



THIRUVALLUVAR UNIVERSITY
MASTER OF SCIENCE
DEGREE COURSE

M. Sc. BIOTECHNOLOGY

Under CBCS
Regulations & syllabus
(For University Department)

(With effect from 2014-2015)

THIRUVALLUVAR UNIVERSITY

SERKADU, VELLORE- 632 115

MASTER OF SCIENCE IN BIOTECHNOLOGY

UNDER CBCS (effective from 2014-15 onwards)

The course of study and scheme of examination

1. Name of the course: **M.Sc., Biotechnology**
2. Medium of instructions: **English**

3. Choice based credit system (CBCS)

Choice - based credit system is a flexible system of learning. 'Credit' defines the quantum of contents / syllabi prescribed for a course and determine the number of hours of instruction required.

Choice based credit system (CBCS) has unique features such as enhanced learning opportunities, ability to match students scholastic need and aspirations, inter institution transferability of students, part completion of an academic program in the institution of enrollment and part completion in specialized and recognized institution, improvement in educational quality and excellence, flexibility for working students to complete programme over an extended time and standardization and comparability of educational programmes across the country.

4. Eligibility criteria

A candidate with bachelor degree in any life science in the discipline of Biology/ Biochemistry/Botany/ Biotechnology /Bio-Informatics/Chemistry with Biology ancillary/ environment biotechnology/genetics/ microbiology/ zoology/ agriculture/ B.E./ genetic engineering /B.Tech.(Bio-tech)/B.V.Sc./M.B.B.S/B.D.S or examination of some other university accepted by the syndicate or equivalent thereto shall be permitted for admission into the course.

5.Course details

Duration of course	: 04 semesters (2 semesters /year)
Total of papers	: 15
Total number of lab. Courses	: 16
Project	: 4th semester only
Total marks for M.Sc. Degree	
Theory papers	: 1500 marks
Lab courses	: 600 marks
Project	: 200 marks
Total	: 2300 marks / 90 credits

6. Preamble of the syllabus

Master of Science (M.Sc.) in biotechnology course curriculum was designed to Thiruvalluvar University. The curriculum is prepared by following the prospectus of various national and international universities. The syllabi are all set to meet the standard of UGC-CSIR (NET) and (SLET) examinations. The credit system to be implemented through this curriculum would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his / her liking and abilities. The students pursuing this course would have to develop in-depth understanding of various aspects of Biotechnology. The conceptual understanding, development of experimental skills, designing and implementation of novel synthetic methods, developing the aptitude for academic and professional skills, acquiring basic concepts for structural elucidation with hyphenated techniques, understanding the fundamental biological process and rationale towards computer. The project introduced in the curriculum will motivate the students to pursue the research and find a job in reputed pharmaceutical and other industries abroad.

7. Instruction to the Students

The students admitted to M.Sc Biotechnology course that they are supposed to adhere to the following rules:

1. A minimum of 75% attendance for lecture / practical is the pre-requisite for grant of term.
2. There shall be tutorial / practical / surprise test / home assignment / referencing of research papers/ seminar/ industrial visits/ training course as a part of internal assessment in each semester. The students are supposed to attend all the tests. The students should note that retest will not be given to the student absent for the tests

3. FEE STRUCTURE

As per Thiruvalluvar university norms

8. PATTERN OF EXAMINATION

Evaluation of students

1. The odd-semester and even –semester examinations will be of 100 marks each.
2. Students has to obtain 50% marks in all the examinations (both theory and Laboratory Course).

9. SCHEME OF EXAMINATION

The semester examination will be conducted at the end of each semester (both theory and lab course examination), for odd semesters in the month of November / December; for even semester in April/May. All theory examinations are conducted for three hours irrespective of total marks. However, duration of laboratory course examinations is for 4 hours only.

Theory paper will be of 75 marks each for university examination and 25 marks for internal evaluation.

Question paper settings

Question papers will be set in the view of the entire syllabus and preferably covering each unit of syllabus.

Pattern of question paper (theory):

(Part A & B –two questions from each unit & part C- one from each unit)

10questions x 02Marks –No Choice (Answer in about 50words)	Part A	(10x2=20Marks)
5questions (either or type) x 05 marks (Answer in about 200words)	Part B	(5x5=10Marks)
3out of 05 questions x 10marks (Answer in about 500 words)	Part C	(3 x 10 = 30Marks)
Total = 75 marks		

Internal assessment

Test	: 10 marks (best 2 out of 3)
Assignment	: 5 marks
Seminar	: 10 marks
Total	: 25 marks

Lab. Course examination (practical) will be of 60 marks each for university examinations and 40 marks for internal evaluation.

Distribution of marks for lab. Course (practical) examination

University examinations experiment: 60 Marks

Procedure	: 05 marks
Experiment	: 20 marks
Interpretation	: 10 marks
Result	: 10 marks
Lab. Course viva –voce	: 10 marks
Record	: 05 marks
Total	: 60 marks

Lab. Course internal assessment: 40 Marks

Number of experiments	: 10 marks
Performance	: 10 marks
Test	: 20 marks
Total	: 40 marks

Passing minimum in lab. Course (practical) examinations : 50% marks

Project dissertation	: 200 marks
Dissertation	: 150 marks
Viva-voce	: 50 marks
Total	: 200 marks

Distribution of marks for dissertation / project

Project will be evaluated by the concerned by the project guide along with departmental project committee. Assessment will be done by the committee every month. Evaluation will be on the basis of monthly progress of project work, progress report, referencing, oral results and documentations.

Project	:150 marks
Dissertation format	: 50marks
Scope of the research problem	: 20marks
Methodology	: 20 marks
Analysis	: 30 marks
Results and findings	: 30 marks
Total	: 150 marks

Viva-voce examinations	: 50 marks
Presentation	: 20 marks
Subject knowledge	: 20 marks
Interaction	: 10 marks
Total	: 50marks

Question paper settings

Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus.

Standard of passing

A candidate should not get less than 50 % in the university examinations, compulsorily, in all papers, including lab, course. Also, the candidate who secures not less than 50% marks in the university examinations (UE) and internal assessment (IA) examinations put together in any theory paper/ practical shall be declared to have successfully passed the examinations.

Internal marks will not change. Students cannot repeat internal assessment. If a student misses internal assessment examinations, he / she will have score passing minimum in the external examinations only.

Illustration

Theory – internal assessment	: 12 marks
University examinations	: 38 marks

OR

Internal Assessment	: 0 marks
University examinations	: 50 marks

There shall be revaluation of answer script of end semester examinations, but not of internal assessment papers.

Internal assessment answer scripts may be shown to the concerned student but not end semester answer script.

THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE- 632 115

Name of the course: **M.Sc., Biotechnology**

Choice based credit system (CBCS)

Choice - based credit system is a flexible system of learning.

‘Credit’ defines the quantum of contents / syllabi prescribed for a course and determine the number of hours of instruction required.

Choice based credit system (CBCS) has unique features such as enhanced learning opportunities, ability to match students scholastic need and aspirations, inter institution transferability of students, part completion of an academic program in the institution of enrollment and part completion in specialized and recognized institution, improvement in educational quality and excellence, flexibility for working students to complete programme over an extended time and standardization and comparability of educational programmes across the country

Eligibility criteria

A candidate with bachelor degree in any life science in the discipline of Biology/ Biochemistry/Botany/ Biotechnology /Bio-Informatics/Chemistry with Biology ancillary/ environment biotechnology/genetics/ microbiology/ zoology/ agriculture/ B.E./ genetic engineering /B.Tech.(Bio-tech)/B.V.Sc./M.B.B.S/B.D.S or examination of some other university accepted by the syndicate or equivalent thereto shall be permitted for admission into the course.

Duration of the Course:

The duration of the course shall consist of 4 semesters in two academic years.

Examination Pattern:

Time allotted: theory – 03Hrs. & practical – 04 hrs

Marks allotted for university examination:

	External marks	Internals marks	Total marks
Theory	75	25	100
practical	60	40	100

Marks distribution for internals:

	Test	seminars	Assignment	Total marks
Theory	10	10	05	25

	Test	Record	Total marks
Practical	30	10	40

Pattern of question paper (theory):*(Part A & B –two questions from each unit & part C- one from each unit)***Part A**10questions x 02Marks –No Choice
(Answer in about 50words)

(10x2=20Marks)

Part B5questions (either or type) x 05 marks
(Answer in about 200words)

(5x5=10Marks)

Part C3out of 05 questions x 10marks
(Answer in about 500 words)

(3 x 10 = 30Marks)

Total = 75 marks**M.sc., Biotechnology (CBCS)****The course of study and the scheme of Examination**

S. No	Study components	Ins hrs/ week	Cre dit	Title of the paper	Paper code	Maximum marks		
SEMESTER I								
1	Paper 1	5	4	Biochemistry	PDBT 11	25	75	100
2	Paper 2	5	4	Cell & Molecular Biology	PDBT 12	25	75	100
3	Paper 3	4	4	Microbiology	PDBT 13	25	75	100
4	Practical I	6	3	Lab in Cell & Molecular Biology + Biochemistry	PDBT 15	40	60	100
5	Practical II	6	3	Lab in Microbiology	PDBT 16	40	60	100
6	Elective I	4	3	Medical Laboratory Technology	PDBT 14A	25	75	100
				Virology	PDBT 14B			
				Genetics	PDBT 14C			
				Food and Nutrition	PDBT 14D			
		30	21			180	420	600
SEMESTER II								
7	Paper 4	2	2	Human Rights	PDHR 20	25	75	100
8	Paper 5	5	4	Immunotechnology	PDBT 21	25	75	100
9	Paper 6	5	4	Genetic Engineering	PDBT 22	25	75	100
10	Paper 7	5	4	Genome Technology	PDBT 23	25	75	100
11	Paper 8	4	3	Bioinformatics	PDBT 24	25	75	100
12	Practical III	4	3	Lab in Immunotechnology	PDBT 26	40	60	100
13	Practical IV	4	3	Lab in Genetic Engineering &	PDBT 27	40	60	100

				Bioinformatics				
14	Elective II	3	3	Enzyme technology	PDBT 25A	25	75	100
				Dairy technology	PDBT 25B			
				Pharmaceutical Technology	PDBT 25C			
				Cell signaling	PDBT 25D			
		32	26			230	570	800
SEMESTER III								
15	Paper 9	5	4	Plant Biotechnology	PDBT 31	25	75	100
16	Paper 10	5	4	Animal biotechnology	PDBT 32	25	75	100
17	Paper 11	5	4	Microbial biotechnology	PDBT 33	25	75	100
18	Paper 12	4	4	Environmental Biotechnology	PDBT 34	25	75	100
19	Practical V	4	3	Lab in Plant Biotechnology & Animal Biotechnology	PDBT 36	40	60	100
20	Practical IV	4	3	Lab in Microbial Biotechnology & Environmental Biotechnology	PDBT 37	40	60	100
21	Elective III	3	3	Genomics & Proteomics	PDBT 35A	25	75	100
				Marine Biotechnology	PDBT 35B			
				Nano Biotechnology	PDBT 35C			
				Stem Cell biology	PDBT 35D			
		30	25			205	495	700
SEMESTER IV								
22	Paper 13	6	5	Research methodology	PDBT 41	25	75	100
23	Project 1	24	13	Project/ dissertation with viva-voce	PDBT 42	50	150	200
		30	18			75	225	300
	Grand total	122	90			690	1710	2400

Structure of the course:

Subject	Papers	Credit awarded	Total credits	Marks	Total marks
Core	19	3-5	66	100	1900
Elective	3	3	9	100	300
project	1	13	13	200	200
			90		2400

SEMESTER I

PAPER 1: BIOCHEMISTRY (PDBT 11)

Objectives: To enable the students to understand the basic concepts in biochemistry and biomolecules and also to learn the various metabolic cycles and also to analyze the significance of biochemical findings

UNIT I

Basic Concepts: Units of measurements of solutes in solution ,e.g. Normality, Molality ,molarity ,hyper and hypotonic solution pH, pK, acids ,bases ,ionic bonds, covalent bonds and secondary bonds (hydrogen bonds and Vander Waal's bonds).classes of organic compounds and functional groups – atomic and molecular dimensions.

