



College of Arts,
Science &
Commerce

RISE WITH EDUCATION
Sion (West), Mumbai – 400022.
(Autonomous)

Faculty: Science

Program: M.Sc

Subject: MICROBIOLOGY

Academic Year: 2018 – 2019

MSc. Part I

**Credit Based Semester and Grading Syllabi approved by
Ad-hoc Board of Studies in Microbiology to be brought
into effect from June 2018.**

PROGRAMME: M.Sc.
COURSE: MICROBIOLOGY (SIPSMIC)
Semester-I & Semester-II

PREAMBLE

With the introduction of Autonomy by the S.I.E.S. College of Arts, Science and Commerce under the University of Mumbai; from the academic year 2018-19; the syllabus for the M.Sc. Microbiology has been drafted to cover the many aspects of the subject. In order to assist students in developing research skills in general and in specific area of their interest/ specialization in particular, research proposal & research project component has been retained in the revised syllabus. This component will provide students with an opportunity to conduct independent research in the subject of Microbiology at their own P.G. centers and if the research project demands, in conjunction with relevant industries/ research institutes. Topics like Research Methodology, Biostatistics & Biomolecular analysis have been introduced in the revised syllabus. In order to enable students to develop employable skills concurrently with an understanding of theoretical foundations and practical techniques required in R &D, quality control, regulatory function in pharmaceuticals, food industry, environmental sciences, papers on Pharmaceutical Microbiology, Food Microbiology, Advances in Biotechnology, Applied & Environmental Microbiology and Applied & Environmental monitoring and management have been included in the revised syllabus.

As mentioned in the syllabus, all the 16 courses of theory & practicals are compulsory to M.Sc. Microbiology (By Papers) students. (Semester I, II, III, IV).

SIPSMIC-11 and SIPSMIC-21: Cell Biology and Virology and developmental microbiology, SIPSMIC- 12 and SIPSMIC-22: Genetics, SIPSMIC-13 and SIPSMIC-23: Microbial Biochemistry, SIPSMIC-14 and SIPSMIC-24: Medical Microbiology and Immunology, SIPSMIC -32 and SIPSMIC-42: Food and Pharmaceutical Microbiology SIPSMIC-33 and SIPSMIC-43: Advances in Biotechnology, SIPSMIC-34 and SIPSMIC-44: Applied and Environmental Microbiology.

To be implemented from the Academic year 2018-2019
SEMESTER I

Theory:

| Course Code | Title | Credits | Lectures / week |
|--------------------|---|----------------|------------------------|
| SIPSMIC11 | Cell Biology & Virology | 4 | |
| Unit I | Virology(Bacterial Viruses) | | 1 |
| Unit II | Virology(Plant Viruses) | | 1 |
| Unit III | Cell Biology -Membrane Structure & Transport | | 1 |
| Unit IV | Cell Biology-Respiratory & Photosynthetic Organelle | | 1 |
| SIPSMIC12 | Microbial Genetics | 4 | |
| Unit I | Gene expression and regulation | | 1 |
| Unit II | Replication, recombination, mutation and repair | | 1 |
| Unit III | Cytoplasmic Inheritance & Chromosomal Rearrangements | | 1 |
| Unit IV | Molecular tools for genetics, Population genetics | | 1 |
| SIPSMIC13 | Microbial Biochemistry | 4 | |
| Unit I | Aqueous Solutions and Acid – Base Chemistry. | | 1 |
| Unit II | Bioorganic Molecules | | 1 |
| Unit III | Metabolism of one & two carbon compounds. | | 1 |
| Unit IV | Transfer of biomolecules. | | 1 |
| SIPSMIC14 | Medical Microbiology & Immunology | 4 | |
| Unit I | Advances in Medical Microbiology:Part I | | 1 |
| Unit II | Epidemiology of infectious diseases | | 1 |
| Unit III | Immune System and Health : Part I | | 1 |
| Unit IV | Recent advances in Immunology | | 1 |

Practicals:

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|-------------------|--|---|---|
| SIPSMIC1P1 | Cell Biology and Virology | 2 | 4 |
| SIPSMIC1P2 | Microbial Genetics | 2 | 4 |
| SIPSMIC1P3 | Microbial Biochemistry | 2 | 4 |
| SIPSMIC1P4 | Medical Microbiology & Immunology | 2 | 4 |

