M.Sc. MICROBIOLOGY
SEMESTER - I

COURSE TITLE: CELL BIOLOGY

Course code: PSMBTC101
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2018, Dec 2019 & Dec 2020

Objectives: Cell is the basic unit of life. Therefore knowledge concerning it is important for the pursuit of other branches in life sciences. The course has been designed to provide insight to students into the structures of cell and constituents, and to some extent their functioning, which will serve as the edifice for subsequent learning.

UNIT – I: CELL STRUCTURE AND DIVERSITY

i. Universal Properties of Cell; cell theory, diversity of the cell size and shape, different classes of cells
ii. Preliminary methods used in cell biology, Microscopic techniques for study of cells; Sub-cellular fractionation.
iii. Membrane structure and function; Transport of nutrients, ions and macromolecules across membranes, exocytosis, and endocytosis, Membrane pumps; Na^+, K^+, Ca^{2+} pumps.
iv. Cell wall and ECM, Cell motility; cilia, flagella of eukaryotes and prokaryotes.

UNIT - II: CELL ORGANELLES

i. Cellular organelles; Structure and function of endoplasmic reticulum, golgi bodies, lysosomes, endosome, Mechanism of vesicular transport.
ii. Mitochondria, chloroplast and peroxisomes.
iii. Nucleus; nuclear envelope, NPC, nucleolus, nuclear matrix.
iv. Chromosomes and chromatin, centromeres, telomeres, nucleosome, Hetero- and euchromatin, types of chromosomes and alterations.

UNIT - III: CELL SIGNALING AND CELL COMMUNICATION

i. Cell signaling- signaling molecules, cell surface receptor; G- protein linked cell-surface receptors, protein-kinase linked cell surface receptors, signal transduction pathways; Ras/MAPK' Pathways, second messengers.
ii. Cell signaling in micro-organisms; bacterial chemotaxis, quorum sensing.
iii. General principle of cell communication, cell-cell interaction, structural and functional significance of plasmodesmata.
iv. Cellular junction and adhesion; role of different adhesion molecules, gap junction.

UNIT – IV: CELL CYCLE, GROWTH, DIVISION AND REGULATION

i. Biology of cancer; Cancer Genes (Oncogenes and Tumor Suppressor Genes), retinoblastoma and E2F proteins.
ii. Introduction to growth control and cell cycle; Mitotic Spindle, Microtubules, checkpoints.
iii. Regulators of cell cycle progression; role of cyclin and cyclin dependent kinases.
iv. Apoptosis and cell death; program cell death, extrinsic and intrinsic pathways

UNIT –V: **DEVELOPMENT BIOLOGY**

i Cellular basis of differentiation and development- mitosis, gametogenesis and fertilization.
ii Development of *Drosophila*- early drosophila development, pattern formation, maternal and gap genes, pair rule and segmentation genes, nervous system and eye development, Homeotic genes and their role in development.
iii Development of *C. elegans*-Introduction, life cycle, organogenesis (vulva formation).
iv Morphogenesis and organogenesis in *Arabidopsis thaliana* as model plant- shoot and root development, leaf and floral development.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walsh, P. (2006) Molecular Biology of the Cell. Garland Science, USA. . 4th edition.
2. Alberts, B., Bray, J.L., Roberts, K. and Watson, J.D. (2008). Molecular Biology of the Cell. Garland Publishing House, New York. 2nd ed.
3. Du Praw, E.J. (1968). Cell and Molecular Biology. Allyn & Bacon, Boston, USA.

4. Dyson, R.D. (1975). Essentials of Cell Biology. Allyn & Bacon, Boston, USA.
5. Swanson, C.P. and Webster, P. (2006). The Cell. Prentice – Hall, Englewood Cliffs, USA.
6. De Robertis, E. D. P. and De Robertis, E.M.F. (2001) Cell and Molecular Biology. Lippincott Williams and Wilkins, Philadelphia, USA. .8th ed.
7. Karp, G (2007) Cell and Molecular Biology : Concepts and Experiments. John Wiley Inc. New York. 5th ed.
8. Szallasi, Z., Stelling, J., and Periwal,V.(2007). System Modelling in Cellular Biology, Prentice Hall, India.

M.Sc MICROBIOLOGY
SEMESTER-I

COURSE TITLE: BACTERIOLOGY AND VIROLOGY

Course code: PSMBTC102
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2018, Dec 2019, Dec 2020

Objective: A microbiologist must be acquainted did many biological disciplines and with all major groups of micro organisms. Bacteria and viruses has a great impact on fields such as medicines, agricultural and food sciences, ecology, genetics, bio chemistry and molecular biology. The course on Bacteriology and Virology would provide a balanced introduction of these areas to the students of microbiology.

UNIT – I: GENERAL BACTERIOLOGY

i. Morphology and ultrastructure of bacteria. Cell Wall of Archaebacteria, Gram negative, Gram positive and of eukaryotes, L-Form cell wall synthesis.
ii. Structure, composition and function of: cell membranes, flagella, cilia, pili, inclusion bodies, nucleoid.
iii. Antigenic properties of capsule, Chemotaxis and Endospore.
iv. Cell division.

UNIT – II: BACTERIAL GROWTH AND KINETICS

i. Culture media- types and composition. Methods of preservation of microbial cultures.
ii. Cultivation of bacteria, Aerobic and Anaerobic, Growth Kinetics; Batch and Continuous culture, Synchronous, Asynchronous.
iii. Growth measurement, Factors affecting growth. Control of bacterial growth, Physical and chemical agents.
iv. Basis of microbial classification, classification and silent features of bacteria according to the Bergey's manual of determinative bacteriology, Cyanobacteria, Prochlorons and Cyanelles.

UNIT – III: GENERAL VIROLOGY

i. Discovery, nomenclature, classification of animal and plant viruses, distinctive properties and cultivation of viruses.
ii. Morphology and ultrastructure; Capsid, and their arrangements, Types of envelopes and their composition. Viral genome; types and structure.

iii. Virus related agents; viroids and prions. Bacteriophage structural organization, Life cycle; lysogenic and lytic. Bacteriophage typing and its application in bacterial genetics.
iv. Brief details on M13, Mu, T-even, T-odd and lambda P1.

UNIT – IV: PLANT VIRUSES

i. Effects of viruses on Plants, Common viral diseases of plants.
ii. Viruses of Cyanobacteria, Algae, Fungi.
iii. Life cycle of TMV, Cauliflower mosaic virus, potato mosaic virus.
iv. Various plant virus vectors; insects, nematodes and fungi. Vectorless mediated transmission. Prevention of crop loss due to virus free planting material, vector control.

UNIT- V ANIMAL VIRUSES

Epidemiology, life cycle, pathogenicity, diagnosis, prevention and treatment of :

i. RNA viruses-Picorna, Ortho myxo, Para myxo, Toga.
ii. Arthopod viruses, Rhabdo, Rota, and other Oncogenic viruses.
iii. DNA viruses; Pox, Herpes, Adeno, SV40, Hepatitis virus.
iv. Viral vaccines, interferons and Antiviral drugs.

NOTE FOR PAPER SETTING AND COURSE EVALUATION:

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Moat,A.G., Foster, J.W. and Spector, M.K.(2002) Microbial physiology. Wileyliss a John Wiley and sons, Inc. Publication.
2. Stainer, R.Y., Ingrahm, J.L., Wheelis, M.L. and Painter, P.R.(1991) General Microbiology. The MacMillian Press.
3. Pelczar, M.J., Chan, E.C.S.,Kraig N.R., (2002). Microbiology, Mc Graw Hills.
4. Balows, A.G.Thuper, M. Dworkin. W. Harder, K. Springer Verlag (1991). The Prokaryotes.
5. Zubey, G.L., Pearson, W.W, and Vance, D.E.(1994) Principles of Biochemistry-W.W.C.Brown, Publishers, Oxford, England.
6. Sneath, P.H.A., Elizebeth, S.N.M. (2001) Bergeys manual of systemic Bacteriology.
7. Cappuccino,J.G and Shreman, N. (2005) Microbiology- A Laboratory Manual Addison Weseley
8. Saravanan,P. (Virology) 2007 (MJP Pub.)

9. Dimmock N.J., Easton A.J., & Leppard K.N. (2007) (An introduction to modern Virology) Blackwell pub. 5th ed.

M.Sc. MICROBIOLOGY
SEMESTER - I

COURSE TITLE: BIOCHEMISTRY AND METABOLISM

Course code: PSMBTC103
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2018, Dec 2019 & Dec 2020

Objectives: The basic goal of this course is to determine how the collections of inanimate molecules that constitute living organisms, interact with each other to maintain and perpetuate the living state. Biochemistry yields important insights and practical application in medicine, agriculture, nutrition and industry, but its ultimate concern is with the wonder of life and living things.

