।। सा विद्या या विमुक्तये ।।

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

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प्रस्तुत विद्यापीठाच्या जैवतंत्रज्ञान सकुंलातील विज्ञान व तंत्रज्ञान विद्याशाखेतील M. Sc. Biotechnology I year पदव्यूत्तर स्तरावरील CBCS Pattern नुसारचा Revised अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, प्रस्तुत विद्यापीठाच्या जैवतंत्रज्ञान संकुलातील **विज्ञान व तंत्रज्ञान विद्याशाखेतील M. Sc. Biotechnology I year या पदव्यूत्तर स्तरावरील C.B.C.S. (Choice Based Credit System) Pattern** नुसारचा **Revised** अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्याच्या दृष्टीन मा. कुलगुरू महोदयांनी मा. विद्यापरिषदेच्या मान्यतेच्या अधीन राहून अभ्यासक्रमास मान्यता दिलेली आहे.

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शैक्षणिक–१/परिपत्रक/पदव्यूत्तर–सीबीसीएस अभ्यासक्रम/संकुल/ २०२१–२२/**१२१**

दिनांक : ३०.०८.२०२१.

स्वाक्षरित
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) संचालक, जैवतंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.
७) अधीक्षक, परिक्षा विभाग विज्ञान व तंत्रज्ञान विद्याशाखा प्रस्तुत विद्यापीठ.

Swami Ramanand Teerth Marathwada University, Nanded
School of Life Sciences

Two Year M. Sc. Degree Program in Biotechnology
Choice Based Credit System Revised Syllabus of M.Sc. Biotechnology
(With effect from academic year 2021-2022)

Title of the Program: M. Sc. Biotechnology

Preamble: M. Sc. Biotechnology programme is of 100 credits, spread over four semesters. The programme emphasizes theory, practicals, dissertation & review writing. The M.Sc. programme is structured to provide knowledge and skills in depth necessary for the employability of students working in industry, research organisations as well as in academics. The programme has unique features, along with Basic core courses, Research methodology, Bioinformatics, discipline specific electives, Environmental Biotechnology, Medical Biotechnology, Microbial Technology, Plant Biotechnology & Animal Biotechnology under choice based options. However, the skill based specific electives are also the integral part of syllabus and students have choice to opt courses like Advanced Instrumentation, Communication skills in English and Foreign languages such as French & Spanish, In addition to these courses, students have freedom to opt courses from NPTEL, SWAYAM & MOOC. The independent project work is one of the important components of this program. The syllabus has been framed with open electives for other Department & other Faculty students viz Infectious Diseases and Vaccine Technology, Computer Aided Drug Design, Food Biotechnology & Patent Writing and IPR which focuses primarily on the different applied area of biotechnology. The M.Sc. biotechnology students also have mandatory to earn a total 6 credits of their choice from other departments & schools of SRTMU Nanded campus. These interdisciplinary open elective courses learning will have employment benefits.

Programme Specific Objectives:

1. To develop strong student competencies in biotechnology and promotes the use of technology based on the students interests and skills

2. To develop strong student skills in research, analysis and interpretation of problems and information relevant to modern biology.

3. To prepare the students to successfully compete for employment in biotechnology based research and development sectors, industrial sectors and teaching, and to offer a wide range of experience in research methods, data analysis to meet the industrial needs.

Programme outcomes: on completion of program, the students will

1. Apply knowledge and skill in the design and development of solutions for the problems relevant to modern biology to cater the needs of biotechnology industries.

2. Become professionally trained in the area of molecular biology, recombinant DNA technology, Microbial technology, Animal and Plant tissue culture, Pharmaceutical & Food biotechnology etc.

3. Excel in the research related to biotechnology and quality control of biologicals.

4 Demonstrate highest standards of critical, interpersonal and communication skills as well as a commitment to life-long learning

Swami Ramanand Teerth Marathwada University, Nanded
School of Life Sciences
Name of Programme: M.Sc. Biotechnology
Programme Structure 2021-2022 onwards (CBCS Pattern)

Semester	Code	Title of theory/ practicals	No. of instructional hrs/ week	Type of course	Total credits	Marks		Total marks
						CIA	ESA	
		Theory						
Semester I	BTT-C-101	Biochemistry	04	CC	04	50	50	100
	BTT-C-102	Cell Biology	04	CC	04	50	50	100
	BTT-C- 103	Microbiology	04	CC	04	50	50	100
	*BTT-E-101 OR *BTT-E-102	**Bioinstrumentation and Biochemical Techniques OR Biostatistics and Basic Computer**	04	DSE	04	50	50	100
		Practical						
	BTL-C-101	Lab in Biochemistry	04	CC	02	25	25	50
	BTL-C-102	Lab in Cell Biology	04	CC	02	25	25	50
	BTL-C-103	Lab in Microbiology	04	CC	02	25	25	50
	*BTL-E-101 OR *BTL-E-102	**Lab in Bioinstrumentationand Biochemical Techniques OR Lab in Biostatistics and Basic Computer**	04	DSE	02	25	25	50
	Total		32	3-CC 1-DSE	24	300	300	600
Semester II			Theory					
	BTT-C-201	Genetics and Molecular Biology	04	CC	04	50	50	100
	BTT-C-202	Bioinformatics	04	CC	04	50	50	100
	BTT-C-203	Immunology	04	CC	04	50	50	100
	*BTT-E-201 OR *BTT-E-202	**Environmental Biotechnology OR Medical Biotechnology**	04	DSE	04	50	50	100
		****Open Elective**	02	OE	02	25	25	50
		Practical						
	BTL-C-201	Lab in Genetics and Molecular Biology	04	CC	02	25	25	50
	BTL-C-202	Lab in Bioinformatics	04	CC	02	25	25	50
	BTL-C-203	Lab in Immunology	04	CC	02	25	25	50

	*BTL-E-201 OR *BTL-E-202	**Lab in Environmental Biotechnology OR Lab in Medical Biotechnology**	04	DSE	02	25	25	50
		Total	34	3-CC 1-DSE 1-OE	26	325	325	650
		Theory						
	BTT-C-301	r-DNA Technology	04	CC	04	50	50	100
	BTT-C-302	Bioprocess Engineering and Technology	04	CC	04	50	50	100
	BTT-C-303	Enzyme Technology	04	CC	04	50	50	100
	BTT-C-304	Research Methodology	02	CC	02	25	25	50
Semester III	***BTT-E-301 **OR** ***BTT-E-302 OR ***BTT-E-303 OR ***BTT-E-304	**Advanced Instrumentation OR Communication Skill in English OR Foreign Language French OR Foreign Language Spanish**	02	**SDC**	02	25	25	50
		****Open Elective**	02	**OE**	02	25	25	50
		Practical						
	BTL-C-301	Lab in r-DNA Technology	04	CC	02	25	25	50
	BTL-C-302	Lab in Bioprocess Engineering and Technology	04	CC	02	25	25	50
	BTL- C-303	Lab in Enzyme Technology T	04	CC	02	25	25	50
		Total	**30**	**4-CC, 1-SDC, 1-OE**	**24**	**300**	**300**	**600**
		Theory						
	BTT- C-401	Pharmaceutical Biotechnology	04	CC	04	50	50	100
	BTT- C-402	Food Biotechnology	04	CC	04	50	50	100

Semester IV	BTT- C-403	Genomics and Proteomics	04	CC	04	50	50	100
	*BTT- E- 401 OR *BTT- E-402 OR *BTT– E-403	**Microbial Technology** **OR** **Plant Biotechnology** **OR** **Animal Biotechnology**	04	**DSE**	04	50	50	100
		****Open Elective**	02	**OE**	02	25	25	50
	Practical							
	BTL- C-401	Lab in Pharmaceutical Biotechnology and Food Biotechnology	04	CC	02	25	25	50
	BTL- C-402	Lab in Genomics and Proteomics and Microbial Technology/Plant Biotechnology/Animal Biotechnology	04	CC	02	25	25	50
	*BTL-403	**Project/ Review writing**	04	CC	04	-	100	100
		Total	**30**	**3-CC, 1-DSE, 1-OE**	**26**	**275**	**375**	**650**

CC: Core course, OE: Open Elective, DSE: Discipline Specific Elective, SDC: Skill Development Course, CIA: Continuous Internal Assessment, ESA: End Semester Assessment., Credits of Four Semesters = 100.

