THIRUVALLUVAR UNIVERSITY

MASTER OF SCIENCE

DEGREE COURSE

M. Sc. BIOTECHNOLOGY

Under CBCS
Regulations & syllabus
(For University Department)

(With effect from 2018-2019)

Regulations, Syllabus and Scheme ofExamination for

M. Sc., BIOTECHNOLOGY

(With effect from 2018-2019)

DEPARTMENT OF BIOTECHNOLOGY

THIRUVALLUVAR UNIVERSITY (State University)

Vellore – 632 115

THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE- 632 115

MASTER OF SCIENCE IN BIOTECHNOLOGY

UNDER CBCS (effective from 2018-2019 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.

The 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. Eligibilitycriteria

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. Coursedetails

Durationofcourse	: **04 semesters (2 semesters/year)**
Totalofpapers	**16**
Total number oflab. Courses	**6**
Project	: **4thsemesteronly**
Total marks for M.Sc. Degree	
Theorypapers	: **1600marks**
Labcourses	: **600marks**
Project	: **200marks**
Total	: **2400 marks / 90credits**

6. Preamble of thesyllabus

Master of Science (M.Sc.) in Biotechnology, the curricula and course content were designed to meet the standards of UGC-CSIR (NET) and (SLET) examinations. The choice based credit system of learning develop a strong base in the core subject and specialize in the disciplines of his / her liking and abilities and develop in-depth understanding of various aspects of Biotechnology. The students develop experimental skills, to design and implementation of novel synthetic methods, and to develop the aptitude for academic and professional skills, by 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 research and towards entrepreneurial skill development**.**

Instruction to the Students

The students admitted to M.Sc. Biotechnology course are 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 re-test will not be given to those student who are absent for thetests.
3. FEESTRUCTURE
   As per the Thiruvalluvar University norms

8. PATTERN OF EXAMINATION

Evaluation of students

1. The odd-semester and even –semester examinations will be of 100 markseach.
2. A Student should obtain 50% marks in all the examinations (both theoryand LaboratoryCourse).

9. SCHEME OFEXAMINATION

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 hoursonly.

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

Question paper settings

Question papers will be set in the view of the entire syllabus by giving equal weight for each unit of syllabus.

Pattern of question paper (theory):
(*Part A & B –two questions from each unit & part C- one from each unit)*

Part A

10questions x 02Marks–NoChoice (10x2=20Marks)
(Answer in about50words)

Part B

5questions (either or type) x05marks (5x5=25Marks)
(Answer in about200words)

Part C

3out of 05 questionsx10marks (3 x 10 = 30Marks)
(Answer in about 500words)

Total = 75 marks

Internal assessment

Test	: 10 marks (best 2 out of3)
Assignment	: 5marks
Seminar	: 10marks
Total	**: 25marks**

Lab. Course examination (practical) will be of 75 marks each for university examinations and 25 marks for internal assessment.
Distribution of marks for lab. Course (practical) examination

University examinations experiment: 75 Marks

Experiment&Result	: 55marks
Lab. Courseviva–voce	: 10marks
Record	: 10marks
Total	**: 75marks**

Lab. Course internal assessment: 25Marks

Performance	: 15marks
Record	: 10marks
Total	**: 25marks**

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

Projectdissertation	: 200marks
Dissertation	: 150marks
Viva-voce	: 50marks
Total	**: 200marks**

Distribution of marks for dissertation / project
Project will 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	**: 150marks**
Dissertationformat	: 50marks
Scope of the research problem	: 20marks
Methodology	: 20marks
Analysis	: 30marks
Resultsand findings	: 30marks
Total	**: 150marks**

Viva-voceexaminations	**: 50marks**
Presentation	: 20marks
Subjectknowledge	: 20marks
Interaction	: 10marks
Total	**:50marks**

Question paper settings

Question papers will be set in the view of the entire syllabus and preferably coveringeach unit of thesyllabus.

Standard ofpassing

A candidate should get not 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 –internalassessment	: 12 marks
Universityexaminations	: 38marks
	OR
InternalAssessment	: 0marks
Universityexaminations	: 50marks

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

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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	75	25	100

Marks distribution for internals:

	Test	**seminars**	**Assignment**	**Total marks**
Theory	15	05	05	25

	Test	**Record**	**Total marks**
Practical	10	15	25

Pattern of question paper (theory):

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

Part A

10questions x 02Marks–NoChoice (10x2=20Marks)

(Answer in about 50 words)

Part B

5questions (either or type) x05marks (5x5=25Marks)

(Answer in about 200 words)

Part C

3out of 05 questionsx10marks (3 x 10 =30Marks)

(Answer in about 500 words)

Total = 75 marks

M.sc., Biotechnology (CBCS)

The course of study and the scheme of Examination

S. No	Study components	Ins hrs/ week	Credit	Title of the paper	Paper code	Maximum marks		
SEMESTER I								
1	Paper 1	5	4	Biochemistry	RPDBT 11	25	75	100
2	Paper 2	5	4	Cell & Molecular Biology	RPDBT 12	25	75	100
3	Paper 3	4	4	Microbiology	RPDBT 13	25	75	100
4	Practical I	6	3	Lab In Biochemistry And Cell & Molecular Biology	RPDBT 15	25	75	100
5	Practical II	6	3	Lab in Microbiology	RPDBT 16	25	75	100
6	Elective I	4	3	Medical Laboratory Technology	RPDBT 14A	25	75	100
				Virology	RPDBT 14B			
				Basic Analytical Methods	RPDBT 14C			
				Food and Nutrition	RPDBT 14D			
		30	**21**			**150**	**450**	**600**
SEMESTER II								
7	Paper 4	5	4	Immunology	RPDBT 21	25	75	100
8	Paper 5	5	4	Genetic Engineering	RPDBT 22	25	75	100

9	Paper 6	5	4	Genetics	RPDBT 23	25	75	100
10	Paper 7	4	3	Bioinformatics	RPDBT 24	25	75	100
11	Paper 8	3	2	Human Rights	RPDHR 20	25	75	100
12	Practical III	4	3	Lab in Immunology	RPDBT 26	25	75	100
13	Practical IV	4	3	Lab in Genetic Engineering & Bioinformatics	RPDBT 27	25	75	100
14	Elective II	3	3	Enzyme technology	RPDBT 25A	25	75	100
				Dairy technology	RPDBT 25B			
				Pharmaceutical Technology	RPDBT 25C			
				Genome technology	RPDBT 25D			
		33	**26**			**200**	**600**	**800**
SEMESTER III								
15	Paper 9	5	4	Plant Biotechnology	RPDBT 31	25	75	100
16	Paper 10	5	4	Animal biotechnology	RPDBT 32	25	75	100
17	Paper 11	5	4	Microbial biotechnology	RPDBT 33	25	75	100
18	Paper 12	4	4	Environmental Biotechnology	RPDBT 34	25	75	100
19	Practical V	4	3	Lab in Plant Biotechnology & Animal Biotechnology	RPDBT 36	25	75	100
20	Practical IV	4	3	Lab in Microbial Biotechnology & Environmental Biotechnology	RPDBT 37	25	75	100
21	Elective III	3	3	Genomics & Proteomics	RPDBT 35A	25	75	100
				Biodiversity	RPDBT 35B			
				Nano Biotechnology	RPDBT 35C			
				Stem Cell biology	RPDBT 35D			
		30	**25**			**175**	**525**	**700**
SEMESTER IV								
22	Paper 13	6	5	Research methodology	RPDBT 41	25	75	100
23	Project 1	24	13	Project/ dissertation with viva-voce	RPDBT 42	50	150	200
		30	**18**			**75**	**225**	**300**
	Grand total	**123**	**90**			**600**	**1800**	**2400**

Structure of the course:

Subject	Papers	Credit awarded	Total credits	Marks	Total marks
Core	19	3-5	68	100	1900
Elective	3	3	9	100	300
Project	1	13	13	200	200
			90		**2400**

SEMESTER I

PAPER 1: BIOCHEMISTRY (MDBT 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

CO 1: Learn basic definitions involved in biochemistry.

CO 2: Learn definitions and classifications of carbohydrates and its derivatives.

