Basket 4

Biotechnology

Course Code	*Course Title*	*Course type*	*Credits*	*Prerequisite*
CCBT0101	*Genomics and Proteomics*	*Theory*	*3*	*FCEN0408 Principles of Biochemistry*
CCBT0102	*Enzymology and enzyme technology*	*Theory*	*3*	*FCEN0408 Principles of Biochemistry*
CCBT0103	*Animal Biotechnology*	*Theory*	*3*	*FCEN0115 Introduction to Biotechnology*
CCBT0104	*Plant Biotechnology*	*Theory*	*3*	*FCEN0115 Introduction to Biotechnology*
CCBT0105	*Analytical techniques*	*Theory*	*3*	*FCEN0116 Introduction to Biophysics FCEN0408 Principles of Biochemistry*
CCBT0106	*Computational Biology*	*Theory*	*3*	*FCEN0116 Introduction to Biophysics FCEN0408 Principles of Biochemistry*
CCBT0107	*Bioprocess Principles*	*Theory*	*3*	*Nil*
CCBT0108	*Environmental Biotechnology*	*Theory*	*2*	*Nil*
CCBT0401	*Molecular Biology*	*Theory + Practice*	*5*	*Nil*
CCBT0402	*Immunology*	*Theory + Practice*	*4*	*FCEN0408 Principles of Biochemistry*
CCBT0403	*Introductory Biostatistics and Bioinformatics*	*Theory + Practice*	*4*	*Nil*
CCBT0404	*Recombinant DNA technology*	*Theory + Practice*	*4*	*FCEN0408 Principles of Biochemistry, FCEN0115 Introduction to Biotechnology*
CCBT0405	*Microbiology*	*Theory + Practice*	*5*	*Nil*

CCBT0101 GENOMICS AND PROTEOMICS (3 0 0 3)

Prerequisite: Nil

OBJECTIVES

To familiarize and expose the students to the

1. Principle of gene expression

2. Concepts of functional genomics in biopharmaceutical industry

3. Application of gene therapy

4. Principles of proteomics

5. Role of models in genetic disorder

MODULE 1: Introduction to Genomics 17

New science of genomics, orientation and structure of genomes, subdividing the genome, assembling a physical map of a genome.

Comparative and structural genomics

Sequencing methods and strategies, genome annotation and bioinformatics, comparative Genomics, protein structural genomics.

MODULE 2: Mapping protein interactions and aplications 13

Global expression profiling, comprehensive mutant libraries, mapping protein interactions, applications of genome analysis and genomes.

MODULE 3: Tools of proteomics and application 12

Proteomics and Proteomes, Various tools used in proteomics. Mining proteomes, protein expression profiling, identifying protein – protein Interactions and protein complexes, mapping-protein identification, new directions in proteomics.

Total hours :45

TEXT BOOK:

Introduction to Proteomics by Daniel. C. Liebler, Humana press, 2002,198 pages.

CCBT0102 ENZYMOLGY AND ENZYME TECHNOLOGY (3 0 0 3)

Prerequisite: Biochemistry

OBJECTIVES

1. To introduce the basic concepts about enzymes, action, and kinetics

2. Advanced information about immobilized enzyme systems and biosensors

MODULE 1: Application and characterization of enzymes 14

Classification of Enzymes; Commercial application of enzymes in food, pharmaceutical and other industries; Enzymes for analytical and diagnostic applications. Production and Purification of Crude Enzyme extracts from plant, animal and microbial sources-some case studies; Techniques to isolate and analyze proteins- salt fractionation, ion-exchange chromatography, gel permeation, HPLC, SDS-PAGE, methods of characterization of enzyme; development of enzymatic assays.

MODULE II: Mechanisms and kinetics of enzyme action 14

Mechanism of Enzyme Action; Concept of active site and energetic of enzyme substrate complex formation; Specifically of enzyme action; Kinetics of single substrate reactions; turnover number; estimation of Michaelis –Menten parameters, multi - substrate reactions- mechanism and kinetics; Types of inhibition – kinetic models; Substrate and Product Inhibition; Allosteric regulation of enzyme; Deactivation kinetics

MODULE III: Enzyme Immobization and Biosensors 17

Physical and Chemical techniques for enzyme immobilisation – adsorption, matrix entrapment, encapsulation, cross linking, covalent binding etc. examples; advantages and disadvantages of different immobilization techniques, overview of application of immobilized enzyme systems.