UNIT-I: CARBOHYDRATE METABOLISM

i. Occurrence, classification, structure of disacharrides and polysacharrides, properties and biological importance of carbohydrates.
ii. Metabolic pathways; glycolysis, aerobic and anaerobic glycolysis, oxidation of Pyruvate to Acetyl Co A
iii. Citric acid cycle and its regulation, Glyoxylate cycle; Gluconeogenesis.
iv. The pentose-phosphate reductive pathway, uronic acid pathway and their significance

UNIT-II: PROTEIN CHEMISTRY AND METABOLISM

i. Proteins: Structure, classification and functions. Structure and classification of amino acids
ii. Titration curves; Metabolism of simple, branched and aromatic amino acids; Biosynthesis of essential amino acid.
iii. Degradation of different amino acids to TCA Cycle intermediates; glucogenic and ketogenic amino acids metabolism; Allosteric regulation of amino acid biosynthesis.
iv. Urea cycle; Inborn errors of amino acid metabolism, Aminoaciduria.

UNIT-III: PHOTOSYNTHESIS AND ATP SYNTHESIS

i. Photosynthesis: concept and significance, Z scheme of photophosphorylation; C3 and C4 pathways, their nature and regulation.
ii. ATP cycle; bioenergetics; concept of entropy; free energy.
iii. Electron transport chain, substrate- level and oxidative phosphorylation.
iv. Chemiosmotic theory for ATP synthesis, regulation of ATP production; Glycerol 3 P shuttle and Malate Aspartate shuttle system.

UNIT-IV: LIPID CHEMISTRY AND METABOLISM

i. Fatty acids as building blocks of most lipids, major classes of lipids and their role.
ii. Biosynthesis of even-Chain, odd-Chain, saturated and unsaturated- fatty acids.
iii. Biosynthesis of fats, phospholipids, glycolipids and sphingolipids, prostaglandins and cholesterol.
iv. Oxidation of fatty acids, α- β- and ω oxidation; Ketogenesis and its regulation.

UNIT-V: NUCLEIC ACID CHEMISTRY AND METABOLISM

i. Nucleic acid chemistry and structure of DNA and various RNAs.
ii. Metabolism of purine- and pyrimidine- nucleotides; biosynthesis of pyrimidine nucleotides; their regulation, catabolism of pyrimidines.
iii. Purine salvage pathway, Pathway of de novo purine biosynthesis from ribosephosphate and ATP, their regulation, catabolism of purines.
iv. Regulation of biosynthesis by feedback control; Genetic disorders and hyperuricemia.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Voet, D . and Voet, J.G. (2007) Biochemistry. John Wiley and Sons inc. USA.4th ed.
2. Stryer, L. (2004). Biochemistry. W.H. Freeman & Company, New York.4th ed.
3. Lehinger, A.L. (2006). Principles of Biochemistry. CBS Publishers & Distributors, New Delhi.
4. Seage, S.L and Slabaugh, M.R. (1997). Organic and Biochemistry for Today. 3rd edition. Brooks/ cole Publishers.
5. Ritter, P. (1996). Biochemistry: A foundation. Books/ cole Publishers.
6. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2003). Harper's Biochemistry. Appleton, Lange Publishers, CT. 6th edition.
7. Burtis, C.A., Ashwood, E. R. (2007). Clinical Chemistry. Elsener Publishers. 5th edition.
8. Luxton, B. and Pallister, K. (2007). Clinical Biochemistry. Butterworth Heinemann Publishers.
9. Voet, D and Voet, J.G. (1995), Biochemistry, John Wiley and Sons, Inc.USA. 2nd edition.

M. Sc. MICROBIOLOGY
SEMESTER - I

COURSE TITLE: MOLECULAR BIOLOGY

Course code: PSMBTC104
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2018, Dec 2019 & Dec 2020

Objectives: In today's scientific world no biological study is complete till it is studied at the molecular level. This course will guide students about the basic background (physical and chemical) of molecular biology. The primary objective is to make students achieve a simple, comprehensive and interested view of basic composition of nucleic acids, their structure and their mode of replication. The study deals with conversion of genetic information coded in DNA to cellular macromolecules. The contents cover important aspects like, synthesis, modification and regulation of important cellular macromolecules, namely RNA and Protein.

UNIT-I: DNA STRUCTURE, FUNCTION AND REPLICTION

i. DNA as a genetic material, DNA Structure and function: Physical and chemical structure of DNA, Alternate forms of DNA A,B,Z; Alternate DNA structure H-, G- DNA loops; D-loop, R-loop cruciforms, hairpin loops
ii. DNA structures; Primary, secondary, tertiary and quartenary DNA structure; Function of alternate forms and structure of DNA
iii. Denaturation analysis of DNA; denaturation curve and assessement of GC % and Tm, Hyper and hypochromic effect of DNA
iv. Replication of DNA, Replication of core genome and replication of extrachromosomal DNA, Elements and factors required for replication of core genome in eukaryotes, prokaryotes and viruses taking *E.coli, S. cerevisae* and phi X174 as models

UNIT-II: RNA STRUCTURE FUNCTION AND REPLICATION

i. RNA Structure; Physical and chemical structure and Function. Secondary structures of RNA, RNA as genetic material; RNA genomes; Denaturation analysis of RNA
ii. Linear and circular RNA genomes. Single stranded as well as double stranded genomes. Replication of RNA genomes + sense, -ve sense, ambi-sense and dsRNA genomes.
iii. RNA as a structural molecule transfer and ribosomal RNA, RNA as a information molecule messenger RNA, RNA as an biocatalyst, Ribozymes, RNA as a regulatory molecule; RNAi and Antisense RNA

iv. Introduction to various types of small nuclear, small nucleolar, small cytoplasmic Mi and Si RNA molecules and their role in cell.

UNIT-III: GENE EXPRESSION - TRANSCRIPTION

i. Mechanism of transcription in prokaryotes: Elements and factors involved in prokaryotes; Promoter sequences and regulatory factors,
ii. Operon concept; Inducible and repressible operons in prokaryotes. Attenuation, antitermination, auto- regulation of gene expression. Negative and positive control of gene expression
iii. Mechanism of transcription in Eukaryotes: Gene activation in eukaryotes, Basal transcription apparatus, Eukaryotic promoter sequences, enhancers and silencers and general and specific factors.
iv. Initiation, elongation and termination of transcription in Eukaryotes. Comparison of basic transcription and regulation of transcription in Prokaryotes and eukaryotes

UNIT-IV: GENE EXPRESSION - TRANSLATION

i. Genetic Code; Universality and degeneracy of code and exceptions to code, Wobble hypothesis, Codon usage bias.
ii. Mechanism of translation in prokaryotes: Elements and factors required for translation, Co-transcriptional- translation,
iii. Initiation, elongation and termination of translation in prokaryotes. Non- ribosomal peptide synthesis.
iv. Mechanism of translation in Eukaryotes: Elements and factors required for translation, Initiation, elongation and termination of translation in eukaryotes.

UNIT V: REGULATION OF REPLICATION, TRANSCRIPTION, TRANSLATION

i. Regulation of DNA replication, Origin of replication and regulatory factor, Relation between origin, regulatory factors and copy number
ii. Regulation of transcription in eukaryotes; Post transcriptional regulation: mRNA processing capping and polyadenylation.
iii. mRNA splicing and editing, nucleo-cytoplasmic mRNA transport, mRNA stability, degradation and half life period .
iv. Regulation of translation, co- and post translational modification of peptides, role of molecular chaperons.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of

teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Watson G.D (2008). Molecular biology of the gene. Cold spring habor Ltd Press.
2. Burton E (2008). Molecular Biology: gene to protein. Jones & Bartlett.
3. Clark & Pazdernik (2009).Biotechnology: applying the genetic revolution. Academic Press.
4. Hartwell(2004). Genetics from genes to genomes. Macgrawhill.
5. Russell (2006). Genetic: molecular Approaches. Pearson Press.
6. Lewin (2011). GenesX. Jones & Bartlett.

M.Sc MICROBIOLOGY
SEMESTER-II

COURSE TITLE: GENETIC ENGINEERING

Course code: PSMBTC201
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: The aim of the course is to extend the student's understanding of new concepts and expertise in molecular biology and fundamentals of recombinant DNA technology.