***Discipline specific Electives**	****Open Elective/***Skill Development Elective Course**
* Indicates an elective course. Biotechnology students in a particular semester can opt from either of these courses	** Indicates an open elective course Biotechnology student must opt for any open elective course **OR** skill development course offered by other departments / schools of the campus **OR** NPTEL /SWAYM /MOOC

- Total credits/ year = 50
- Total credits of all four semester = 100
- Total marks of all four semester = 2500
- CIA - Two internal exams of 15 marks each (MCQ)
  - Home assignment -10 marks per paper
  - Seminar -10 marks per paper.

List of Open Electives from Biotechnology for other programs of campus Schools SRTMU Nanded

Sr. No	Course code	Title of open Elective course	Number of Credits	Semester in which open electives are offered
1	BTT-OE-101	Infectious Diseases and Vaccine Technology	02	I/III
2	BTT-OE-201	Computer Aided Drug Design	02	I/III
3	BTT-OE-301	Food Biotechnology	02	II/IV
4	BTT-OE-401	Patent Writing and IPR	02	II/IV

SEMESTER-I

BIOCHEMISTRY

COURSE CODE: BTT-C-101

CREDITS: 4

Course Objective: The Students will know how the collection of thousands of inanimate molecules that constitute living organisms interact each other to maintain and perpetuate life governed solely by the physical and chemical laws as applicable to the non-living things.

COURSE CONTENTS:

UNIT -I

Chemical Foundations of living systems: Molecular basis of life, Biological chemistry-Biomolecules, Bioenergetics- Entropy, Biochemical equilibria, Dissociation and association constants, pH and buffers. Interactions in biological systems: Intra and intermolecular forces, Electrostatic and hydrogen bonds, Disulphide bridges, Hydrophobic and hydrophilic molecules and forces, Water and weak interactions.

UNIT-II

Carbohydrates: Classification, Monosaccharides– structures and function; reactions of monosaccharides- mutarotation, glycoside formation, reduction and oxidation, epimerization and esterification, important monosaccharides and disaccharide; Polysaccharides –overview, structure; important polysaccharide; plant polysaccharide; Glycosaminoglycans and Glycoproteins.

Lipids: Fatty acids as building blocks of most lipids, their structure and properties, classification of lipids, General structure and function of major lipid subclasses: Acylglycerols, phosphoglycerides, sphingolipids, glycosphingolipids, terpenes, steroids, Prostaglandins.

UNIT-III

Amino acids and Proteins: Amino acids as building blocks of proteins, their structure, classification and chemical properties; non-proteinogenic amino acids; Structure of peptide bond, organizational levels of protein structure; alpha- helix, beta pleated sheet, Ramachandran Plot.

UNIT-IV

Nucleic Acids and Porphyrins: Structure and properties of nucleic acid bases, nucleosides and nucleotides, biologically important nucleotides, Physical and chemical properties of RNA/DNA. Hydrolysis of nucleic acids, Structure, properties and classification of porphyrins.

BTL-C-101

Laboratory course in Biochemistry

1. Calibration of instruments and verification of Lambert-Beer's Law

2. Preparation of buffer solutions

3. Determination of pK values of amino acids

4. Estimation of reducing sugars

5. Total carbohydrates, amino acids and proteins

6. Qualitative tests of carbohydrates

7. Quantitative analysis of lipids

8. Quantitative analysis of nucleic acids

Student Learning Outcomes (LO): Students will be able to

1. Know the chemical constituents of cells, the basic units of living organisms.

2. Explain various types of weak interactions between the biomolecules.

3. Know how the simple precursors give rise to large biomolecules such as proteins, carbohydrates, lipids and nucleic acids.

4. Correlate the structure-function relationship in various biomolecules

5. Know the role of biomolecules for orderly structures of the cells/tissues.

Recommended Textbooks and References

1. Nelson, DL and Cox MM. Lehninger: Principles of Biochemistry, WH Freeman (2008) 5th edition

2. David E Metzler: Biochemistry, The Chemical reactions of Living Cells Vol. 1. 2nd Edition, Elsevier Academic Press (2003),

3. Berg JM, Tymoczko JL and Stryer L: Biochemistry, 5th Edition, WH Freeman and Company, (2005)

4. Koolman J and Roehm K H Color Atlas of Biochemistry, 2nd Edition, Georg ThiemeVerlag Publishers (2005)

5. Jain, J.L., Jain, S. and Jain, N., Fundamentals of Biochemistry, S. Chand and Company Ltd. (2005).

6. Plummer DT An Introduction to Practical Biochemistry, Tata McGraw-Hill Publishing Company Limited (1988)

CELL BIOLOGY

COURSE CODE: BTT-C-102

CREDITS: 4

Course Objectives:

The objectives of this course are to provide understanding of the different microscopic techniques used to study the biology of cell. Comprehend the structure and role of various organelles. Acquire in-depth knowledge of the mitotic and meiotic cell division, regulation of cell cycle, transport and cell to cell communication in animals as well as plants and to provide wider perspective of cancer and its control.

COURSE CONTENTS:

UNIT-I

Investigating the Cell: Cell theory, Microscope and its modifications: light, phase contrast, fluorescence, scanning and transmission electron microscopy

Cell Organelles: Cell wall: Structure and functions; Plasma membrane: Molecular organization and functions; Vacuole: Tonoplast membrane, transporters, storage organelle; Glyoxysomes and peroxisomes: Structure, enzymes and functions: Golgi complex: Organization, role in storage and secretion; Cytoskeleton: Composition and organization of microtubules and microfilaments, role in cell division and mobility, intracellular motility; Lysozymes: Enzymes and role, Nucleus: structure, organization and regulation of nuclear pore complex, Role of Sarcoplasmic Reticulum in muscle contraction; Melanosomes, ER etc.

UNIT-II

Transport across membrane: Cell and transport processes, simple diffusion, facilitated diffusion, Active transport, Sodium- potassium pump, proton pump, and transport into prokaryotic cells, endocytosis and exocytose.

Cell Interactions: Extracellular matrix of animal cells, cell-cell recognition, adhesion and cell junctions. **Energy transduction**: Role of mitochondria and chloroplast in energy transduction.

Cell division and cell cycle: Mitosis, meiosis, their regulation, steps in cell cycle and control of cell cycle.

UNIT-III

Cell Signaling: Hormones and their receptors, Cell surface receptors, signaling through G-protein coupled and protein kinase associated receptors, Signal transduction pathways, second messenger, Bacterial and plant two component signaling systems, Bacterial chemotaxis and quorum sensing, Signal transduction induced by auxins and GA in plants.