UNIT II

Biomolecules : Definitions ,nomenclature, classification, structure, chemistry and properties of carbohydrates, amino acids ,proteins (hemoglobin, myoglobin and plasma proteins), lipids and Nucleic acids.

UNIT III

Metabolism: Metabolism of Carbohydrates –EMP, TCA, HMP. Protein, Amino Acids, Lipids and Nucleic Acids-Their Biosynthesis And Degradation; Mechanism Of Oxidative Phosphorylation and Its Inhibitors, Photophosphorylation and Urea Cycle.

UNIT IV

Enzymology: Enzymes: general aspects(classifications and structure),allosteric mechanism, regulatory and active sites ,activation energy ,iso-enzymes, enzyme kinetics(MM, LB plot, Km) and hormones.

UNIT V

Clinical biochemistry: Blood sugar level-factors controlling blood sugar level – hypo, hyper glycemia , diabetes mellitus ,types – GTT, Metabolism of bilirubin- jaundice-types differential diagnosis and liver function tests. Renal functional test and gastric function test

Reference

1. Biochemistry ,7th Edition, jermy M.Berg John,L .Tymoczko, Lubert stryer 2012.W.H,freeman & company ,new York
2. Molecular Bio methods handbook,2nd edition R.Rapley &J.M Walker,2008,Humana press.
3. Principles of Biochmeistry ,5th Edition AL. Lehninger ,D.L. Nelson and M.M Cox ., 2008.worth publishers ,New York.
4. Biochemistry 4TH Edition,G.Zubay,1998.Mc Millan publishing Co.New York.
5. Harper's Biochemistry,29th Edition-Rober K.Murray,Daryl K.Grammer,2012 McGraw Hill, lange Medical Books

6. Understanding enzymes -5th edition Trevor palmer, Prentice Hall/Ellias Horwood 1995
7. Text Book Medical Biochemistry M.N.Chatterjee 8th edition Jaypee brothers Medical publishers 2013
8. Biochemistry – 4th edition Donald voet and Judith G.Voet ,VP Publishers 2011 steitz and A.M.Weiner ,The Benjamin /CUMMINGS publ.Co.,Inc .,California,2013
9. Genes VI(9th Ed).Benjamin Lewin, oxford university press,uk.,2007
10. Molecular biology of cell (5th edition) bruce alberts,alexander johnson,Julian lewis,martin raff,keith Roberts,peter walter ,garland science publications.2008
11. Molecular Biology (5th edition).weaver .R.F,McGraw Hill publications,2011.
Cell and molecular biology : concepts and experiments (5th edition).gerald karp,wiley publications,2013

PAPER 2: CELL AND MOLECULAR BIOLOGY

Objectives : Understanding the structural and functional aspects of the cell provides the students with a strong foundations in molecular mechanism underlying cellular functions.

UNIT I

Cell biology: Structure and functions of cells in prokaryotes and eukaryotes ; structure and organization of membrane – model membranes, active and passive ,transport channels and pumps ,structure & biogenesis of mitochondria and chloroplast. Structure of endoplasmic reticulum, golgi complex , lysosomes; protein synthesis and post translation modifications ; of proteins vesicular transport and import into cell organelles .

UNIT II

Cell division : Mitosis, meiosis, regulation of cell cycle- factors regulating cell cycle. cell signaling – types of cell signaling –G protein mediated , Tyrosine kinase mediated signaling.

DNA replication: DNA polymerases, replication enzymes, mechanism of DNA replication in prokaryotes and eukaryotes, replication models ,DNA damage, DNA repair and recombination.

UNIT III

Transcription : Basic mechanism in prokaryotes and eukaryotes.RNA polymerase, reverse transcriptase and regulation.post-transcriptional processing: processing of hn RNA, tRNA,rRNA;5'-cap formation;3'-end processing and polyadenylation -splicing - RNA editing ; nuclear export of mRNA, mRNA stability; Catalytic RNA.

Translation-Prokaryotic and eukaryotic translation, the translation machinery, mechanism of initiation ,elongation and termination, regulation of translation, co and post translation modifications of proteins and localization.

UNIT IV

Gene regulation : prokaryotic gene regulation- operon concept ; lac operon ara operon ; Eukaryotic gene regulation: transcriptional and translational regulations.

Biochemistry of ribozyme, hammerhead ,hairpin and other ribozymes, strategies for designing ribozymes, applications of antisense RNA and ribozyme technologies.

UNIT V

Mutations : Oncogenes and tumor suppressor genes : Nonsense, missense and point mutations ; intragenic and intergenic suppression ;frame shift mutations; physical, chemical and biological mutagens; transposition – transposable genetic elements ; role of transposons in mutation; viral and cellular oncogenes; tumor suppressor genes from humans ; structure, functions and mechanism of actions of pRB and p53 tumor suppressor proteins and genes; oncogenes as transcriptional activators.

Reference:

- 1.Molecular Cell Biology.darnell , lodish ,Baltimore. scientific American books , inc ., 2013
- 2.Molecular and cellular biology ,Stephen l.wolfe , wadsworth publishing company ,2006
- 3.Molecular cloning :a laboratory manual , (4th ed) .J.Sambrook,EF.Fritsch and T.Maniatis, Cold spring harbor laboratory press, new York, 2012
- 4.Introduction to practical molecular biology .P.D Dabre, john Wiley & Sons ltd., new York, 2010.
- 5.Molecular biology labfax .t.a. brown (ed) bios scientific publishers ltd., oxford , 2010
- 6.Molecular biology of the gene(7th ed).jd Watson, N.H.Hopkins,J.W.Roberts,J.A a laboratory press, new York, 2012

PAPER 3: MICROBIOLOGY

Objective: To develop skill of students in microbiology and understanding the current concepts in microbiology. At the end of this course, the students would have learnt about principles of microbiology, including bacteria ,fungi , algae and virus and their role in different environment and its applications. To develop highly qualified professional manpower with the basic requirement lies on the microbiology quality based coaching , R&D and training in industry oriented techniques (quality controller in pharmaceuticals & Food and Dairy products etc).

UNIT I

Introduction to microbiology :History scope, relevance, discovery and origin of microbial world theories .Interaction of light with objects; Microscopy-compound, phase contrast fluorescence-principle applications. Staining-simple, differential and specialized techniques.

UNIT II

Nutrition: Basic nutritional requirements, nutritional classification, types of biological complex media. Reproduction and growth: concept of growth and reproduction, binary fission, growth curve and generation time and measurement of growth. Pure culture isolation techniques- storage methods.

UNIT III

Microbial control: Definition of sterilization, disinfection, antiseptics, germicides. Methods of sterilization physical and chemical methods, dynamics of sterilization. Microbial control: methods and dynamics of sterilization, mechanisms of control, bio control and preservation .concept of chemotherapy, chemotherapeutic agents, Mechanisms of actions. Drug resistance. MDR, assessment and management of drug resistance.

UNIT IV

Microbial Genetics: conjugation-Hfr, F+, F-,sex pilli, transduction-abortive and specialized, transformation, Griffith experiment, Extra chromosomal DNA-plasmid and its types, episomes and genetic recombination.

UNIT V

Microbial diversity & classification: classification of Bacteria according to Bergeys manual, archaea, cuapnacteroa fungi, protozoa Identificaion of bacteria; molecular methods

such as denaturing gradient gel electrophoresis (DGGE), temperature gradient gel electrophoresis(TGGE).

References:

- 1.General Microbiology .Tortora, funke and case.11th edition pearson Higher education,USA,2012.
- 2.Microbiology .L.M. Prescott, J.P.harley and D.A.klein 7/e,McGraw – Hill , Boston,2007.
3. Microbial functional genomics. J.ZHOU, d.k.Thomson, Y.Xu,J.m. Tiedje,J.Wiley,2004
4. Microbial ecology-fundamentals and application.Atlas.R.M and Bartha. M. Benjamin-Cummings, Menlo park, California, 2003.
- 5.Biology of Microorganisms. Madigan .M.T,martinko .J.M,Parker,J,Brock,10th edition, prentice hall publishers,2003.
- 6.Fundamentals of Microbiology ,Alcamo I. E, 6th Ed, Benjamin –Cummings publishing Company ,Inc 2001.
- 7.Microbiology ecology- fundamentals and applications .R. M. Atlas and R.Bartha,2000
- 8.Fundamentals principles of bacteriology .A.J. sale Tata McGraw – Hill Publishing company limited, New delhi,1999
- 9.Medical microbiology D.Greenwood , R.Slack and J.Peutherer.ELST with Churchill Livingstone, Hong kong,1997.
10. Molecular biology and biotechnology .Robert A. Meyers, Wiley India pvt Ltd,1995.
- 11.Microbiology .M.J.Pelzer Jr,E.C.S chan and N.R. Kreig.McGraw Hill,Inc, New York,1993
- 12.The Microbial world Stainer.R. Y,Ingraham. J.L, Wheelis.M.L and Painter.P.R. new Jercy, Prentice- hall,1986

**Practical 1 : LAB IN BIOCHEMISTRY AND CELL & MOLECULAR BIOLOGY
(PDBT 15)**

Lab in biochemistry

1. Determination of Chl.a, Chl.b & total Chl. By Arnon method.
2. Estimation of blood glucose & urea
3. Estimation of LDH,SGPT & SGOT
4. Estimation of total serum proteins
5. Estimation of urine creatinine & creatinine clearance test.
6. Paper & thin layer chromatography

Lab in cell and molecular biology

7. Isolation of genomic DNA from *e.Coli*
8. Isolation of plasmid DNA from *e.Coli*
9. Elution & quantification of DNA from agarose gel.
10. Preparation of *E.coli* competent cell and transformation of plasmid harboring desired Cdna
11. Confirmation of transformants using PCR
12. Isolation of total RNA from bacteria.
13. Synthesis of Cdna by reverse transcription polymerase chain reaction.

Reference

1. Introduction to Practical Biochemistry, E.F Plummer Mu, Plummer Tata McGraw-Hill Education,1998.
2. Molecular cloning: a laboratory manual,4th ed. J.Sambrook, Fritsch and T.Maniatis. cold spring harbor laboratory press ,New York,2012
3. Essential cell biology : a practical approach volume 1: cell structure. John Davey, J.Michaellord. Oxford university press, USA, 2003
4. Principles and techniques of biochemistry and molecular biology (7th ed).keith Wilson (editor),john walker (editor),Cambridge university press,2010.

