html

Cord Blood: Establishing a National Hematopoietic Stem Cell Bank Program (2005).

http://www.nap.edu/catalog/11269.html

Guidelines for Human Embryonic Stem Cell Research (2005).

http://www.nap.edu/catalog/11278.html

http://stemcells.nih.gov/info/scireport/2006report.htm

http://www.eurekalert.org

http://scitechdaily.com/

http://www.sciam.com/

http://www.stemcellresearchnews.com/

Sem – II Hours / Week: 4
10PBT2202B Credits: 4

ARTIFICIAL CELLS TECHNOLOGY

Objectives

1. *To study the principle, preparation, types and applications of artificial cells.*

Unit I (12 Hrs)

Artificial cells: Introduction – concept and history, basic features, macro, micro, nano and molecular dimensions. Design of artificial cells – liposomes and nanoparticles; membrane materials; production of artificial cells – microencapsulation technologies.

Unit II (12 Hrs)

Artificial cells for cell encapsulation – artificial cells in the treatment of liver diseases, kidney diseases, Myocardial infarction, and diabetes. Applications of artificial cells containing genetically engineered cells, stem cells and microorganisms.

Unit III (12 Hrs)

Enzyme Artificial Cells (EACs) for genetic enzyme defects: Acatalasemia & Phenylketonuria. EACs in substrate-dependent tumors and activation of prodrug. Artificial RBCs as blood substitutes. Artificial cells as novel approach for gene therapy.

Unit IV (12 Hrs)

Carrier & Artificial-cell mediated drug delivery: Applications in cancer, brain targeting & inflammatory bowel diseases. Current treatment strategies: Microcapsules and nanocapsules. Artificial cells containing bioadsorbants. Artificial organs.

Unit V (12 Hrs)

Future of Artificial Cells: Cells with lipid-polymer membrane, ion channels and Na-K-ATPase, living artificial cells containing microsomes, cytosol, ribosomes and polymerases. A primer on Synthetic Biology

BOOKS

1. Chang TMS (2007) Artificial cells: Artificial Cells and Nanomedicine – Vol. 1, World Scientific Publishing Co. Pvt. Ltd. 5, Toh Tuck Link, Singapore. (Unit - I & V)

REFERENCES

1. Prakash S (2007) Artificial Cells, Cell Engineering and Therapy. Woodhead Publishing Limited, Abington Hall, Abington, Cambridge CB21 6AH, England.

2. Chang TMS (2005) Therapeutic applications of polymeric artificial cells. *Nature Review on Drug Discovery*, Vol. 4: 221-235.

3. Chang TMS (1997) Blood Substitutes: Principles, Methods, Products and Clinical Trials. Karger AG P O Box CH – 4009 Basel, Switzerland

4. Chang TMS (1972) Artificial Cells. Charles C. Thomas Publishers, Springfield, Illinois, USA.

Sem – II Hours / Week: 4
10PBT2401 IDC 1 Credits: 4

BASIC BIOINFORMATICS

Objectives

1. *To analyze the various databases available for protein and nucleic acids.*
2. *To learn sequence analysis and to compare between species and individuals.*

UNIT – I (12 Hrs)

Computer concepts – structural organization of computer- evolution of computer-operating system-computer application in biology – bioinformatics and its applications. Web browsing.

UNIT – II (12 Hrs)

Information networks- NCBI, EMBL, DDBJ. Databases – primary nucleic acid databases-Structure of Genbank entries. Protein sequence databases, primary databases

UNIT – III (12 Hrs)

PIR, MIPS, SWISS-PROT, TrEMBL, NRL-3D. Structure of SWISS-PROT entries. Secondary databases, PROSITE, PROFILES, PRINTS, Pfam, BLOCKS and IDENTIFY. Composite protein databases. Protein structural databases: PDB, MMDB.

UNIT – IV (12 Hrs)

EST analysis tools- sequence similarity search tools, sequence assembly tools and sequence clustering tools. Alignment techniques-multiple alignment Dotplot, pairwise database searching-FASTA & BLAST, building sequence search protocol.. Phylogenetic analysis.