CO 3: Learn the concepts of metabolic pathways and its end products.

CO 4: Learn classification of enzymes and mechanism involved in it.

CO 5: Learn the concept of Biochemistry tests and principles involved in it.

UNIT I

Basic Concepts: Unitsofmeasurements of solutes insolution,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'sbonds).

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. Amino Acids, Lipids and Nucleic Acids-Their Biosynthesis; Mechanism Of Oxidative Phosphorylation and Its Inhibitors, Photophosphorylation.

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 ,7thEdition, jermy M.BergJohn,L .Tymoczko, Lubertstryer2012.W.H,freeman & company ,newYork
2. Molecular Bio methods handbook,2nd edition R.Rapley&J.M Walker,2008,Humana press.
3. Principles of Biochmeistry ,5thEdition AL. Lehninger ,D.L. Nelson and M.M Cox ., 2008.worth publishers ,NewYork.
4. Biochemistry 4TH Edition,G.Zubay,1998.McMillan publishing Co.NewYork.
5. Harper's Biochemistry,29th Edition-Rober K.Murray,Daryl K.Grammer,2012 McGraw Hill, lange MedicalBooks
6. Understanding enzymes -5thedition Trevorpalmer,Prentice Hall/Ellias Horwood1995
7. Text Book Medical Biochemistry M.N.Chatterjee 8thedition Jaypee brothers Medical publishers2013
8. Biochemistry – 4thedition 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(9thEd).Benjamin Lewin, oxford universitypress,uk.,2007
10. Molecular biology of cell (5thedition) brucealberts,alexanderjohnson,Julianlewis,martinraff,keithRoberts,peterwalter ,garland sciencepublications.2008
11. Molecular Biology (5thedition).weaver .R.F,McGraw Hillpublications,2011.
    Cell and molecular biology : concepts and experiments (5thedition).geraldkarp,wiley publications,2013

PAPER 2: CELL AND MOLECULAR BIOLOGY (MDBT 12)

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

CO 1: Learn basic of cell, its structure and function in prokaryotes and eukaryotes.

CO 2: Learn about various cell cycles and process involved in it.

CO 3: Learn the concepts of Transcription and Translation and enymes involved in it.

CO 4: Learn the concept of gene regulation and its significance.

CO 5: Learn the new concept of epigenetics and genes involved in cancer biology.

UNIT I

Cell Biology: Structure and function of cells in prokaryotes and eukaryotes; Structure and organization of Membrane - Membrane Model, active and passive, transport channels and pumps., Structure & Biogenesis of Mitochondria and Chloroplast. Structure of Endoplasmic reticulum, Golgi complex, lysosomes.

UNIT II

Cell division:Mitosis, Meiosis, regulation of cell cycle; factors regulating cell cycle. Nucleic acid structure,Genome Organization. **DNA replication** : Enzymes and mechanisms of DNA replication in prokaryotes and eukaryotes, Telomeres, telomerase and end replication. Role of telomerase in aging and cancer. DNA replication models DNA damage, Mutations, DNA repair andrecombination.

UNIT III

Transcription: Basic mechanism in prokaryotes and eukaryotes. RNA polymerase, Reverse transcriptase and regulation. Post-transcriptional processing: 5'-Cap formation; 3'-end processing and polyadenylation; splicing: RNA editing; Nuclear export of mRNA; mRNA stability.

Translation-Prokaryotic and eukaryotic translation, the translation machinery, Mechanisms of initiation, elongation and termination,Regulation of translation, co-and post-translational modifications of proteins and localization.

UNIT IV

Gene regulation: **Prokaryotic gene regulation**- Operon concept ; Lac operon and tryptophan operon. **Eukaryotic gene regulation**: Chromatin Structure, Regulation at transcriptional Level: DNA binding domains of the regulatory proteins.

Biochemistry and applications of ribozyme technologies. Transposable genetic elements. CRISPR CAS gene editing.

UNIT V

Epigenetics : Epigenetic regulation of gene expression, Modifications, Cancer Epigenetics.
Cancer Biology: Viral and cellular oncogenes; Tumor suppressor genes - Structure, function and mechanism of action of pRB and p53, p21, BRACA1.Oncogenes as transcriptional activators.

References:

1. Molecular cell Biology, by Darnell, Lodish, Baltimore, Scientific American Books,Inc., 1994.
2. Molecular and cellular Biology, Stephen L.Wolfe, Wadsworth Publishing Company,1993.
3. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis,Cold Spring Harbor Laboratory Press, New York,2000.
4. Introduction to Practical Molecular Biology, P.D.Dabre, John Wiley & Sons Ltd., NewYork, 1998.
5. Molecular Biology LabFax, T.A. Brown (Ed.), Bios Scientific Publishers Ltd., Oxford,1991.
6. Molecular Biology of the Gene (4th Edition), J.D.Watson, N.H.Hopkins, J.W.Roberts, J.A. Steitz and A.M.Weiner, The Benjamin/Cummings Publ. Co., Inc., California,1987.
7. Genes VI (6th Edition) Benjamin Lewin, Oxford University Press, U.K.,1998
8. Molecular biology of cell – Albert Bruce et al.,1994 3rdEd
9. Molecular Biology-Weaver. R. F. 3rd ed. Mc Graw Hill publication ,2005
10. Cell and Molecular Biology: Concepts and Experiments 5th Ed,Gerald Karp. Wiley publications,2013.
11. The Molecular Biology of Cancer: S. Pelengaris, M. Khan. Blackwell Publication.2002

PAPER 3: MICROBIOLOGY (MDBT 13)

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 pharmaceutics & Food and Dairy products etc).

CO 1: Learn the History of microbiology and basic staining techniques.

CO 2: Learn about Nutritional media and various culture techniques.

CO 3: Learn the importance of sterilization and about chemotherapeutic agents.

CO 4: Learn about microbial diversity and some assay techniques.

CO 5: Learn various classification of microbial diversity and itssignificant uses.

UNIT- I

History of Microbiology - Classification of microorganism – Kingdom - Protista, Prokaryotic and eukaryotic microorganisms, Five kingdom concept of classification, Archae bacteria, Eubacteria and eukaryotes. Microscope - Light field, Dark field, Fluorescent and Electron microscope, Prokaryotic and Eukaryotic cell structure. Staining techniques - Simple and Differential staining.

UNIT II

Nutritional classification of bacteria, Isolation, cultivation, enumeration and preservation of microbes; Culture media and its types - Pure culture technique - Growth curve; Axenic culture, Synchronous culture, Continuous culture; Effect of physical and chemical factors on microbial growth.

UNIT- III

Sterilization and Disinfection: Moist heat, Dry heat, Radiation, Filtration, Phenols, Halogens, Phenol coefficient method. Antibiotics - Inhibitors of Nucleic acid, protein and cell wall synthesis. Chemotherapeutic agents - Anti microbial susceptibility test.

UNIT IV

Microbial diversity- methods to assess microbial diversity, Culture dependent and culture independent methods. Molecular analysis of bacterial community; Denaturating Gradient Gel Electrophoresis (DGGE), Terminal Restriction Fragment Length (TRFL) Polymorphism (T-RFLP), Amplified Ribosomal DNA and Restriction Analysis (ARDRA).

UNIT- V

Microbial community in natural habitats – air, water, soil, food and milk. Food and milk borne diseases, Extremophiles- habitant & Classification, Halophiles, Thermophiles,

Alkaliphiles, Acidophiles, Biotechnological applications of Extremophiles.

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 hallpublishers,2003.