Practical II Microbiology (PDBT 16)

1. Sterilization techniques
2. Microbial isolation techniques.-bacteria, algae and fungi
3. Establishment of pure cultures – streak, pour and spread plating techniques
4. Identification of microbes by biochemical test
5. Simple, differential, negative, spore staining methods.
6. Establishment of bacterial growth curve
7. To perform antibiotic sensitivity test by the method of Kirby and bauer.
8. To isolate a specific type of micro-organism by use of selective/enrichment method form a given environmental sample (soil, water ,and air).
9. Selection of auxotropic mutants
10. Demonstration of utilization of sugars by oxidation and fermentation techniques

References:

1. Microbiology- A Laboratory manual P. Gunasekaran . New age publications, New delhi, 1995.
2. Molecular cloning-A Laboratory manual. Sambrook, J , Fritsch. E.F, and T.Maniatis, 2nd Edition. Cold spring Harbor Laboratory press, New York, 1989.
3. Laboratory exercise of Microbiology, J.P. Harley and L.M. Prescott, 5th Edition, the McGraw-Hill companies, 2002.
4. Microbiology: A Laboratory Manual, J.G. Cappuccino and N. Sherman, Addison-Wesley, 2002.
5. Laboratory Manual of Experimental Microbiology ,R.M.Atlas, A.E.Brown and L.C.Parks, 1995. Mosby, St.Louis,2002.
6. Laboratory manual in General Microbiology, N.Kannan, Panima publishers.
7. Bergey's Manual of Determinative Bacteriology. Ninth Edition J.G.Holt, N.R.Krieg.,Lippincott Williams, Wilkin publishers, 2000.

ELECTIVE1: MEDICAL LABORATORY TECHNOLOGY (PDBT 14 A)

Objectives: to enable the students to learn about the General laboratory and instrumentation. Know the significance of biological samples examination & to understand the various types of infection and clinical symptoms caused by microorganisms.

UNIT I

General Laboratory and instrumentation: Code of conduct for laboratory personnel-safety measures in the laboratory-chemical/Reagents, labeling, storage and usage .First aid in laboratory accidents-Precautions and first aid equipments. Sterilization , preparation of reagents .General approach to quality control, quality control of quantitative data.

UNIT II

Clinical pathology: Urine analysis: Collection, composition, preservation, gross examination, chemical examination. Significance of sugar in urine, ketone bodies, bile pigment, hematuria, uric acid, microscopic examination of the urinary sediment: stool Examination-specimen collection, pH, Interfering substance. Test for occult blood, fecal fat, microscopic examination of stool specimen.

UNIT III

Clinical Hematology: Collection of blood-Anticoagulant, preservation ,Estimation of Hb, PCV,WBC (TC & DC),RBC, platelets, ESR. Clotting time, bleeding time-normal value, clinical interpretation .Serology-VDRL,CRP,RA, HIV,HBs Ag.

UNIT IV

Histology: Basic concepts of different mammalian tissues and their histological structure. Different human organs and their gross and histological structure and functions. Receiving of biopsy specimens at laboratory (Clinical notes/fixatives). Fixation of tissue –different fixatives and their mode of action .Methods of decalcification. Use of microtomes, selection and maintenance of knives, technique of section cutting & mounting on slides. Staining of tissue sections, preparation of different stains, staining methods for Haematoxylin & Eosin.

UNIT V

Blood banking: blood group(ABO & Rh)-methods of grouping & reverse grouping .Basic blood banking procedures- collection of blood, anticoagulants used, cross matching ,different screening ;tests including Coomb's Test for incomplete antibodies preparation

of different blood components for use and how to serve a requisition. preparation of red cell suspension. Blood transfusion & hazards. Detect the time when to discard blood in blood bank, computerized record.

References:

1. Medical Laboratory Technology-6th edition L.Mukherjee.vol.I,II,III.2010Tata Mcgraw-Hill publishing company limited.
2. Hand book medical laboratory technology 2nd edition-V.H.Talib CBS publishers & 2008.
3. Clinical laboratory practices in CMC procedure, CMC, Vellore.
4. Text book of Medical lab technology, 1st Edition-Ranmnik sood.jaypee 2006.
5. Laboratory manual in biochemistry-Jayaraman New Age International Pvt Ltd publishers 2011.

ELECTIVE 1: VIROLOGY (PDBT-14B)

Objectives: To understand the biology of viruses, pathogenesis, clinical features, epidemiology and prophylaxis of dreadful viral infections in susceptible hosts.

UNIT I

General Virology: Structure of viruses: Enveloped and non-enveloped viruses, Capsid symmetries-icosahedral , polyhedral and helical, structural proteins-matrix proteins and lipoproteins, viral genomic organization and replication-types of nucleic acids, protein nucleic acid interactions and genome packaging, Virus related structures-viroids and prions. Cultivation of viruses: Inovo, In vivo ,Ex vivo/In vitro. Cytopathic effect-pock forming unit.

UNIT II

Viral diagnostic and detection methods: Sample processing-enrichment and concentration, Direct methods of detection-light microscopy (inclusion bodies),electron microscopy ,Immuno diagnosis ,hemagglutination, Complement fixation, neutralization, Western blot, Radioactive Immuno precipitation Assay (RIPA), Flow Cytometry and Immuno histochemistry. Nucleic acid based diagnosis: Nucleic acid hybridization, PCR, microarray and nucleotide sequencing, LINE probe assay.

UNIT III

Bacterio phages and plant viruses: Bacterio phage: Morphology, genome organization, classification-Lifecycle-Lytic and Lysogenic Cycle, Head and tail phages-T4 phage-phage-Filamentous Bacteriophages-174-M13,phage therapy for control of bacterial poultry diseases. Viral Disease in Plants: Histological, physiological and cytological changes in infected plants, Behavior of viruses in plants, Methods for detection of plant viruses, Transmission of plant viruses through vectors-insects, nematodes and fungi.

UNIT IV

Clinical virology: Pathogenesis, clinical symptoms, epidemiology and prophylaxis of DNA Viruses-pox virus ,Herpes Virus ,Adenovirus, Hepatitis Virus. RNA Viruses- Picorna Virus, Orthomyxo Virus, Rabies Virus, HIV. Oncogenic viruses; Virus induced cell transformation and oncogenesis, Mechanism of cell transformation by tumor viruses, Retrovirus mediated oncogenesis.

UNIT V

Viral vaccines and anti-viral drugs: Viral vaccine, conventional vaccines-killed and attenuated, Modern vaccines-DNA vaccines, recombinant DNA/protein vaccines, subunits vaccines, peptide vaccines, anti-idio type vaccines, edible vaccines, immunomodulators (cytokines), adjuvants to increase immunogenicity of vaccines. Antivirals: Interferons, designing and screening for antivirals, mechanisms of action, antiretrovirals-mechanism of action and drug resistance.

References:

1. Flint S.J., V.R. Racaniello, L.W. Enquist, V.R. Rancaniello, A.M. Skalka, (2003), principle of virology: Molecular Biology, pathogenesis, and control of animal Viruses, American society Microbiology, Chapters 3-13
2. Topley & Wilson's. (1990) Principles of Bacteriology, Virology and Immunity VIII Edition Vol. Iv Virology, Edward Arnold, London.
3. Haaheim L.R., J.R. Pattison and R.J. Whitley, (2002), A practical Guide to Clinical virology, 2nd Ed. Edited by, John Wiley & Sons, Ltd.
4. International Congress on Taxonomy of Viruses ; <http://WWW.ncbi.nlm.nih.gov/ICTV>
5. Knipe David M., Peter M. Howley, Diane E. Griffin, Robert A. Lamb, Malcolm A. Martin, Bernard Roizman, Stephen E. Straus, (2007), Field's Virology, 5th Ed. Lippincott Williams & Wilkins
6. Cann Alan J, (2000), DNA virus Replication, Oxford University press
7. Plotkin Stanley A., Walter A. Orenstein, (2003), Vaccines Elsevier Health Sciences
8. Tying. Stephen K. (2004), Antiviral Agents, vaccines, and Immunotherapies, Marcel Dekker
9. Timbury MC. (1994) Medical Virology X Edition. Churchill Livingstone.

ELECTIVE 1:GENETICS (PDBT 14 C)

Objective: To provide lucid knowledge in principles of Genetics, overall view about genetic makeup of organisms, and to pave path for students to take up genetic engineering research.

UNIT I

Principles of Mendelian inheritance-mono hybrid, di hybrid, tri hybrid and multi hybrid crosses. Gene interactions-incomplete dominance, co-dominance, epistasis, complementary genes, pleo trophy, genome imprinting, inheritance of lethal genes. Environment and gene expressions :penetrance and expressivity. Multiple alleles sex determination; extra chromosomal inheritance, Linkage and crossing over, gene mapping.

UNIT II

Genetic code, gene expression & central dogma, Mutations-chromosomal aberrations, gene mutation-types.

UNIT III

Human chromosomes: structure and normal human karyo type. chromosomal aberration; Numerical-aneuploidy. Polyploidy(Eg. Turner,Downs & Klinenefelters syndromes).structural –Translocation Duplication, inversion deletion (Eg. Cri-du-chat syndrome).Mendelian traits: curly hair straight hair, blue and brown colour of the eyes, rolling of the tongue, free ear lobes and hyper trichosis.

UNIT IV

Genes in population: The Hardy-Weinberg law-gene frequency and phenotype frequency. Factors of evolution. Mutants in population .natural selection genetic death. Equilibrium between mutation and opposing selection.

UNIT V

Physiological Genetics: Genetic control of pigments in flowering plants. Genetic control of antigens .genetic control of protein structure and of metabolic patterns.

References

1. genes-by Benjamin Lewin. Wiley Eastern Limited
2. Molecular cell Biology-Darnell, Lodish, Baltimore. Scientific American Books Inc.
3. Human genetics, A. Gardener, R.T.Howell and T.Davies. published by vinod vasista for Viva Books private Ltd.
4. Hartl,D.L. S primer of population genetics, III Edition . Sinauer associates Inc.Sunder land 2000.

ELECTIVE 1: FOOD & NUTRITION (PDBT 14D)

Objectives: To enable students to gain a deeper understanding about principles of nutrition and also to develop competence to carry out investigation in nutrition

UNIT I

Nutrition and Dietary System: Definition of food nutrition, basic food groups, physiological role and nutritional significance of carbohydrates, protein, lipids, vitamins and minerals .protein malnutrition (Kwashiorkar) and under nutrition (marasmus) and their preventive, curatives measures.

UNIT II

Nutrients: Macro minerals: Calcium ,phosphorus Magnesium, sodium, potassium chloride. Micro minerals :Iron, zinc, copper, selenium, chromium, iodine, manganese, molybdenum and fluoride. Ultra trace minerals :Arsenic, Boron, Nickel, silicon, vanadium & cobalt: Digestion & absorption, Functions, Toxicity, interaction with other nutrients. Fat soluble vitamins: Vitamin A, Vitamin D,E &k. Water soluble vitamins: Vitamin c, Thiamine, Riboflavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12,Vitamin B6.