UNIT – V (12 Hrs)

Comparative and functional genomics: Genome annotation – genome maps, types & uses. Human genome physical map. Secondary & tertiary structure prediction.

BOOK

1. Attwood T K and Parry smith D J. 1999. Introduction to Bioinformatics. Longman publications, Sussex UK (Unit - I & V)

REFERENCES

1. Andreas D. Baxevanis and B.F. Francis Ouellette Bioinformatics A Laboratory Course guide to the analysis of Genes and Proteins. 2002 Ed.. A. John Wiley & Sons, Inc., Publications
2. Primrose, S B and Twyman R M. 2005. Principles of genome analysis and Genomics. Blackwell Publishers. Australia.

Sem – III Hours/ Week:4
10PBT3109 Credits: 4

PLANT BIOTECHNOLOGY

Objectives

1. *To study the basics of tissue culture and its applications.*
2. *To understand the manipulation of genes that confers special traits on transgenics.*

Unit – I (12 Hrs)

Establishment of plant tissue culture: explants, callus, suspension cultures, organogenesis and embryogenesis, somatic embryogenesis and somaclonal variation, meristem culture, anther, embryo and ovule culture. Protoplast fusion, artificial seeds, hardening of plants, applications of tissue culture in agriculture and forestry

Unit – II (12 Hrs)

Plant – microbe interactions – Type I to V secretions, *Agrobacterium* mediated gene transformation – Ti plasmid (*Agrobacterium tumefacians*) & Ri Plasmid (*Agrobacterium rhizogenes*). Viral vectors – *Cauliflower mosaic virus* and *Gemini virus*. Pathogenesis related proteins (PR Proteins).

Unit – III (12 Hrs)

Nitrogen fixation – *Nif* gene, *Nod* gene, *Hup* gene. Biotechnology for crop improvement – drought, salt stress, disease resistance – antibacterial, antifungal and pest resistance. Genetic engineering for quality improvement: proteins, carbohydrates and vitamins. Chloroplast and Mitochondrial genome.

Unit – IV (12 Hrs)

Metabolic engineering – manipulation of phenylpropanoid pathway & shikimate pathway. Food vaccines, bioplastics, plantibodies. Antisense RNA technology and its applications. Terminator technology.

Unit – V (12 Hrs)

Molecular markers in plant breeding, Molecular breeding – constructing molecular maps, molecular tagging of genes / traits, marker assisted selection of qualitative and quantitative traits. Orthologous genes and gene synteny. The concept of map based cloning and the use in transgenics. Plant genomics: *Arabidopsis* and *Rice*.

Book

1. Adrian Slater, Nigel Scott and Mark Fowler 2003. Plant Biotechnology – The genetic manipulation of plants, Oxford University press. (Unit - I & V)

REFERENCES

1. Old, R.W., and Primrose, S.B., 2001. Principles of Gene Manipulation – An Introduction to Genetic Engineering, Black Well Science Ltd., New York.
2. Winnacker, E.L., 2002. From Genes to Clones – Introduction to Gene Technology, VCR publisher, Weinheim.
3. Yury E. Khudyakov and Howard A. Fields. 2003 Artificial DNA: Methods and Applications, CRC Press, USA.
4. Gamborg, O.L and Philips, G.C., 1995. Plant Cell, Tissue and organ culture. Fundamental methods, Narosa Publishing House, New Delhi.
5. George, E.F and Sherrington, P.D., 1984. Plant Propagation by Tissue culture, Exegetics Limited, London.
6. Hedin, P.A., Menn, J.J and Hollingworth, R.M., 1988. Biotechnology for crop protection, American Chemical society, Washington.