UNIT-I: FUNDAMENTALS OF GENETIC ENGINEERING

i. Scope of genetic engineering; Genetic Engineering guidelines. *E.coli* as model organism.
ii. Concept of cloning; Gene centric cloning and genome centric cloning, concept of isolation and identification of gene
iii. Molecular tools and their uses; enzymes used in genetic engineering: restriction endonucleases, Ligases, Kinases, Phosphatases, Polymerases, terminal transferases
iv. Gene cloning vectors; plasmids, bacteriophages, cosmids and artificial chromosomes.

UNIT-II: TECHNIQUES IN GENETIC ENGINEERING

i. Isolation, purification, quantitation and electrophoresis of genomic and extra genomic DNA.
ii. Isolation, purification, quantitation and electrophoresis of nuclear, organelles and cytoplasmic RNA.
iii. Size standards for DNA and RNA. Enrichment of RNA molecules for studying gene expression
iv. Southern, Northern and Western blotting; Preparation of labeled DNA probes- radioactive and non- radioactive labeling,

UNIT-III: GENE CLONING

i. Construction of genomic. Preparation of vector and insert for cloning and construction of recombinant DNA molecule. Transformation of *E.coli* with recombinant DNA.

ii. Construction of cDNA library, Cloning differentially active genes. Subtractive hybridization
iii. Screening and analysis of genomic and cDNA library by function and sequence based methods.
iv. Expression strategies for hetrologous genes; vector engineering and codon optimization, host engineering, Expression in eukaryotic and prokaryotic systems.

UNIT-IV: ALTERNATE WAYS OF GENE CLONING AND MODIFICATION

i. Polymerase chain reaction, nucleic acid amplification, primer design and programming. Modifications of basic PCR
ii. Site directed mutagenesis and protein engineering; methods, strategies and applications.
iii. Cloning interacting genes; two and three hybrid system, RNase protection assay and reporter assay,
iv. Phage display, Gene tagging, Transposon tagging. *In vitro* transcription and translation, methods and application

UNIT-V: ADVANCED TECHNIQUES IN GENETIC ENGINEERING

i. DNA sequencing; Sanger's Chain termination methods, next generation sequencing methods ,
ii. Nucleic acid micro arrays; method and applications. RNA antisense, ribozyme and interference; methods and applications.
iii. Gene Knock out technology; method and applications: Chromosome engineering; method and application.
iv. Genetic engineering in molecular diagnostics, production of genetically engineered drugs and vaccines, industrial products of genetically modified organisms.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. William, W. et al. (1997). Methods in Gene Technology. Bios Scientific Publications.
2. Glick, B.R. and Pasternack, J. J. (2007). Molecular Biotechnology: Principles and applications of recombinant DNA. ASM Press.

3. Miesfeld, R.J. (1999). Applied Molecular Genetics . John Wiley and sons Inc. Publications.
4. Ream, W. and Field, K. G. (2003). Molecular Biology Techniques. An intensive Laboratory Course. Academic Press.
5. Sambrook, J. et al.(2005). Molecular cloning: A Laboratory Manual. Cold Spring Harbour Laboratory Press , New York.
6. Primrose,S. (2007). Gene Manipulation: an embracing techniques. Blackwell Science pub.6th ed.
7. Brown, T. A. (2004). The Basic Principles of Gene cloning and DNA analysis. Blackwell science pub. IV ed.

M.Sc. MICROBIOLOGY
SEMESTER-II

COURSE TITLE: ENZYMOLOGY

Course code: PSMBTC202
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: The course is structured to provide the students insight into protein/ enzyme structure, enzyme kinetics and mechanism & control of enzyme action, enzyme folding, enzyme purification and enzymes characterization. It also aims at acquainting students with clinical and industrial applications of enzymes.

UNIT-I: INTRODUCTION TO ENZYMES

i. General characteristics of enzymes, nature of enzymatic and non-enzymatic catalysis, Enzyme specificity, biocatalysts vs chemical catalysts

ii. Criteria for Nomenclature and IUB classification of enzymes, significance of nomenclature and classification of enzymes; significance of numbering system,

iii. Holoenzyme, apoenzyme cofactor, coenzyme, prosthetic group

iv. Basis of enzyme assays, Units of enzyme activity- IU, katal, turn over number and specific activity;

v. Structure of enzyme proteins, N and C terminal amino acid determination, sequencing of polypeptides, protein folding, amino acid side chains and their influence on preferred folding; other catalytic bio-molecules.

UNIT-II: MECHANISM OF ENZYME ACTION

i. Enzyme catalysis; effect of enzyme on the rate and equilibrium of a reaction;

ii. Specificity of enzyme action: type of specificity, lock and key, induced fit hypothesis,

iii. Chemical mechanisms involved in biocatalysis, proximity and orientation effect, acid/base catalysis covalent catalysis, strain and distortion theory;

iv. Active (catalytic) site, elucidation of amino acids involved in active site, identification of functional groups at active sites;

v. Mechanism of action of chymotrypsin, carboxypeptidase, ribonuclease and lysozyme;

UNIT-III: KINETICS OF ENZYME CATALYSED REACTIONS

i. Principles of bioenergetics, basis of kinetics of enzyme catalysed reactions

ii. Steady state vs equilibrium assumption, Henri and Michaelis-Menten equations, Michaelis-Menten equation for uni-substrate enzyme catalysed reactions and its significance,

iii. Kinetic parameters V_{max}, K_m , Lineweaver-Burk plots, Eadie-Hofstee and Hanes plots,

iv. Factors affecting enzyme activity: enzyme/substrate concentration, pH and temperature dependence of enzymes,

v. Enzyme inhibitions: Reversible and irreversible inhibition, types of enzyme inhibitions, and determination of K_i.

UNIT-IV: REGULATORY ENZYMES

i. Enzymes in regulation of metabolic pathways, Covalent and noncovalent modification of enzymes,

iii. Allosteric enzymes, sigmoidal kinetics and its physiological significance,

iv. General mechanisms of enzyme regulation: Feedback inhibition, Feedback repression, induction, Partial Proteolysis;

v. Covalent modification of enzymes-reversible covalent modification.

vi. Phosphorylation, adenylylation, uridylation, ADP-ribosylation, methylation, disulphide reduction as means of regulation.

UNIT-V: ENZYME TECHNOLOGY

i. Strategies for bulk enzyme production, sources of enzyme isolation,

ii. Enzyme purification, criteria and aim for purification, techniques /steps involved

iii. Chromatography, ion exchange, adsorption, hydrophobic, and gel filteration; salting out;

iv. Ascertaining purity level of enzyme, specific activity; criteria of enzyme purity, characterization of an enzyme, determination of the molecular weight (Mr)

v. Industrial applications of enzymes- in diagnosis, therapy, brewery, dairy, food processing, detergent, textile; enzyme immobilization and its industrial importance; protein engineering, enzyme inhibitors and drug design.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Segal, L.H. (1975). Enzyme Kinetics. Wiley Interscience, USA.
2. Walsh, C. (1979). Enzymatic reaction mechanism. Freeman and company, USA.
3. Gerhartz, W. (1990). Enzyme in Industry,Production and application VCH.
4. Shultz, A.R. (1994). Enzyme Kinetics. Cambridge Press.
5. Fresht (1995) 2nd Ed. Enzyme structure and mechanism. Freeman and company.
6. Trevor, P. (2002) 4th Ed. Understanding Enzymes. Prentice Hall/Ellis, Harwood, England.
7. Dixon, M. and Webb,E.C. (1997). Enzymes, 3rd Ed. Academic Press, New York.
8. Nicholas, C. Price and Lewis Stevens (2007). Fundamentals of Enzymology. 6th edition.
9. Biotol, P. (2008). Principles of Enzymology for technological Applications. Elsevier Pub

M.Sc. MICROBIOLOGY
SEMESTER – II

COURSE TITLE: MOLECULAR VIROLOGY

Course code: PSMBTC205
Duration of Examinations
Minor Test1: 1 hour
Major Test2: 2.0 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test1: 10
Major Test: 40
Total: 50

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: This course has been designed to develop broad understanding of molecular virological strategies, mechanisms and their relationship to current paradigms in virus pathogenesis. Also, it will provide theoretical knowledge of virus groups which are pathogens, including analyses of emerging infections, through an in depth study of selected viruses. Study of antiviral activities along with their application and relevance in current research, diagnoses and treatment will remain the main learning objectives of this course.