6. Fundamentals of Microbiology ,Alcamo I. E, 6thEd, Benjamin –Cummings publishing Company ,Inc2001.

7. Microbiology ecology- fundamentals and applications .R. M. Atlas andR.Bartha,2000

8. Fundamentals principles of bacteriology .A.J. sale Tata McGraw – Hill Publishing company limited, Newdelhi,1999

9. Medical microbiology D.Greenwood ,R.Slack and J.Peutherer.ELST with Churchill Livingstone, Hongkong,1997.

10. Molecular biology and biotechnology .Robert A. Meyers, Wiley India pvtLtd,1995.

11. Microbiology .M.J.Pelzer Jr,E.C.S chan and N.R. Kreig.McGraw Hill,Inc, NewYork,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 (MDBT 15)

Lab in biochemistry

1. Determination of Chl.a, Chl.b& total Chl. By Arnonmethod.
2. Estimation ofCarbohydrates
3. Estimation of salivary amylase activity in relation to,substrate/pH/Temperature
4. Estimation of blood glucose &urea
5. Estimation ofLDH.
6. Estimition of total serumproteins
7. Estimation of creatinine in urine.
8. Paper / thin layer chromatography

Lab in Cell and Molecular biology

9. Isolation of Genomic DNA fromE.coli
10. Isolation of plasmid DNA fromE.coli
12. Elution & quantification of DNA from agarosegel.
13. Preparation of competent cells andtransformation
14. PCR
15. Isolation of Total RNA frombacteria
16. Synthesis of cDNA by Reverse transcription polymerase chainreaction

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 ,NewYork,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 universitypress,2010.

Practical II Microbiology (MDBT 16)

1. Sterilizationtechniques
2. Preparation of culture media(Selective and Enrichedmedia)
3. Staining techniques- Simple, Differential, Negative staining and Motilitystudies
4. Determination of Bacterial growthcurve
5. Enumeration of bacteria from environmental samples- soil, water, air andmilk.
6. Pure culture techniques - Streak, pour plate and spreadplate.
7. Biochemical tests for identification of bacteria (IMViC, TSI, Catalase,Oxidase)
8. Antimicrobial assay, phenol coefficient, agar plate sensitivitymethod.
9. Water quality analysis - MPNmethod.
10. Milk quality analysis – MBRTmethod

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, Panimapublishers.

7. Bergey's Manual of Determinative Bacteriology. Ninth Edition J.G.Holt, N.R.Krieg.,Lippincott Williams, Wilkin publishers, 2000.

ELECTIVE1: MEDICAL LABORATORY TECHNOLOGY (MDBT 14A)

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.

CO 1: Learn basic concepts of General lab techniques and quality control.

CO 2: Learn how to collect sample for urine and fecal and perform basic test.

CO 3: Learn the concepts of interpretation of results by performing lab tests.

CO 4: Learn the basis of Histology and performs sectioning of tissues.

CO 5: Learn the concepts of blood grouping, identifies blood group and understands blood banking procedures.

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 biospsy 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 antibodiespreparation 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.2010TataMcgraw-Hill publishing companylimited.

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-Ranmniksood.jaypee2006.

5. Laboratory manual in biochemistry-Jayaraman New Age International Pvt Ltd publishers2011.

ELECTIVE 1: VIROLOGY (MDBT-14B)

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

CO 1: Learn basic classification of viruses and its cultivation procedures.

CO 2: Learn to perform viral diagnostic procedures and techniques.

CO 3: Learn the concepts of viral cycle and understands ways to detect plant viruses.

CO 4: Learn classification of virus, pathogenesis and mechanism involved in transmission.

CO 5: Learn the concept of viral vaccines and its mechanism of action and drug resistance

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: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 Immunohistochemistry. Nucleic acid based diagnosis: Nucleic acid hybridization, PCR, microarray and nucleotide sequencing, LINE probeassay.

UNIT III

Bacterio phages and plant viruses: Bacteriophage: 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 drugresistance.

References:

1. Flint S.J., V.R.Racaniollo ,L.W.Enquist, V.R.Rancaniello,A.M.Skalka ,(2003),principle of virology:Molecular Biology , pathogenesis, and control ofanimal Viruses, American society Microbiology, Chapters3-13

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4. International Congress on Taxonomy of Viruses;http://WWW.ncbi.nlm.nih.gov/ICTV

5. Knipe David M.,PeterM.Howley, Diane E.Griffin,Rober t A.Lamb,Malcolm A. Martin,BernardRoizman, Stephen E .Straus,(2007),Field's Virology, 5thEd. Lippincott Williams&Wilkins

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7. Plotkin Stanley A.,WalterA.Orenstein, (2003), Vaccines Elsevier HealthSciences

8. Tyring. Stephen K.(2004),Antiviral Agents, vaccines, and Immunotherapies,Marcesl Dekker

9. Timbury MC.(1994)Medical Virology X Edition. ChurchillLivingston.

ELECTIVE 1: BASIC ANALYTICAL METHODS (MDBT 14C)

Objective: To provide knowledge of various analytical techniques in biological research

CO 1: Learn basic techniques and principles involved in analytical instrumentation.

CO 2: Learn to perform various chromatography techniques.

CO 3: Learn the concepts of centrifugation and blotting techniques.

CO 4: Learn about electrophoresis techniques and its types.

CO 5: Learn the basis of isotopic techniques and microscopic handling and its uses.

UNIT I

Electrochemical techniques- basic principles- The pH electrode- Ion-selective gas-sensing and oxygen electrodes- Elementary details of biosensors. Beer – Lambert law, light absorption and its transmittance. Basic principles & brief outline of instrumentation of UV-Visible Spectroscopy: Infrared Spectroscopy, NMR. Mass spectrometry. Spectrofluorimetry, Flame photometry, Atomic absorption spectrophotometry– Principles, instrumentation and applications

UNIT II

Introduction & classification of chromatography. Theory, instrumentation & applications of Column chromatography, TLC, Paper chromatography, GC, HPTLC and HPLC - detection methods and systems qualitative and quantitative aspects applications.

UNIT III

Centrifugation- basic principles-instrumentation-centrifugation units, Nature of particles-centrifugation methods and accessories - sedimentation velocity-sedimentation equilibrium-cell fractionation method. Differential, density gradient, isopyenic and equilibrium centrifugation. Preparative and analytical ultracentrifugation techniques. Isoelectric focusing- blotting methods-western- southern and northern- application- methods in life sciences and biotechnology.

UNIT IV

General principles. Factors affecting the migration rate – sample, electric field, buffer and supporting medium. Tiselius moving boundary electrophoresis. PAGE. SDS– PAGE. Immunoelectrophoresis. Cellulose acetate membrane electrophoresis. Agarose gel electrophoresis.

UNIT V

Radioisotopic techniques: Introduction to radioisotopes, Detection, Measurement and uses of radioisotopes, Counting efficiency and autoradiography, Biotechnological

applications Microscopy: Principles of microscopy, Fluorescent, Transmission and Scanning electron microscopy, Confocal microscopy, Microtomy and analysis and measurement of images.

References

1. Principles and Techniques of Practical Biochemistry (Paperback) by KeithWilson (Editor), John Walker (Editor), John M. Walker (Author) " Fifth Edition2000
2. Introductory Practical Biochemistry (Hardcover).by S. K. Sawhney; RandhirSingh (Editor) 2005
3. Principles of Physical Biochemistry (2nd Edition) by Kensal E van Holde,Curtis Johnson, and PuiShing Ho (Hardcover – April 16,2005)
4. Physical Biochemistry: Applications to Biochemistry and Molecular Biologyby David M. Freifelder (Paperback – Aug 15,1982)
5. Instrumental Methods of Chemical Analysis by G R Chatwal and S KAnand (Hardcover – Jun1980).

ELECTIVE 1: FOOD &NUTRITION (MDBT 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

CO 1: Learn basic concepts of nutrition and dietary and malnutrition

CO2:Learn concepts of macro and micronutrients, vitamins and minerals.

CO 3: Learn the importance of BMR and nutritive value of food according to ages

CO 4: Learn the facts behind food adulteration and remedies to overcome it.

CO 5: Learn about food preservation and food processing techniques.

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 colorimeter, 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 flood spoilage ,,types of food spoilage, food preservations, food processing – different types, sterilizations & pasteurization

References:

1. Seemayadav: - Food Chemistry, anmol publishing (P) Ltd, NewDelhi

2. Car H.Synder: -the extraordinary chemistry for ordinary things, John Wiley & sonsinc, NewYork,1992.

3. B.S ivasankar – food processing and preservation – PHI learni9ng (P) LTD , New Delhi – 11001.

SEMESTER II

PAPER 4: IMMUNOLOGY (MDBT 21)

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

CO 1: Learn basic concepts of immunology and cells involved in immune response.