UNIT-IV

Cancer: Normal cells and cancer cells, Causes, Genetic arrangements in progenitor cells, Oncogenes, Tumour suppressor genes, Cancer and cell cycle, virus induced cancer, Metastasis, interaction of cancer cells with normal cells, Therapeutic interventions of uncontrolled cell growth.

Apoptosis: Role of different genes, Cell organelles during apoptosis, Genetic control of apoptosis. Flower induction, development its regulation in Arabidopsis.

Brief introduction to Life Cycle and Molecular Biology of some important pathogens: AIDS, Malaria, Hepatitis, Filaria and Kalazar.

BTL-C-102

Laboratory course in Cell biology

1. Microscopy

2. Demonstration of phenomenon of osmosis through a cell membrane.

3. Histochemical techniques.

4. Microtomy.

5. Isolation of chloroplasts from spinach leaves.

6. Demonstration of Hill reaction to measure intactness of chloroplasts.

7. Isolation of mitochondria and mitochondrial swelling.

8. Isolation of mitochondria and activity of its marker enzyme, Succinate dehydrogenase(SDH).

9. Fluorescence staining with FDA for cell viability and cell wall staining with calcofluor.

10. Study of mitosis.

11. Study of meiosis.

12. Induction of polyploidy using colchicine treatment.

13. Isolation of lysosomal fraction and estimation of acid phosphatase activity.

14. Study of Karyotyping and idiogram.

15. Orcein and Feulgen staining of salivary gland chromosomes of chironomus and Drosophila.

16. WBC count.

17. Sub-cellular fractionation and marker enzymes.

18. Visit to National Level institutes undertaking studies in cell and molecular biology.

Student Learning Outcomes (LO): On completion of this course, the students shall

1. Understand the structure and function of cell and its organelles

2. Acquire combined knowledge on Cell division, cell cycle and cell cycle regulation

3. Acquire the knowledge about transport and cell to cell communication in animals as well as plants.

4. Acquire knowledge about causes of cancer, tumour suppressor genes and control of cancer.

Recommended Textbooks and References

1. Alberts, B, Bray D, Lewis J Raff M, Roberts K, Watson J. D., (1994), Molecular Biology ofCell, Garland publishing Company.

2. Darnell J, Lodish H, Baltimore D, (1990), Molecular Cell Biology by Scientific AmericanBooks, New York.

3. Backer, Kleinsmith and Hardin, (2004), The World of the Cell by Pearson Education.

4. Gerald Karp, (1996), Cell and Molecular Biology by McGraw Hill Publishing Company, NewYork.

5. David E, Sadava, (1992) Cell Biology – Organell Structure and Function by Bostan andBartlett publisher.

6. Loewy, Siekevitz, Manniger and Gallant, (1991), Cell Structure and Function (An integratedApproach), Saunders college publishing house

7. Lewis J. Kleinsmith, Principles of Cell and Molecular Biology

8. Philip Sheeler and Donald Bianehi, Cell and Molecular Biology by John Wiley and Sons

9. Harrmann R. G., Wien, (1992), Cell organelles by Springer Verlag

MICROBIOLOGY
COURSE CODE: BTT-C-103

CREDIT: 4

Course Objectives: The objectives of this course are to introduce field of microbiology with special emphasis on microbial diversity, morphology, physiology and nutrition; methods for control of microbes and host microbe interactions. To provide practical skills on basic microbiological technique

COURSE CONTENTS:

Unit- I

Microbial characteristics

Introduction to microbiology and microbes, history & scope of microbiology, morphology, structure, growth and nutrition of bacteria, bacterial growth curve, bacterial culture methods; bacterial genetics: mutation and recombination in bacteria, plasmids, transformation, transduction and conjugation; antimicrobial resistance.

Unit-II

Microbial diversity

Microbial taxonomy and evolution of diversity, classification of microorganisms, criteria for classification; classification of bacteria; Cyanobacteria, acetic acid bacteria, Pseudomonads, lactic and propionic acid bacteria, endospore forming bacteria, Mycobacteria and Mycoplasma. Archaea: Halophiles, Methanogens, Hyperthermophilicarchae, Thermoplasm; eukarya: algae, fungi, slime molds and protozoa; extremophiles and unculturable microbes.

Unit-III

Control of microorganisms

Sterilization, disinfection and antisepsis: physical and chemical methods for control of microorganisms, antibiotics, antiviral and antifungal drugs, biological control of microorganisms.

Unit -IV

Host-microbes interaction

Host-pathogen interaction, ecological impact of microbes; symbiosis (Nitrogen fixation and ruminant symbiosis); microbes and nutrient cycles; microbial communication system; bacterial quorum sensing; microbial fuel cells; prebiotics and probiotics.

BTL-C-103

Laboratory course in Microbiology

1. Sterilization, disinfection and safety in microbiological laboratory.

2. Preparation of media for cultivation of bacteria.

3. Isolation of bacteria in pure culture by streak plate method.

4. Study of colony and growth characteristics of some common bacteria: Bacillus, E. coli, Staphylococcus, Streptococcus, etc.

5. Preparation of bacterial smear and Gram's staining**.**

6. Enumeration of bacteria: standard plate count.

7. Antimicrobial sensitivity test and demonstration of drug resistance.

8. Maintenance of stock cultures: slants, stabs and glycerol stock cultures

9. Determination of phenol co-efficient of antimicrobial agents.

10. Determination of Minimum Inhibitory Concentration (MIC)

11. Isolation and identification of bacteria from soil/water samples

Student Learning Outcomes (LO): Students should be able to:

1. Identify major categories of microorganisms and analyze their classification, diversity, and ubiquity

2. Identify and demonstrate structural, physiological, genetic similarities and differences of major categories of microorganisms;

3. Identify and demonstrate how to control microbial growth;

4. Demonstrate and evaluate interactions between microbes, hosts and environment

5. Isolate, characterize and identify common bacteria & determine bacterial load of different samples;

6. Perform antimicrobial sensitivity tests & preserve bacterial culture

Recommended Textbooks and References:

1. Pelczar, M. J., Reid, R. D., & Chan, E. C. (2001). Microbiology (5th edition). New York:McGraw-Hill.

2. Willey, J. M., Sherwood, L., Woolverton, C. J., Prescott, L. M., & Willey, J. M. (2011). Prescott's Microbiology. New York: McGraw-Hill.

3. Matthai, W., Berg, C. Y., & Black, J. G. (2005). Microbiology, Principles and Explorations. Boston, MA: John Wiley & Sons.

4. Stanier, R.Y., Ingraham, J.L. and Wheelis, M.L., General Microbiology, MacMillan (2007) 5th edition.

5. Tortora, G.J., Funke, B.R., and Case, C.L., Microbiology- An Introduction, Pearson Education (2007) 8th edition.

6. Brock -Biology of Microorganisms by Michael T. Madigan, John M. Martinko, Jack Parker.

BIOINSTRUMENTATION AND BIOCHEMICAL TECHNIQUES

COURSE CODE: BTT-E-101

CREDITS: 4

Course Objectives: To impart knowledge about basic principles of Bioinstrumentation and Biochemical Techniques and to acquaint the students with knowledge on various techniques and methods of biochemical analysis.