SEMESTER II

| Course Code | Title | Credits | Lectures / week |
|--------------------|---|----------------|------------------------|
| SIPSMIC21 | Cell Biology & Virology | 4 | |
| Unit I | Virology(Animal Viruses) | | 1 |
| Unit II | Virology in relation to human health | | 1 |
| Unit III | Cell Biology – Cell Division and cell cycle | | 1 |
| Unit IV | Cell Biology- Cell Communication | | 1 |
| SIPSMIC22 | Microbial Genetics | 4 | |
| Unit I | Viral Genetics, Gene transfer | | 1 |
| Unit II | Transposable Genetic Elements, Genetic basis of cancer | | 1 |
| Unit III | Developmental Genetics | | 1 |
| Unit IV | Applications and Ethics of genetic technology | | 1 |
| SIPSMIC23 | Microbial Biochemistry | 4 | |
| Unit I | Analytical Biochemistry | | 1 |
| Unit II | Enzymology | | 1 |
| Unit III | Signalling and stress | | 1 |
| Unit IV | Microbial degradation | | 1 |
| SIPSMIC24 | Medical Microbiology & Immunology | 4 | |
| Unit I | Advances in Medical Microbiology:Part II | | 1 |
| Unit II | Clinical Research and Modern diagnostics | | 1 |
| Unit III | Immune System and Health : Part II | | 1 |
| Unit IV | Challenges in Immune System | | 1 |

Practicals:

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|--------------------|---|---|---|
| SIPSMIC-2P1 | Cell Biology and Developmental Biology | 2 | 4 |
| SIPSMIC-2P2 | Microbial Genetics | 2 | 4 |
| SIPSMIC-2P3 | Microbial Biochemistry | 2 | 4 |
| SIPSMIC-2P4 | Medical Microbiology & Immunology | 2 | 4 |

Semester I Detail Syllabus

SIPSMIC-11 (Cell Biology & Virology)

| Course Code | Title | Credits |
|---|--|-----------|
| SIPSMIC11 | Cell Biology & Virology (60L) | 04 |
| <p>Unit I: (15L)</p> <p style="text-align: center;">VIROLOGY(Bacterial Viruses)</p> <p>1.1 Bacteriophages : General properties of phages, properties of phage infected Bacterial cultures, Specificity of Phage Infection (3L)</p> <p>1.2 <i>E. coli</i> Phage T4 : Properties of T4 DNA, Genetic organization, the T4 growth cycle, Replication of T4 DNA (3L)</p> <p>1.3 <i>E. coli</i> Phage T7 and Lambda : Organization of the T7 genes, Growth Cycle, Regulation of transcription of T7 phage. (4L)</p> <p>1.4 <i>E. coli</i> Phage (phi) X174, Filamentous DNA phages, Single stranded RNA phages, Lysogenic cycle. (5L)</p> | | |
| <p>Unit II: (15L)</p> <p style="text-align: center;">VIROLOGY(Plant Viruses)</p> <p>2.1 Plant viruses : Morphology, Transmission of plant viruses, symptoms of plant diseases caused by viruses. (4L)</p> <p>2.2 Plant virus life cycles, Plant satellite viruses and satellite Nucleic acids (3L)</p> <p>2.3 TMV, Citrus Tristeza Virus (CTV), : Viral structure, Genome, Host range, Transmission, Symptom and Control. (6L)</p> <p>2.4 Diagnosis of viral infections in plants (2L)</p> | | |

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| <p>Unit : III (15L) CELL BIOLOGY(Membrane structure and transport)</p> <p>3.1 Cell membrane structure : Lipid bilayer, membrane proteins, Spectrins, Glycophorin, Multipass membrane proteins Bacteriorhodopsin (4L)</p> <p>3.2 Membrane Transport : Principles of membrane transport, ion channels and electrical properties of membranes. (3L)</p> <p>3.3 Intracellular Compartments and protein sorting: Compartmentalization of cells, transport of molecules between the nucleus and cytosol, peroxisomes, Endoplasmic reticulum, transport of proteins into mitochondria and chloroplasts (5L)</p> <p>3.4 Intracellular vesicular traffic : Endocytosis, exocytosis, transport from the ER through the Golgi apparatus (3L)</p> | <p>01</p> |
| <p>Unit : IV (15L) CELL BIOLOGY(Respiratory & Photosynthetic organelle)</p> <p>4.1 Mitochondria : Structure, electron-transport chains and proton pump (3L)</p> <p>4.2 Chloroplasts : Structure, energy capture from sunlight, genetic system (3L)</p> <p>4.3 Cytoskeleton : Cytoskeletal filaments, Microtubules, Actin regulation, molecular motors, cell behavior. (5L)</p> <p>4.4 Cell study : Study of cells under the microscope, Phase contrast, Fluorescence microscopy , Confocal microscopy & electron microscopy.(4 L)</p> | <p>01</p> |