UNIT-I: INTRODUCTION TO MOLECULAR VIROLOGY

i. Mechanisms of viral entry and Spread of Infection/ viral pathogenesis;

ii. Host Resistance to Viral Infections;

iii. Cellular receptors and virus entry. Definition, structure and methods of discovery of viral receptors (polio, herpes, HIV).

iv. Cellular interactions-clathrin coated pits, lipid rafts

v. Virus uncoating mechanisms, virus-cytoskeletal interactions, chaperons.

UNIT-II: DNA AND RNA VIRUSES

i. Types of Viruses, Animal viruses, Oncogenic viruses (tumor viruses),

ii. DNA containing oncogenic viruses, human adenovirus,

iii. RNA containing oncogenic viruses, retroviruses (Onco RNA viruses), AIDS virus.

iv. Viral diseases: Description and pathology of diseases caused by myxo and paramyxo viruses (influenza and measle virus); viruses affecting nervous system (poliomyelitis virus), enterovirus (Coxsackie), viral hepatitis.

UNIT-III: VIRUS CONTROL

i. *Viral Vaccine:* Conventional vaccines- killed and attenuated, modern vaccines recombinant proteins, subunits, DNA vaccines, vaccine delivery and adjuvants.

ii. *Antivirals:* Interferons, designing and screening for antivirals, mechanisms of action,

iii. Antiretrovirals—mechanism of action and drug resistance.

iv. *Modern approaches of virus control:* Anti-sense RNA, siRNA, ribozymes

NOTE FOR PAPER SETTING AND COURSE EVALUATION:

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

RECOMMENDED BOOKS:

1. S. J. Flint, V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka (2003) Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses. Publisher: American Society Microbiology.

2. Alan J. Cann (2000) DNA Virus Replication. Publisher: Oxford University Press.

3. Alan J. Cann (2005) Principles of Molecular Virology. Publisher: Elsevier Science & Technology Books.

4. Stephen K. Tyring. (2004) Field Virology Vol.1 and 2. Antiviral Agents, Vaccines, and Immunotherapies. Publisher: Marcel Dekker.

5. Paul F. Torrence. (2005) Antiviral Drug Discovery for Emerging Diseases and Bioterrorism Threats. Publisher: Wiley, John & Sons, Incorporated.

6. Stanley A. Plotkin, Walter A. Orenstein (2008) Vaccines. Publisher: Elsevier Health Sciences.

M.Sc MICROBIOLOGY
SEMESTER-II

COURSE TITLE: IMMUNOLOGY

Course code: PSMBTC204
Duration of Examinations:
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: This course introduces students to molecular and cellular immunology, including antigen and antibody structure and function, major histo-compatibility complexes, B- and T- cell receptors, antibody formation and immunity and regulation of immune system. The course will also provide birds eye view of the applied aspects of the immunology.

UNIT - I: INTRODUCION TO THE IMMUNE SYSTEM

i. Introduction to immune system, Innate and acquired immunity, clonal nature of immune response; Organization and structure of lymphoid organs
ii. Cells of the immune system: Hematopoiesis and differentiation, B- lymphocytes, T-lymphocytes, Macrophages, Dentritic cells, Natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells.
iii. Nature and Biology of antigens and super antigens, Antibody structure and function, antibody mediated effector functions, antibody classes and biological activity
iv. Antigenic determinants on immunoglobulins, Immunoglobulin superfamily, BCR & TCR, generation of antibody diversity.

UNIT - II: HUMORAL AND CELL MEDIATED IMMUNITY

i. Regulation of immune response, Antigen processing and presentation, generation of humoral and cell mediated immune responses, Activation of B- and T- lymphocytes,
ii. Complement System: components of complement, complement activation, complement cascade, regulation of complement System
iii. Cytokines, cytokines receptors, cytokines antagonists, role of cytokines in T_H1/T_H2 subset development and their role in immune regulation, MHC: MHC molecules and genes, MHC restriction,
iv. Cell-mediated cytotoxicity: Mechanism of T cell and NK cell mediated lysis, Antibody dependent cell mediated cytotoxicity, macrophage mediated cytotoxicity.

UNIT - III: IMMUNOLOGICAL DISORDERS

i. Autoimmunity and auto immune disorders: organ specific and systemic autoimmune diseases, animal models for autoimmune diseases and the molecular mechanism, immunodeficiency disorder- AIDS
ii. Hypersensitivity: IgE mediated Hypersensitivity, Antibody mediated cytotoxic Hypersensitivity, Immune comlex- mediated Hypersensitivity, Delayed type Hypersensitivity
iii. Transplantation immunology: Immunological basis of graft rejection, clinical manifestation of graft rejection, general immunosuppressive therapy, specific immunosuppressive therapy, immune tolerance to allografts
iv. Immunological tolerance: central tolerance, peripheral tolerance, component of peripheral tolerance

UNIT IV: IMMUNODIAGNOSTIC PROCEDURES

i. Antigen- Antibody interactions and Techniques – ELISA and its variants, ELISPOT, Radio immunoassay, Immunofluorescence, Flow cytometry and Fluorescence, Immunoelectron microscopy
ii. Agglutination and haemagglutination assays
iii. Types of immundiffusion and immunoelectrophoretic procedures, isolectric focusing
iv. Affinity chromatographic methods and Immunoblotting.

UNIT - V: IMMUNOBIOTECHNOLOGY

i. Hybridoma Technology and Monoclonal antibodies detection and application of monoclonal antibodies;
ii. lymphokines: production and applications, Interleukine therapy
iii. Vaccines: History of vaccine development, introduction to the concept of vaccine, Active and passive immunization, Designing vaccines for active immunization: Conventional vaccines, subunit vaccines, conjugate vaccines, DNA vaccines, Recombinant vector vaccines
iv. Cell culture and maintenance of cell lines

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Goldsby, R. A., Kindt, T.J. and Osborne,B.A. (2002) Kuby Immunology. W.H. Freeman and company, New York.

2. Coleman, R.M., Lombard, M.F. and Sicard, R.E.(1992).Fundamental Immunology. Wm.C.Brown publishers,USA.
3. Roitt,I., Brostoff, J. and Male,D. (1999). Immunology. Hartcourt Brace and Company , Asia Pte.Ltd.
4. Benjamini,E.,Coico,R., and Sunshine, G. (2000). Immunology – a short course. John Wiley and Sons. Inc., New York.
5. Davies,H. (1997). Introductory Immunology. Chapman and Hall, New York
6. Bratke & Myrtek (2007). Immunology : The experimenter series.Elsener Pub.
7. Wood, Peter (2008). Understanding Immunology Elseiver Pub. 2nd edition.

M.Sc. MICROBIOLOGY
SEMESTER – II

COURSE TITLE: MICROBIAL GENETICS

Course code: PSMBTC208
Duration of Examinations :
Minor Test 1: 1 hour
Major Test 2: 2.5 hours

Contact hours: 24
Credits: 2
Max. Marks: 50
Minor Test1: 10
Major Test : 40
Total: 50

Syllabi for the examinations to be held in the years May 2019, May 2020 & May 2021

Objectives: In recent years, genetics and related sciences have grown explosively, generating large body of new information regarding the fine structure of gene and gene expression in prokaryotes. Besides, the molecular approach is being adopted in altering genotype and tailoring plants and animals to answer human needs. This course will introduce student to the basic concepts of genetics and prepare him to appreciate the boom of biotechnology and participate in the on going revolution.

Unit-I : Bacterial Genetics and Mapping

i. Fundamentals of Bacterial Genetics: Identification and selection of mutants; plasmids - types, detection, replication, partitioning, copy-number control and transfer
ii. Properties of some known plasmids; genetic rearrangements and their evolutionary significance; BACs
iii. Transformation : Discovery of transformation, mechanism of transformation; Gene mapping by transformation.
iv. Conjugation-Unidirectional gene transfer –F+ and F- ; High frequency recombination and gene mapping.
v. Genetics of Bacteriophages: Lytic cycle and Lysogenic cycle, λ-phage, Factors governing lytic and lysogeny

Unit-II : Viral Mediated transduction in Bacteria

i. Transduction : Generalized transduction, Co-transduction and Linkage, Mapping by Co-transduction.
ii. Specialized transduction – Formation of specialized transducing particle from a λ-lysogeny. Specialized transduction from λ gal and λ bio.
iii. High frequency of transducing lysates, Specialized transducing phage as a cloning vehicle, abortive transduction
iv. Biology and genetics of Bacteriophage - virulent phage (T4) and temperate phage (lambda); host parasite relationship, immunity and repression;

v. Site specific recombination (lambda); transposable phage (Phage Mu), genetic organization, transposition, Mu as a genetic tool, PACs