CO 2: Learn concepts of Antigens and antibodies and their types.

CO 3: Learn various antigen-antibody reaction techniques and their significance.

CO 4 : Learn basis of cytokines, MHC, HLA, Hypersensitivity and concept of Autoimmunity.

CO 5: Learn the principles of insitu techniques and vaccine techniques.

UNIT I

Introduction to the study of Immunology: Historic perspective, Overview and Concepts, Humoral and cellular- Mediated Immunoresponses. Components of immunity, Innate and Adaptive immunity, Cells and Tissues of the 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. Haematopoiesis and differentiation, lymphocyte trafficking.

UNIT II

Antigens and Immunogenicity. Nature of Antigens and antibodies. Theories of Antibody formation. Antibody structure, structural basis of Antibody diversity; Immunoglobulin as Anitgen, Properties of immunoglobulin and subtypes.

UNIT III

Antigen - Antibody Reaction, Strength of Antigen and Antibody reaction, Cross reactivity, Precipitation and Agglutination reactions, Radioimmunoassay and ELISA. B-cell generation, activation and differentiation. Antibody production, Regulation and Diversity.

UNIT IV

Cytokines: structure of Cytokines; function of Cytokines. Complement and its role in Immune Responses. Complement fixation. Structure and function of MHC class I and II molecules - antigen recognition and presentation, HLA typing, Cellular Immunity, 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. Immunological techniques for identification of infectious diseases : immune-electrophoresis, western blot, flowcytometry and immune-fluorescence microscopy including *in situ* localization techniques such as FISH and GISH.

References

1. Immunology (7thed) J.Kuby ,W.H freeman and company , newYork.2013
2. Basic immunology updates ed: functions and disorders of immune system (3rded). abulk.abbas, Andrew H.HLictman ,saunders publishers , newYork,2010
3. Immunology: an introduction (4th) I.R Tizard, saunders college publishers, newYork.
4. Essential immunology (11thed).peter delves,seamusmartin,dennjis burton, Ivan Roitt, Wiley – Blackwell publication, Singapore,2006
5. Immunology (Lippincotts illustrated reviews series) thaodoan, roger melvold, susanviselli, Carl Waltenbaugh, Lippincott Williams & Wilkins publications2012
6. Fundamental immunology (7thed) William e Paul, Lippincott Williams & Wilkins publications,2012
7. Essentials of clinical immunology (6thed) Helen chapel ,Manselhaeney, Sirajmisbah, Neil snowden, Wiley-Blackwell publications,2014
8. Monoclonal antibodies principles and practice(3rded) W.Goodings, academic press,2010
9. Monoclonal antibodies :P methods and protocols (2nded) .Vincent ossipo, Nicolas fisher, Humana press,2014
10. Essentials of clinical immunology (6thed).Helen chapel, Manselhaeney, ,Sirajmisbah, Neil Snowden, Wiley- Blackwell publications,2014 J.Kuby, 2003, Immunology 5thedition, W.H. Freeman and Company, New york..
11. C.V.Rao. 2002, An Introduction to Immunology, Narosa Publishing House,Chennai.
12. I.R.Tizard, 1995, Immunology: An Introduction , 4th edition , SaundersCollege Publishers, NewYork.
13. I.Roitt, 1994, Essential Immunology, Blackwell Science,Singapore.
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15. Current Protocols in Immunology 3 Volumes, Wiley Publications1994.
16. Monoclonal Antibodies: Principles and Practice, J. W. Goding, 1983. AcademicPress
17. Hybridoma Technology in the Biosciences and medicine, T.A. Springer, 1985. Plenum PressNY.
18. Vaccines, New Approaches to immunization, F.Brown, R.M.Chanock, KA Lerner, 1986. Cold springHarborolab.
19. Topley and Wilson principles of bacteriology, Virology and immunology, G. Wilson, A.Miles, M.T.Paker, 1984. Arnold,Heineman.
20. Basic and Clinical Immunology, D.P. Stities and J.D.Stobo.

PAPER 5: GENETIC ENGINEERING (MDBT 22)

Objective:

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.

CO 1: Learn basic concepts of genetics and enzymes involved in it.

.CO 2: Learn about plasmids, insertion vectors, cosmids and Gene fusion vectors and their types.

CO 3: Learn the concepts gene manipulation and cloning techniques.

CO 4: Learn the principles of recombinant selection and screening.

CO 5: Learn the knowledge of DNA technology in therapeutics and health care.

UNIT I

Tools of Genetic Engineering: Enzymes - endo&exo nucleases, Restriction endonucleases-types, nomenclature, recognition sequences and mechanism of action; Isochizomers, Isocaudomers - star activity, Methylation and modification. Ligases – types (NAD and ATP dependent), mechanism of action. Role of Kinases, phosphotases, polynucleotide phosphorylase, polynucleotide kinases, terminal transferase, Alkaline phosphatase, Reverse transcriptase - Taq polymerase.

UNIT II

Cloning vectors: General characteristics of vectors, Brief account of naturally occurring plasmids. Promoter, MCS, Ori, and Marker genes-lac Z. Construction of pBR 322, pBR325, pBR327, pUC8 , pUC 18 & 19 vectors and Expression vectors, Bacteriophage vectors, Lambda phage, Insertion vectors, Replacement vectors, Cosmids, Phagemids, Mini chromosomes, BAC's, YAC's, Shuttle vectors, Ti plasmids, Vectors for animals-SV40 and Bovine papilloma virus.

UNIT III

Gene cloning strategies and transformation techniques: Chimeric DNA, Cloning strategies-ligation, Transformation and selection, use of adaptors and linkers, Homopolymer tailing in cDNA cloning, genomic DNA libraries, Short gun method, Partial digestion, End modification, Cloning from mRNA- Isolation and purification of RNA, Synthesis of cDNA, Isolation of plasmids, Cloning cDNA in plasmid vectors, Cloning cDNA in bacteriophage vectors. cDNAlibray. Advanced cloning strategies-synthesis and Cloning of cDNA, PCR amplified DNA.

Transformation techniques: Preparation of competent cells, Physical methods - Electroporation, Microinjection, Gene gun, chemical methods - PEG, DEAE, CaCl, calcium phosphate precipitation method, liposome mediated method

UNIT IV

Selection, screening and analysis of recombinants: Genetic selection - Insertional inactivation, Antibiotic Resistant genes, lac Z genes, Blue white screening, α - Complementation, colony hybridization, Immunological screening, Plaque hydridization, Blotting techniques, DNA sequencing - chemical and enzymatic methods, PCR and its variants, Preparation of radiolabelled and non - radiolabelled probes and its applications.

UNIT V

Applications of rDNA technology: Production of vaccines – Hepatitis B, Edible Vaccine, Hormones – Somatotropin, Humulin, Blood clotting factor VIII , Interferons, Diagnostics of inherited disorders and infectious diseases, Gene therapy, ADA- Cystic fibrosis.

References:

1. Nicholl D.S.T. Introduction to Genetic Engineering Cambridge (3rd Ed.) Universitypress.UK. 2008
2. 2. Old R.W., Primrose S.B. Principles of gene manipulation - An introduction to genetic engineering (5th Ed.), Blackwell Scientific Publications, UK.1996.
3. David S L. Genetics to Gene Therapy – the molecular pathology of human disease (1st Ed.) BIOS scientific publishers, 1994.
4. Ernst-L Winnacker, From Genes to Clones: Introduction to Gene Technology. WILEY-VCH Verlag GmbH, Weinheim, Germany Reprinted by Panima Publishing Corporation, New Delhi. 2003
5. Benjamin Lewis, Genes VIII (3rd Ed.) Oxford University & CellPress,NY.2004
6. Robert Williamson.Genetic Engineering (1st Ed.) AcademicPress.1981.USA
7. Rodriguez. R.L (Author), Denhardt D.T. Vectors: A Survey of Molecular Cloning Vectors and Their Uses (1st Ed.) Butterworth-Heinemann publisher.UK.1987
8. Ansubel F.M., Brent R., Kingston R.E., Moore D.D. et al. Short protocols inmolecular biology(4th Ed), Wiley publishers. India.1999.
9. Sambrook J et al. Molecular cloning Volumes I, II and III. Cold Spring Harbor laboratoryPress, New York, USA. (1989,2000)
10. Terence A Brown. Genomes, (2nd Ed.) BioScientificPublishers.UK.2002
11. Anthony JF Griffiths, William M Gelbart, Jeffrey H Miller, and Richard C Lewontin Modern Genetic Analysis (1st Ed.)W. H. Freeman Publishers.NY. 1999
12. S. B. Primrose, Richard M. Twyman.Principles of gene manipulation and genomics (7thEd.) John Wiley & Sonspublishers.2006

PAPER 6: GENETICS (MDBT 23)

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

CO 1: Learn basic concepts of genetics and mendelian inheritance.