UNIT III

Nutritive and calorific Value of food: Unit of energy measurements of food stuffs by Bomb calorimeter, calorific value and RQ of food stuffs. Basic metabolic rate (BMR), its measurements and influencing factors, SDA of food. Nutritive value of protein, essential amino acid. composition of balanced diet for infants, pregnancy and lactating women, old age.

UNIT IV

Food adulteration & food poisoning: sources of floods, types ,advantages and disadvantages, constituents of foods, carbohydrate ,protein, fats, oils, colors, flavours, natural toxicants. Sources ,causes and remedies for acidity, gastritis, indigestion and constipation

UNIT V

Food preservation and processing: food spoilage, causes of food spoilage ,,types of food spoilage, food preservations, food processing – different types, sterilizations & pasteurization

Reference:

1.Seema yadav: - Food Chemistry, anmol publishing (P) Ltd, New Delhi

2. Car H. Synder: -the extraordinary chemistry for ordinary things, John Wiley & sons inc, New York, 1992.

3. B. Sivasankar – food processing and preservation – PHI Learning (P) LTD , New Delhi – 11001.

SEMESTER II

PAPER 4: IMMUNOTECHNOLOGY (PDBT 21)

Objective: to provide the students insights into the various aspects of immunology such as classical immunology, clinical immunology, immunotherapy and diagnostic immunology.

UNIT I

Introduction and scope of immunology, humoral and cellular- mediated immune responses. components of immunity, innate and adaptive immunity, cells and tissues of immune system: cells involved in the immune response: macrophages, B and T lymphocytes, Dendritic cells ,natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and mast cells. the lymphoid organs : bone marrow, spleen, lymph nodes, MALT. Haemopoiesis and differentiation, lymphocyte trafficking.

UNIT II

Antigens and immunogenicity. Nature of antigens, adjuvants, haptens and antibodies. Theories of antibody formation. antibody structure ,structural basis of antibody diversity; immunoglobulin as antigen, properties of immunoglobulin and subtypes.

UNIT III

Antigen-antibody reactions, strength of antigen and antibody reaction, cross reactivity, precipitation and agglutination reactions, radioimmunoassay and ELISA. B-cell generation, activation and differentiation.

UNIT IV

Cytokines: structure of cytokines; function of cytokines. complement and its role in immune response. complement fixation structure and function of MHC class I and II molecules – antigen recognition and presentation, HLA typing , immune tolerance and suppression, hypersensitivity reactions, types of hypersensitivity, autoimmunity.

UNIT V.

Hybridoma secreting monoclonal antibodies – recombinant antibody molecules, catalytic antibodies. vaccine technology including DNA vaccines, identification of B and T epitopes for vaccine. Development immunotechnology and infectious diseases: immune eletrophoresis, western blot, flow Cytometry and immune flurescence microscopy including *in situ* localization techniques such as FISH and GISH.

Reference

1. Immunology (7th ed) J.Kuby ,W.H freeman and company , new York.2013
2. Basic immunology updates ed: functions and disorders of immune system (3rd ed). abul k.abbas, Andrew H.HLictman ,saunders publishers , new York,2010
3. Immunology: an introduction (4th) I.R Tizard, saunders college publishers, new York.
4. Essential immunology (11th ed).peter delves,seamus martin,dennjis burton, Ivan Roitt, Wiley – Blackwell publication, Singapore, 2006
5. Immunology (Lippincotts illustrated reviews series) thao doan, roger melvold, susan viselli, Carl Waltenbaugh, Lippincott Williams & Wilkins publications 2012
6. Fundamental immunology (7th ed) William e Paul, Lippincott Williams & Wilkins publications,2012
7. Essentials of clinical immunology (6th ed) Helen chapel ,Mansel haeney, Siraj misbah, Neil snowden, Wiley-Blackwell publications ,2014
8. Monoclonal antibodies principles and practice(3rd ed) W.Goodings, academic press,2010
9. Monoclonal antibodies :P methods and protocols (2nd ed) .Vincent ossipo, Nicolas fisher, Humana press, 2014
10. Essentials of clinical immunology (6th ed).Helen chapel, Mansel haeney, ,Siraj misbah, Neil Snowden, Wiley- Blackwell publications,2014

PAPER 5: GENETIC ENGINEERING (PDBT 22)

Objectives:

To impart sound knowledge about core strategies of implementation and transmission of genetic material at molecular and cellular levels and also about the techniques to alter the genes to construct genetically modified organisms with biotechnologically desirable characters.

UNIT I

Tools of genetic engineering : nucleic acid manipulating enzymes – exonuclease-endonuclease, restriction enzymes – nomenclature – classification – restriction modifications – isoschizomers – star activity – restriction mapping, ATP and NAD dependent DNA ligase, Reverse transcriptase, DNA polymerases, T4 polynucleotide kinase, terminal transferases, alkaline phosphatase, Taq polymerase.

UNIT II

Cloning vectors : plasmids – general properties – types of plasmids – PBR₃₂₂, PBR₃₂₅, PBR₃₂₇, PUC₈, - a lac selection plasmid. Bacterio phage vectors – lambda phage – genomic organization- *IN vitro* packing – insertion vectors – replacements vectors –cosmids, M13 Bacterio phage, genome –a inter genic region-M₁₃MP₁, -M₁₃MP₂, -M₁₃MP₇ – phage mids – pEMBL8, ARTIFICIAL chromosomes- YAC –Bac-Hac, Shuttle vectors. Expression vectors-Gene fusion vectors, Vectors for plant cells-Ti plasmid. Vectors for animal cells-BPV, SV-40,Retrovirus).

UNIT III

Core techniques in gene manipulation: Chimeric DNA cloning strategies-ligation, rDNA, Transformation & selection. Adaptors-Linkers- Homo polymer tailing, DNA libraries- Genomic libraries (short gun method) – Partial Digestion-End Modification- Reverse Transcription, c DNA libraries, clone preservation and Amplification. Transformation techniques-Preparation of Competent cells-Physical Methods-Electroporation-Microinjection-gene Gun, chemical methods-cac₂,PEG,DEAE-Dextran.

UNIT IV

Screening and selection of recombinants: Insertional inactivation-antibiotic resistant genes- Lac Z' gene-Blue white screening- α complementation-colony hybridization-Immunological screening-plaque Hybridization, Nucleic acid and protein Hybridization (Blotting techniques), DNA sequencing- chemical and enzymatic, PCR and its variants, site Directed mutagenesis, Preparation of radio labelled and non-labelled probes & applications.

UNIT V

Applications of rDNA technology in therapeutic products and Healthcare: Production of vaccines-Hepatitis B-Edible vaccine; Hormones-Somato tropin & Humulin, Blood clotting factor VIII, Interferons, Diagnosis of inherited disorders and infectious diseases, Diagnosis and management of cancer, Gene Therapy-ADA-Cystic Fibrosis.

Reference:

1. Gene cloning and DNA analysis: An introduction, 6th Edition, T.A. Brown, Wiley-Blackwell, 2010.
2. DNA cloning I & II by DM Glover & BD. Hames, IRL Press, 1996.
3. Recombinant DNA (2nd Edition), Watson, J.D., Gilman, M., Wikowski, J., and Zoller, M Scientific American Books, W.H. Freeman and Co, New York, N.Y., U.S.A., 1999.
4. Principles of Gene Manipulation. Sixth Edition, Primrose, S.B., Twyman, R.M., and R.W. Old. Blackwell science, 2001.
5. Lodish, H., Baltimore, D., and A. Berk. Molecular Cell Biology. W H Freeman & Co (sd); 3rd Edition, 1995.
6. Sambrook, J., Fritsch, E.F., and T. Maniatis. Molecular cloning. A Laboratory Manual. 2nd Ed. Cold Spring Harbor Laboratory Press, New York, 1989.
7. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and P. Walter. Molecular Biology of the cell, fourth Edition. Garland & Co. 2002.
8. From Genes to clones: Introduction to Gene Technology. Winnacker, E.L. 1987.

PAPER 6: GENOME TECHNOLOGY (PDBT 23)

Objective: To enable us to understand genome organization and its relation to biotechnological applications.

UNIT I

Structural Organization: Definition, historical prospective and strategies. Prokaryotic and Eukaryotic genome size & structure-genome physical mapping Structural and functional annotations of genes and genomes.

UNIT II

Genes and Genomes: Interpreting expression data using Gene ontology; Evolution of modularity and transcriptional networks, Ribo switches metabolite sensing and translational control-Microarrays-types and applications. Comparative genomics of non-coding sequence, An overview of genome projects : human, plant, animal and microbial genomics. Analysis of Human genome map viewer, Human Microbiome project-Earth Microbiome project-holo genome theory.

UNIT III

Taxonomy and phylogeny: Basic concepts in Systematics, taxonomy and phylogeny; molecular evolution; nature of data used in Taxonomy and Phylogeny, Definition and description of phylogenetic trees various types of trees, phylo genetic analysis algorithms such as maximum parsimony, UPGMA, Transformed Distance, Neighbors-Relation, Neighbor-Joining.

UNIT IV

Whole genome library: Whole genome shotgun sequencing: DNA sequencing theory pair wise and end sequencing, the Institute for Genomic Research (TIGR), Celera Genomics. Hierarchical shotgun sequencing, High throughput pyro sequencing, Next-generation sequencing and full genome sequencing platforms and sequencing – tools in genome analysis.

UNIT V

Synthetic biology and bio engineering introduction to synthetic biology – metabolomics and synthetic microbiology, predictive model building (metabolomes)- secondary metabolism and synthetic biology – synthetic bacterium, mycoplasma laboratorium, omics concept – metabolomics, transcriptomics, intactomics, phenomics, localizomes; gene networks – integration of networks.

References:

1. From genes to genomes: concepts and applications of DNA technology . Jeremy W.Dale, Malcom von schantz, Nicholas plant Wiley; 3 ed, 2011
2. Molecular cell biology, Harvey lodish, W. H. freeman; seventh Ed 2012
3. Gene and genome synthesis : technologies and applications .jingdong tian, crc pr L1c;1 edition 2014.
4. Molecular biology of the gene James D. Watson, Tania A. baker, Stephan p. bell, Alexander Gann, Michalle Levine, Richard losick, Benjamin cummings; 7 edition 2013.
5. Molecular cell biology – Darnell lodish Baltimore .scientific American books inc.
6. Human genetics, a. Gardener. R.T.Howell and T.Davies. published by Vinod Vasista for viva books Private ltd.
7. Hartl, D.L.A Primer of populations genetics, III Ed. Sinauer associates Inc. Sunderland 2000

PAPER 7: BIOINFORMATICS (PDBT 24)

Objective: to provide information and understanding of the major computational problems in the field of molecular biology and to gain knowledge on molecular databases, comparative genomics, pattern search, classification of sequence and structure, alignment of sequence, rapid similarity searching, phylogenies, automated pattern learning, representing and searching protein structure, gene expression profiling, clustering expressed genes, discovering transcription factor binding sites, discovering common functions of co-expressed genes, metabolic pathways, signal transduction pathways.