COURSE CONTENTS:

UNIT- I

Separation Techniques, Chromatography and Centrifugation: General principles, classification, separation, mechanisms, Thin layer, Paper, affinity, gel permeation, ion exchange, GLC, HPLC, HPTLC, Preparative and analytical centrifugations and their applications.

Unit -II

Electrophoretic Techniques: Basic principles of electrophoresis, factors affecting electrophoresis, Electrophoretic mobility, paper and gel electrophoresis, Native and denaturing PAGE, iso-electric focusing, purse field gel electrophoresis.

Unit- III

Special Techniques: Theory and applications of ultra violet and visible spectroscopy, Infrared (IR), Nuclear magnetic resonance (NMR), AAS, Mass spectroscopy (MS) Raman spectroscopy, Fluorescence and X-ray spectroscopy and it's applications.

Unit -IV

Radiation and Non-Radioactive Techniques: Tracer Technology, dose response relationship, radioisotopes in diagnostic and biotechnology. Geiger Muller Counter, Scintillation counter, metabolic tracer techniques, non-radioactive labels, labeling and detection methods using florescent molecules.

BTL-E-101

Lab Course in Bioinstrumentation and Biochemical Techniques

1. Separation of Lipids by thin layer chromatography
2. Gel filtration chromatography
3. Separation of blue dextran and cobalt chloride on Sephadex G25
4. The separation of proteins by ion exchange chromatography
5. The separation of serum proteins by electrophoresis on cellulose acetate
6. Separation of sub cellular organelles by differential centrifugation
7. Separation of amino acids by paper chromatography.
8. Separation and identification of plant pigments by Thin Layer Chromatography.
9. Demonstration of HPTLC
10. Determination of absorption maxima of proteins and nucleic acids.

11. Demonstration of Geiger Muller Counter (GMC)
12. Separation and identification of plant pigments by Radial Chromatography

Student Learning Outcomes (LO): On completion of this course, the students shall:
1. Demonstrate the knowledge about the techniques of Bioinstrumentation and Biochemical Techniques
2. Acquire knowledge in biochemical analysis.
3. Shall develop scientific skills to analyze the structure of biomolecules and their functions.

Recommended Textbooks and References:

1. Instrumental methods of Analysis 6th edition - H. H. Willard, L. L. Merrit Jr. and others ,(1986) CBS Publishers and Distributors
2. Instrumental Methods of Chemical Analysis. (1989)- Chatwal G. and Anand, S., Himalaya Publishing House, Mumbai.
3. A Biologist's Guide to Principles and Techniques of Practical Biochemistry. (1975) – Williams B, L Wilson, K.
4. Spectroscopy Volume I – B. B. Straughan and Walker, Chapman and Hall Ltd.
5. Gel Electrophoresis of Proteins- A Practical Approach – Hanes
6. Chromatography: Concepts and Contrasts, (1988) - Jaines Miller, John Wiley and Sons Inc New York.
7. Introduction to High Performance Liquid Chromatography – R. J. Hamilton and P. A. Sewall.
8. Spectroscopy- B. P. Straughan and S. Walker
9. Practical Aspects of Gas Chromatography and Mass Spectrometry (1984) - Gordon M. Message, John, Wiley and Sons New York.
10. Gel Chromatography – Tibor Kremmery, Wiley Publications
11. Isotopes and Radiations in Biology – C. C. Thornburn. Butterworth and Co. Ltd. London
12. The Use of Radioactive isotopes in the Life Sciences – J. M. Chapman and Ayrey. George Allen and Unwin Ltd. London.

BIOSTATISTICS AND BASIC COMPUTER

COURSE CODE: BTT-E-102

CREDITS: 4

Course Objective: To understand the basics of statistics and computers and apply it to solve biological problems. In addition to this, to learn basic word processing skills with Microsoft Word, such as text input and formatting, editing, cut, copy and paste, spell check, margin and tab controls, keyboard shortcuts, printing, as well as how to include some graphics such as pictures and charts. In general, develop an intuitive sense of how computers work and how they can be used to make academic work more efficient.

COURSE CONTENTS:

UNIT–I

Introduction to biostatistics, collection of data, sampling methods, processing & presentation of data. Measures of central tendency and dispersion (mean, median, mode, range, standard deviation, mean deviation and variance)

UNIT-II

Correlation, calculation of Karl Pearson's coefficient of correlation, Regression Analysis, linear regression, regression equation, Hypothesis testing: Types of hypothesis testing: t-test, χ 2 -test, and F- test., ANOVA. Software used in biostatistics- SPSS

UNIT-III

Computer basics, hardware, software, architecture, input/output devices, Internet and resources related to Biology like google scholar, science direct and other major free and commercial databases, downloading open access articles, Searching for articles: search, advance search and search within search, E-mail: creating e-mail ID, sending and receiving, CC, BCC, attachments.

UNIT-IV

Word Processing: Word Processing Basics; Opening and Closing of documents, editing with online tools; Text creation and Manipulation; Formatting of text; Table handling;Spell check, language setting and thesaurus; Printing of word document. Using Spread Sheet: Basics of Spreadsheet; Manipulation of cells; Formulas and Functions; Editing of Spread Sheet, printing of Spread Sheet and MS-Excel. Making Presentation: Basics of presentation software;Creating Presentation; Preparation and Presentation of Slides; Slide Show; Taking printouts of presentation / handout and other formats

BTL-E-102

Laboratory course in Biostatistics and Basic Computers

1. Calculate Mean, Mode and Median.
2. Equation formulation and analysis for sample testing, correlation, standard deviation, variance and regression
3. Problems in Probability

4. ANOVA, multiple comparisons
5. Preparation of PPT
6. MS Excel and Graph pad, data entry and graphical representation
7. Searching and downloading articles from commercial and free resources
8. Email: creating e-mail ID, and sending attachments
9. Formatting Text in MS-Word with Styles (paragraph and whole document)
10. Creating automatic TOC in MS-Word
11. Creating automatic Bibliography in MS-Word

Student Learning Outcomes (LO): Students will be able to

1. How to calculate and apply measures of location and measures of dispersion -- grouped and ungrouped data cases.

2. General Information about collection and analysis of data.

3. Knowledge on use of statistical method in analysis and interpretation of biological data.

4. Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.

5. Compute and interpret the results of Bivariate and Multivariate Regression and Correlation Analysis, for forecasting and also perform ANOVA and F-test.

6. Understand both the meaning and applicability of a dummy variable and the assumptionswhich underline a regression model.

7. Be able to perform a multiple regression using computer software.

Recommended Textbooks and References

1. Statistics in biology, Vol. 1 by Bliss, C.I.K. (1967) Mc Graw Hill, New York.

2. Practical Statistics for experimental biologist by Wardlaw, A.C. (1985).

3. Statistical Methods in Biology - 2000 by Bailey, N.T. J. English Univ. Press.

4. Biostatistics - 7th Edition by Daniel

6. Fundamental of Biostatistics by Khan

7. Biostatistics by P Rama Krishna, Saras Publication, 1995.

8. Biostatistical Methods by Lachin

9. Gupta S. C. and Kapoor, V. K., Elements of mathematical statistics (Third edition), Sultan Chand & Sons Publishers

10. Mahajan, B. K., Methods in biostatistics (Sixth edition), JAYPEE Brothers Medical Publishers

SEMESTER-II

GENETICS AND MOLECULAR BIOLOGY

COURSE CODE: BTT-C-201

CREDITS: 4

Course Objectives:

Understanding Concept of Mendelian and post Mendelian genetics. Understanding Genome organization, Genome duplication and genome function in viruses, prokaryotes and Eukaryotes.