Unit- III : Genetics of Eukaryotic Viruses and Yeast

i. General features of Eukaryotic viruses, DNA viruses Adeno viruses, Herpes, SV40, Papilloma viruses Cauliflower mosaic viruses, Baculo viruses
ii. RNA viruses Retro viruses – Rous Sarcoma viruses and HIV viruses; Tobacco Mosaic viruses, Polio viruses and Rio viruses
iii. Yeast genetics- life cycles, nuclear and organellar genomes, making mutants and analyzing genetic interactions in yeast
iv. Genetic nomenclature and genome manipulation strategies, random spore analysis, complementation
v. Heterothallism and mating type switches, gene disruption plasmids, YACs

Recommended Books

1. Microbial Genetics By Maloy, Freifelder
2. Molecular Genetics By Gunther and Stent
3. Microbiology By Prescot
4. Genetic Analysis By Griffith, Suzuki and others
5. Microbiology : Concepts and Applications By John Wiley
6. General Microbiology By Stanier

M.Sc. MICROBIOLOGY
SEMESTER-III

COURSE TITLE: MYCOLOGY AND PHYCOLOGY

Course code: PSMBTC301
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the year Dec 2019, Dec 2020 & Dec 2021

Objectives: The course on Mycology and Phycology has been designed for the students who need an orderly presentation of certain fundamental facts on the structure and classification of fungi and algae. With the recent studies in the genetics and the biochemistry of fungi, and with the realization of the role which fungi play in the causation of allergies and parasitic diseases of man, the need for such a course is envisaged.

UNIT I: INTRODUCTION TO FUNGI

i. Historical introduction to mycology, Importance of studying fungal diversity, distribution of fungi, Nutrition in fungi

ii. Thallus organization, Cell structure and cell differentiation.

iii. Reproduction: asexual, sexual and parasexual

iv. Nomenclature and Classification; Systems of classification: (Alexopoulos, Ainsworth, Alexopoulos and mims; Modern method of classification

UNIT – II: LOWER FUNGI

i. Division myxomycota; Acrasiomycetes, Hydromyxomycetes, Plasmo- diophoromycetes

ii. Zoosporic fungi; Chytridiomycetes, Hypochytridiomycetes, Oomycetes,

iii. Zygomycotina- Zygomycetes, Trichomycetes.

iv. Evolutionary tendencies in lower fungi. Evolution of Asexual Apparatus (Conidium) from a Sporangium in the Mucorales.

UNIT – III: HIGHER FUNGI

i. Ascomycotina; Hemiascomycetes, Plectomycete, Pyrenomycetes,

ii. Discomycetes, Laboulbeniomycetes, Loculoascomycetes.

iii. Basidiomycotina; Teliomycetes, Hymenomycetes (Gasteromycetes)

iv. Deuteromycotina; Hyphomycetes, Coelomycetes, Blastomycetes.Heterothalism, Sex hormones in fungi, Physiological Specialization.

UNIT – IV: FUNGI AND ECOSYSTEM

i. Lichens-ascolichens, basidiolichens, deuterolichens.

ii. Mycorrhiza, ectomycorrhiza, endomycorrhiza, vesicular arbuscularmycorrhiza, fungi.

iii. Fungal diseases; mycoses systemic and subcutaneous, candidiasis, Pneumocystis, blastomycoses, dermatophytosis.

iv. Economic importance of fungi, Fungi and bioremediation

UNIT – V: ALGAE

i. Distribution of algae, classification of algae, algal nutrition, algal thallus, algal reproduction.

ii. Green algae, diatoms, euglenoids.

iii. Brown Rhodophyta, Pyrrophyta.

iv. Algal ecology and algal biotechnology.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Mehrotra, R.S. and K.R. Aneja (1990), An introduction to Mycology, New Age International publishers.
2. Alexopoulos, C.J. and C.W. Mims (2001), Introduction to Mycology. Wiley Eastern Ltd. New Delhi. (3rd ed.).
3. Subbalis, G.(2004) The Fungi. Narosa Publishing House, N.Delhi.
4. Stainer, R.Y., Ingrahm, J.L., Wheelis, M.L. and Painter, P.R.(1991) General Microbiology. The MacMillian Press.
5. Pelczar, M.J., Chan E.C.S.,Kraig N.R., (1998). Microbiology, McGraw Hills.
6. Balows, A.G.Thuper, M. Dworkin. W. Harder, K. Springer Verlag (1991). The Prokaryotes.
7. Madigan, M.T.,Martinko, J.M. and Parker, J. (2008).Brock Biology of microorganisms (14 th ed.)
8. Cappuccino, J.G. and Shreman, N. (2005) Microbiology:- A Laboratory Manual. Addison Wiley.
9. Tortora, G.J., Funke, B.R. and Case (2008) Microbiology: An introduction 9th ed. Ed., Benzamin Cummings.

M.Sc. MICROBIOLOGY
SEMESTER -III

COURSE TITLE: FOOD MICROBIOLOGY

Course code: PSMBTC302
Duration of Examinations
Minor Test: 1 hour
Major Test: 2.0 hours

Contact hours: 48
Credits: 2
Max. Marks: 50
Minor Test1: 10
Major Test: 40
Total: 50

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec 2021

Objectives: While microorganisms are increasingly being used for food production or augmentation, these are also responsible for food spoilage and considerable losses. Huge inputs are required to preserve the foods against microbial invasion and above all these are major cause of the most horrible diseases outbreaks.

UNIT – I: INTRODUCTION TO FOOD MICROBIOLOGY

i. Food as a substrate for microorganisms, microorganisms important in food microbiology.
ii. Brief account of moulds, yeast and bacteria,
iii. General characteristics and importance, principles of food preservation, asepsis, removal of microorganisms, anaerobic conditions, high and low temperatures, drying.
iv. Chemical preservatives and food additives.

UNIT – II: FOOD SPOILAGE

i. Food spoilage and food borne infections, general principle underlying food spoilage and contamination,
ii. Canned foods- sugar products, vegetables, fruits, meat and meat products, milk and milk products, fish, sea food, and poultry spoilage.
iii. Spoilage of fermented foods, diary products and oriental fermented foods.
iv. HACCP concept for foods production, storage and transport, Hurdle technology.

UNIT – III: FOOD BORNE INFECTIONS AND INTOXICATIONS

i. Bacterial and non bacterial food borne infections and intoxification- *Brucella, Bacillus, Clostridium, Esherichia, Salmonella, Shigella, Staphylococcus, Vibrio, Yersinia.*
ii. Nematodes, algae, fungi and viruses in food borne infection and intoxications.
iii. Food borne outbreaks- laboratory testing; prevention measures- food sanitation in manufacture and retailing.
iv. Food control agencies their rules and regulations, plant sanitation- worker's health standards, quality control, waste disposal.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Arnold L Demain, Julia E Davis (1999) Mannual of Industrial Microbiology and Biotechnology,ASM press.
2. Whataker and P.F. Stanbury (1995) Principles of Fermentation Technology. Butterworth- Heinemann.
3. William,s C, Frazier and Dennis Westhoff (1988) Food Microbiology. McGraw Hill Inc., New York.
4 Montville .J. Thomas and karl R. Mathews (2008), (Food Microbiology).An introduction) ASM Press.
5. Modi,H.A (2007), (Introductory Food Microbiology). Aavishkar Pub. Distributors . Jaipur.
6. Khatkar, Singh Bhupendra (2007), (Food sciences tech.) (Daya Pub. House).
7. Doyle.P and Bucchat larry, (2008).Food Microbiology.ASM pub.(3rd ed).

M.Sc. MICROBIOLOGY
SEMESTER-III

COURSE TITLE: BIOPROCESS ENGINEERING

Course code: PSMBTC303
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec 2021

Objectives: This course is to introduce students to the engineering aspects of microbial processes and help them to develop understanding of design, operation and optimization of bioprocess systems.

UNIT - I: INTRODUCTION TO BIOPROCESS ENGINEERING

i. Introduction to bioprocess engineering and technology, Concept of fermentation vs bioprocess
ii. Bioprocess based products of industrial importance
iii. Kinetic of microbial growth and death, Types of fermentation processes: batch, Fed-batch and continuous bioprocesses,
iv. Industrially important microorganisms, Isolation, Preservation and Maintenance of Industrial microorganisms
v. Media for industrial Fermentation, Sterilization of air and media,

UNIT-II: BIOREACTORS, BIOPROCESS MONITORING AND BIOMASS IMMOBILIZATION

i. Bioreactors, typical design of stirred tank reactor, nonagitated bioreactors, Specialized bioreactors-packed bed, fluidized bed
ii. Concept of Scale up, scale up paradox, Bioprocess economics,
iii. Process monitoring and control of bioprocess parameters, sensors, Role of computers in process control
iv. Biomass immobilization, approaches, merits, limitations, and Industrial Applications
v. Use of Microorganisms in mineral beneficiation and oil recovery.