UNIT I

Biological data bases: gen bank: sequence data/ types ; - protein data bases – ESTs STSs – GSSs – HTGS; NCBI- PubMed- Entrez –BLAST – OMIM; Types Of Accession Numbers- Locus Link, Unigene, Entrez, EBI and ExPasy.

UNIT II

Sequence alignment: alignment algorithms – global and local – significance ; BLAST search steps –BLAST algorithm –BLAST search strategies ; advanced BLAST-alignment tools.

UNIT III

Gene expression analysis tools: the mRNA-c DNA-libraries ; microarrays: experimental design – probe – hybridization – image analysis – data analysis- biological confirmation – microarray database.

UNIT IV

Proteomic analysis tools: protein domains and motifs – bio informatic tools for high throughput protein analysis – protein structure – homology and functional genomics.

UNIT V

Pathway bioinformatics : protein – carbohydrate metabolism – biochemical cycles – interconnection of pathways – metabolic regulation – translating biochemical networks into linear algebra –KEGG: theory and practice. computational methods : nucleic acid and protein sequence databases; determining methods for sequence analysis, web based tools for sequence searches, motif analysis and presentation.

Reference :

1. Bioinformatics and functional genomics (2nd ed). Jonathan Pevsner, Wiley Blackwell publications 2009
2. Introduction to bioinformatics (4th ed).Arthur M .lesk ,oxford university press (UK),2013
3. Bioinformatics for biologists. Paval pevzner, ron Shamir, Cambridge university press.2011.
4. practical bioinformatics (1st ed).Michael Agostino ,Garland science publication,2012
5. Exploring informatics (2st ed) .Caroline St.clair, Jonathan E.Visick , Jones & Barlett learning,2013.
6. Bioinformatics : sequence and genome analysis(2nd) David mount, cold spring harbor laboratory press 2013.
7. Bioinformatics and molecular evolution .Paul G.Higgs, Teresa K.Attwood, Wiley – Blackwell publication,
- 8.instant notes in bioinformatics (2nd ed).Charlie Hodgman, Andrew French, David West head, Taylor & francis,2009.
9. next-generations DNA sequencing informatics. Stuart M. Brown, cold spring harbor laboratory press,2013
10. from genes to genomes: concepts and applications of Dddna TECHNOLOGY (3rd Ed).Jeremy W.Dale, Malcom von Schantz, Nicholas plant, Wiley publications, 2011

PRACTICAL III: LAB IN IMMUNOTECHNOLOGY (PDBT 26)

1. Blood Grouping
2. Handling of laboratory animals.
3. Routes of inoculation.
4. Lymphocyte subset identification and enumeration.
5. Radial immune-diffusion test.
6. Immune electrophoresis.
7. Complement fixation test.
8. ELISA
9. Western blotting
10. Antigen – antibody reaction (precipitation and agglutination reaction tests)

Reference:

1. Practical Immunology. Franck C. Hay, Olwyn M.R. Westwood. Wiley-Blackwell publications, 2010.
2. Immunoassays: A Practical Approach. James P. Gosling (editor). Oxford University Press, USA, 2010.
3. Lab manual in biochemistry, immunology and biotechnology. Arti Nigam Archana Ayyagari. McGraw-Hill Education, 2008.
4. Practical Immunology. Rabindra Narain, DDM & Wisdom Publications, 2012

PRACTICAL IV

LAB IN GENETIC ENGINEERING AND BIOINFORMATICS (PDBT 27)

GENETIC ENGINEERING

1. Isolation and purifications of vector DNA from E. Coli
2. Plasmid curing by chemical agents
3. Restriction digestion of Lambda Phage DNA
4. Ligation of restricted fragments
5. TA cloning and screening of blue /white colonies – α complementation.
6. Expression of cloned genes and analysis by SDS-PAGE
7. Southern blotting & Northern blotting
8. Genetic diversity of pseudomonas by RAPD
9. Reporter gene assay (GUS / β (beta)- galactosidase)

BIOINFORMATICS

1. restriction mapping
2. PCR Primer Designing
3. ORF finding
4. Homology search
5. Multiple sequence alignment

ELECTIVE 2: ENZYME TECHNOLOGY (PDBT 25A)

UNIT I

Introduction to enzymes: History of enzymes, nomenclature and classification of enzymes. Structural features of Enzymes: Chemical nature of Enzymes: amino acids, protein structure: Primary, secondary, tertiary and quaternary structure. Specificity of Enzymes: Types of specificity, the Koshland "induced fit" hypothesis, strain or transition-state stabilization hypothesis.

UNIT II

Enzyme Catalysis and Kinetics: Factors affecting the rate of chemical reactions, kinetics of un-catalyzed chemical reactions, kinetics of enzyme-catalyzed reaction, methods for investigating the kinetics of enzyme-catalyzed reaction, nature of enzyme catalysis, inhibition of enzyme activity.

UNIT III

Extraction and purification of microbial enzymes : Importance of enzyme purification, different sources of enzymes. Extracellular and intracellular enzymes. Physical and Chemical methods used for cell disintegration. Enzyme fractionation by precipitation (using Temperature, salt, solvent pH, etc.), liquid-liquid extraction, ionic exchange, gel chromatography, affinity chromatography and other special purification methods, Enzyme crystallization techniques. Criteria of purity of enzymes. Pitfalls in working with pure enzymes.

UNIT IV

Enzyme inhibition and Co-factors: Irreversible, reversible, competitive, non-competitive and un-competitive inhibition with suitable examples and their kinetic studies. Allosteric inhibition, types of allosteric inhibition and their significance in metabolic regulation & their kinetic study. Vitamins and their co-enzymes: Structure and functions with suitable examples, Metallo enzymes and Metal ions as co-factors and enzyme activators.

UNIT V

Immobilization of microbial enzymes and Enzyme Engineering: Methods viz. adsorption, covalent bonding, entrapment & membrane confinement and their analytical, therapeutic & industrial applications. Properties of immobilized enzymes. Enzyme Engineering- Chemical modification and site-directed mutagenesis to study the structure-function relationship of industrially important enzymes.

UNIT VI

Applications of microbial enzymes: Microbial enzymes in textile ,leather, wood industries and detergents. Enzymes in clinical diagnostics. Enzyme sensors for clinical processes and environmental analyses. Enzymes as therapeutic agents.

Reference:

1. Enzymes by palmer(2001): Horwood publishing series.
2. Fundamentals of Enzymology by price and Stevens (2002): Oxford University Press.
3. Enzyme Technology by Helmut Uling (1998): John Wiley.
4. Introduction to proteins Structure by Branden and Tooze (1998): Garland Publishing Group.
5. Methods in Enzymology. Volume 22-Enzyme purification and related techniques. Edited by William B. Jakoby. Academic press, New York.
6. Allosteric Enzymes-Kinetic Behaviour. 1982. By B.I .Kurganov ,John Wiley and Sons. Inc., New York.
7. Biotechnology . Volume 7 A- Enzymes in Biotechnology. 1983 Edited by H.J.Rehm and G.Reed. Verlag Chemie.
8. Enzymes as Drugs Edited by John S. Holcenberg and Joseph Roberts, John Wiley & sons New York.
9. Methods of Enzymatic analysis by Hans Ulrich, Bergmeyer, Academic Press.
10. Methods in Enzymology by W.A.Wood, Academic Press.
11. Advances in Enzymology by Alton Meister, Interscience Publishers.
12. Topics in Enzyme and Fermentation Biotechnology by L.N. Wiseman ,John Wiley and sons.

ELECTIVE 2: DAIRY TECHNOLOGY (PDBT 25B)

Objective: to impart current knowledge of basic and applied microbiological aspects of fluid milks and dairy products for improved quality and food safety.

Unit I

Common microbes in milk and their significance .sources of microbial contamination of raw milk in influencing quality of milk during production, collection, transformation and storage. Clean milk production and antimicrobial systems in raw milk. Microbial changes in raw milk during long storage. Microbiological grading of raw milk.

UNIT II

Microbiological processing techniques: bactofugation, thermization ,pasteurization, sterilization ,boiling ,UHT, non thermal processes and membrane filtration of milk role of psychrophilic mesophilic, thermophilic and thermoduric bacteria in spoilage of processed milks and prevention microbiological standards (BIS/PFA) of heat treated fluid milks.

UNIT III

Microbiological quality of dairy products; fat rich (cream and butter),frozen (ice cream),concentrated (evaporated and condensed milk),dried milks(roller and spray dried), infant dairy foods and legal standards. Factors affecting microbial quality of these products during processing, storage and distribution. Pro biotics and pre biotics(GRAS),cloning - sanitation, control of micro organisms in dairy processing.

UNIT IV

Microbiology quality of traditional dairy products; heat desiccated (khoa, burfi, peda, kheer),acid coagulated (paneer, chhana, rasgulla), fermented (lassi, srikhand)and frozen (kulfi).sources of microbial contaminants and their role in spolage. Importance of personnel and environmental hygiene on quality of traditional milk products. microbiological standards for indigenous dairy foods.

UNIT V

Milk-borne diseases – viral and bacterial, zoonotic infections ,pathogens associated with fluids milks, dairy products and their public health significance. sources of pathogens and their prevention .importance of bio flims, their role in transmission of pathogens in dairy products and preventive strategies. regulatory control of dairy products, testing of milk and milk products, treatment of dairy wastes.

References:

1. Adams MR and Moss MO.(1995).food microbiology, the royal society of chemistry, Cambridge.
2. Andrews AT, Varley J(1994) biochemistry of milk products. Royal society of chemistry.
3. Banwart GJ(1989),basic food microbiology, Chapman & hall, new York .
4. Frazier WC and Westhoff DC.(1988) food microbiology, TATA McGraw hill publishing company Ltd. New Delhi.
5. Hobbs BC and Roberts D. (1993) food poisoning and food hygiene, Edward Arnold (a division of Hodder and Stoughton), London.
6. May JM. (1987) modern food microbiology, CBS publishers and distributors, New Delhi.
7. Robinson RK. 1990.the microbiology of milk. Elsevier applied Science. London
8. Edward Harth , J.T.Steele. Applied dairy microbiology .1998. Marcel Decker Inc.
9. Modi, HA (2009) dairy microbiology pointer publishers, India. Marth, E.H and steel J. L(2001) applied Dairy microbiology, 2nd Edition, Marcel Dekker, Inc.270 Madison Avenue, new York, New York 10016.

ELECTIVE 2: PHARMACEUTICAL TECHNOLOGY (PDBT 25C)

Objectives: To impart knowledge on the importance of drug during life span. To enlighten on the biotechnological modifications in drugs. To find mechanism of action of drugs used in therapy.

UNIT I

Drug- structural feature and pharmacology activity, pro drug concept. Absorption – first – pass effect . distributor , metabolism- phase I, II reactions, action of cyto chrome p450 & elimination of drug receptor- localization, type and subtypes, models and their drug- receptor interaction, against & antagonist .

UNIT II

Adverse response to drugs, drug tolerance, drug intolerance , Idio SYNERACY (pharmacogenesis), drug allergy. Tachy phylaxis, drug abuse, vaccination against infection , factor that modifies the effect of drug. Assay of drug potency – bioassay and immunoassay.

UNIT III

Biotechnology and pharmacy: genetically engineered protein and peptide agents. novel drug delivery systems – non conventional routes of administration. Anti AIDS drug development, oncogenes target for drugs, multi- drugs resistance.