COURSE CONTENTS:

UNIT-I

FUNDAMENTALS OF GENETICS

Review of basic terminologies (Allele, multiple alleles, pseudo allele, complementation tests) and principles of Mendelian (Dominance, segregation, independent assortment) and post Mendelian genetics (Co-dominance, incomplete dominance, gene interactions, pleiotropy), genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters, Maternal inheritance.

Overview of human genetics (Pedigree analysis, LOD Score for linkage testing, karyotypes, genetic disorders). Quantitative genetics, Population genetics, Structural and numerical aberrations of chromosomes, linkage maps, tetrad analysis, recombination and sex determination.

Introduction to Microbial genetics (Transformation, Conjugation and Transduction), Mutation, Focus of genetic studies as a platform for advances in molecular biology.

UNIT-II

DNA STRUCTURE AND GENOME ORGANIZATION

DNA structure and topology. Physical properties of DNA: Tm, hypo and hyper chromicity, solubility, mutarotation and buoyancy. Organization of Viral, Prokaryotic and Eukaryotic genome (Structure of chromatin, nucleosome, chromatin organization, chromosome, centromere, telomere. General organization (size, banding, microsatellites, Gene distribution and density) of plant (rice) and animal (human) genome including their organelle genomes, Organization of genes: rRNA encoding Genes, mRNA encoding Genes, small nuclear RNA genes. Overlapping genes, genes within genes, gene families, pseudo genes, truncated genes and gene fragments. Operon, Fine structure of gene (r-II locus), fine structure analysis of gene (complementation and recombination).

Techniques and Technology involved in genome mapping low- and high-resolution mapping; Strategies and milestones in mapping and sequencing of human genome approaches to physical and genetic mapping. Next generation sequencing: principles and platforms. Principles and strategies for identifying unknown disease or susceptibility genes. Major genomic databases, Glimpses and significance of the recently sequenced genomes of organisms.

UNIT-III

DNA REPLICATION AND REPAIR

DNA Replication models, DNA replication mechanism (Prokaryotes/eukaryotes). RNA world and RNA Replication, DNA modifying enzymes: DNA polymerases: types and mechanism of action. DNA damage and repair and recombination: mechanisms and structure and functions of enzymes involved. RNA Polymerases and reverse transcriptase: structure and mechanisms of action. DNA methyl transferases, Topoisomerase, Gyrase and Nucleases. Types, mechanisms, and significance of mutations.

UNIT-IV

REGULATION OF GENE EXPRESSION

Chromatin structure and remodeling. Regulation of gene expression at chromatin level. Epigenetics: Genome imprinting, DNA methylation, Acetylation, Chromosome inactivation and sex determination. Gene silencing, RNA interference. Homeotic gene expression and pattern formation in plants and animals. Oncogenes and proto-oncogenes. Transcription in pro and eukaryotic organisms and transcription factors. Regulation of gene expression at transcriptional level (Phages, viruses, prokaryotic and eukaryotic genes). RNA processing: capping, polyadenylation, splicing, editing and transport of RNA. Structure and functions of ribonucleoproteins. Translation in prokaryotic and eukaryotic organisms and its regulation. Genetic code and factors. Translational proofreading, translational inhibitors. PTM.

BTL-C-201

Laboratory course in Genetics and Molecular Biology

1. Use of drosophila as a model system in genetics: Life history, morphology, mutants, culture, sexing pupae for setting up crosses etc.

2. Gene interactions

3. Mutants of Drosophila Mono and Di-hybrid crosses in Drosophila.

4. Sex linked lethal in Drosophila.

5. Estimating gene frequencies in population, estimation of heterozygote frequencies, pedigree analysis.

6. Human karyotype and chromosomal aberrations.

7. Ames test for genotoxins.

8. UV mutagenesis.

9. Bacteriophage titration.

10. Bacterial transformation, bacterial conjugation. & bacterial transduction.

13. Isolation of nuclei and chromatin. Determination of mononucleosomal size.

14. Chromatin gel electrophoresis.

15. Isolation of genomic DNA from different sources viz. plant, animal, yeast and bacteria.

16. Restriction digestion of genomic DNA and analysis.

17. Thermal melting of DNA.

18. Agarose gel electrophoresis of DNA.

19. Isolation of organelle genome and restriction digestion.

Student Learning Outcomes (LO): Students will be able to learn

1. Fundamentals of Mendelian and post-Mendelian genetics.

2. Genome (viral, prokaryotic and eukaryotic) organization, duplication and function.

Recommended Textbooks and References

1. Birge, E.A. (2006) Bacterial and Bacteriophage Genetics. 5th Edition. Sriger Publications

2. Concepts of Genetics, 9th edition, 2009 by Klug et al

3. Dale, J.W., Park, S.F. (2005) Molecular Genetics of Bacteria 4th Edition Wiley and Sons Inc

4. Freifelder, D. (2005). Molecular Biology. 2nd Edition. Narosa Pub. House

5. Genes IX. Lewin B. (2008),

6. Introduction to Genetic Analysis, 9 th edition by Griffiths et al, 2008

7. Molecular Biology by Weaver.

8. Molecular Biology of the Cell. Alberts et. al. (5^{th} edition, 2007)

9. Molecular Biology of the Gene. Watson et. al. (6^{th} edition, 2009),

10. Molecular Cell Biology. Lodish et. al. (6^{th} edition, 2008)

11. Principles of Genetics by Snustad et al (2004)

12. Problems and Approaches 3rd edition (1997) and 4th edition (revised2009) Speicher, Michael; Antonarakis, Stylianos E.; Motulsky, Arno G. (Eds.)

13. Read Andrew and Donnai Dian (2007) New Clinical Genetics, Scion Publishing Ltd, UK.

14. Strachan Tom and Read Andrew P. (2004) Human Molecular Genetics, 3 rd Edition, Garland Science (Taylor and Francis Group), London and New York18

15. Synder, L., Champness W. (1997) Molecular Genetics of Bacteria. ASM Press.

16. Turn, N., Trempy, J. (2006) Fundamental Bacterial Genetics. Blackwell Publishers

17. Vogel and Motulsky's Human Genetics

BIOINFORMATICS

COURSE CODE: BTT- C-202

CREDITS: 4

Course Objective: The objective of this course is to familiarize students with basic concepts of sequences, structural alignment, database searching and protein structure prediction.

COURSE CONTENTS

UNIT-I

Introduction to Bioinformatics Resources Bioinformatics Resources: NCBI, EBI, ExPASy, RCSB, And DDBJ: The knowledge of databases and bioinformatics tools available at these resources, organization of databases: data contents, purpose and utility. Open access bibliographic resources and literature databases: PubMed, BioMed Central, Public Library of Sciences (PloS), Cite Xplore.

UNIT-II

Sequence databases Sequence databases: Nucleic acid sequence databases: GenBank, EMBL, DDBJ; Protein sequence databases: Uniprot-KB: SWISS-PROT, TrEMBL, UniParc; Structure Databases: PDB, NDB, PubChem, ChemBank. Sequence file formats: Various file formats for bio-molecular sequences: GenBank, FASTA, GCG, MSF etc. Protein and nucleic acid properties: Proteomics tools at the ExPASy server, GCG utilities and EMBOSS, Computation of various parameters

UNIT-III

Sequence analysis Sequence Analysis: Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues and xenologues Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, matrix derivation methods and principles.