.CO 2: Learn about basis of blood grouping and inheritance in drosophila and man.

CO 3: Learn the concepts of sex linkage in drosophila and man.

CO 4: Learn the principles of genetic code, concept of operon and mutation and its types.

CO 5: Learn the knowledge of genetic engineering and simple laws.

Unit I

History of Genetics: Definition and scope of Genetics- Pre-mendelian genetic concepts. Basis of Mendelian Inheritance and Mendelian genetics. Simple Problems Relating to Inheritance. Structure of gene-Interaction of Gene-Commentary factors, Supplementary factors, Inhibitory and lethal Factors-Atavism. Chromosome theory of linkage, crossing over, recombinations and mapping of genes onchromosomes

Unit- II

Blood Groups and their Inheritance in Human – Linkage and Crossing Over:- Drosophila – Morgans' Experiments – Complete and Incomplete Linkage, Linkage Groups, Crossing Over types, Mechanisms – Cytological Evidence for Crossing Over, Mapping of Chromosomes – Interference and Coincidence.

Unit-III

Sex Linkage in Drosophila and Man, Sex influenced and Sex Limited Genes – Non-Disjunction and Gynandromorphs – Cytoplasmic Inheritance – Meternal Effect on Limnaea(Shell Coiling), Male Sterlity (Rode's Experiment). CO_2 sensitivity in Drosophila, Kappa particles in Paramecium, Milk factor Mice.

Unit-IV

Nature and Function of Genetic Material – Genetic code – Why the genetic code is comma less, non ambiguous, degenerate triplet code. Fine Structure of the Gene – Cistron, Recon, Muton – Gene Regulation – Operon Concept – Lac Operon – Positive and Negative Regulation. Mutation – Molecular Basis of Mutation, Types of Mutation, Mutagens, Mutable and Mutator Genes. Chromosomal Aberrations – Numerical and Structural Examples from Human.

Unit-V

Genetic engineering – Objectives, tools, gene cloning, and gene isolation. Transgenic plants and animals, Animal Breeding – Heterosis, Inbreeding, Out Breeding, Out Crossing, Hybrid Vigour. Population Genetics- Hardy Weinberg Law – Gene Frequency, Factors Affecting Gene Frequency, Eugenics, Euphenics and Ethenics, Bioethics.

References:

1. Gunther, S. Stent, 1986. Molecular Genetics. Macmillan PublishingCoInc. 773pp.
2. Goodenough, V., 1978. Genetics, 2nded., New York Holt, Rinchart and Winston, 894 pp.
3. Hart,D.L.andD.Freifelder,188.BasicGenetics,John&BarletPublishers, 505 pp.
4. Garder, 1972. Principles of Genetics, Wiley Eastern Pvt. Ltd. 590pp.
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6. Winchester, 1967. Genetics, Oxford IBH Publications, 504pp.
7. Stickberger, 1968. Genetics, Macmillan Publications, New York, 914pp.
8. Verma, P.S. and V.K. Agarwal, 1995. Genetics, 8thedition, S. Chand & Co., New Delhi – 110 055, 580pp.

PAPER 7: BIOINFORMATICS (MDBT 24)

Objective: to provide information an 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 bindings sites, discovering common functions of co-expressed genes, metabolic pathways, signal transductionpathways.

CO 1: Learn basic concepts of data bases and its types.

CO 2: Learn concepts of algorithm and its significance.

CO 3: Learn the concepts of Gene expression analysis tools.

CO 4: Learn the concept of proteomic analysis tools.

CO 5: Learn the principles of pathway bioinformatics and web based tools.

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 andpresentation.

Reference :

1. Bioinformatics and functional genomics (2nded). Jonathan Pevsner, Wiley Blackwell publications2009

2. Introduction to bioinformatics (4thed).Arthur M .lesk ,oxford university press(UK),2013

3. Bioinformatics for biologists. Pavalpevzner, ron Shamir, Cambridge university press.2011.

4. practical bioinformatics (1sted).Michael Agostino ,Garland sciencepublication,2012

5. Exploring informatics (2sted) .Caroline St.clair, Jonathan E.Visick , Jones &Barlett learning,2013.

6. Bioinformatics : sequence and genome analysis(2nd) David mount, cold spring harbor laboratory press2013.

7. Bioinformatics and molecular evolution .Paul G.Higgs, Teresa K.Attwood, Wiley – Blackwellpublication,

8.instant notes in bioinformatics (2nded).Charlie Hodgman, Andrew French, David West head, Taylor &francis,2009.

9. next-generations DNA sequencing informatics. Stuart M. Brown, cold spring harbor laboratorypress,2013

10. from genes to genomes: concepts and applications of Dddna TECHNOLOGY (3rdEd).Jeremy W.Dale, Malcom von Schantz, Nicholas plant, Wiley publications,2011

PRACTICAL III: LAB IN IMMUNOLOGY (MDBT 26)

1. Bloodgrouping
2. Lymphocyte subset identification andenumeration.
3. Radial immuno-diffusiontest.
4. Ouchterlony doublediffusion
5. Immunoelectrophoresis
6. Rocket Immunoelectrophoresis
7. LatexAgglutination
8. Quantitative Precipitinassay
9. Complement fixationtest
10. ELISA
11. WesternBlotting
12. Antigen-antibody reaction (precipitation and agglutination reactiontests).

References:

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 Archanaayyagari. McGraw-Hill education, 2008.

4. Practical immunology .RabindraNarain, dom& wisdompublications,2012

PRACTICAL IV

LAB IN GENETIC ENGINEERING AND BIOINFORMATICS (MDBT 27)

GENETIC ENGINEERING

1. Isolation of genomic DNA from the given sample and its molecular weightdetermination
2. Isolation of RNA from the given sample and its molecular weightdetermination
3. Isolation of plasmid DNA from the givensample
4. Restriction digestion of Lambda phageDNA
5. Ligation of DNA and analysis byelectrophoresis
6. DNA amplification by PCR andRAPD
7. Preparation of competent cells and transformation by CaCl2 method and Selectionof transformed colony by X-Galmethod
8. Determination of molecular weight of proteins by SDSPAGE

BIOINFORMATICS

1. Restrictionmapping
2. PCR PrimerDesigning
3. ORFfinding
4. Homologysearch
5. Multiple sequencealignment

ELECTIVE 2: ENZYME TECHNOLOGY (MDBT 25A)

Objective: To provide knowledge of various enzymes and enzyme technology applied in the industries.

CO 1: Learn about enzymes and its classification.

CO 2: Learn concepts of enzyme catalysis and activity.

CO 3: Learn the concepts of extraction and purification of extracellular and intracellular enzymes.

CO 4: Learn about various enzyme inhibition process and their significance.

CO 5: Learn about various enzyme immobilization techniques.

CO 6: Learn about enzyme applications in clinical and therapeutic use.

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 quartenery 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 enzymes 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 an 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 pureenzymes.

UNIT IV

Enzymes 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 enzymes 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 importantenzymes.