UNIT-III: BIOPROCESS BASED INDUSTRIAL PRODUCTION OF CHEMICALS

i. Alcohol (ethanol), bioethanol- Biofuel from lignocellulosic biomass,

ii. Acids (citric, acetic and gluconic)
iii. Solvents (glycerol, acetone, butanol),
iv. Antibiotics (penicillin, streptomycin, teracycline),
v. Aminoacids (lysine, glutamic acid), Single Cell Protein.

UNIT-IV: DOWNSTREAM PROCESSING AND EFFLUENT TREATMENT

i. Downstream processing, DSP, Criteria, steps involved in DSP
ii. Removal of microbial cells and solid matter, foam separation, Precipitation, filtration, centrifugation
iii. Methods for cell disruptions, liquid-liquid extraction, chromatography, Membrane process, Drying and Crystallization
iv. Effluent treatment: B.O.D and C.O.D, treatment and disposal of effluents.

UNIT-V: FOOD TECHNOLOGY

i. Introduction to food technology,
ii. Sterilization and Pasteurization of food products,
iii. Elementary idea of canning and packing,
iv. Technology of Typical Food/Food products (bread, cheese, idli),
v. Food preservation and hygiene, Hurdle concept, HACCP System.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Aiba, S.,Humphrey, A.E. and Millis (1973). Biochemical Engineering, N.F. Univ. of Tokyo Press, Tokyo.
2. Atkinson, B.,(1991). Biochemical Engineering, Pion Ltd. London.
3. Baily, J.E. and Ollis, D.F.(1986). Biochemical Engineering Fundamentals, McGraw-Hill Book Co. New York
4. Rehm H.J. and Reed G. (1993). Biotechnology Vol. 1-12 VCH, Weinheim.
5. Murray Moo-Young (2004). Comprehensive Biotechnology Vol 1-4 KTH, Stockholm, Bioprocess Technology: Fundamentals and Applications
6. Jachson, A.T., Process Engineering in Biotechnology. Prentice Hall, Engelwood Cliffs,

Shuler, M.L. and Kargi, F. (2003). Bioprocess Engineering: Basic concepts Prentice Hall, Engelwood Cliffs.
7. Stanbury, P.F. and Whitaker, A., (2007). Principles of Fermentation Technology Pergamon Press, Oxford,
8. Lee, J.M., Biochemical Engineering, Prentice Hall Inc. Crueger, W. and Crueger, A. (2002). Biotechnology: A text book of industrial Microbiology, Science Tech Inc. Publishers.

M.Sc. MICROBIOLOGY
SEMESTER - III

COURSE TITLE: BIOINFORMATICS

Course code: PSMBTC304
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credit: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec 2021

Objectives: - The last decade has seen veritable explosion in of information generated by molecular biologists. To come in grips with the cascade of information knowledge of computers and their applications has become very important. Bioinformatics, loosely defined as interaction of molecular and computational biology, has to do this and to unravel more of nature's secrets. The present course has been designed to provide the students basic knowledge about genomics, proteomics and bioinformatics.

UNIT-I: BASIC STATISTICS

i. Measures of central tendency and measures of dispersion, probability and its types: permutation, combination, probability computations
ii. Theoretical distributions: Bionomial, Poisson and Normal, hypothesis testing; two types of errors
iii. Tests of significance; t-test, chi-square test, one way and two way analysis of variance
iv. Simple correlation and regression.

UNIT-II: FUNDAMENTALS OF COMPUTERS

i. Introduction to digital computers; organization, binary number system, flow chart and programming techniques
ii. MS OFFICE software covering word processing, spreadsheets and presentation software
iii. Types of networks, data transmission methods, communication protocols.
vii. Internet- Evolution and its Uses, Intranet Protocols, Concepts of Internet, URL, Domain Names, E-mail concepts, FTP & its usages.

UNIT-III: INTRODUCTION TO BIOLOGICAL DATABASES

i. Internet and the biologist, Scope of Bioinformatics, Biological Databases; Primary, Secondary & Composite databases.
ii. Nucleotide Sequence Databases; GenBank, EMBL, DDBJ, NCBI Data Model.
iii. Protein Sequence Databases; SWISS-PROT protein sequence database, Translated EMBL (TrEMBL), UniProt, PROSITE,Pfam, OWL: A composite protein sequence database.
iv. Structural Databases; Protein Data Bank (PDB), Molecular Modelling Database (MMDB), Nucleic Acid Database (NDB), SCOP (Structural Classification of Protein), CATH (Class Architecture Topology Homology)

UNIT-IV: INFORMATION RETRIEVAL & SEARCHING OF BIOLOGICAL DATA

i. Retrieval Systems: SRS, ENTREZ, GQuery: Global cross database NCBI Search, DBGET Search, LinkDB: Database of link information
ii. Sequence Similarity Search: BLAST, FASTA, CLUSTALW.
iii. Sequence submission tools: BankIt, Sequin, Webin, SAKURA.
iv. Retrieval of Structural Data from PDB, MMDB, CDD, Protein Visualization Software: RASMOL, Cn3D, JMol., PyMol, Swiss-PDB (SPDBV)

UNIT-V: COMPUTATIONAL ANALYSIS OF BIOLOGICAL DATABASES

i. Analysis of DNA and protein sequences, ESTs, SAGE and Gene prediction
ii. Definition of Genome, Introduction to Human Genome Project, Genome Sequencing, Genome Maps & their uses.
iii. Sequence assembly, Genome analysis, Phylogenetic analysis.
iv. Currently existing biological databases (Summary) ACEDB: A database for genome information.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor tests per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Baxevanis, A.D. and Francis Onellete, B.F. (2001). Bioinformatics. Wiley Interscience. John Wiley and Sons Inc. New York.
2. Attwood, T.K. and Parry-Smith, D.J. (1999). Introduction to Bioinformatics. Pearson Education Ltd., Singapore.
3. Mueller, J.P. and Sheldon, T. (1998). Internet information server 4. Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Curtin, D.P. et al. (1999). Information Technology. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5. Dhar, M.K. and Kaul, S. (1997). Statistics in Biology. Malhotra Brothers, Jammu.
6. Snedecor, G.W. and Cochran, W.G. (1989). Statistical methods. Iowa State University Press, Ames.
7. Steel, R.G.D. and Torrie, J.H. (1981). Principles and procedures of statistics: A Biometrical approach. McGraw-Hill Book Company, Singapore.
8. Ye, Q. S. (2008). Bioinformatics: A practical approach. Champman & Hall/ CRC.
9. Noah, H. (2008) Bioinformatics Genomics and postgenomics. Wiley.
10. Tramontano Anna (2008). Int. to Bioinformatics. Chapman & hall/ CRC.

M.Sc BIOTECHNOLOGY
SEMESTER-III

COURSE TITLE: TECHNIQUES IN BIOTECHNOLOGY

Course code: PSMBTE307 **Contact hours**: 48
Duration of Examinations **Credits**: 4
Minor Test1: 1 hour **Max. Marks**: 100
Minor Test2: 1 hour **Minor Test1**: 20
Major Test: 2.5 hours **Minor Test2**: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years Dec 2019, Dec 2020 & Dec2021

Objective: The course is designed to give students a sound and basic exposure to Biotechnology. This course offers a very robust and forward-looking programme in the theory and techniques of Biotechnology. The course gives exposure to the various basic techniques of biotechnolgy used in molecular biology, enzymology, plant and animal tissue culture and immunology.

UNIT I: BASIC TECHNIQUES IN MOLECULAR BIOLOGY

i. Nucleic acid structure and types, Isolation of nucleic acids from microbes, plants and animals, methods and principles.
ii. Eletrophoretic analysis of nucleic acids (DNA, RNA) by Agrose gel electrophoresis, Molecular weight determination.
iii. Spectrophotometric analysis of DNA, RNA, Estimation of concentration and purity, Introduction to PCR.
iv. Cloning, Genomic DNA and cDNA library construction, DNA fingerprinting, molecular markers

UNIT II: BASIC TECHNIQUES IN ENZYMOLOGY AND BIOPROCESSING

i. General characteristics of Enzymes, biocatalysts vs chemical catalysts, Basis of Nomenclature and classification of enzymes, Enzyme activity, enzyme action, Nature of active sites, Enzyme substrate complex, Types of enzymes.
ii. Approaches for enzyme assays, Units of enzyme activity, specific activity, kinetics of enzyme catalyzed reactions, enzymes in regulation of metabolism,
iii. Industrial application of enzymes. Fundamentals of bioprocess development, products based on bioprocessing, growth and product synthesis kinetics
iv. Upstream and downstream processing, process optimization, scale up paradox, effluent treatment.