UNIT-IV

Sequence alignment Sequence alignment: Measurement of sequence similarity; Similarity and homology. Pairwise sequence alignment: Basic concepts of sequence alignment, Needleman and Wunsch, Smith and Waterman algorithms for pairwise alignments, gap penalties, use of pairwise alignments for analysis of Nucleic acid and protein sequences and interpretation of results.

BTL-C-202

Laboratory course in Bioinformatics

1 Proteomics tools

2 Structural and functional predictions

3 Phylogenetic Analysis, Phylogenetic tree construction

4 DNA and protein sequence and PDB file formats

5 Local and global sequence alignments of protein and DNA sequences

6 Needleman Wunsch and Smith-Waterman algorithm

7 BLAST, Multiple sequence alignment

Student Learning Outcomes (LO): At the end of the course, a student should be able to:

1. Explain the theoretical knowledge of database system and algorithms.

2. Analyze and discuss the results in light of molecular biological knowledge (sequence alignment and Phylogenetic tree plot)

3. Collect the proficient knowledge to solve biological system- a multi-disciplinary problem

4. Develop the key skills of molecular modeling techniques currently practiced in any pharmaceutical research and development unit

Recommended Textbooks and References

1. Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. (2004)

2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. (2009)

3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith, Pearson Education. 1999 4. Bioinformatics for Dummies by Jean-Michel Claverie Cedric Notre dame. Publisher: Dummies (Jan 2007)

IMMUNOLOGY

COURSE CODE: BTT-C-203.

CREDITS: 4

Course Objectives The objectives of this course are to learn about structural features of components of immune system as well as their function. The major emphasis of this course will be on development of immune system and mechanisms by which our body elicits immune response. This will be imperative for students as it will help them to predict about nature of immune response that develops against bacterial, viral or parasitic infection, and prove it by designing new experiments

COURSE CONTENTS

UNIT-I

Immunology- fundamental concepts and anatomy of the immune system Componentsof innate and acquired immunity; Phagocytosis; Complement and Inflammatory responses; Haematopoiesis; Organs and cells of the immune system- primary and secondary lymphoid organs; Lymphatic system; Lymphocyte circulation; Lymphocyte homing; Mucosal and Cutaneous associated Lymphoid tissue.(MALT & CALT); Mucosal Immunity; Antigens - immunogens, haptens, Major Histocompatibility Complex - MHC genes, MHC and immune responsiveness and disease susceptibility.

UNIT-II

Immune responses generated by B and T lymphocytes Immunoglobulins- basic structure, classes & subclasses of immunoglobulins, antigenic determinants; Multigene organization of immunoglobulin genes; B-cell receptor; Immunoglobulin superfamily; Basis of self –non-self discrimination; memory; B-cell maturation, activation and differentiation; Generation of antibody diversity; T-cell maturation, activation and differentiation and T-cell receptors; Functional T Cell Subsets; Cell-mediated immune responses, ADCC; Cytokines- properties, receptors and therapeutic uses; Antigen processing and presentation- endogenous antigens, exogenous antigens, non-peptide bacterial antigens and super-antigens; Cell-cell co-operation, Hapten-carrier system.

UNIT-III

Antigen-antibody interactions Precipitation, agglutination and complement mediated immune reactions; Advanced immunological techniques - RIA, ELISA, ELISPOT assay, immunofluorescence, flow cytometry and immunoelectron microscopy; Surface plasmon resonance, Biosenor assays for assessing ligand–receptor interaction, CMI techniques-lymphoproliferation assay, Mixed lymphocyte reaction, Cell Cytotoxicity assays, Apoptosis, Microarrays, Transgenic mice, Gene knock outs

Immunization Active and passive immunization; Live, killed, attenuated, sub unit vaccines; Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein-based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines; Catalytic antibodies and generation of immunoglobulin gene libraries.

UNIT- IV

Clinical Immunology Immunity to Infection : Bacteria, viral, fungal and parasitic infections (with examples from each group); Hypersensitivity – Type I-IV; Autoimmunity; Types of autoimmune diseases; Mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; Treatment of autoimmune diseases; Transplantation – Immunological basis of graft rejection; Clinical transplantation and immunosuppressive therapy; Tumor immunology – Tumor antigens; Immune response to tumors and tumor evasion of the immune system, Cancer immunotherapy, Immunodeficiency- Primary immunodeficiency, acquired or secondary immunodeficiency.

BTL-C-203

Laboratory course in Immunology

1. To detect the blood group of the given sample.
2. To perform differential count (DLC) of given sample.
3. To perform the Technique of Radial immune diffusion
4. To learn and perform the Ouchterlony Double Diffusion Technique
5. To perform the pregnancy test with the help of Pregnancy Kit
6. To learn the technique of Immunoelectrophoresis
7. To study the technique of Rocket Immunoelectrophoresis for determination of concentration of antigen in unknown sample
8. To perform Widal test for detection of typhoid.
9. To study the different immunoinformatic tools.
10. To perform the sandwich Dot ELISA Test for antigen detection
11. To perform Affinity chromatography for antibody purification.
12. To identify cells in a blood smear
13. To isolate monocytes from blood
14. To Isolate peripheral blood mononuclear cells
15. Identification of t cells by T-cell rossetting using sheep RBC

Student Learning Outcomes (LO): On completion of this course, students should be able to:

1. Evaluate usefulness of immunology in different pharmaceutical companies;
2. Identify proper research lab working in area of their own interests;
3. Apply their knowledge and design immunological experiments to demonstrate innate, humoral or cytotoxic T lymphocyte responses and figure out kind of immune responses in the setting of infection (viral or bacterial).

Recommended Textbooks and References

1. Kuby, RA Golds by, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition,Freeman, (2002)
2. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, (2002)
3. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., (1999)
4. Paul, Fundamental of Immunology, 4th edition, Lippencott Raven, (1999)
5. Goding, Monoclonal antibodies, Academic Press. (1985)
6. Edward S. Golub Immunology: A Synthesis (1991)
7. Immunology: Theoretical and practical concepts in Laboratory Medicine. Hannah D. Zane,Saunders; 1 edition (2001)
8. Clinical Immunology and Serology: A Laboratory Perspective by Christine Dorresteyn Stevens, F.A. Davis Company; 2nd Revised edition (2009)

ENVIRONMENTAL BIOTECHNOLOGY

COURSE CODE: BTT-E-201

CREDITS: 4

Course Objectives This course aims to introduce fundamentals of Environmental Biotechnology. The course will introduce major groups of microorganisms' tools in biotechnology and their most important environmental applications. The environmental applications of biotechnology will be presented in detail and will be supported by examples from the national and international literature

COURSE CONTENTS

UNIT-I

Introduction to Environmental Biotechnology Ecosystems: biotic and abiotic components, ecological pyramids, food chains, food webs, habitat and niche, energy flow inecosystems and types of ecosystems. Biological magnification, pollutants of atmosphere, water and solid wastes, hazardous wastes. Microbial interactions in ecosystems. Introduction to Novel biocatalysts and biomaterials, Lignocellulosic residues, Biofuel and fossil fuels, biomining and bioleaching, Bioremediation, Biosensors in bioprocessing,

UNIT-II

Air, Water and Soil pollution Point and non-point source pollution, Air pollution control: particulate emission, control devices, control of Sulphur dioxide pollution and vehicular pollution. Water pollution control: primary, secondary and tertiary treatment. Solid waste and soil pollution management: waste monitoring, treatment and management of non- hazardous solid waste, non-degradable solid waste, medical solid waste.