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 publishingseries.
2. Fundamentals of Enzymology by price and Stevens (2002): Oxford UniversityPress.
3. Enzyme Technology by Helmut Uling (1998): JohnWiley.
4. Introduction to proteins Structure by Branden and Tooze (1998): GarlandPublishing Group.
5. Methods in Enzymology. Volume 22-Enzyme purification and related techniques. Edited by William B. Jakoby. Academic press, NewYork.
6. Allosteric Enzymes-Kinetic Behaviour. 1982. By B.I .Kurganov ,John Wiley and Sons. Inc., NewYork.
7. Biotechnology . Volume 7 A- Enzymes in Biotechnology. 1983 Edited by H.J.Rehm and G.Reed. VerlagChemie.
8. Enzymes as Drugs Edited by John S. Holcenberg and Joseph Roberts, John Wiley& sons NewYork.
9. Methods of Enzymatic analysis by Hans Ulrich, Bergmeyer, AcademicPress.
10. Methods in Enzymology by W.A.Wood, AcdemicPress.
11. Advances in Enzmology by Alton Meister, InterscicencePublishers.
12. Topics in Enzyme and Fermentation Biotechnology by L.N. Wiseman ,John Wileyand sons.

ELECTIVE 2: DAIRY TECHNOLOGY (MDBT 25B)

Objective: to impart current knowledge of basic and applied microbiological aspects offluid milks and dairy products for improved quality and foodsafety.

CO 1: Learn about microbes in milk and during production, collection and transformation.

CO 2: Learn concepts of microbiological processing techniques.

CO 3: Learn the concepts of milk quality and factors affecting milk quality.

CO 4:Learn the microbiological standards of dairy foods.

CO 5: Learn the knowledge of milk borne diseases and its prevention

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 dairyfoods.

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 ofchemistry, Cambridge.

2. Andrews AT, Varley J(1994) biochemistry of milk products. Royal society ofchemistry.

3. BanwartGJ(1989),basic food microbiology, Chapman & hall, new York.

4. Frazier WC and Westh off DC.(1988) food microbiology, TATA McGraw hill publishing company Ltd. NewDelhi.

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, NewDelhi.

7. Robinson RK. 1990.the microbiology of milk. Elsevier applied Science.London

8. Edward Harth ,J.T.Steele. Applied dairy microbiology .1998. Marcel DeekerInc.

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 York10016.

ELECTIVE 2: PHARMACEUTICAL TECHNOLOGY (MDBT 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.

CO 1: Learn about drug structure and features.

CO 2: Learn the responsiveness to drug and performs drug potency.

CO 3: Learn the concepts of genetically engineered drugs.

CO 4: Learn various mechanism of different types of drugs.

CO 5: Learn the knowledge of novel drug strategy.

UNITI

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. Tachyphylaxis, 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- drugsresistance.

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 screeningstrategies.

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's1980.

3. Pharmacology and pharmaco therapeutics – R.S.Satoskar. S.D.Bhandhhakar&S.S.Anilapure popular PrakasharBombay.

4. Principles of medical chemistry – William O. Foge. B.I. WaverksPvt Ltd, NewDelhi.

5. Oxford text books of clinical pharmacology and drug therapy. D.G.Burger's Medical chemistry & drugdiscovery.

6. Principles and practice – Manfred. E. Wolf John Wiley andsons.

ELECTIVE 2: GENOME TECHNOLOGY (MDBT 25D)

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

CO 1: Learn about various microbial genes and genomes arrangement.

CO 2: Learntechniques of interpretation of data in genes and genomes.

CO 3: Learn the concepts of phylogenetics and its significance.

CO 4:Learn about genomic library and its analysis.

CO 5: Learn the concept of omics and understand about gene networks.

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.

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.

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.

UNITV

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 ofnetworks.

References:

1. From genes to genomes: concepts and applications of DNA technology .JeremeyW.Dale, Malcom von schantz, Nicholas plant Wiley; 3 ed,2011
2. Molecular cell biology, Harvey lodish, W. H. freeman; seventh Ed2012
3. Gene and genome synthesis : technologies and applications .jingdongtian, crcpr L1c;1 edition2014.
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 booksinc.
6. Human genetics, a. Gardener. R.T.Howell and T.Davies. published by VinodVasista for viva books Privateltd.
7. Hartl, D.L.A Primer of populations genetics, III Ed. Sinauer associates Inc. Sunderland 2000

SEMESTER III

PAPER 8: PLANT BIOTECHNOLOGY (MDBT 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.

CO 1: Learn about various genome organization in plants.

CO 2: Learn about various types of culture media and cryopreservation techniques.

CO 3: Learn different types of vectors and concept behind plant genetics.

CO 4: Learn about various techniques behind gene transfer in plants.

CO 5: Learn the uses of transgenesis and concept of molecular pharming.

UNIT – I Genome 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; Somaclonal variation; Micropropagation; 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 Antibiotic resistance marker and reporter genes GUS gene, Lux gene and GFP protein. Transgene 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 freetransformation.

UNIT-V
Application of transgenesis in crop improvement: Insect resistance, disease resistance, virus resistance,herbicide resistance, and resistance to biotic &abioticstress. Transgenesis for male sterility and terminator seed. Transgenesis for quality improvement: Protein, lipids,

carbohydrates, 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. Slater A, NW Scott, MR Fowler. Plant bio technology, Oxford University Press,2003
2. Hans Walter Heldt. Plant Biotechnology & Molecular Biology, Oxford University Press, 1997
3. Nigel W. Scott, Mark R. Fowler,Adrian Slater. Plant Biotechnology: The genetic manipulation of plants 2nd Edition 2nd Edition, Oxford University Press,2008
4. J. Hammond, P. McGarvey,V. Yusibov. Plant Biotechnology: New Products and Applications 1st ed. Springer1999.
5. Bob Buchanan,Wilhelm Gruissem, Russell Jones. Biochemistry & Molecular Biology of Plants. I.k. International Pvt. Ltd,2007.
6. Robert J. Henry. Practical Applications of Plant Molecular Biology. Routledge Chapman & Hall,1997.
7. Introduction to Plant Biotechnology by H.S. Chawla, 2002. Oxford and IBH P Publishing Co.Pvt. Ltd. NewDelhi.
8. Plant molecular genetics by Monica. A. Hughes.1999. Pearson Education limited, England.
9. An introduction to genetic engineering in plants, Mantel S.H, Mathews J.A. Mickee R.A.1985. Blackwell Scientific Publishers.London.
10. Scott and Mark R. Fowler, 2003, Oxford University press, UK. 11. Molecular Plant Biology: A practical approach (Vol. I and II), Edited by Gilmartin and Bowler, 2002, Oxford University press,UK.
11. In Vitro culture of higher plants by R.L.M. Pierik, 1987. MartinusNijhoffPublisher, Dordrecht.
12. Gonzales.1994.Oxford University Press. Oxford. 4. Plant Molecular Biology by Donald Grierson and S.V. Convey.1984. Blackie andSon.
13. Plant cell culture. A practical approach. Second edition. Edited by R.A. Dixon andR.A.

PAPER 9: ANIMAL BIOTECHNOLOGY (MDBT 32)

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

CO1 : Learn about technique of culturing cells.

CO 2: Learns the nutrient supplements required for cell growth and cloning techniques.

CO 3: Learn the concepts of gene transfer and its potential applications.

CO 4:.Learn various mechanism behind production of vaccines.

CO 5: Learn the knowledge of cytotoxicity and apoptosis.

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.

UNITV

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, 3rdEdition, R. Ian Freshney . A John Wiley & Sons, Inc.,publications.
2. Animal Cell Culture – Practical Approach, R.W. Masters, Oxford. AnimalCell Culture Techniques. Ed. Martin Clynes, Springer.
3. Biotechnology by Kashav. T (Wiley EasternLtd).
4. Animal Cell Biotechnology; Methods and protocols, Nigel Jenkins, HumanaPress.
5. Biotechnology of Animal Tissue. P.R. Yadav & Rajiv Tyagi, 2006. Discovery publishing House. NewDelhi.
6. From Genes to Clones Introduction to Gene Technology – Winnacker, E.L.1987., Panima Educational Book Agency, NewDelhi.
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. 7thEdition. Blackwell PublishingCompany.
9. Recombinant DNA Second Edition – James D. Watson, Micheal Gilman, MarkZoller, 2001. W.H. Freeman and Company, NewYork.
10. Biotechnology, Satyanarayanan .U, (2008), Books and Allied (p)Ltd.

PAPER 10: MICROBIAL BIOTECHNOLOGY (MDBT 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.