UNIT IV

Mechanism of action of drugs used in therapy of : respiratory system-cough, bronchial-asthma, pulmonary tuberculosis .GIT – digestents , appetite suppressants. hypolipidemia agents,, vomiting, constipation and peptic ulcer. antimicrobial drugs- sulfonamide s,trimethoprim, cotrimoxazole, penicillin and macrolides . aminoglycosides, cephalosporin and bacterial resistance .Insulin and oral diabetic drugs, anti fertility and ovulation inducing drugs.

UNIT V

Drugs of plant origin: drug dependence and abuse- management of self poisoning cancer. Chemotherapy- cytotoxic drug. immuno suppressive drug therapy. New biological targets for drug development. Novel drug screening strategies.

Reference:

1. The pharmacology Vol I and Vol II– Goodman and Gillman, Mc Graw Hill professional;12 ed (2010)
2. Basic pharmacology – Foxter cox bulter worth's 1980.
3. Pharmacology and pharmaco therapeutics – R.S.Satoskar. S.D.Bhandhhakar & S.S.Anilapure popular Prakashar Bombay.
4. Principles of medical chemistry – William O. Foge. B.I. Waverks Pvt Ltd, New Delhi.
5. Oxford text books of clinical pharmacology and drug therapy. D.G.Burger's Medical chemistry & drug discovery.
6. Principles and practice – Manfred. E. Wolf John Wiley and sons.

ELECTIVE 2: CELL SIGNALING (PDBT 25D)

UNIT I

HOST parasite interaction: recognition and entry process of different pathogens like bacteria, viruses into animal and plant host cells, alterations of host cell behavior by pathogens, virus – induced cell transformation, pathogen-induced diseases in animal and plants, cell- cell fusion in both normal and abnormal cells.

UNIT II

Cell signaling: hormones and their receptors, cell surface receptor, signaling through G-Protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component signaling systems.

UNIT III

Cellular communications: regulation of hematopoiesis, general principles of cell communications, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation. Quorum sensing-Lux genes & reporter assay-*Agrobacterium tumefaciens*, *chromobacter violaceum*.

UNIT IV

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

UNIT V

Innate and adaptive immune system: cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules, generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions. MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, Humoral and cell-mediated immune responses, Primary and secondary immune modulation, the complement system, toll-like receptors, cell-mediated effector functions, inflammation, Types of Hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immune deficiencies, vaccines.

Reference :

1. Biochemistry of signal transduction and regulation. Wiley- Vch Verlag GmbH & Co. KGaA, Weinheim 4th Edition.2008.
2. Cellular signal processing: an introduction to the molecular mechanisms of signal transduction friedrich marks, Ursula klingmuller, Karin Muller-Decker, garland science;1 Edition 2008
3. signal transduction, second edition Bastien D.Gomperts, Ijsbrand M.kramer, peter E.R. Tatham, academic press;2 ed,19,2009
4. G-Proteins as Mediators of cellular signaling process miles D.Houslay,Graeme Milligan, Wiley ; edition,1990
5. Cell signaling (cancer surveys).P.J.Parker, T.Pawson, Cold Spring Harbor Laboratory Pr;1996.

SEMESTER III

PAPER 8: PLANT BIOTECHNOLOGY (PDBT 31)

Objective: This paper has been designed to give the students comprehensive knowledge about the applications of plant Molecular biotechnology for increasing agricultural production, environment improvement, human, nutrition and health. Help students to get a career in both industry/R & D.

UNIT I

Cellular organization in plants: Nucleus, Chloroplast and Mitochondria, Molecular Marker-aided Breeding: RFLP maps, linkage analysis, RAPD markers, STS, Microsatellites, SCAR (Sequence Characterized Amplified Regions),SSCP (Single Strand Conformational Polymorphism), AFLP, QTL ,map based cloning, molecular marker assisted selection.

UNIT II

Plant cell and Tissue Culture: Tissue culture media (composition and preparation), Callus and suspension culture; Soma clonal variation; Micro propagation; Organogenesis; Somatic embryogenesis; transfer and establishment of whole plants in soil; greenhouse technology. Embryo culture and embryo rescue, Artificial seeds, Protoplast fusion and somatic hybridization; cybrids; anther, pollen and ovary culture for production of haploid plants. Cryopreservation and DNA banking for germplasm conservation.

UNIT III

Concepts in plant Genetic Engineering: Plant vectors: Co-integrate, binary vectors and viral vectors,35S and other promoters , Terminators, selectable Abiotic resistance marker, Anti metabolite resistance marker and reporter genes GUS gene, Lux gene and GFP protein. Transgenes stability and gene silencing.

UNIT IV

Methods of gene transfer in plants: Transient and stable gene transformation: Agrobacterium mediated gene transfer, Ti & Ri plasmid, the process of T DNA transfer and integration. Physical method of gene transfer, Particle bombardment, electroporation, microinjection, chemical mediated transformation, silicon carbide mediated and floral dip method. Transplastomics: Chloroplast transformation: advantages, vectors, success with tobacco and potato. Strategies for marker free transformation.

UNIT V

Application to transgenesis in crop improvement: Insect resistance, disease resistance, virus resistance, herbicide resistance, and resistance to biotic & abiotics tree. Transgenesis for male sterility and terminator seed. Transgenesis for quality improvement: Protein, lipids, carbohydrate, vitamins & mineral nutrients. Molecular pharming: Exploitation of Biotechnological techniques for plant therapeutic compounds – production of recombinant proteins in plants. Expression of antibodies in plants for immunotherapy. Expression of recombinant antibody fragments in plants.

References:

1. Plant biotechnology. Slater A, NW Scott, MR Fowler. Oxford University Press, 2003
2. Plant Biotechnology & Molecular Biology. Hans Walter Heldt. Oxford University Press, 1997.
3. Plant Biotechnology: The genetic manipulation of plants. Nigel W. Scott, Mark T. Fowler, Adrian Slater.. Oxford University Press, 2008.
4. Plant Biotechnology: New products and Applicationa. J. Hammond, P. Mc Garvey, V. Yusibov. Springer 2010.
5. Biochemistry & Molecular Biology of plants. Bob Buchanan, Wilhelm Gruissem , Russell Jones. I.K. International Pvt. Ltd, 2007.
6. Practical Applications of Plant Molecular Biology. Robert J. Henry. Routledge Chapman & Hall, 2008.
7. Introduction to plant Biotechnology. H.S. Chawla, 2002. Oxford and IBH P publishing Co. Pvt. Ltd. New Delhi.
8. Molecular Plant Biology: A practical approach (Vol. I and II). Gilmartin and Bowler. Oxford University Press, UK, 2002.
9. Plant Molecular Biology by Donald Grierson and S.V. Convey .1984. Blackie and Son.
10. Plant cell culture. A practical approach. Second Edition. Edited by R.A. Dixon and R.A.
11. Plant Biochemistry (4th Ed). Hans-Water Heldt, Birgit Piechulla. Academic Press, 2010.

12. Plant Biotechnology and Agriculture: Prospects for the 21st Century. Arie Altman, Paul Michael Hasegawa, Academic Press, 2011.
13. From plant Genomics to plant Biotechnology. P Poltronieri, N Burbulis, C Fogher. Woodhead Publishing, 2013.
14. Chloroplast Biotechnology: Methods and protocols (Methods in Molecular Biology). Pal Maliga. Humana press, 2014.
15. Plant Biotechnology: The Genetic Manipulation of Plants. Adrian Slater, Nigel W. Scott, Mark R. Fowler. Oxford University Press, 2003.
16. Plant Biotechnology. Anwar Hussain Paolo Fasella. Medtech, 2013.

PAPER 9: ANIMAL BIOTECHNOLOGY (PDBT 32)

Objective: To provide an overview and current developments in different areas of animal Biotechnology and its application.

UNIT I

Culture of mammalian cells, Tissues and Organs, Primary Culture, Secondary Culture, Continuous cell lines, Suspension cultures, Cryopreservation and transport of Animal germplasm (Embryo, Semen and ovum).

UNIT II

Cell cultures media and Growth parameters of animal cell culture, Role of serum and essential supplements to medium and their applications. Cell Synchronization, Cell cloning Methods and Micromanipulation.

UNIT III

Gene transfer to Animal cell, Animal Germ cell and development, Valuable genes for Animal biotechnology, Transgenic Animals (story of Dolly) and gene knockout, Somatic cell cloning and Hybridization, Transfection and Transformation of cells, Production of transgenic animals – mice, sheep and fish. Potential applications of transgenic animals – Animal models for diseases and disorders. Transgenic poultry, transgenic insects as bioreactor.

UNIT IV

Commercial scale production of animal cells, application of animal cell culture for in vitro, testing of drugs, testing the toxicity of environmental pollutants in cell culture, application of cell cultures technology in production of pharmaceutical proteins, human and animal viral vaccines.

UNIT V

Stem cell culture, embryonic stem cells and their applications. Cytotoxicity, Apoptosis, Tissue engineering. Diagnostic antigens and other pharmaceutical agents.

References:

1. Culture of Animal cells, 2006, 3rd Edition, R. Ian Freshney . A John Wiley & Sons, Inc., publications.
2. Animal Cell Culture – Practical Approach, R.W. Masters, Oxford. Animal Cell Culture Techniques. Ed. Martin Clynes, Springer.
3. Biotechnology by Kashav. T (Wiley Eastern Ltd).
4. Animal Cell Biotechnology; Methods and protocols, Nigel Jenkins, Humana Press.
5. Biotechnology of Animal Tissue. P.R. Yadav & Rajiv Tyagi, 2006. Discovery publishing House. New Delhi.
6. From Genes to Clones Introduction to Gene Technology – Winnacker, E.L.1987., Panima Educational Book Agency, New Delhi.
7. Gene VII – Benjamin Lewin, 2000. Oxford University Press, UK.
8. Principles of Gene Manipulation and Genomics – Primrose, S.B. and Twyman, R.M. 2006. 7th Edition. Blackwell Publishing Company.
9. Recombinant DNA Second Edition – James D. Watson, Micheal Gilman, MarkZoller, 2001. W.H. Freeman and Company, New York.
10. Biotechnology, Satyanarayanan .U, (2008), Books and Allied (p) Ltd.

PAPER 10: MICROBIAL BIOTECHNOLOGY (PDBT 33)

Objective: To understand the various processes involved in Microbial Technology uses in industries for the production of Primary and secondary metabolites that will be useful for the benefit of human beings.

UNIT I

Introduction to Microbial technology , Growth of different types of Microorganism, Sterilization and Media preparation, fermentation , Screening of industrially important microorganism of bacterial and fungal source.

UNIT II

Screening for a new Metabolites, Primary and Secondary metabolites, Strain development – mutation, Selection of Mutants, & Recombination Screening for a new Metabolites: Primary and Secondary metabolite, Strain development – mutation, Selection of Mutants, & Recombination, Rate of Microbial growth.

UNIT III

Development of medium, Screening for production media, Sterilization, Upstream Processing, Fermentation- types, basic requirements and factors involved in fermenter design – temperature control – Aeration, Agitation, Gas exchange and Mass transfer, Antifoaming agents, Scale up of fermentation Process, Principal operating different types of fermenter.