UNIT III: BASIC TECHNIQUES IN GENOMICS AND BIOINFORMATICS

i. Restriction mapping, nucleic acid hybridization and Microarray
ii. DNA sequencing, Maxam and Gilbert's degradation method and Sanger's dideoxynucleotide synthetic method
iii. Introduction to Bioinformatics, biological databases: Primary and secondary databases, structural databases.
iv. Sequence analysis at Nucleotide and protein level, Database retrieval systems, SRS, ENTREZ, NCBI datamodel, Database searching: BLAST, FASTA

UNIT IV: BASIC TECHNIQUES IN PLANT AND ANIMAL BIOTECHNOLOGY

i. Plant tissue culture, culture media, Establishment of cultures, acclimatization to field conditions and their applications
ii. Gene transfer in plants, vector mediated and vectorless methods, applications with reference to BT cotton and Golden rice
iii. Primary and established cell lines, mono-layer and suspension culture, cryopreservation
iv. Stem cells and therapy, three dimension culture, useful products from transgenic animals.

UNIT V: BASIC TECHNIQUES IN IMMUNOLOGY

i. Hematopoiesis and cell of immune system, T-cell subsets and surface markers, Immunogloublins – classes, structures and functions

ii. Antigen-Antibody interaction, Affinity and avidity, Recognition of antigen by T-cells and role of MHC, Structure of T and B cell receptors.
iii. Immuno-diffusion and Immuno-electrophoresis, Immuno-blot, ELISA, RIA,

iv. Introduction to Monoclonal antibodies, production and application.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED:

1. Primrose, S.B. (1994). Molecular Biotechnology, 2nd edition, Blackwell Scientific Publishers.Oxford.

2. Berger, S.L and Kimmel, A.R (1996). Methods in Enzymology, Guide to Molecular Cloning Techniques, vol. 152, Academic Press Inc., San Diego.
3. Bhojwani S.S. and Razdan M.K. (2005) Plant tissue culture: Theory and practice. Elsevier Science, New Delhi.
4. J. Reinert and Y. P. S. Bajaj Applied and Fundamental Aspects of Plant Cell, Tissue, and Organ Culture . Springer-Verlag, Berlin, New York
5. Karl-Hermann Neumann, Ashwani Kumar, Jafargholi Imani: Plant Cell and Tissue Culture - A Tool in Biotechnology: Basics and Application (Principles and Practice). Springer-Verlag, Berlin, New York
6. Keshavachandran and Peter, KV (2008): Plant Biotechnology: Methods in Tissue Culture and Gene Transfer. Orient Blackswan
7. Sambrook, J. Fritsch, E.F. and Maniatis, T. (2001). Molecular Cloning. A Laboratory Manual 2nd ed., Cold Spring Harbor Laboratory Press.
8. Kuby, J. (2007), Immunology. 6th Edition. W.H. Freeman and company, New York.
9. Satyanarayana, U. (2005). Biotechnology. Books and Allied (P) Ltd, (Kolkatta) India
10. Nicholas, P, Stevans, L. Fundamental of Enzymology (1999). Oxford University Press, New York.
11. Tripathi, G. (1999). Enzyme Biotechnology. Technoscience Publications, Jaipur, India.
12. Palmer T. The Chemical Nature of Enzyme Catalysis, Enzymes: Biochemistry, Biotechnology and Clinical Chemistry. Horwood Publishing Limited, Coll House, Westergate, England, 2001.
13. Stanbury, P. F., Whitaker, A., Hall, S. J., Principles of Fermentation Technology, Butterworth-Heinemann, UK 1995.
14. Creuger W and Crueger A (1991) Biotechnology: Text Book of industrial microbiology and Biotechnology. Sinauer Associatesw Inc. Sundarland , MA.
15. Molecular cloning: A laboratory manual, 3 volumes by Green & sambrook. 4th edition, cold spring. Harbor laboratory press, 2012.
16. Gene cloning & DNA analysis : An introduction by T.A.Brown, 6th edition , wiley-Blackwell,2010.
17. Recombinant DNA principles & methodologies edited by James.J.Greeene & venigalla.B.Rao, CRC press, 2009.
18. Essentials of molecular biology by David Freifelder & George.M.Malacinski; 2nd edition, panama publishing corporation.reprinted 1996.

M.Sc. MICROBIOLOGY
SEMESTER-IV

COURSE TITLE: MEDICAL MICROBIOLOGY

Course code: PSMBTC404
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2020, May 2021 & May 2022

Objectives: We are in contact of myriad of organisms in the environment and also with an enormous number that inhabit out bodies. Human kind has long been beset by diseases that may spread with devastating effects. The study in medical microbiology has practical benefits by an understanding to explore the cause and control of these diseases.

UNIT – I: PRINCIPLES OF MEDICAL MICROBIOLOGY

i. Early discovery of pathogenic microorganisms; development of bacteriology as scientific discipline; contribution made by eminent scientists
ii. Classification of medically important microorganisms
iii. Normal microbial flora of human body; role of the resident flora; normal flora and the human host.
iv. Opportunistic pathogens and true pathogens. Exogenous infection, mode of spread of infection.

UNIT – II: MECHANISMS OF BACTERIAL PATHOGENESIS

i. Microbial pathogenecity; transmission, infectivity and virulence.
ii. Establishment, spreading: invasiveness, tissue damage: Toxigenicity and anti-phagocytic factors.
iii. Mechanism of bacterial adhesion, colonization and invasion of mucous membrane of respiratory enteric and urogenital tracts.
iv. Role of aggressins, coagulase, fibrinolysin or kinase, Depolymerizing enzymes

UNIT – III: MICROBIAL AGENTS OF BACTERIAL DISEASES-I

i. Classification of pathogenic bacteria, *Staphylococcus, Streptococcus, Neisseria.*
ii. *Corynebacterium, Bacillus*, *Clostridium*, Non sporing anaerobes (*Actinomyces, Propionibacterium.*)

iii. Organisms belonging to Enteriobactericeae *(Escherichia, Klebsiella, Enterobacter)*, Vibrios.
iv. Non fermenting gram negative Bacilli *(Bacteroides), Haemophylius, Bordetella, Brucella, Mycobacterium*.
v. *Treponema*, Rickettsia, Chlamydiae.

UNIT – IV: MICROBIAL AGENTS OF VIRAL DISEASES-II

i. General properties, of viruses, virus- host interaction
ii. Pox viruses, Herpes viruses, Adenoviruses, Arboviruses
iii. Picarno viruses, Orthomyxoviruses, Paramyxoviruses, Oncogenic viruses
iv. Rhabdoviruses, Hepatitus viruses, Human Immuno Deficiency viruses (AIDS).

UNIT – V: MICROBIAL AGENTS OF FUNGAL DISEASES AND LABORATORY DIAGNOSIS

i. Description and classification and their laboratory diagnosis: Dermatophytes, dimorphic fungi and opportunistic fungal pathogens.
ii. Laboratory control of antimicrobial therapy: various methods of drug susceptibility testing, antibiotic assay in body fluids.
iii. Brief account of available vaccines and schedules, passive prophylactic measures,
iv. Noscomial infection, common types of hospital infections: their diagnosis and control.

NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

BOOKS RECOMMENDED

1. Ananthanarayan, R and Jayaram, C.K, (2002) Textbook of microbiology. Orient longman.
2. Livingstone, Churchill.(1996) vol.I microbial infection. Mackie and McCartney.
3. Livingstone, Churchill.(1996) vol.II Practical Medical microbiology, Mackie and McCartney.
4. Shanson, D.C. Wright, P.S.G. (1982) Microbiology in clinical practice.
5 Baron, E.J., Peterson, L.R. and Finegold, S.M. (1990). Bailey and Scott's Diagnostic Microbiology.
6. Burton,R.W & Gwendalyn., Paul, Engelkirk, G. (2008). (Microbiology for Health sciences). 6th edition.