CO 1: Learn about scope behind industrial based biotechnology engineering.

CO 2: Learn the concept of fermentation technology and its types.

CO 3: Learn principles of downstream processing and its uses.

CO 4:Learn various methods of immobilization and biotransformation techniques.

CO 5: Learn the concept of commercial important products and its significance.

UNIT I

Scope and importance of bioprocess engineering technology, Development and strain improvement of industrially important microorganisms. Bioreactors: Typical structure of advanced bioreactor and their working mechanism; Design features - Heat transfer and Mass transfer; Specialized bioreactors- design and their functions; Airlift bioreactor, Tubular bioreactors, Membrane bioreactors, Tower bioreactors, Fluidized bed reactor, Packed bed reactors and Photo bioreactors.

UNIT II

Fermentation technology: Natural and synthetic media; Strategies for media formulation, sources of carbon, nitrogen, vitamins and minerals. Role of buffers, precursors, inhibitors, inducers and antifoam agents. Types of fermentation process-submerged fermentation, surface or solid state fermentation, batch fermentation, continuous fermentation, kinetics of fermentation process, bioprocess control, monitoring of variables-temperature, agitation, pH and pressure.

UNIT III

Downstream processing: cell disruption, precipitation methods, solid-liquid separation, liquid-liquid extraction, filtration, centrifugation, chromatography, drying devices (Lyophilization and spray dry technology), crystallization-biosensors-construction and applications

UNIT IV

Immobilization and Biotransformation: Methods of immobilization - adsorption, crosslinking, ionic bonding, entrapment, encapsulation; Advantages and industrial applications of Immobilization of enzymes and whole cells. Biotransformation of antibiotics, steroids and their applications.

UNIT V

Production of Industrially important products: Alcohol- Ethanol, glycerol, butanol, Acetone; Organic acids- citric, acetic, and gluconic acid; Amino acids- lysine, glutamic acid; Antibiotics- penicillin, streptomycin, tetracycline; Vitamins- riboflavin; Enzymes- amylase, protease; biodegradable plastic- polyhydroxyalkanoates (butyarate, propionate).

References:

1. Jackson AT., Bioprocess Engineering in Biotechnology, Prentice Hall,Engelwood Cliffs,1991.
2. Shuler ML and Kargi F., Bioprocess Engineering: Basic concepts, 2ndEdition, Prentice Hall, Engelwood Cliffs,2002.
3. Stanbury RF and Whitaker A., Principles of Fermentation Technology,Pergamon press, Oxford,1997.
4. Mansi EMTEL, Bryle CFA. Fermentation Microbiology and Biotechnology,(2nd Ed). Taylor & Francis Ltd, UK, 2007.
5. Colin Ratledge and Bjorn Kristiansen, Basic Biotechnology (2ndEd.).Cambridge University Press.2002.
6. Prescott, Sc and Dunn, C. Industrial Microbiology, McGraw Hill, New York.1984
7. Michael, L. Shulers and FikretKargi. Bioprocess Engineering: Basic concepts(2nd Ed.) Prientice Hall Publishers.2001
8. Paulins, M. D. Bioprocess Engineering Principles. John WileyPublishers.

PAPER 11: ENVIRONMENTAL BIOTECHNOLOGY (MDBT 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.

1.CO: Learn aboutconcepts of Global warming and biological environment pollution control measure.

2.CO: Learn about different waste treatments and composting techniques.

3.CO: Learn the concepts of bioremediation ,its types and its applications.

4.CO:.Learn various microbial recovery techniques and its uses.

5.CO: Learn various techniques of biodegradation and concept of bioenergy.

UNIT-I

Environmental pollution: Basic concepts and global issues-Global warming & Acid rain. Pollution measurements- air and water. Biosensor in environmental monitoring. Bioremediation of environmental pollutants in soil and water- oils, heavy metals and detergents. Biofouling and Biosensors.

UNIT-II

Waste treatment: Waste water treatment: Physical, chemical and biological treatment processes. Various industrial effluent treatment methods- Sugar, distillery, dairy, tannery and pharmaceutical industries. Solid wastes: Types and characteristics. Solid waste disposal- land filling, incineration. Biogas from solid waste. Composting and vermicomposting. Monitoring parameters for composting.

UNIT-III

Bioremediation: Introduction of Bioremediation advantages and applications; Types of bioremediation. Microbial remediation of phenolics-sewage nutrients (phosphate and nittare). Impact of bioremediation in petroleum industry, paper industry, marine oil pollutants and chemical industry. Phytoremediation advantages and applications (agriculture).

UNIT-IV

Biocorrosion and microbial mediated recovery: Microbial corrosion and its control (petroleum industry and cooling tower system). Bio metallurgy- Bioleaching- application, biotechnology approaches for heavy metal elimination from effluents. Bio-mediated recovery of metals (gold and platinum). Recovery of petroleum-MEOR- Biosurfactant.

UNIT-V

Biodegradation: Biodegradation of organic pollutants: Mechanisms and factors affecting biodegradation. Pollution problems and biodegradation of simple aliphatic, aromatic, polycyclic aromatic hydrocarbons, halogenated hydrocarbons, azo dyes, lignin and pesticides.Bioenergy.

References

1. Murugesan AG and Rajakumari C. (2005). Environmental Science and Biotechnology: theory andTechniques.
2. Sharma PD. (1994). Environmental Biology, RastogiPublications.
3. Eugenia J.Olguin. (2000). Environmental Biotechnology and cleaner Bioprocesses, Tayloir and Francis.
4. Beech IB and Gaylarde CC (1999). Recent advance in the study of biocorrosion- an overview. *Rev Microbial* **30**, 177- 190.
5. Booth GH (1971). Microbiological corrosion, M and B monographs CE11, Mills and Boon,London.
6. Agarwall KV. (2005). Environmental Biotechnology, NidhiPublishers.
7. Jogdand SN.(2008).Environmental Biotechnology, 4th Edition, Himalaya Publishing House Pvt.Ltd.

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

Plant Biotechnology

1. Introduction to plant tissue culture-induction of callus and suspensioncultures.
2. Isolation and purify the protoplasts and check itsviability.
3. Induction of somatic embryogenesis and analysis of differentstages.
4. Extract the genomic DNA from plants byCTAB
5. Culture and selection of *Agobacterium*on Agarmedium
6. *Agrobacterium* mediated genetransformation
7. Use of Agroinfilteration for Transient Expression inPlant
8. Gusassay
9. Analysis of WT/ Transgenic plant byPCR
10. Isolation of Total RNA fromleaves
11. Gene gun method oftransformation
12. Synthetic seedpreparation

Lab in Animal Biotechnology

1. Development of primary cell lines/maintenance of established celllines.
2. Cell counting and cellviability.
3. Trypsinization of monolayer and subculturing.
4. Gene transfer bytransfection
5. Preparation of metaphase chromosomes from culturedcells.
6. Isolation of DNA and demonstration of apoptosis of DNAladdering
7. MTT assay for cell viability andgrowth

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 andBowler. 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, 3rdEd). Victor M. Loyola-Vargas, Neftali Ochoa-Alejo. Humana Press,2012.
6. Plant Cell, Tissue and Organ Culture: Fudamental Methods (Springer Lab Manuals). Oluf L. Gamborg (Editor), Gregory Phillips (Editor), Springer,2013.

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

Microbial Technology

1. Study of fermentor-Demonstration.
2. Production and isolation of antibiotics (Penicillin andStreptomycin)
3. Production and analysis of Single cell protein (Spirullina andyeast)
4. Production of yoghurt and estimation of lacticacid.
5. Estimation of percentage of alcohol of givensample
6. Production and assay of α-amylase from *Aspergillusniger*by solid substratefermentation.
7. Immobilization of given enzyme/wholecells
8. Estimation of amount of citric acid in the givensample.