UNIT IV

Batch , Continuous and fed batch fermentation, Immobilization and methods of Immobilization, Computer control of fermentation Process, Production of Antibiotics, Organic acids, Amino acids and Vitamins , Single cell Protein.

UNIT V

Extracellular and Intracellular Enzyme Production, Downstream processing, Types of fermenter- Batch, CSTR, PFR, Airlift, Tower fermenter, Photo bioreactor, Membrane bioreactor, Animal Cell line culture, Scale up of Animal cell and Insect cell using fermentation Technology, Biological waste water treatment, Biosensors.

Reference:

1. Stanbury P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon press, Oxford UK.
2. Steinkraus, K.H. 1983. Handbook of 1 Indigenous Fermented Foods. Marcel Dekker, New York.
3. Curegar , W. and Cregar, A., 1989. Biotechnology: A text book of industrial Microbiology, 2nd Edition. Panima Publishing corportation, New Delhi.
4. Patel. A.H. 1985. Industrial Microbiology, Mac Millan India Ltd.
5. Bioprocess Engineering Principles 1995 Pauline M. Doran Academic Press Ltd.
6. S. Shiek Asraf and P .Gunasekaran, 2010, current Research , Technology an Education Topics in Applied Microbiology and Microbial Biotechnology. Microbiology book series – Number 2. Pg:880-890. Antonio Mendez Vilas (Ed.) Publisher.
7. Stanbury, A.H., A. Whittaker and Hall S.J. 1995. Principles of fermentation technology 2nd Edition pergamon press.

PAPER 11: ENVIRONMENTAL BIOTECHNOLOGY (PDBT 34)

Objective: To acquire a basic comprehension of the environment in its totality and of its problems and to provide an understanding of the environmental and biological challenges facing society through the integration of biology with legal, regulatory and social issues.

UNIT I

Environmental Pollution: Types of pollution – Water-Air-Soil. Global environmental problems –Ozone depletion- Greenhouse effect – Acid rain, Energy sources – Conventional- Non conventional- Wind – Solar – Tidal. Effect Of Radioactive energy to environment, Radioactive pollution. Microbiology Of corrosion. Biomonitoring of water pollution using algae – bacteria – plankton - macrophytes – invertebrates – fishes, Bioaugmentation, Biofuelling . Biosensors _ Types- Construction – Applications.

UNIT II

Waste Treatment: Waste water treatment – Physical – Chemical – biological treatment – Oxidation Ponds _ Trickling filter- Biofilm – Activated sludge digestion, Treatment schemes for waste waters of dairy-Distillery-tannery-sugar-Textile-pharmaceutical industries, bioreactors for waste water treatment – Solid waste disposal – Land filling – Incineration – Composting –Biogas production, H₂ production to reverse global warming. Biomonitoring and management for effluent toxicity – Heavy metal pollution..

UNIT III

Bioremediation: Types – Advantages, Biodegradation of inorganic and organic wastes – lignin – tannin – pesticides, Microbial remediation of phenolics – sewage nutrients (Phosphate and nitrate) – Role of Bioremediation in petroleum Industry – Paper Industry – Chemical industry – Marine oil pollutants, Phyto remediation - Removal of Mercury by Carrot – Impacts of phyto remediation in agriculture.

UNIT IV

Microbial mediated recovery: Bio metallurgy – Bioleaching – Applications, Biotechnological approaches for heavy metal elimination from sewage water and effluents , Bio mediated recovery of metals – Gold – Copper – Platinum – Uranium, Recovery of petroleum – MEOR – Biosurfactants.

UNIT V

Cleaner and Greener Production: Renewable and non-renewable energy. Criteria for choosing appropriate green energy technologies, life cycle cost; the emerging trends-process/product innovation-, technological/environmental leap- frogging; Eco/green technologies for addressing the problems of water, Energy, Health, Agriculture and

Biodiversity-WEHAB. Bio energy, Solar Energy: Solar radiation: measurements and prediction. Wind Energy: Atmospheric circulations, classification, factors influencing wind energy. Ocean Energy; Ocean energy resources - ocean energy routes. Other Sources of energy: Hydropower, Nuclear fission and fusion-Geothermal energy.

References

1. Alan Scragg. 1999. Environmental Biotechnology. Pearson Education Limited, England.
2. Jogdand, S.N. 1995. Environmental Biotechnology. Himalaya Publishing House, Bombay.
3. Technoglous, G., Burton, F.L. and Stensel, H.D. 2004. Wastewater Engineering – Treatment, Disposal and Reuse. Metcalf and Eddy, Inc., Tata Mc Graw Hill, New Delhi.
4. Athie, D. and C.C. Cerri. 1990. The Use of Macrophytes in Water Pollution Control, Pergamon press, Oxford.
5. Henze, M. and W. Gujer 1992. Interactions of WasteWater: Biomat and Reactor Configurations in Biological Treatment Plan- Pergamon Press, Oxford.
6. Jenkins, D. and B.H. Olson(Eds). 1989. Water and Wastewater Microbiology. Pregamon press, oxford.
7. Kaul, T. Nady and Trivedy, R.K. 1993. Pollution Control in Distilleries. Environmedis,Karad,India.
8. Sastry, C.A., Hashim, M.A., and Agamuthu, P.(Eds.)1995. Waste Treatment Plants . Narosa publishing House, New Delhi, India.
9. Microbial Bioremediation, P. Rajendran and P. Gunasekaran , MJP Publisher , Chennai Publication Date:2006.

PRACTICAL V: LAB IN PLANT BIOTECHNOLOGY & ANIMAL BIOTECHNOLOGY (PDBT 36)

Plant Biotechnology

1. Introduction to plant tissue culture-induction of callus and suspension cultures.
2. Isolation and purify the protoplasts and check its viability.
3. Induction of somatic embryogenesis and analysis of different stages.
4. Extraction of the genomic DNA from plants by CTAB method and resolve in the agarose Gel.
5. Isolation of Total RNA from leaves.
6. Agrobacterium Mediated Genetic Transformation of GUS gene in plant.
7. Gene gun mediated genetic transformation of GUS gene in plant.
8. Analysis of GUS gene in transgenic plants by histo chemical staining.
9. Identification of WT/Transgenic plant by PCR.
10. Use of Agro infiltration for Transient Expression of Plants.
11. Preparation of plant cell suspension culture.

Lab in Animal Biotechnology

12. Development of primary cell lines/maintenance of established cell lines.
13. Cell counting and cell viability.
14. Trypsinization of monolayer and sub culturing.
15. Preparation of metaphase chromosomes from cultured cells.
16. Isolation of DNA and demonstration of apoptosis of DNA laddering
17. MTT assay for cell viability and growth

References

1. Practical Applications of Plant Molecular Biology. Robert J. Henry . Routledge Chapman & Hall, 2008.
2. Molecular Plant Biology: A practical approach (Vol. I and II). Gilmartin and Bowler. Oxford University press, UK, 2002.
3. Plant Cell Culture: Essential Methods. Michael R. Davey, Paul Anthony. Wiley, 2010.
4. Plant Tissue Culture, Third Edition: Techniques and Experiments . Roberta H. Smith. Academic Press, 2012.
5. Plant cell culture Protocols (Methods in Molecular Biology, 3rd Ed). Victor M. Loyola-Vargas, Neftali Ochoa-Alejo. Humana Press, 2012.
6. Plant Cell, Tissue and Organ Culture: Fundamental Methods (Springer Lab Manuals). Oluf L. Gamborg (Editor), Gregory Phillips (Editor), Springer, 2013.

PRACTICAL VI: LAB IN MICROBIAL TECHNOLOGY & ENVIRONMENTAL BIOTECHNOLOGY (PDBT 37)

Microbial Technology

1. Screening of yeast strains (Normal, Flocculent Strains) from Molasses.
2. Immobilization techniques.
3. Ethanol production from Mono and Disaccharides using renewable resources.
4. Ethanol estimation, Sugar Estimation from fermentation process.
5. Familiarization with the Bioreactor and its Operation, Equipment, Media and seed Culture Preparation.
6. Isolation and purification of product (downstream processing)
7. Fed batch fermentation for recombinant strains
8. Citric acid production using *Aspergillus* sp.

Environmental Biotechnology

9. Water Analysis: Measurement of Total Solids, Total – dissolved solids, Total-suspended solids, dissolved oxygen, total hardness, chloride, turbidity, nitrite, nitrate, fluoride and total nitrogen.
10. Estimation of COD, BOD of industrial effluents.
11. Potability test of water (MPN technique).
12. Degradation of phenols. Colorimetric assay
13. Estimation of MIC and Heavy metal tolerance of chromium resistant bacteria
14. Screening of Biosurfactant activity-Oil Displacement test-Drop collapse test
15. Isolation of *Thiobacillus ferrooxidans* and *Thiobacillus thiooxidans* from metal sulphides, rock and acid mine water.
16. Microbial degradation, decolourisation and adsorption of organic dyes by free and immobilized cells
17. Studies on halophiles from sea water (pigmentation and salt tolerance)

ELECTIVE 3: GENOMICS & PROTEOMICS (PDBT 35A)

OBJECTIVE: To enable us to explore many different components of living systems and the advent of proteomics will made it possible to identify a broad spectrum of proteins in living systems. This elective subject will help to understand basic principles and applications in genomics and proteomics.

UNIT I :

Organization of genes across living systems, interrupted genes, overlapping genes, alternative genes , (RNA editing and RNA Splicing) etc. identification and characterization of insert DNA fragments, gene content and C value paradox – gene cluster and gene families .restriction mapping, chromosome walking and chromosomal localization of genes. RFLP and other uses of cloned sequences, cloning of microbial genes.

UNIT II

Methods of preparing genomic DNA, DNA sequence analysis methods, Sanger Di deoxy method, next generation sequencing, SNP – single nucleotide polymorphism, expressed sequenced Tags(ESTs),Gene disease association, site directed mutagenesis and molecular chimeras , gungal genome and genomics.PCR based Analysis, DNA Fingerprinting.

UNIT III

Scope of proteomics, protein separation techniques – ion exchange chromatography, size – exclusion and affinity chromatography techniques, size – exclusion and affinity chromatography techniques , protein analysis (includes measurement of concentration , amino acid composition, N-terminal sequencing); SDS-PAGE , two dimensional gel electrophoresis and image analysis.

UNIT IV

Introduction to mass spectrometry; strategies for protein identification ; protein sequencing ; protein modifications and proteomics ; applications of proteome analysis to drug; protein – protein interaction (Two hybrid interaction screening), analysis and sequencing individual spots by mass spectrometry (Maldi toff) and protein microarrays .

UNIT V

Meta genomics – construction, vector design and screening o f meta genomic libraries-biotechnological applications of meta genomics.