M.Sc. MICROBIOLOGY
SEMESTER-IV

COURSE TITLE: ENVIRONMENTAL MICROBIOLOGY

Course code: PSMBTC406 **Contact hours**: 24
Duration of Examinations **Credits**: 2
Minor Test: 1 hour **Max. Marks**: 50
Major Test: 2.5 hours **Minor Test1**: 10
Major Test: 40
Total: 50

Syllabi for the examinations to be held in the years May 2020, May 2021 & May 2022

Objectives: The aim of the course is to introduce the students to the growing environmental problems due to ever increasing industrialization and civilization and how the microbes can play vital role in circumventing some of the problems.

UNIT-I: AEROBIOLOGY, AQUATIC AND SOIL MICROBIOLOGY

i. Aerobiology and Aquatic; Air borne microorganisms. Fresh water (ponds, lakes, streams), marine (Estuaries, mangroves, deep sea), classification of soil, microflora of various soil types, rhizosphere, phyllosphere.

ii. Dispersal of airborne microorganisms; Droplet nuclei and aerosol Water zonation, upwelling, eutrophication and potability of water. Major biogeochemical cycles and the organisms: carbon, nitrogen, Phosphorous and Sulphur cycles

iii. Assessment of air quality, Microbial assessment of water quality and Biological nitrogen fixation-nitrogenase enzyme, nif genes, symbiotic nitrogen fixation and non symbiotic nitrogen fixation.

iv. Air borne disease caused by bacteria, fungi, virus -their symptoms and preventive measures. Brief account of water borne diseases and preventive measure. Rumen microbiology.

UNIT-II: WASTE TREATMENT

i. Waste -types (solid, Liquid) and characterization of wastes.

ii. Waste treatment; Primary secondary and tertiary treatments. Physical, chemical and biological treatment of wastes, activated sludge, oxidation ponds.

iii. Solid waste treatment-saccharification, gasification, composting, effluent treatment, BOD, COD.

iv. Utilization of solid waste-food, fuel (ethanol, methane), fertilizer (composting).

UNIT-III: **BIODEGRADATION AND BIODETERIORATION**

i. Biodegradation of recalcitrant compounds. Bioaccumulation of metals and detoxification, biopesticides.
ii. Biodeterioration of paper, leather, wood, textile- modes of deterioration and organisms involved.
iii. Bioremediation of contaminated soils and wastelands.
iv. Impact of Genetically modified organisms on environment

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NOTE FOR PAPER SETTING AND COURSE EVALUATION

Minor test 1 should cover upto 20% of syllabus. Minor test II should cover 21%- 40% of syllabus. Major test should cover 41% -100% of syllabus. Major test will have 7 questions each of 15 marks. One question will be very short answer type of multiple parts compulsory spread over entire syllabus. The remaining 6 questions will be from remaining 41%-100% part of the syllabus and the candidate will have to attempt any three of them. The major test should test both the subjective and objective aptitudes of the student. Minor test 1 will be held after 3-4 weeks of teaching and Minor test II will be held 8-9 weeks after the start of session. Two minor test per day should be conducted and no preparatory holiday shall be given.

Books Recommended:

1. Baker, K.H. and Herson, D.S. (1994) Bioremidation. McGraw Hill Inc., New York.
2. Bagyaraj and Rangasamy Agricultural Microbiology
3. Martin Alexander (1999) Biodegradation and Biodeterioration. Academic Press.
4. Pepper Gerba and Maier. (2000) Enviornmental Microbiology. Academic Press.

M.Sc BIOTECHNOLOGY
SEMESTER-IV

COURSE TITLE: ESSENTIALS IN MICROBIOLOGY AND BIOCHEMISTRY

Course code: PSMBTE405
Duration of Examinations
Minor Test1: 1 hour
Minor Test2: 1 hour
Major Test: 2.5 hours

Contact hours: 48
Credits: 4
Max. Marks: 100
Minor Test1: 20
Minor Test2: 20
Major Test: 60
Total: 100

Syllabi for the examinations to be held in the years May 2020, May 2021, May 2022

Objective: The basic goal of this course is to determine how the collections of inanimate molecules that constitute living organisms, interact with each other and show an exciting excursion into human metabolism and life. Biochemistry yields important insights and practical application in medicine, agriculture, nutrition and industry, but its ultimate concern is with the wonder of life and living things.

UNIT I: INTRODUCTORY MICROBIOLOGY

i. Methods in Microbiology, Pure culture techniques; culture collection and maintenance of cultures; Theory and practice of sterilization;
ii. Principles of microbial nutrition, Construction of culture media.
iii. Microbial growth: batch and continuous culture; Factors affecting growth;
iv. Prokaryotic cell structure and function; Flagella and motility; cell inclusions like endospores, gas vesicles.

UNIT II: MICROBIAL DIVERSITY

i. Microbial taxonomy, Methods for determining evolutionary relationships Prokaryotic diversity: Protobacteria, Cyanobacteria, Chlamydias, Cytophaga, Gram positive bacteria, Green sulphur bacteria, Green non-sulphur bacteria, Spirochaetes, Deinococci
ii. Archaea as earliest life forms, Halophiles, Methanogens, Hyperthermophilic Archea, Thermoplasma.
iii. Eukarya: Overview of Algae, Fungi, Slimemolds and Protozoa.
iv. Viruses: Discovery, Classification and Structure of Viruses. Viruses of Prokaryotes and Eukaryotes. Examples of Herpes, Pox, Adenoviruses, Retroviruses, Viriods and prions.

UNIT III: INTRODUCTORY BIOCHEMISTRY

i. General concepts

ii. Thermodynamics, reaction kinetics, equilibrium,
iii. Water, pH, buffers, solubility,
iv. Bioenergetics, biocatalysis.

UNIT IV: CARBOHYDRATE AND LIPIDS

i. Structure and function of Carbohydrates, monosaccharides, disaccharides, polysaccharides,
ii. Glycolysis, Kreb's cycle, Gluconeogenesis, Pentose Phospahte Pathway
iii. Electron Transport chain, Chemiosmotic theory for ATP synthesis, regulation of ATP production; Photosyntheis and respiration concept.
iv. General concept of lipids, Phospholipids, glycolipids, sphingolipids, steroids and functions of lipids, biosynthesis of fatty acids and catabolism of lipids: β - oxidation of fatty acids

UNIT V: PROTEINS AND NUCLEIC ACIDS

i. Introduction to types of proteins, primary secondary and tertiary and quartenary structures, globular and fibrous proteins and function of proteins
ii. Enzymes, regulatory enzymes, essential amino acids, glucogenic, ketogenic, urea cycle
iii. Structure and function of nucleic acids: DNA (A, B and Z types) and RNA (rRNA, tRNA and mRNA) and their role
iv. Ribose, deoxyribose sugars, Nucleotides and nucleosides, Purines and pyrimidines

NOTE FOR PAPER SETTING AND COURSE EVALUATION

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BOOKS RECOMMENDED:

1. Voet, D . and Voet, J.G. Biochemistry. John Wiley and Sons inc. USA.
2. Stryer, L. Biochemistry. W.H. Freeman & Company, New York.
3. Lehinger, A.L. Principles of Biochemistry. CBS Publishers & Distributors, New Delhi.
4. Ritter, P. Biochemistry: A foundation. Books/ cole Publishers.
5. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. Harper's Biochemistry. Appleton, Lange Publishers, CT. 6th edition.

6. Moat, A.G., Foster, J.W. and Spector, M K. (2002) Microbial Physiology Wiley- Liss a John Wiley and sons, Inc. Publication.
7. Stainer, R.Y., Ingraham, J.L., Wheelis, M. L. and Painter, P.R.(1991) General Microbiology. The MacMillan press.
8. Madigan, M.T., Martinko, J.M. and Parker, J. (2007). Brock Biology of Microorganisms. J. Prentice Hall. 11th ed.
9. Pelczar, M. J., Chan, E.C.S. and Kreig, N.R. (1998) Microbiology. McGraw Hill.
10. Maloy, S. R., Cronan, J. E. and Freifelder, D. Microbial Genetics. Jones Barlett Publishers.
11. Cappuccino,J. G. and Sherman, N. (2003). Microbiology – A Laboratory Manual. Addison Wesley..
12. Tortora, G.J., Funke, B.R. and Case (2007). Microbiology: An Introduction. Benzamin Cummings. 2nd edition.
13. Prescott, L. M., Harley, J.P. and Klein, D. A. (2002) Microbiology. W.C.B. Oxford.
14. Atlas, R. M. (2004), Microbiology: Fundamentals and Applications. Macmillan Publishing Co. New York. 2nd edition.
15. Salkia,R., Bora,C. and Bezbamah,K.L.(2008). Microbial Biotechnology. New India Publishing Agency.