Sem – III Hours / Week: 4
10PBT3110 Credits: 4

ANIMAL BIOTECHNOLOGY

Objectives

1. *To know the techniques of animal transgenesis.*
2. *To evaluate the transgenic animals towards human benefit.*

UNIT – I (12 Hrs)

Introduction to animal biotechnology. Animal cell: production and culture. Development and maintenance of cell lines, continuous cell lines, culture media, sterilization and storage. Suspension culture, embryo culture, teratogenesis. Lab based and large-scale culture, applications of animal cell culture. Stem cell – isolation and manipulation.

UNIT – II (12 Hrs)

Genetic engineering in animals – cloning vectors, expression vectors and viral vectors. Transgenic animals – improving important genes, production of recombinant proteins, immunotoxins, recombinant vaccines, hybridoma. Recombinant antibodies.

UNIT – III (12 Hrs)

Integrated pest management – pest management using juvenile hormone analogues. Pheromones and genetic manipulations – silkworm and fish as bioreactors. Baculovirus in biocontrol.

UNIT – IV (12 Hrs)

Biotechnology in aquaculture – ploidy induction, gynogenesis, androgenesis and transgenic fishes. Animal husbandary – *in vitro* fertilization, gamete selection, embryonic cell selection, embryo manipulation, demi embryos and embryo transfer. Therapeutic and reproductive cloning. Cryobiology.

UNIT – V (12 Hrs)

Human genome organization. DNA fingerprinting and PCR in forensic sciences. Xenografting – methods, problems and issues. Gene therapy – method, gene delivery systems and applications. Neurobiotechnology. Social, ethical and legal issues- human reproductive biology, foeticide and sex determination.

BOOKS

1. Jose and Robert , 2005, Principles of Cloning, Academic press. (Unit - I, II & III)
2. Bernard R Glick and Jack J Pasternak 2001 Molecular Biotechnology principles and applications of Recombinant DNA ASM Press, Washington, D.C. (Unit - V)
3. James D Watson *et al* 2000 Recombinant DNA W H Freeman and Co. NY. (Unit - IV)

REFERENCES

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 procedures, Open University press, New York.
3. Strachan, T and Read A P. 1999. Human Molecular genetics, John Wiley and sons, Pvt. Ltd., Singapore.

Sem – III Hours / Week: 4
10PBT3111 Credits: 4

BIOPROCESS TECHNOLOGY

Objectives

1. *To study the avenues of exploiting microbes.*
2. *To study the down stream processes for product recovery in fermentation.*

UNIT – I (12 Hrs)

Introduction to Fermentation process, Media formulation – growth factors, buffers, O2, antifoams, media optimization Basic concepts- batch, Continuous and fed batch culture, selection methods for industrially important microorganisms. Strain improvement, preservation, and properties of industrial strains.

UNIT – II (12 Hrs)

Bioreactor design, parts and functions, sterilization. Impellers, baffles and sparger. Types of reactor- submerged reactor – mechanically stirred draught- tube reactor- continuous flow stir type reactor – airlift reactor- jet loop reactor, surface reactor, packed bed reactor

UNIT – III (12 Hrs)

Bioprocess control and monitoring variables – O2 requirement and uptake, factors affecting KLa- aeration, agitation, pressure and Ph, medium rheology. Flow measurement and control, control system – manual and automatic. PID control. Application and the role of computers in bioprocess.

UNIT – IV (12 Hrs)

Production strategies for insulin, lactic acid, vinegar, hydrocarbons, single cell oil, amino acids. Scale-up and scale-down.

UNIT – V (12 Hrs)

Down stream processing: Introduction, recovery of microbial cells, precipitation, filtration-theory of filtration, batch and continuous filters. Centrifugation. Cell disruption-physical and chemical methods. Extraction- liquid-liquid extraction and aqueous-two phase extraction. Chromatography, membrane processes, drying and crystallization.