References:

Environmental Biotechnology

1. Water Analysis: Measurement of Total Solids, Total – dissolved solids, Total-suspended solids, dissolved oxygen, total hardness, chloride, turbidity, nitrite, nitrate, fluoride and totalnitrogen.
2. Estimation of COD, BOD of industrialeffluents.
3. Potability test of water (MPNtechnique).
4. Degradation of phenols. Colorimetricassay
5. Estimation of MIC and Heavy metal tolerance of chromium resistantbacteria
6. Screening of Biosurfactant activity-Oil Displacement test-Drop collapsetest
7. Isolation of *Thiobacillusferrooxxidans and Thiobacillusthiooxidans*from metal sulphides, rock and acid minewater.
8. Microbial degradation, decolourzsation and adsorption of organic dyes by free and immobilizedcells
9. Studies on halophiles from sea water (pigmentation and salttolerance)

ELECTIVE 3: GENOMICS & PROTEOMICS (MDBT 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.

CO 1: Learn about various microbial genes.

CO 2:Learn various methods of preparing genomic DNA.

CO 3: Learn the principle of protein separation techniques.

CO 4:Learn various protein micro arrays.

CO 5: Learn the concept of metagenomics and its applications.

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 genefamilies .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 imageanalysis.

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 (Malditoff) 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 DNAII.Craig Nancy, Craigie ,Robert:Gellert, Martin: Lambowitz. Alan M. ASM Press2002.

3. Genomes 2nd ed. Brown.T.A Wiley- Liss, Oxford2002.

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. Gudiograndi.John Wiley&sons,

New York.2004

8. Ge, Benjamin Lewin, Jones and Bartletts Publishers, 2008.

9. Molecular genetics MYOBACTERIA. W.R. Jacobs, ASM press2000.

ELECTIVE 3: BIODIVERSITY (MDBT 35B)

Objective: Enable to understand the inter-relationships between flora and fauna with Environment and their geographical distribution.

CO 1: Learn about basis of Ecosystem and its diversity.

CO 2: Learn various topics related to biodiversity and threats behind it.

CO 3: Learn the principles and challenges behind conservation biology.

CO 4: Learn various types of Environment pollution and its control measures.

CO 5: Learn various water conservation methods and Disaster management .

Unit 1:

Ecosystem concept Introduction and overview of ecosystem ecology - History of ecosystem ecology, Ecosystem structure and functioning, Ecosystem diversity and landscapes, Ecosystem resilience and change, Trophic dynamics and temporal dynamics, Ecological efficiencies, Human induced Ecosystem change, Urban Ecosystem Species effects on ecosystem processes- Overview, Functional type effects, Functional type response, integrating the effects of traits on ecosystems, Species interaction and ecosystem processes, Ecosystem Services.

Unit 2:

Biodiversity and its origin, Global and local trends , Mega biodiversity countries, hot spots and heritage sites, types of diversity, levels of biodiversity (genetic, species, ecological diversities), value of biodiversity. Threats to biodiversity: Mass extinction, global climate change and its impact on biodiversity, ecosystem degradation and loss, habitat fragmentation, overexploitation, exotic and invasive species, deforestation and loss of biodiversity.

Unit 3:

History, guiding principles, conservation challenges and models of conservation biology. IUCN Red list categories and criteria, habitat management and establishment of wildlife corridors and protected areas, bio-indicators. Biosphere reserves, in situ and ex situ conservations (sanctuaries, national parks, zoological parks, botanical gardens, oceanorium). Wild life conservation (Global and Indian) projects – scope and success. Biodiversity and wildlife policies: Biodiversity conventions, biodiversity Act and Rules, Global, National and Regional conservation efforts and legal aspects.

Unit IV

Environmental Pollution- Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution and solid waste management. Environment Protection Act: Air, water, forest and wild life acts, issues involved in enforcement of environmental legislation.

Unit V

Water conservation, Rain water harvesting & watershed management, and environmental ethics. Climate change, global warming, acid, rain, ozone layer depletion. Environmental protection act, population explosion. Disaster management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology, disaster management cycle, and disaster management in India.

References

1. Alcock J 2013 Animal Behavior: An Evolutionary Approach, 10th edition (Sinauer Associates,Inc.)
2. Bolhuis J J and L Giraldeau (eds) 2005 The behaviour of animals (BlackwellPub.)
3. Breed and Moore 2011 Animal Behavior, 1st Edition (Academic Press) 4. Burnse D (ed.) 2001 Animal: the definitive visual guide to worlds' wildlife (Cambridge UniversityPress)
4. Collen B, Pettorelli N, Baillie J E M and Durant S M (Eds) 2013Biodiversity Monitoring and Conservation: Bridging the Gap Between Global Commitment and Local Action(WileyBlackwell)
5. GL. Karia and R.A. Christian, West Water Treatment, Concepts and Design Approach, Prentice Hall of India,2005.
6. Benny Joseph, Environmental Studies, Tata McGrawHill,2005

ELECTIVE 3.NANO BIOTECHNOLOGY (MDBT 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 ofnanotechnology.

CO 1: Learn about basis of nanotechnology.

CO 2: Learn the various nanoparticles and its uses.

CO 3: Learn the concepts of preparation of nanoparticles.

CO 4:Learn various significance of nanoscale applications.

CO 5: Learn the importance of implications 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- Nanoshels – Tectodentrimers 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–potentialbenefitsandriskfor developing countries – intellectual property issues – criticism of Nanotechnology – studies on the implications ofNanotechnology.

References:

1. Parthasarathy, B.K(2007). Introduction to Nano technology ,Ishapublication.

2. Elisabeth Papazoglou and AravindParthasarathy (2007).Bio nanotechnology. Morgan & Claypoolpublishers.

3. Bernd Rehm (2006). Microbial bio nanotechnology: biological self-assembly systems and biopolymer – based nanostructures. Horizon scientificpress.

4. David E. Reisner ,Joseph D. Bronzino (2008). Bio nanotechnology : global prospects.CRC Press.

5. EhudGazit(2006).Plentyofroomforbiologyatthebottom: An introduction to bio nanotechnology.Imperial collegepress.

6. Hari Singh Nalwles , " Nano structured materials and nanotechnology ",2002academic press

7. M.H.Fulekar,2010" Nanotechnology importance and applications ."I.K. International publishing housePvt.

8. Nanotechnology : Global strategies, Industry Trends and applications 2005John Wiley & sonsLtd.

ELECTIVE 3: STEM CELL BIOLOGY (MDBT 35D)

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

CO 1: Learn about basic concept in stem cell biology.

CO 2: Learn the role of stem cells in human cells.

CO 3:Learn various stem cells used for stem cell characterization.

CO 4:.Learn various uses of stem cells.

CO 5: Learn the concept of stem cell banking and its advances.

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, mesenchymal stem cell, cardiac stem cells , planaria stem cells, prostate and breast stem cells, transfoeming growth factor (TGFβ), 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 ofregeneration.

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 andbartett,2003
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SEMESTER IV

PAPER 12: RESEARCH METHODOLOGY (MDBT 41)

Objective: 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.

CO 1: Learn about basis of research and methodology.

CO 2: Learn the concept of research problem and techniques to solve it.

CO 3: Learn the various techniques of research methods and its applications.

CO 4: Learn the techniques of data collection and interpretation.

CO 5: Learn various types of reports and its uses and ethical importance.

UnitI - Objectives and types of research: Motivation and objectives – Research methods *vs* Methodology. Types of research – Descriptive *vs*. Analytical, Applied *vs*. Fundamental, Quantitative *vs*. Qualitative, Conceptual *vs*. Empirical.

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Unit-II - Research Formulation – Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis.

Unit-III - Research design and methods – Research design – Basic Principles- Need of research design — Features of good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis, experimentation. Determining experimental and sample designs. Research techniques-microscopy, HPLC, HPTLC, GC-MS, FTIR, SEM/TEM, NMR andAAS.

Unit-IV - Data Collection and analysis: Execution of the research - Observation and Collection of data - Methods of data collection – Sampling Methods- Data Processing and Analysis strategies - Data Analysis with Statistical Packages - Hypothesis-testing - Generalization and Interpretation.

Unit-V - Reporting and ethics – Structure and components of scientific reports - Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports. Environmental impacts - Ethical issues - ethical committees - Commercialisation – Copy right – royalty - Intellectual property rights and patent

law – Trade Related aspects of Intellectual Property Rights – Reproduction of publishedmaterial – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

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