UNIT-III

Biodegradation, Bioconversion and Bioabsorption, Microorganisms in lignocellulose degradation, Cellulases and xylanases, Biodegradation of starch, glycogen, pullulan, dextrins and proteins. Xenobiotic compounds: chemical properties influencing biodegradability, mechanisms of degradation, microorganisms for degrading organic pollutants (petroleum products, methane/n-alkanes, alkenes, cycloaliphatic compounds). Microorganisms in metal absorption, factors affecting bioabsorption, Phytoremediation.

UNIT-IV

Biotechnological Applications in Environmental Management Carbon sequestration, Bioremediation: microorganisms and techniques, Bioenergy, Bioethanol and Biodiesel, Biomethanation (Biogas from anaerobic treatment), Biofertilizers and biopesticides, Composting: process and decomposition stages, vermicomposting, Biopolymers and Bioplastics,

Remedial Mechanisms of Industrial Problems Pulp and paper industry: problems associated and treatment of pollutants, Tannery industry: effluent characteristics and treatment, Ex situ bioremediation, Distillery effluent treatment, Treatment methods for dye industry effluents, Waste reduction and treatment of effluents from pharmaceutical, petroleum and dairy industries.

BTL-E-201

Laboratory course in Environmental Biotechnology

1. Estimation of biological oxygen demand in sewage samples
2. Estimation of chemical oxygen demand in sewage samples
3. Determination of total dissolved solids in water samples
4. Determination of coliforms to estimate quality of water samples
5. Isolation of xenobiotic degrading bacteria by selective enrichment technique
6. Estimation of heavy metals in water/soil by atomic absorption spectrophotometry
7. Production of microbial fertilizers
8. Preparation and formulations of microbial biopesticide

Student Learning Outcomes On completion of course, students will be able to understand use of basic microbiological, molecular and analytical methods, which are extensively used in environmental biotechnology

Recommended Textbooks and References

1. Environmental Science, S.C. Santra
2. Environmental Biotechnology, Pradipta Kumar Mohapatra
3. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
4. Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill
5. Agricultural Biotechnology, S.S. Purohit
6. Environmental Microbiology: Methods and Protocols, Alicia L. Ragout De Spencer, John F.T. Spencer.
7. Introduction to Environmental Biotechnology, Milton Wainwright.
8. G. M. Evans and J. C. Furlong (2003), Environmental Biotechnology: Theory and Applications, Wiley Publishers.
9. B. Ritmann and P. L. McCarty, (2000), Environmental Biotechnology: Principle & Applications, 2nd Ed., McGraw Hill Science.
10. Scragg A., (2005) Environmental Biotechnology. Pearson Education Limited.
11. H. J. Rehm and G. Reed, (2001), Biotechnology – A Multi-volume Comprehensive Treatise, Vol. 11, 2nd Ed., VCH Publishers Inc

MEDICAL BIOTECHNOLOGY

COURSE CODE: BTT-E-202

CREDITS: 4

Course Objective

The objective of this course is to provide detailed knowledge of infectious disease causing microorganism its pathogenicity, virulence factor and toxin biosefety. Genetic diseases and modern therapies used also covered. More emphases is given on etiology of important diseases caused by bacteria, viruses, fungi and protozoa

COURSE CONTENTS:

UNIT-I

Introduction Normal microflora of human body, nosocomial infections, carriers, septic shock, septicaemia, pathogenicity, virulence factors, toxins, biosafety levels.

Genetic disorders Genetic disease, type of inheritance, single-gene and multifactorial inheritance, example of genetic diseases. Therapeutic intervention in blood disorder by stem cell transplantation/gene therapy.

UNIT-II

Etiology of bacterial diseases Morphology, pathogenesis, symptoms, laboratory diagnosis, preventive measures and chemotherapy caused by Gram negative bacteria *(E. coli, N. gonorrhoea, N. meningitidis, P. aeruginosa, S. typhi, S. dysenteriae, Y. pestis, H. influenzae,)* and Gram-positive bacteria *(S. aureus, S. pyogenes, B. anthracis, C. perferinges, C. tetani, C. botulinum)*

UNIT-III

Viral diseases; caused by viruses- Picorna virus, Orthomyxo-viruses, Paramyxo viruses, Rhabdo-viruses, Reo-viruses, Pox virus, Herpes virus, Papova virus, Retro viruses (including HIV/AIDS) and Hepatitis viruses. Antigenic shift and drift.

UNIT-IV

Fungal and protozoan diseases; Fungal and Protozoan infections. Dermatophytosis Subcutaneous infection (Sporothrix, Cryptococcus), systemic infection (Histoplasma, Coccidiosis) and opportunistic fungal infections (Candidiasis, Aspergillosis), Gastrointestinal infections (Amoebiasis, Giardiasis), Blood-borne infections (Leishmaniasis, Malaria)

BTL-E-202

Laboratory course in Medical Biotechnology

1. Synder test for evaluation of dental caries
2. Haematology – (Total count, RBC and WBC counting, Haemoglobin level, bleeding time,clotting time)
3. Study of biofilm microorganisms

4. Demonstration of malaria parasite in blood film
5. Isolation of bacteria from clinical samples and their partial characterization.
6. Determination of sensitivity of bacteria to antibiotics (Disc method)
7. Enrichment, isolation and identification of Enteric pathogens
8. Conventional and rapid methods of isolation and identification of following pathogenic bacteria and fungi.

   Bacteria: Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Proteus vulgaris, Salmonella typhi, Shigella dysenteriae, Pseudomonas aeruginosa, Vibrio cholerae. [Any five]

   Fungi: Candida albicans, Cryptococcus neoformans, Microsporum, Trichophyton, Histoplasma capsulatum. [Any two]
9. Different staining: Acid fast staining, Giemsa staining, Leishmann staining, Flurochrome staining Special staining methods to demonstrate granules, capsule and spores.

Student Learning Outcomes (LO):

Upon successful completion of this course the student will be able to

1. Understand basic principles of medical microbiology & infectious diseases.
2. Learn mechanisms of transmission of infectious diseases & role of normal flora of human body.
3. Understand importance of pathogens in disease formation.
4. Explain the methods of prevention & control of microbial diseases.

Recommended Textbooks and References:

1. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). Jawetz, Melnick and Adelberg's Medical Microbiology. 24th edition. McGraw Hill Publication.

2. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). Mims' Medical Microbiology. 4th edition. Elsevier.

3. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

INFECTIOUS DISEASES AND VACCINE TECHNOLOGY

COURSE CODE: BTT-OE-101

CREDITS: 2

Course Objective

The objective of this course is to provide detailed knowledge of important infectious diseases of human caused by viruses, bacteria, Fungi and protozoa, their mode of infection, symptoms, detection, epidemiology and treatment. The significance of conventional and modern vaccine in prevention of diseases This elective course is designed for those who wish to work in area of infectious diseases andvaccine students having background other than life science

COURSE CONTENTS:

UNIT-I

Microbial Diseases of Humans: mode of infection, symptoms, detection, epidemiology and control measures of disease caused by Viruses (AIDS, Hepatitis- B, Rabies, HSV-1) Bacteria (Typhoid, STD, TB, Plague) Fungi (Aspergillosis, Histoplasmosis, Cryptococcosis) Protozoa (Malaraia, Amoebiasis)

UNIT-II

History of vaccines, Conventional vaccines; Bacterial vaccines; Viral Vaccines; Vaccines based on routes of administration: parenteral, oral, mucosal; Live attenuated and inactivated vaccine; Subunit Vaccines and Toxoids; Peptide Vaccine.