BOOK

1. Stanbury, P F and Whitaker, A 1995. Principles of Fermentation Technology, Pergamon press. (Unit - I & V)

REFERENCES

1. E.MT. El-Mansi and C F A Bryce, 2002 Fermentation Microbiology and Biotechnology, Tatlor and Francis Co. USA.
2. Bailley and ollis, 1986, Biochemical Engineering fundamentals, McGraw Hill, New York.
3. Coulson, J M and Richardson, S F, 1984. Chemical Engineering, Pergamon press.
4. Mooyoung (ed.) 1985. Comprehensive Biotechnology, Vol. I, II, III & IV Pergamon press.
5. Wulf Crueger and Anneliese Cruger, 2004. Biotechnology: A Textbook of Industrial Microbiology 2nd edition Panima Publishing Co.
6. Michael L shuler and Fikret Kargi, 2002. Bioprocess Engineering: Basic Concepts 2nd edition Prentice Hall, NJ.

Sem – III Hours/ Week:4
10PBT3112 Credits: 4

DRUG DYNAMICS & DESIGN

Objectives

1. *Understand the mechanisms of drug biology in human system.*
2. *Designing the steps in the process of drug discovery.*

Unit I (12 Hrs)

Drugs – definition, source and nature, classification and nomenclature. Absorption, distribution, bioavailability and bioequivalence of drug products. Pharmacokinetics and pharmacodynamics of drugs in biological systems.

Unit II (12 Hrs)

Drug metabolism – phase I and phase II biotransformation, microsomal and non-microsomal biotransformation reactions. Drug metabolism in liver, kidney, intestine and placenta. Drug metabolism in infants and aged.

Unit III (12 Hrs)

Principles and applications of Pharmacogenomics; Genetic factors for variability in drug response and disease susceptibility. Haplotypes and strategies for tag SNP selection, haplotype association studies in pharmacogenomics, HapMap project.

Unit IV (12 Hrs)

Drug Designing – Introduction to QSAR. Lead module, linear and nonlinear modeled equations, biological activities, physicochemical parameters and molecular descriptors, molecular Structure Based Drug Design: 3D pharmacophores, molecular docking, *De novo* Ligand design, Free energies and . High-throughput screening in drug metabolism and pharmacokinetic support of drug discovery.

Unit V (12 Hrs)

Pharmacodynamics, pharmacokinetics of peptide and protein drugs and immunogenicity of protein therapeutics. Biological nano-pores: protein nanopores – maltoporin, nanocontainer – liposome nanocontainers, biopolymer nanocontainers, nanocapsules: applications in drug delivery.

BOOKS

1. Arthur J. Atkinson Jr 2007, Principles of Clinical Pharmacology Second Edition, Academic Press publications, Elsevier, UK. (Unit - I & II)
2. Werner Kalow *et al.,* 2005, Pharmacogenomics II Ed Taylor & Francis, LLC, London. (Unit - III)
3. Reza Mozafari, M 2007 Nanomaterials and Nanosystems for Biomedical Applications, Springer, The Netherlands.
4. Elisabeth S. Papazoglou, Aravind Parthasarathy 2007, BioNanotechnology, Morgan & Claypool Publishers.
5. Michael A. Stroscio and Mitra Dutta 2004, Biological Nanostructures and Applications of Nanostructures in Biology Electrical, Mechanical, and Optical Properties, Kluwer Academic Publications, London. (Unit - V)
6. Drug Delivery Systems (Methods in Molecular Biology volume 437) 2008 Publisher: Humana Press. (Unit - IV)

Sem – III Hours / Week: 6
10PBT3113 Credits:4

LABORATORY COURSE – III

[90 Hrs]

1. *In vitro* studies in plants: Micropropagation, callus culture, somatic embryogenesis.
2. Isolation of DNA from Plants (CTAB method) and profiling in Agarose gel.
3. Protoplast isolation and fusion using PEG
4. Triparental mating, *Agrobacterium* – mediated gene transfer
5. Fermentation kinetics – determination of product yield.
6. Microbial production of amino acids and organic acids.
7. Production of Single cell proteins.
8. Production of Organic acids.
9. Production of Cellulase by Solid-state fermentation and assay of cellulase activity.
10. Production of ethanol from molasses by Yeast.
11. Immobilization of enzymes: Entrapment and covalent coupling.
12. Activity and thermal stability of immobilized enzyme.
13. Methods of isolation of enzymes:
    a. *Ammonium sulfate precipitation.*
    b. *Solubilization of membrane bound proteins in detergents.*
14. Purification of enzymes by molecular sieve chromatography (gel filtration).