Reference

1. Microbial Genomes. Fraser, Clarie M:read ,timothy D:Nelson , Karen E,Ed. Humana press 2004.
2. mobile DNA II. Craig Nancy, Craigie , Robert: Gellert, Martin: Lambowitz. Alan M. ASM Press 2002.
3. Genomes 2nd ed. Brown.T.A Wiley- Liss, Oxford 2002.
4. Laboratory Manual winter school on Meta genomics .P.Gunasekaran, MKU Press, Madurai,2009.
5. Laboratory manual : Winter school on Microbial genome typing . P.Gunasekaran, MKU press, Madurai, 2008.
6. Biotechnology of antibiotics, Stroh, William R, 2nd ed. Marcel Dekker Inc. 1997.
7. Gnesenomics, proteomics & vaccines. Gudio grandi. John Wiley&sons, New York.2004
8. Ge, Benjamin Lewin, Jones and Bartletts Publishers, 2008.
9. Molecular genetics MYOBACTERIA. W.R. Jacobs, ASM press 2000.

ELECTIVE 3: MARINE BIOTECHNOLOGY (PDBT 35B)

UNIT I

Marine biotechnology – marine organisms as sources of untapped resources. Bioactive compounds from marine organisms (microorganisms , sponges, corals, bryozoans and tunicates).seaweeds as a source of polysaccharides. Seaweeds for removal of heavy metal pollutants.

UNIT II

Hydrothermal vents: vent biodiversity , hyper thermophilic and barophilic microorganisms and their applications. biotechnological applications of extremozymes from extremophilic organisms. Unculturable bacteria, occurrence, characteristics and exploitation.

UNIT III

GFP characteristics and applications. Probiotics bacteria and their importance in aquaculture. Vaccines fro aquaculture. PCR and others techniques for identification of bacterial and viral pathogen in aquaculture . gene probes and their applications in disease diagnosis.

UNIT IV

Chromosomal manipulation of commercially important marine organisms. Transgenic fish technology .transgenic fishes with growth hormone (GH) and antifreeze genes. Transposon in fishes.

UNIT V

Bacterial cell – cell communication system – quorum sensing and its inhibition – types of auto inducers- QS inhibitor compounds and its role in expression of virulence genes among bacterial pathogens.

Reference

1. Handbook of Probiotics and Probiotics (2009) Y.K.Lee and S.Salminen , second ed,Wiley, A john Wiley and Sons inc publication.
2. Advances in biochemical engineering / biotechnology – marine biotechnology I & II (2005)Y.LeGal,R.Ulber, springer verlag berlin Heidelberg.
3. Aquaculture medicine , 2003first ed, I.S Bright Singh, S.Somnath Pai, Rosamma Philip and A.Mohan Das Paico printing Pre kochi, india.

4. Drugs from the sea (2000), fusetani N.Karger , Tokyo
5. Recent advances in marine biotechnology. Vol 2 (1998)by Fingerman, M., Nagabhushanam, R., Thompson, M.Oxford & IBH Publ.
6. Biotechnology and biodegradation advances in biotechnology series, vol 4(1990)by kamely, D chakrabarty , A&Omum ,G.S Gulf publishing company, Houston.
7. The microbiology of deep-sea hydrothermal Vents (1995) karl, D.M. CRC press, Boca raton.

ELCTIVE 3.NANO BIOTECHNOLOGY (PDBT 35C)

Objective: This discipline helps to indicate the merger of biological research with various fields of nanotechnology. This technical approach to biology allows scientists to imagine and create systems that can be used for biological research. The most important objectives that are frequently found in nano biology involve applying nano tools to relevant medical/biological problems and refining these applications. developing new tools for the medical and biological fields in another primary objective in nanotechnology . microbes are playing an important role in the synthesis of nano particles. this syllabus would enlighten the students to understand basic concepts and applications of nanotechnology.

UNIT I

Introduction to nanotechnology: characteristic scale for quantum phenomena, nano particles, nano-clusters ,nano composite ,nao tubes, nano wires emergence of bio nanotechnology. characterization of nano particles- UV-Vis spectroscopy, electron Microscopy- HRTEM,SEM,AFM,EDS,XRD.

UNIT II

Microbial nanotechnology – microbial synthesis of nano drugs-metal nano particles and drug delivery vehicles- Nanoshells – Tecto dendrimers Nano particle drug systems – diagnostic applications of nanotechnology.

UNIT III

Preparation of nano biomaterials – polymeric scaffolds collagen, elastins: Mucopolysaccharides, Proteoglycans ,cellulose and derivates; dextrans ; alginates; Pectins; Chitin. Nanoparticles – types, functions-Silver, Gold and Titanium. Physical and chemical properties of nanoparticles.

UNIT IV

Nanoscale applications in biology and medicine: nanotechnology fro biology and medicine – micr and nano-fluides- scanning probe microscopy in biology and medicine- self –assembly of biological molecules .drug delivery – protein mediated and nanoparticle mediated. Hybrid conjugates of gold nano particles –DNA oligomers - use of DNA molecules in nanomechanics and computing . Nano particles as carrier for genetic material .Genetically modified organisms (GMO) and applications.

UNIT V

Implications of nanotechnology : health and safety implications from nano particles: health issues- environmental issues- need for regulation – societal implications : possible military

applications – potential benefits and risk for developing countries – intellectual property issues – criticism of Nanotechnology – studies on the implications of Nanotechnology.

References:

- 1.Parthasarathy, B.K(2007). Introduction to Nano technology , Isha publication.
- 2.Elisabeth Papazoglou and Aravind Parthasarathy (2007).Bio nanotechnology. Morgan & Claypool publishers.
- 3.Bernd Rehm (2006). Microbial bio nanotechnology: biological self-assembly systems and biopolymer – based nanostructures. Horizon scientific press.
- 4.David E. Reisner ,Joseph D. Bronzino (2008). Bio nanotechnology : global prospects.CRC Press.
- 5.Ehud Gazit (2006). Plenty of room for biology at the bottom: An introduction to bio nanotechnology.Imperial college press.
- 6.Hari Singh Nalwles , “ Nano structured materials and nanotechnology “,2002academic press
- 7.M.H.Fulekar,2010” Nanotechnology importance and applications .”I.K. International publishing house Pvt.
- 8.Nanotechnology : Global strategies, Industry Trends and applications 2005John Wiley & sons Ltd.

ELECTIVE 3: STEM CELL BIOLOGY (PDBT 35D)

Objective: to understand the recent advances and its applications to modern biotechnology.

UNIT I

Introduction to concepts in stem cell biology (renewal and potency etc) introduction to issue stem cells, Germ line stem cells and germ line derived pluripotent cell ,Epigenetics ,nuclear transfer and cloning, introduction to cell, tissues and organ.

UNIT II

Stem cell basic: embryonic development of human, introduction to embryonic and adult stem cell, sources of adult stem cells, reprogramming and induced pluripotent cells(iPS cells), chromatin and stem cells, telomers and stem cells, stem cell differentiation and characterization : CD antigens and its role in stem cell differentiation.

UNIT III

Neuronal stem cell, mesen chymal stem cell, cardiac stem cells , planaria stem cells, prostate and breast stem cells, transfoeming growth factor (TGF β), G PROTEIN – COUPLED RECEPTORS(GPCRs).hematopoietic stem cells, stem cells and diabetics, techniques used for stem cell isolation, enumeration and Ex-VIVO expansion, techniques used for stem cell characterization.

UNIT IV

Therapeutic applications of stem cell: fundamentals of regenerative medicine, autologous and allogenic stem cell transplation, HLA typing, Animal models of regeneration.

UNIT V

Stem cell banking – cryopreservation techniques, national guideline by ICMR, recent advances in stem cell biology.

References:

1. Essentials of stem cell biology 2009, (second ed)Robert Lanza, John Gearhart , Brigid Hogan, Douglass Melton, roger Pedersen, E. Donnall Thomas, James Thomson and sir Ian Wilmutt.
2. Ann a. Kiessling, human embryonic stem cells: an introduction to the science and therapeutic potential, Jones and bartett,2003
3. Peter J ,Quesenberry, stem cell biology and gene therapy, 1st ed, willyless, 1998
4. Robert lanja, essential of stem cell biology , 2nd ed, academic press, 2006

5. A. D. Ho. R. Hoffiman, stem cell transplantation biology processes therapy, willy – VCH, 2006
6. C.S. Potten, stem cells, Elsevier, 2006

SEMESTER IV

PAPER 12: RESEARCH METHODOLOGY (PDBT 41)

Objectives: To enable the students to understand the importance's of research, familiarize on writing the project report, learn about the various applications of statistics in the research

UNIT I

Overview of research and writing: research and its types, identifying and defining research problem, Introduction to different research designs. Basic principles of experimental design, selection of experimental material, essential constituents of literature review. Basic principles of experimental design. Scientific writing – characteristics – logical format for writing thesis and paper. Essential features of abstract, introduction , review of literature, materials and methods and discussions. Effective illustration – tables and figures .reference styles – Harvard and Vancouver systems

UNIT II

Biostatistics: collection and classification of data- diagrammatic and graphic representation of data – measurement of central tendency – standard deviation- normal distribution – test of significance based o large samples- small samples- student t test – correlation and regression – chi square test for independence of attributes-ANOVA.

UNIT III

Research techniques: Enzyme assay, enzyme activity and specific activity determination. Cell disintegration and extractions techniques, separation of proteins by fractionation (ammonium sulphate, organic solvents).Ion exchange chromatography, molecular sieve chromatography, affinity chromatography, paper chromatography, thin layer chromatography, ultra filtration, ultracentrifugation, gel electrophoresis. Microscopy, HPLC,HPTLC,GCMS,FTIR,SEM/TEM,NMR,AAS.

UNIT IV

Bioethics and patenting: declaration of Bologna . ethics in animal experimentation CPCSEA guidelines-animal care and technical personnel environment, animal husbandry, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia. composition of (Human)institutional ethic committee(IEC)- general ethical issues. specific principles fro chemical evaluation of drugs, herbal remedies and human genetics research, ethics in food and drug safety, patenting – definition of patent. Product and process patents .patenting multi cellular organisms. Patenting and fundamentals research.

UNIT V

Research methodology in biotechnology: survey of techniques used in biotechnology: principle, general procedure and instrumentation in centrifugation, electrophoresis, chromatography, spectrophotometry, spectroscopy, crystallography, autoradiography and microscopy, general technique in microscopy.

References

1. How to write a scientific paper. R.A Day 4th Edition Cambridge University Press. 1995
2. Cooray P.G. Guide to scientific and technical writing . P.G. Cooray, 1992
3. Carter V.Good and Douglas E Seats Methods of Research.
4. Alley, Michael. The craft of scientific writing. Englewood Cliffs. N.N. Prentice 1987.
5. M.C. Sharma, Desk Top Publishing on PC, BPB Publications, 1997.
6. Bergeron BP 2002 Bioinformatics Computing 1st Edition, Printice Hall.
7. Sundar Rao, jesudian Richard-An Introduction to Biostatistics.
8. S.P. Gupta –Fundamentals of statistics, Sultan Chand.
9. Ethics and the use of alternatives to animals in research and education , ShiraneePereira, CPCSEA.
10. CPCSEA guidelines for laboratory animal facility (CPCSEA) –No.13 Seaward road, Valmiki Nagar, Chennai-41.
11. Ethical guidelines for biomedical research on human subjects. ICMR, New Delhi, 2000.
12. Dickson. Molecular and cell biology of human gene therapeutics. Series Chapman and Hall 1995.

PROJECT / DISSERTATION WITH VIVA-VOCE