SEMESTER I

PRACTICALS : SIPSMICP- 11 (60 Contact Hrs)

- 1) Isolation and Purification of coliphages from sewage**
- 2) Phage Typing of E. coli and Salmonella strains.**
- 3) Study of One Step Growth Curve of Lambda phage / T4 Phage.**
- 4) Study of Lysogeny in E. coli.**
- 5) Assignment on Virology – Research Paper.**
- 6) Isolation of Lysozyme from egg white.**
- 7)Preparation of protoplast using Lysozyme.**
- 8)Writing a Research proposal.**
- 9)Study of cell cytology using Phase contrast Microscopy. Demonstration**
- 10)Study of Cell structure using Confocal Microscopy. Demonstration**
- 11)Study of Cell structure using Fluorescence Microscopy. Demonstration**
- 12)Isolation of Chloroplasts.**
- 13)Isolation of Mitochondria from the cell.**

REFERENCES

- 1) Animal Virology – Fenner and White. Academic Press. NY**
- 2) Bacterial and Bacteriophage Genetics – Edward Birge**
- 3) Cell Movements : from Molecules to Motility- Bray Garland Pub. NY.**
- 4) Chemistry of Viruses – Knight C. Springer Verlag. NY**
- 5) General Virology – Luria**
- 6) Introduction to Plant Virology – BOS, I. Longman, London, NY.**
- 7) Microbial and Plant Protoplasts – Perberely**
- 8) Molecular Biology of The Cell – Albert, Johnson, Lewis, Raff, Roberts &Walter.**
- 9) Molecular Cell Biology. Lodish , Birk, and Zipursky. Freeman**
- 10) Principles of Virology – Flint, Enquist, Racaniello & Skalka, Vol I and II. ASM,**
- 11) The Structure and Dynamics of Cell Membrane. – Lipowsky and Sackmann. Elsevier.,**
- 12) Understanding Viruses – Teri Shors. Jones and Bartlett pub.**
- 13) Virology – Delbecco and Giasberg. Harper and Ravi Pub. NY.**

Course code: SIPSMIC-12

(Microbial Genetics)

Semester I

| Course Code | Title | Credits |
|-------------|---|---------|
| SIPSMIC12 | Microbial Genetics (60L) | 04 |
| Unit I: | 1.1 Gene Expression [05L] (15L) | |
| A. | Transcription- | |
| i. | Transcription process in prokaryotes | |
| ii. | Transcription process in eukaryotes | |
| B. | RNA molecules and processing- | |
| i. | Post transcriptional processing- structure of mRNA, pre-mRNA processing, addition of 5' cap, addition of Poly(A) tail, RNA splicing, RNA editing. | |
| ii. | Small RNA molecules- RNA interference, types, processing & function of microRNAs. | |
| C. | Translation- | |
| i. | Mechanism of translation- charging of tRNA molecules, initiation, elongation and termination, mRNA surveillance. | 01 |
| ii. | Post translational modification of proteins | |
| | 1.2 Regulation of gene expression- [10L] | |
| A. | Control of gene expression in prokaryotes- | |
| i. | Genes & regulatory element | |
| ii. | Levels of gene regulation | |
| iii. | DNA binding proteins | |
| iv. | Antisense RNA molecules | |
| v. | Riboswitches | |
| B. | Control of gene expression in eukaryotes- | |
| i. | Regulation through modification of gene structure- DNase I hypersensitivity, histone modifications, chromatin | |