Sem – III Hours / Week: 4
10PBT3203A Credits: 4

GENOMICS AND PROTEOMICS

Unit I (12 Hrs)

Genomes: genome organization, gene structure and expression in eukaryotes and prokaryotes. DNA and chromosome variation – origin of DNA variation: low-copy sequences, dispersed repetitive and tandemly repeated sequences, processes that affect genome size.

Unit II (12 Hrs)

Genome analysis tools: Cloning systems: plasmids, large-insert vectors, cDNA cloning, subtraction libraries. Global gene expression profiling: Differential display, Microarray – DNA and Non-DNA arrays, ChIPs, SAGE, MPSS. Sequencing strategies and automation: physical and genetic maps, MTP sequencing, BAC end sequencing. Marker systems – RFLPs, AFLPs, RAPDs, Microsatellites, SSRs and SNPs.

Unit III (12 Hrs)

Methods of fractionating the genome – Expressed Sequence Tags (ESTs), methyl filtration libraries, methylation restriction libraries, transposon tags, COT fractionation-based libraries, and selecting BAC contigs enriched for expressed genes. Gene identification by mutagenesis – insertional mutagenesis, targeting induced local lesions in genomes (tilling), RNAi. Studying gene function through protein-protein interaction.

Unit IV (12 Hrs)

Proteomics – protein isolation, high-throughput protein and peptide separation and detection, protein identification and phosphorylation site analysis by MS, Tandem Mass spectrometry, peptide mass fingerprinting. Protein expression analysis by 2-DE, 2D-MALDI- TOF MS, LC-MS/MS, Quantitative proteomics.

Unit V (12 Hrs)

Mining the proteome, Protein expression profiling, Identification of protein-protein interaction and protein complexes – Phage display, Yeast two-hybrid & three-hybrid systems; reverse two-hybrids. Protein tags; protein arrays and antibody arrays.

Books

1. Cullis. C. A (2004). Plant Genomics and Proteomics, John Wiley & Sons, Inc., Hoboken, New Jersey. (Unit - I)
2. Grandi .G (2004). Genomics, Proteomics and Vaccines, John Wiley & Sons, Ltd., England.
3. Liebler .D.C (2002). Introduction to Proteomics: Tools for the new biology, Humana press, Totowa, New Jersy. (Unit - IV)
4. Dale. J. W & M.V. Schantz (2002). From Gene to Genomes: Concepts and Applications of DNA Technology, John Wiley& Sons, Ltd. England. (Unit - II & III)
5. Westermeier. R, T. Haven (2002). Proteomics in Practice: A Laboratory Manual of Proteome Analysis, John Wiley & Sons, Ltd., England. (Unit - V)

Sem – III Hours / Week: 4
10PBT3203B Credits: 4

BIOTECHNOLOGY MANAGEMENT

Objectives

1. *Introducing the students to modern scientific thinking; optimizing their international understanding of reproductive biology; evaluation of biological research and responsible citizenship.*

Unit – I (12 Hrs)

Emerging Trends in Biotechnology; Application and Methodology of Biotechnology; Fundamentals of Production Planning and controls for Biotechnology; Human Resource Management in hi-tech Environment; Production Management; Intellectual property rights and Technology Transfer; Safety and Hazard Management in Biotechnology; Biotechnology plant Management; Environment Management and Ethics in Business; Project Management

Unit – II (12 Hrs)

Principles of Biosafety: Laboratory biosafety levels and measures, Classification criteria of microorganisms, Advance Informed Consent, Precautionary Principle, Substantial Equivalence, Deliberate release and Safety evaluation of GMOs, GMO Labelling. Safety of Food & Animal Feed Derived From GM Crops: Nutritional and Toxicological Differences in GM Food; Food Allergies from GM Crops; Fate of Transgenic DNA; Effect of GM Derived Feed in the Food Chain

Unit III (12 Hrs)

Environmental Impacts: Invasiveness / Persistence – Gene Flow and Detection – Gene Flow between Crop Varieties; from GM Crops to Agricultural Weeds and Wild Relatives; from GM Crops to Soil Microbes; from GM Plants to Viruses; Toxicity to Wildlife; Development of Resistance; Management Practices-New Weed Control Strategies; Changes in Agricultural Practices.