New Vaccine Technologies; Rationally designed Vaccines; DNA Vaccination; Mucosal vaccination; New approaches for vaccine delivery; Engineering virus vectors for vaccination; Vaccines for targeted delivery (Vaccine Delivery systems); Disease specific vaccine design: Tuberculosis Vaccine; Malaria Vaccine; HIV/AIDS vaccine; New emerging diseases and vaccine needs (Ebola, Zika & COVID-19).

Student Learning Outcome (LO):

After successful completion of the course student will be able to understand

1. Mode of infection, symptoms, detection, and control of human diseases

2. Understands merit and demerits of conventional vaccines

3. How modern vaccine are designed rationally to enhances efficacy

Recommended Textbooks and References:

1. Judit Pongracz and Mary Keen, Medical Biotechnology 1st Edition, Elsevier publications,2008

2. S N Jogdand Medical Biotechnology 2nd Edition Himalaya publishers 2008

3. Janeway, C. A., Travers, P., Walport, M., &Shlomchik, M. J. (2005). Immuno Biology: The Immune System in Health and Disease. USA: Garland Science Pub.

4. Kindt, T. J., Osborne, B. A., Goldsby, R. A., &Kuby, J. (2013). Kuby Immunology. New York: W.H. Freeman.

5. Kaufmann, S. H. (2004). Novel Vaccination Strategies. Weinheim: Wiley-VCH.

6. Journal Articles (relevant issues) from: Annual Review of Immunology, Annual Review of Microbiology, Current Opinion in Immunology, Nature Immunology, Expert review of vaccines.

COMPUTER AIDED DRUG DESIGN

COURSE CODE: BTT-OE-201

CREDITS: 2

Course Objectives

The objectives of this course are to provide theory and practical experience of the use of common computational tools and databases which facilitate investigation of molecular biology and evolution-related concepts.

COURSE CONTENT

UNIT-I

Introduction to Drug Discovery and Development: Stages of drug discovery and development, Lead discovery and Analog Based Drug Design. Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.

UNIT-II

Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies. Quantitative Structure Activity Relationship (QSAR)

SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

UNIT-III

Molecular Modeling and virtual screening techniques.

Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore-based Screening, Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. De novo drug design.

UNIT-IV

Informatics & Methods in drug design

Introduction to Bioinformatics, cheminformatics. ADME databases, chemical, biochemical and pharmaceutical databases. Molecular Modeling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis

Student Learning Outcomes (LO):

Student should be able to:

Develop an understanding of basic theory of these computational tools; Gain working knowledge of these computational tools and methods; Appreciate their relevance for investigating specific contemporary biological questions; Critically analyse and interpret results of their study.

Recommended Textbooks and References:

1. Computer aided drug design by Khan Suryawanshi, Usman and Wagh.
2. Molecular Docking for Computer-Aided Drug Design: Fundamentals, Techniques, Resources and Applications by Mohane S. Coumar
3. Computer Aided Analysis and Design by Srinivasa Prakash Regalla
4. Computer Aided Drug Design by Dr.Santosh Chhajed, Dr.Virupaksha Bastikar, et al.
5. Computer Aided Drug Design and Tools Directory (by Chittipolu Ajay Kumar and Divya Sreepada

FOOD BIOTECHNOLOGY

COURSE CODE: BTT-OE-301

CREDITS: 2

Course Objective: The objective of this course is to provide knowledge of food biotechnology. This elective course is designed for those students who have not Life Science background wish to study microbial spoilage of food and their control as well as to understand importance of prebiotics and probiotics in human diet.

COURSE CONTENTS:

Unit I

Microbes in Food Spoilage & Control

Types of micro-organism normally associated with food, mold, yeast, and bacteria, Microbial growth pattern, physical and chemical factors, influencing destruction of microorganisms. Micro-organisms in natural food products and their control. Biochemical changes caused by micro-organisms, deterioration and spoilage of various types of food products. Food poisoning and microbial toxins, standards for different foods. Food borne intoxicants and mycotoxins.

Unit II

Prebiotic sand Probiotics

Food Sources- Prebiotics [Dietary fibre, Oligosaccharides (Galacto-oligosaccharides, Fructo-oligosaccharides), Resistant Starch, Sugar alcohols], Traditional Fermented Foods as sources of Probiotics. Strains of microorganisms used as probiotics. Role in Health and Disease, Mechanism of Action, Levels of Probiotics required for therapeutic efficacy. Genetically modified foods (GM foods): Crops Fruits and vegetables Genetically modified livestock and fish (GM fish).

Student Learning Outcome (LO): After successful completion of the course student will be able to understand

1. Scope of microbial food spoilage & control by using different method
2. Food poisoning associated with microbial toxins and food borne intoxicant and mycotoxin
3. Role of prebiotics and probiotics in health and disease control
4. Significance of genetically modified food

Recommended Textbooks and References:

1. Anthony Pometto (2005). Food Biotechnology, 2nd Edition. CRC Press
2. Byong H Lee (2014). Fundamentals of Food Biotechnology, 2nd Edition, Wiley Blackwell
3. Goldberg, I 1994. Functional Foods: Designer Foods, Pharma foods, NutraceuticalsChapman & Hall

4. Gibson, GR and William, CM. (2000). Functional foods - Concept to Product. Wood head publishing.

5. Aluko, R.E. (2012). Functional Foods and Nutraceuticals. Springer

6. Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York.

7. Jay J.M. 1986. Modern Food Microbiology. 3rd Edition. VNR, New York.

8. Robinson, R.K. Ed. 1983. Dairy Microbiology. Applied Science, London.

PATENT WRITING AND IPR
COURSE CODE: BTT-OE-401

CREDITS: 2

Course Objectives: To make the students familiar with basics of IPR and their implications in Research, development and commercialization. Facilitate the students to explore career options inIPR.

COURSE CONTENTS

UNIT-I

Concept of Intellectual Property Rights: Protection of human innovations by IPR such as Patents, Trademarks, Copyright, Industrial Designs Registrations, Geographical Indications, Trade Secrets etc. Territoriality of IPR; Role of WTO and WIPO; Balancing Rights and Responsibilities.

UNIT-II

Patents: Benchmarks for patentability of inventions; Understanding the Patent system in India; Filing patents outside of India. Searching patents databases for designing research objectives; online patents search patent search strategy; Debates surrounding patent protection in fields like biotechnology, computer sciences, etc.

UNIT-III

Industrial Designs Registrations and copyright: Classification, Protection and Enforcement of Industrial Designs in India. Registration and protection of design in India and abroad.

UNIT-IV

Trade Secrets: What are trade secrets; how trade secrets are to be maintained; how trade secrets areused in trade and businesses.

Student Learning Outcomes (LO):

1. The students will be able to get an adequate knowledge on patent and copyright for their innovativeresearch works.

2. During their research career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provides further way for developing their idea or innovations

Recommended Textbooks and References:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN:Cengage Learning India Private Limited.

2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning PrivateLimited.

3. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

4. Ganguli Prabuddha "Intellectual Property Rights--Unleashing the Knowledge Economy", TataMcGraw Hill (2001).