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| <ul style="list-style-type: none"> remodeling, DNA methylation. ii. Regulation through transcriptional activators, Co-activators & repressors, enhancers and insulators iii. Regulation through RNA processing & degradation iv. Regulation through RNA interference. | |
| <p>Unit II: Replication, recombination, mutation and repair (15L)</p> <p>2.1 Regulation of replication [3L]</p> <p>A. Bacterial replication and cell cycle</p> <p>2.2 Recombination [6L]</p> <p>A. Models for homologous recombination</p> <p>B. Homologous recombination protein machines</p> <p>C. Homologous recombination in eukaryotes</p> <p>D. Mating type switching</p> <p>E. Genetic consequences of the mechanism of Homologous recombination</p> <p>2.3 Mutation [3L]</p> <p>A. Mutation: Basic features of the process</p> <p>B. Mutations:</p> <ul style="list-style-type: none"> i. Phenotypic effects ii. Mutations in humans and their effects iii. Conditional lethal mutations <p>C. Molecular basis of mutation (Types, mutations induced by chemicals, radiation and transposable genetic elements; expanding trinucleotide repeats and inherited human diseases)</p> <p>D. Screening chemicals for mutagenicity (Ame's test)</p> <p>2.4 DNA repair mechanisms [3L]</p> <p>A. Types of repair mechanisms</p> <ul style="list-style-type: none"> i. Direct repair, ii. Light dependent repair, iii. Excision repair in E. coli and mammalian cells, | <p>01</p> |

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| <ul style="list-style-type: none"> iv. Mismatch repair, controlling the direction of mismatch repair, v. Base flipping by methylases and glycosylases, vi. Recombination repair in E. coli, recombination as a mechanism to recover from replication errors, vii. SOS repair, viii. Conserved repair systems in eukaryotic cells, ix. Non-homologous end joining (NHEJ) pathway for repairing double stranded breaks <p>B. Inherited human diseases with defects in DNA repair</p> | |
| <p>Unit III: Cytoplasmic Inheritance & Chromosomal Rearrangements (15L) 3.1 Cytoplasmic Inheritance (Organelar Genetics) [10L]</p> <ul style="list-style-type: none"> A. mt-DNA <ul style="list-style-type: none"> i. Mitochondrial genome structure ii. Ancestral and derived mitochondrial genome iii. Mitochondrial DNA of Human, yeast and flowering plants iv. Endosymbiotic theory v. Mitochondrial DNA replication, transcription & translation vi. Codon usage in Mitochondria vii. Damage to Mitochondrial DNA and aging. viii. Evolution of Mitochondrial DNA ix. mt DNA analysis for study of evolutionary relationships | <p>01</p> |

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| <p>B. cp DNA</p> <ul style="list-style-type: none"> i. Gene structure and organization ii. General features of replication, transcription and translation of cpDNA iii. Comparison of nuclear, eukaryotic, eubacterial mitochondrial and chloroplast DNA iv. Examples of extra nuclear inheritance- v. Leaf Variegation, vi. Poky mutant of Neurospora, vii. Yeast petite mutant, viii. Human genetic diseases ix. Maps of mt DNA and cp DNA <p>3.2 Chromosomal Rearrangements and effects on gene expression [5L]</p> <ul style="list-style-type: none"> A. Amplification and deletion of genes B. Inversions that alter gene expression C. Transpositions that alter gene <ul style="list-style-type: none"> i. Expression antigenic variation in Trypanosomes ii. Mating type switching in yeast iii. Phase variation in Salmonella | |
| <p>Unit IV: Molecular tools for genetics, Population genetics (15L)</p> <p>4.1 Molecular tools for genetics [9L]</p> <ul style="list-style-type: none"> A. Molecular tools for studying genes and gene activity B. Use of recombinant DNA technology to identify human genes (Huntington's diseases, Cystic fibrosis), molecular diagnosis of human | <p>01</p> |

diseases, human gene therapy)

- C. Labeled tracers (autoradiography, phosphorimaging, liquid scintillation counting, non-radioactive tracers)
- D. Nucleic acid hybridization (Southern blots, DNA fingerprinting & DNA typing with their forensic applications, Northern blots, in situ hybridization), DNA sequencing (Sanger's chain termination method, Maxam Gilbert's sequencing), Restriction mapping, Site directed mutagenesis
- E. Mapping and quantifying transcripts (S1 mapping, primer extension, run-off transcription)
- F. Measuring transcription rates in vivo (Nuclear run – on transcription, reporter gene transcription), Assaying DNA –protein interactions (filter binding, gel mobility shift, DNAase and DMS footprinting, knockouts)

4.2 Population genetics [6L]

- A. Population and gene pool
- B. Genotypic and Allelic frequencies
- C. Calculation of Genotypic frequencies and Allelic frequencies for autosomal and X linked loci
- D. Problems –calculation of allelic and genotypic frequencies
- E. Hardy-Weinberg Law, genotypic frequencies at HWE,
- F. Implications of the H-W Law ,
- G. H-W proportions for multiple alleles,
- H. X-linked alleles
- I. Testing for H-W proportions and problems
- J. Genetic ill effects of in-breeding
- K. Changes in the genetic structure of populations:
 - i. Mutation,
 - ii. Migration and gene flow,
 - iii. Genetic drift,
 - iv. Natural selection