Design of Immobilized Enzyme Reactors – Packed – bed, Fluidized- bed and Membrane reactors- Application and advantages. Application of enzyme in analysis; Design of enzyme electrodes and their application as biosensors in industry, health care and environment.

Total: 45 hours

TEXT BOOKS

1 *Enzymes* by Trevor palmer

2 *Biochemistry* by Jeremy M.Berg, John L.Tymozko, Lubert Styer, Fifth edition, W.H.Freeman and Company, 1514 pages.

CCBT0103 ANIMAL BIOTECHNOLOGY (3 0 0 3)

Prerequisite: INTRODUCTION TO BIOTECHNOLOGY

OBJECTIVES:

- To provide the fundamentals of animal cell culture, details of the diseases and

therapy

- To offer the knowledge about the micromanipulation and transgenic animals

MODULE I: Animal Cell Culture 15

Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures: suspension cultures, continuous flow cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; organ cultures.

MODULE II: Animal Diseases and their Diagnosis 17

Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, *in-situ* hybridization; northern and southern blotting; RFLP.

Therapy of Animal Diseases

Recombinant cytokines and their use in the treatment of animal infections; monoclonal antibodies in therapy; vaccines and their applications in animal infections; gene therapy for animal diseases.

MODULE III: Micromanipulation of Embryo's 13

What is micromanipulation technology; equipments used in micromanipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ cell manipulations; in vitro fertilization and embryo transfer; micromanipulation technology and

breeding of farm animals.

Transgenic Animals

Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002

2. Ramadass P, Meera Rani S. Text Book of Animal Biotechnology. Akshara Printers, 1997.

REFERENCES:

1. Freshney, R.I., "Culture of Animal Cells: A Manual of Basic Techniques and Specialized Applications", 6th Edition, John Wiley & Sons, 2010.

2. Portner, R., "Animal Cell Biotechnology: Methods and Protocols", 2nd Edition, Humana Press, 2007

3. Masters J.R.W. Animal Cell Culture: Practical Approach. Oxford University Press.2000

CCBT0104 PLANT BIOTECHNOLOGY (3 0 0 3)

Prerequisite: INTRODUCTION TO BIOTECHNOLOGY

OBJECTIVES

1. To impart knowledge on production of transgenic plants

2. To make the students to understand the concepts and applications

MODULE I: Plant genomes and plant tissue culture 12

Introduction-gene structure and gene expression-regulation, implication for plant transformation,-Protein targeting, heterologous promoters, genome size and organization, Arabidopsis and new technologies. Plant tissue cultureplasticity and totipotency, culture environment, growth regulators, media regulators, culture types, plant regeneration.

MODULE 2: Plant transformation technique 17

Introduction- *Agrobacterium* mediated gene transfer –Ti-plasmid-process of T-DNA transfer and integration, transformation in plant, Direct gene transfer methods. Binary vectors- basic features of vectors-optimization-clean gene technology.

Trnagenic Plants: Herbicide and Pest resistance

Herbicide resistance-use of herbicide in modern agriculture-strategies for engineering herbicide-Resistance environment impact, pest resistance-nature and scale of insect / pest damage to crop-GM strategies-Bt approach to insect resistance-copy nature strategy-insect resistant crops and food safety.

MODULE 3: Plant disease resistance and stress tolerance 16

Introduction-plant-pathogen interactions-natural disease resistance pathways-biotechnological - Approaches to disease resistance. Plant viruses- types-entry and replication-transgenic approach-PDR Stress tolerance-abiotic stress-water deficit stress and various approaches for tolerance.

Molecular farming and GM crops future prospects

Introduction-carbohydrates and lipids production-molecular farming of proteins-economic considerations for molecular farming.GM crops-current status-concerns about GM crops regulations of GM crops and products-Greener genetic engineering.

Total hours : 45

TEXT BOOK

Plant Biotechnology-The genetic manipulation of plants. Adrian Slater, NigelW.Scott and MarkR.Fowler.Oxford university press, pg-341.