Unit IV (12 Hrs)

IPR: Introduction, Origin of patent regime, Patent Acts. National and International systems.

Basis of patentability, Novelty and Utility. Basic Principles of Patent Law. Patent application procedure. Drafting of a Patent Specification. Understanding Copyright Law. Basic Principles of Trade Mark. Basic Principles of Design Rights. International Background of Intellectual Property. Issues arising of patenting genes.

Unit V (12 Hrs)

Bioethics: Methods in bioethics; Autonomy, Organ transplantation; Biobanking; Commodification of women's reproductive labour; morality of human embryos and stem cell research; therapeutic cloning; Genetic screening and enhancement; Animal experimentation; International guidelines.

BOOKS

1. Shaleesha A Stanley 2008. Bioethics, Wisdom Educational Services. (Unit - V)
2. Eigner WW 1994. Just Technology? CACL, York Univ. Ontario.
3. The UK Govt. 2006. The GM Science Review, London. (Unit-II)
4. Mulongoy KJ 1997. Trans-boundary Movement of LMOs, Int. Acad. Envir., Geneva. (Unit - III)
5. Sasson A, Biotechnologies and Development, UNESCO Publications. (Unit - IV)
6. Jeffrey M. Gimble, Academia to Biotechnology, Elsevier, Academic Press. (Unit - I)
7. Steinbock, B 2007, The Oxford Handbook of Bioethics, Oxford Univ. Press. (Unit - V)

Sem – III Hours / Week: 4
10PBT3402 IDC 2 Credits: 4

BASIC GENOMICS & PROTEOMICS

Objectives

1. *Understand the modern science of macromolecular interplay.*
2. *Manipulate the data to prediction analysis.*

Unit I (12 Hrs)

Genomes: genome organization, gene structure and expression in eukaryotes and prokaryotes. DNA and chromosome variation – origin of DNA variation: low-copy sequences, dispersed repetitive and tandemly repeated sequences, processes that affect genome size.

Unit II (12 Hrs)

Genome analysis tools: Cloning systems: plasmids, large-insert vectors, cDNA cloning, subtraction libraries. Sequencing strategies and automation: physical and genetic maps, MTP sequencing, BAC end sequencing. Marker systems – RFLPs, AFLPs, RAPDs, Microsatellites, SSRs and SNPs.

Unit III (12 Hrs)

Methods of fractionating the genome – Expressed Sequence Tags (ESTs), Methyl filtration libraries, Methylation restriction libraries, transposon tags, COT fractionation-based libraries, and selecting BAC contigs enriched for expressed genes.

Unit IV (12 Hrs)

Proteomics – protein isolation, High-throughput protein and peptide separation and detection, protein identification and phosphorylation site analysis by MS, Tandem Mass spectrometry, peptide mass fingerprinting. Protein expression analysis by 2-DE, 2D-MALDI- TOF MS, LC-MS/MS, Quantitative proteomics.

Unit V (12 Hrs)

Mining the proteome, Protein expression profiling, Identification of protein-protein interaction and protein complexes – Phage display, Yeast two-hybrid & three-hybrid systems; reverse two-hybrids. Protein tags; protein arrays and antibody arrays.