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| <p style="margin: 0;">v. Simple problems based on the natural forces</p> <p style="margin: 0;">L. Measuring genetic variation :</p> <p style="margin: 0;">i. RFLP, DNA sequencing</p> <p style="margin: 0;">ii. Protein electrophoresis</p> | |
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PRACTICALS : SIPSMICP 12 (60 Contact Hrs)

List of practicals for Semester I

- 1. β galactosidase assay**
- 2. UV mutagenesis**
- 3. Acridine orange mutagenesis**
- 4. Isolation of mutants by Replica plate technique**
- 5. Penicillin enrichment technique**
- 6. Ames test**
- 7. Southern hybridization technique [Demonstration]**
- 8. Northern Blotting technique [Demonstration]**
- 9. Restriction mapping**
- 10. Design of primer & PCR**
- 11. Protein electrophoresis**
- 12. Problems on population genetics**

References

1. Watson, Baker, Bell, Gann, Levine, Losick, “**Molecular Biology of the Gene**”, Fifth Edition, Pearson Education (LPE)
2. Trun, Trempey, “**Fundamental Bacterial Genetics**”, Blackwell Publishing
3. Russell, P.J., “**iGenetics- A Molecular Approach**”, Third Edition, Pearson International Edition
4. Snustad & Simmons, “**Principals of Genetics**”, Third Edition, John Wiley & Sons Inc
5. Watson, Gilman, Witkowski, Zoller, “**Recombinant DNA**”, Second Edition, Scientific American Books
6. Klug & Cummings, “**Concepts of Genetics**”, Seventh Edition, Pearson Education (LPE)
7. Pierce, B.A., “**Genetics- A Conceptual Approach**”, Second Edition, W. H. Freeman & Co
8. Lewin, B., “**Genes-IX**”, Jones and Bartlett Publishers

Course code: SIPSMIC-13

Microbial Biochemistry

THEORY: SEMESTER –I

| Course Code | Title | Credits |
|---|------------------------------|---------|
| SIPSMIC13 | Microbial Biochemistry (60L) | 4 |
| UNIT I AQUEOUS SOLUTIONS & ACID BASE CHEMISTRY (15L) Various units of expressing and interconverting concentration of solutions: 1. molarity, moles normality, osmolarity, molality, Mole Fraction 01 Bronsted concept of conjugate acid-conjugate base pairs, ionization of solutions, 2. pH, titration curves, buffers; preparation, action & their wide use in biology. Henderson –Hasselbalch equation, buffer capacity, polyprotic acids, amphoteric salts, ionic strengths. 3. Problem solving under all heads | | 1 |
| UNIT II BIOORGANIC MOLECULES (15L) 1. Amino acids: classification & stereochemistry (revision), biochemical information from amino acid sequence, Derivative, ionization 2. Proteins: Structure of peptide bond, Stability of formation of peptide bond, Ramchandran plot, Protein structure (revision), factors determining sec, tertiary structure: Amino acid seq., thermodynamics of folding, role of disulphide bonds, Dynamics of globular protein folding, Chaperonins & prions Motifs & domains, protein families , protein stability Prediction of Sec & tertiary structure, protein-protein interactions. 3. Glycobiology: Carbohydrates (revision), stability of glycosidic bond, Glycoconjugates: Proteoglycans, glycoproteins, glycolipids, Homopolysaccharide folding ,Functions of oligosaccharides 4. Lipids: Lipid classification, Structure of lipids in membranes- glycerolipids, ether lipids, galactolipids, sulfolipids, lipids in Archae bacteria, Sphingolipids,terpenes, isoprenoids etc. Functions of lipids : signals, cofactors, pigments, | | 1 |