CCBT0105 ANALYTICAL TECHNIQUES (3 0 0 3)

Prerequisite: BIOCHEMISTRY, BIOPHYSICS

OBJECTIVES:

1. To impart knowledge about the theoretical working of spectrometry and chromatography

2. To teach the application of such techniques in biotechnology and related fields

MODULE 1: Spectroscopy 15

Introduction to absorption an elimination spectroscopy – UV and visible spectrometers UV visible and absorption method, fluorescence and phosphorescence spectrophotometry, Infrared spectrometers, X ray methods.

MODULE 2: NMR and Mass Spectrometry 15

Theory of NMR - environmental effects on NMR spectra - chemical shift- NMR spectrometers,

applicatons of 1H and 13C NMR- Molecular mass spectra, ion sources. Applications of molecular mass - Electron paramagnetic resonance- g values - instrumentation.

MODULE 3: Separation Methods and surface microscopy 15

General description of chromatography, Band broadening and optimization of column performance, Liquid chromatography, Partition chromatography, Adsorption chromatography, Ion exchange chromatography, size exclusion chromatography, Affinity chromatographyprinciples of GC and applications, HPLC- Capillary electrophoresis. Applications HPLC theory and instrumentation HPLC methods and applications. Study of surfaces -Scanning probe microscopes: AFM and STM.

Total hours: 45

TEXT BOOKS

Instrumental methods of analysis by Willard, Merit Dean and Settle Edition 1986. CBS publishers and distributors.

CCBT0106 COMPUTATIONAL BIOLOGY (3 0 0 3)

Prerequisite: Nil

OBJECTIVES

To enable the student to

1. Apply simulations to the study of problems such as protein folding, docking, prediction of protein- protein interaction networks.

2. To understand the approaches to do equilibration, sampling, free energy computation and kinetics of biological molecules.

3. To understand combinatorial approaches for solving biological network problems.

MODULE I: Introduction to computational biophysics and macromolecules 15

Protein folding, protein – ligand and protein- protein docking, Biological networks: protein interaction networks.

Molecular Dynamics: Introduction to molecular dynamics, equilibration and convergence, molecular dynamics ensembles: Langevin dynamics vs. Nose like thermostats.

MODULE II: Conformational Sampling 17

Multicanonical approaches, parallel tempeing\ replica exchange, capturing rare events, free energy computation.

Longtime dynamics: Multiple time stepping integrators, elastic network methods, finding reaction paths, comparison to experiments: NMR and X-ray crystallography. Modeling salvation for biomolecules.

MODULE III: Protein interaction Networks 12

Kinetics of protein folding, inferring protein interaction networks, validating protein interactions experimentally and computationally.

Total: 45 hours

TEXT BOOK:

Molecular Modeling and Simulation: An Interdisciplinary Guide, Springer- Verlag, 2002.

CCBT0107 BIOPROCESS PRINCIPLES (3 0 0 3)

Prerequisite Nil

OBJECTIVES

1. To study the historical development of bio process technology design and construction of fermentor and parameters to be monitored and controlled in fermentation process

2. To evaluate the kinetics and thermodynamics of enzymatic process

3. To teach the principle of sterilization design

4. To study the stoichiometry and energetics of cell growth and product formation

5. To evaluate the kinetics and mechanism of microbial growth

MODULE 1 : Introduction to Bioprocess **13**

Historical development of bioprocess technologies, role of bioprocess engineer in the biotechnology industry, concept of Bioprocess, outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets. A brief survey of organisms, processes, products and market economics relating to modern industrial biotechnology.

Fermentation Process

General requirements of fermentation processes; Isolation, preservation and improvement of industrially important micro- organisms, development of innocula for industrial fermentations. Different types of fermentations, Basic design and construction of fermentor and ancillaries, An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry solid-substrate fermentation and its applications.

MODULE II: Metabolic stoichiometry and Energetics **13**

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass available, electron balances, yield coefficient of biomass and product formation, maintenance coefficients, energetics analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

MODULE III: Media design and sterilization for fermentation process **19**

Designing of media for fermentation processes, Types of media, design and usage of various commercial media for industrial fermentations, thermal death kinetics of micro organisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air, design of sterilization equipment.

Kinetics of microbial growth and product formation

Phases of cell growth in batch cultures, simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms. Growth associated (primary) and non-growth associated (secondary) product formation kinetics, Leudking – Piret models, substrate and product inhibition on cell growth and product formation.