BOOKS

1. Bioinformatics A Laboratory Course guide to the analysis of Genes and Proteins. Ed. Andreas D. Baxevanis and B.F. Francis Ouellette. A. John Wiley & Sons, Inc., Publications (For mapping and comparative genomics and COG and other database repositories). (Unit - I & III)
2. Bioinformatics Sequence and Genome Analysis. 2001. David W. Mount. Cold Spring Harbor Laboratory Press. (Unit - IV & V)
3. Introduction to Bioinformatics Attwood, T K and Parry Smith, D J 1999. Longman Publication, Sussex.

Sem – IV Hours/Week:30
10PBT4501 Credits: 15

PROJECT DISSERTATION & *VIVA VOCE*

The Project / Dissertation are intended to give the students the experience of research on a topic of his interest; a stepping stone into advanced research, often in contemporary area. The thesis writing propels the candidate's acumen in abstraction, comprehension, synthesis, analysis and citation encountered in research and literature surveying. The document presents the author's research and findings and the rationale behind the justification. The project / dissertation are submitted in support of the candidature for a Masters Degree, which assumes one of professional qualification from a routine structured academic qualification. Project / Dissertation research also is intended to present the candidate with options of having it accomplished in leading national centers of excellence that provide an excellent environment of scholarly interaction with scientists and peers. The obligatory oral examination (*viva voce*) comprises presentation by the candidate in defense of the findings and the rationale behind the justification. The questions are posed by an examining committee comprising the guiding supervisor and an external expert.

INTER DEPARTMENTAL COURSE - IDC

BIOCHEMISTRY

10PBC2401 APPLIED NUTRITION

10PBC3402 FIRST AID MANAGEMENT

BIOTECHNOLOGY

10PBT2401 BASIC BIOINFORMATICS

10PBT3402 BASIC GENOMICS & PROTEOMICS

CHEMISTRY

10PCH2401 HEALTH CHEMISTRY

10PCH3402 INDUSTRIAL CHEMISTRY

COMMERCE

10PCO2401 FINANCIAL ACCOUNTING FOR MANAGERS

10PCO3402 MANAGEMENT CONCEPTS & ORGANIZATIONAL BEHAVIOR

COMPUTER APPLICATIONS

10PCA2401 INTERNET CONCEPTS

10PCA2402 FOUNDATION OF COMPUTER SCIENCE

10PCA3403 COMPUTER APPLICATIONS FOR SOCIAL SCIENCES

10PCA3404 FUNDAMENTALS OF PROGRAMMING

COMPUTER SCIENCE

10PCS2401A FUNDAMENTALS OF IT

10PCS2401B WEB DESIGN

10PCS3402A FLASH

10PCS3402B DREAM WEAVER

ECONOMICS

10PEC2401 ECONOMICS FOR MANAGERS

10PEC3402 INDIAN ECONOMY

ELECTRONICS

10PEL2401 ELECTRONICS IN COMMUNICATION

10PEL3402 COMPUTER HARDWARE

ENGLISH

10PEN2401 BUSINESS ENGLISH

10PEN3402 INTERVEIW SKILLS AND GROUP DYNAMICS

HISTORY

10PHS2401 PUBLIC ADMINISTRATION

10PHS3402 APPLIED TOURISM

HUMAN RESOURCE MANAGEMENT

10PHR2401 FUNDAMENTALS OF HRM

10PHR3402 PERSONALITY AND SOFT SKILLS DEVELOPMENT

INFORMATION TECHNOLOGY

10PIT2401A FUNDAMENTALS OF IT

10PIT2401B WEB DESIGN

10PIT3402A FLASH

10PIT3402B DREAM WEAVER

MATHEMATICS

10PMA2401 OPERATIONS RESEARCH

10PMA3402 NUMERICAL METHODS

PHYSICS

10PPH2401 MODERN PHOTOGRAPHY

10PPH3402 MEDICAL PHYSICS

PLANT BIOLOGY & PLANT BIOTECHNOLOGY

10PPB2401 NANOBIOTECHNOLOGY

10PPB3402 REMOTE SENSIND AND GIS

TAMIL

10PTA2401 muRg gzpj NjuTj jkpo - 1

10PTA3402 muRg gzpj NjuTj jkpo - 2