TOTAL 45

REFERENCE BOOKS:

1. Pauline.M.Doran ., "*Bioprocess Engineering Principles*";Academic press ..

2. Peter F.Stanbury, Allan Whitaker, "*Principles of Fermentation Technology*"

3. Michael L.Shuler and Fikret Kargi, "*Bioprocess Engineering Basic concepts*", Prentice Hall, 1992.

CCBT0108 ENVIRONMENTAL BIOTECHNOLOGY (2 0 0 2)

Prerequisite Nil

OBJECTIVES

Students completing this course should be able

1. To understand the role of various environmental pollutants, biooxidation, biotransformation

2. To know the involvement of microbes in waste water treatment, chemicals

MODULE I: Introduction to environmental pollutants 16

Water, Soil and Air: their sources and effects. Removal of Specific Pollutants : Sources of Heavy Metal Pollution, Microbial Systems for Heavy Metal Accumulation, Biosorption & detoxification mechanisms.

Microbiology and biochemistry of waste water treatment

Biological Treatment of anaerobic and aerobic; methanogenesis, methanogenic, acetogenic, and fermentative bacteria- technical process and conditions; Use of Genetically Engineered Organisms. emerging biotechnological processes in waste - water treatment; Applications include treatment of municipal and industrial wastewaters,

MODULE II: Biodegradation of Xenobiotic compound 16

Xenobiotic compounds : Aliphatic, Aromatics, Polyaromatic Hydrocarbons, Polycyclic aromatic compounds, Pesticides, Surfactants and microbial treatment of oil pollution.

Biotransformations and catalysts

Basic organic reaction mechanism - Common prejudices against Enzymes.- Advantages & Disadvantages of Biocatalysts - Isolated Enzymes versus whole cell systems.- Mechanistic Aspects and Enzyme Sources.- Biocatalytic Application - Catalytic Antibodies; Stoichiometry, kinetics, and thermodynamics of microbial processes for the transformation of environmental contaminants.

MODULE 3: Bio oxidation and microbial leaching **13**

Biooxidation – Direct and Indirect Mechanisms – Biooxidation Kinetics; Bacterial oxidation of Sphalerite, Chalcopyrite and Pyrite.; Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.

Total: 45 hours

REFERENCE BOOKS:

1. Environmental Microbiology, W.D. Grant & P.E. Long, Blakie, Glassgow and London.

2. Microbial Gene Technology, H. Polasa (ED.) South Asian Publishers, New Delhi.

3. Biotreatment Systems, Vol. 22, D. L. Wise (Ed.), CRC Press, INC.

4. Standard Methods for the Examination of Water and Waste Water (14 th Education) ,

1985. American Public health Association

5. Environmental Biotechnology by Bruce Rittmann and Perry McCarty

6. Biotransformations : K. Faber (1995), Springer- Verlag.

CCBT0401 MOLECULAR BIOLOGY (3 0 0 3)

Prerequisite: Nil

OBJECTIVES

To impart knowledge on Nucleic acids and their characteristics, transcription, translation, protein sorting, regulation of gene expression

MODULE 1: Introduction to molecular Biology - DNA and RNA 18

Scope and History. Structure of DNA-Nucleoside, Nucleotide, Base pairing, Base stacking, Double Helix, features of Watson and Crick model, major and minor groove, Supercoiling- twist, writhe and linking number. Forms of DNA:A,B, Z. Structure and function of mRNA, rRNA, tRNA. Secondary structures in RNA.

Replication and repair

Types and functions of DNA polymerases in Prokaryote and Eukaryote. Replication in prokaryote and Eukaryote. Proof reading activity, 5'□ 3' exonuclease activity, topoisomerase activity, Telomeric DNA replication and Plasmid Replication-theta model, strand displacement model and rolling circle model. DNA Repair- Nucleotide excision repair, base excision repair, mismatch repair, photo-reactivation, recombination repair and SOS repair.

MODULE II:Transcription and post-transcriptional modification 13

Fine structure of prokaryotic and eukaryotic gene, structure and function of the promoters in mRNA, rRNA, tRNA genes. RNA polymerases in prokaryote and eukaryote, types and function. Transcription of mRNA, rRNA, and tRNA genes in Prokaryote and eukaryote. Post transcriptional processing of mRNA – 5'capping, splicing (including different types), polyadenylation and RNA editing.

MODULE III: Translation and post translational Processing 14

Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, Prokaryotic and eukaryotic ribosomes. Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis. Post translational modifications and its importance.

Gene Regulation

Principles of gene regulation- Transcriptional and post transcriptional gene regulation-activators, co-activators, suppressors, co-suppressors, moderators, silencers, insulators, enhancers. Operon-*lac* operon, *trp* operon, *ara* operon and *gal* operon.

TOTAL 45

TEXT BOOKS:

1. *Molecular Biology of Gene* - Watson

2. *Molecular and Cellular Biology*- Stefen Wolfe

CCBT0402 IMMUNOLOGY (3 0 0 3)

Prerequisite Nil

OBJECTIVES

1. The immune system ,their structure and classification ,genetic control of antibody production

2. Cellular immunology

3. Mechanism of activation in hypersensitive immune reaction

MODULE 1: Overview of the immune system 15

Innate Immunity, adaptive immunity, comparative immunity cells and organs the immune system – Antigens.

Immunoglobulin structure and functions

Basic structures of Immunoglobulins – Ig classes and biological activities, Antigenic determinants on Ig, B Cell receptor, Monoclonal antibodies – cytokines – complement system

MODULE 2: Antigen-antibody interactions 18

Antibody Affinity and activity–Precipitation reactions- agglutination reactions- Radio immunoassay-ELISA-Western blotting, Immunoprecipitation, Immunofluroscence, immunoelectron microscopes, flow cytometers-MHC Antigen processing & presentations.

T cell and B cell maturation, activation and differentiation

T Cell receptor, T Cell maturation, activation and differentiation B Cell generation, activation and differentiation cell mediated effectors responses.

MODULE 3: Immune system in health and disease 12

Leukocyte migration and inflammation, hypersensitive reactions, immune response to infection diseases vaccines.

Total hours: 45

TEXT BOOK:

Kuby Immunology by Richard A. Golds by Tharmas J. kindt fourth edition 2000 and Barbara Osborne. W.H.freeman

and company

REFERENCE BOOK

Immunobiology 6th Edition, Janeway, Travers, Walport, Shlomchik, Garland, 2005

CCBT0403 INTRODUCTORY BIOSTATISTICS AND BIOINFORMATICS (3 0 1 4)

Prerequisite: INTRODUCTION TO BIOTECHNOLOGY

OBJECTIVES

1. Scope of Bioinformatics

2. Introduction to sequence alignment and programming

3. Database and their use

4. Protein analysis using bio informatics tools

5. DNA mapping and other special topics in bio informatics

MODULE I: Introduction to Biostatistics

Handling univariate and bivariate data – Measures of central tendency – Measures of dispersion –Skewness & Kurtosis – Correlation and Regression .

Probability and theoretical distribution: Probability concepts – conditional probability – Baye's theorem – one – dimensional random variables – expectation, variance, moments. Theoretical distributions : Binomial, Poisson, Normal (Problems only).

MODULE II: Introduction and NCBI

Internet basics; Connecting to internet; Email; FTP; www; The NCBI data model: Introduction, BIOSEQ's, BIOSEQsets, SEQ- ANNOT, SEQ- DESCR.

Biological Databases: Biological databases-primary sequence databases- Composite sequence databases- Secondary databases-composite protein pattern databases-structure classification databases. Genome Information Resources: DNA sequence databases specialized genomic resources, GRAIL, GENSCAN

MODULE III: Allignment Techniques and Protein analysis

Pairwise Alignment Technique: Database searching-algorithms and programs-comparing two sequences- identity and similarity-global and local alignment- pairwise database searching. Multiple sequence Alignment: Goal of multiple sequence alignment-Computational Complexity-Manual methods-Simultaneous methods-Progressive methods Databases of multiple alignment-Secondary database searching-Analysis packages. **Protein analysis**: Protein identity based on composition, Motifs and patterns, secondary structure prediction, specialized secondary structures, tertiary structure

LIST OF EXPERIMENTS

1. Knowledge about nucleotide Databases.

2. Knowledge about Protein databases.

3. Literature survey through Pubmed.

4. Local similarity search.

5. Global similarity search.

6. Gene prediction and translation.

7. Protein sequence analysis.

PRACTICAL 15

TOTAL 45

TEXT BOOKS

1. Andreas D Baxevanis & B F Francis," *Bioinformatics- A practical guide to analysis of Genes & Pr*

CCBT0404 RECOMBINANT DNA TECHNOLOGY (3 0 0 3)

Prerequisite MOLECULAR BIOLOGY

OBJECTIVES

1. To strengthen the knowledge on various cloning and expression vectors

2. To impart the importance of vectors in genetic engineering experiments

3. To strengthen the knowledge on various Strategies of gene cloning

4. To impart the importance genetic engineering

MODULE 1: Introduction to Cloning **15**

Overview of Cloning, Purification and Separation of Nucleic Acids – cutting and joining DNA and vectors. Plasmid vectors, phage vectors,cosmids , Manipulation of DNA–Restriction and Modification enzymes, Design of linkers and adaptors. Characteristics of cloning and expression vectors based on plasmid and bacteriophage, Vectors for yeast, insect and mammalian systems, Prokaryotic and eukaryotic expression host systems, Introduction of recombinant DNA in to host cells and selection methods.

MODULE II: cDNA libraries and DNA sequencing **15**

Genomic libraries – cDNA libraries – Screening libraries –PCR.

Principles of DNA Sequencing: Maxam Gilbert's and Sanger Coulson's and automated methods of DNA sequencing, Inverse PCR, Nested PCR, AFLP-PCR, Allele specific PCR, Assembly PCR, Asymmetric PCR, Hot start PCR, Colony PCR, single cell PCR, Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beacons, Site directed mutagenesis.

MODULE III: Analysis and manipulation of Gene expression and function **15**

Analysis of gene expression, analyzing transcription and translation, Analysis of gene function, Genetic maps, linkage analysis, transposon mutagenesis, Manipulation of gene expression, Expression in Bacteria and Eukaryote host cells – in vitro mutagenesis. Site directed mutagenesis.

Application of Cloning: applications – vaccines – human and genetic diseases – transgenics.

Total hours: 45

TEXTBOOKS:

1. *From Genes to Genomes* by Jeremy W. Dale and Malcolm von Schantz, 2002, John Willey and sons Publications - 353 pages.

2. *Principles of Gene Manipulation, An Introduction to Genetic Engineering* Old R.W.Primrose SB, -Blackwell Scientific Publications

CCBT0405 MICROBIOLOGY (3 0 0 3)

Prerequisite: Nil

OBJECTIVES

1. To highlight the roles and characteristics of microorganisms

2. To impart knowledge on the basic concept of replication in microorganisms

3. To study in detail the growth of microorganisms and impact of environment on their growth

4. To evaluate explicitly, the metabolic pathways, role of microbes in public health; insight into the physical and chemical control of microorganisms.

MODULE I: Introduction to microbiology 12

Characterization, Classification and Identification of microorganisms, Microscopic examination of

Micro organisms morphology and fine structure of bacteria, cultivation of bacteria, reproduction &

growth, pure cultures and cultural characteristics.

MODULE II: Microbial Physiology and genetics 17

Enzymes and their regulation, Microbial metabolism energy production, utilization of energy & biosynthesis, bacterial genetics. Fungi – importance, characteristics, morphology, reproduction, physiology cultivation & classification of fungi, molds & repair association with other organisms. Algae – importance of algae – characteristics of algae, classification protozoa: Ecology, importance, morphology, reproduction and classification of protozoa – control of micro organisms.

MODULE III: Viruses of bacteria, animal and plants 16

Bacteriophages- General characteristics-Morphology and structure, Classification and Nomenclature- Bacteriophages of *E.coli* – Replication -viruses of plants and animals- Structure-Replication- Classification- isolation and identification-fatal diseases associated with viruses in animals-viroids. **Environmental and industrial microbiology**: Microbiology of soil – aquatic microbiology, Microbiology of domestic water and waste water. Microbiology of fuel and Industrial microbiology

Total hours: 45

TEXT BOOK

Microbiology by Pelczar, JR E.C.S Chan and noel R.Krieg. Fifth edition Tata Mc GrawHill - 2006