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| <p>UNIT III METABOLISM OF ONE & TWO CARBON COMPOUNDS (15L)</p> <p>1. Metabolism of one-carbon compounds- methane, methanol, methylamines oxidation, carbon assimilation in methylotrophic bacteria and yeasts. Methanogenesis from H₂,CO₂ CH₃OH, HCOOH, methylamines- Energy coupling in methanogens and biosynthesis in methanogenic bacteria, Acetogenic bacteria-autotrophic pathway of citrate synthesis and CO₂ fixation, Carboxybacteria- 01 Biochemistry of chemolithoautotrophic metabolism, cyanide metabolism- cyanogenesis and cyanide degradation.</p> <p>2. Metabolism of two carbon compounds – Acetate (TCA and Glyoxylate Cycle), Ethanol (Acetic acid bacteria), Glyoxylate and Glycollate (dicarboxylic acid cycle, Glycerate pathway, Beta-hydroxy aspartate pathway), oxalate as carbon and energy source. Acetate oxidation (modified citric acid cycle, carbon monoxide dehydrogenase pathway and disproportionation to methane</p> | 1 |
| <p>UNIT IV TRANSFER OF BIOMOLECULES (15L) Peptide, protein transport, Porins/aquaporins –structure & function</p> <ol style="list-style-type: none"> 1. The Sec Systems. 2. The Translocation of membrane bound proteins. 3. The E.coli SRP. 4. Protein translocation of folded proteins. 5. Extracellular protein secretion. 6. Folding of Periplasmic Proteins. 7. Drug Export systems. 8. Biological membranes and Transport. | 1 |

PRACTICALS : SIPSMIC1P3 SEMESTER 1 (60 Contact Hrs)

- 1) Characterization of an organic molecule
- 2) All qualitative tests as in previous syllabus with emphasis on qualitative tests of carbohydrates, proteins & fat
- 3) To resolve compounds by chromatography
- 4) To identify fatty acids & other lipids
- 5) To resolve various lipid contents by GLC
- 6) To determine pI of a given protein
- 7) To determine acid value
- 8) To determine saponification value of fat
- 9) To test given fats & oils for unsaturation
- 10) To purify protein-ammonium sulfate ppt, dialysis
- 11) To estimate protease activity in given enzyme sample
- 12) To monitor catalase activity
- 13) Adaptation of E. coli to anaerobiosis
- 14) Cellular fatty acids of E. coli
- 15) Chemotaxis of pseudomonas
- 16) Factors that affect the relative amounts sat, unsat & branched chain FA
- 17) Preparation of buffers, titration curve of glycine
- 18) Purification of an extracellular enzyme (beta amylase) by salting out and dialysis; Enzyme kinetics: effect of enzyme concentration, substrate concentration, pH, temperature, and inhibitors on enzyme activity.
- 19) Problems on the same

REFERENCES:

Theory:

Unit I: Biochemical calculations , Segel I.R., John Wiley and Sons, 1995

Unit II:

Biochemistry 3rd edition, Mathew, Van Holde and Ahern , Pearson Education

Principles of Biochemistry, 4th edition, Zubay, G., Wm.C. Brown Publishers, 1998

Principles of Biochemistry, Lehninger A.L., Cox and Nelson, CBS publishers and Distributors Pvt. Ltd. 1994

Unit III:

Bacterial metabolism by Gottschalk, Springer-Verlag, 1985

Biotechnology H.J. Rehm and G. Reed (ed.), Volume 6a. Biotransformations, Verlag and Chemie, 1984

Microbial Biochemistry by GN Cohen-2011, Springer

Unit IV:

Biochemistry , 4th edition , Voet D. and Voet J.G., John Wiley and Sons Inc., 1995

Course Code: SIPSMIC14

Medical Microbiology & Immunology

SEMESTER I

| Course code | Title | Credits |
|--|--|----------------|
| SIPSMIC14 | Medical Microbiology & Immunology (60L) | 4 |
| UNIT I Advances in medical Microbiology (15 L) 1.1 Emerging Diseases :- Detailed Study of following infections including Etiology, Transmission, Pathogenesis, Clinical Manifestations, Lab. diagnosis, Prophylaxis, and Treatment. 1.2 AIDS , MOTT (mycobacteria other than TB) Legionellosis, Chicken gueniewa, Cholera caused by V.cholerae 0139, Conditions caused by Helicobacter pylori, SARS. | | 1 |
| UNIT II Epidemiology of infectious diseases (15 L) 2.1 Historical aspects-definition 2.2 Descriptive Epidemiology-aims and uses 2.3 Host parasite interactions in the cause of diseases 2.4 Epidemiological principals in prevention and control of Diseases 2.5 Measures of risks : frequency measures, morbidity frequency measures, mortality frequency measures natality(birth) measures, measures of association, measures of public health impact. 2.6 Public health surveillance: purpose and characteristics , identifying health problems for surveillance, collecting data for surveillance, analyzing and interpreting data, disseminating data and interpretation, evaluating and improving surveillance. | | 1 |

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| <p>UNIT III</p> <p style="text-align: center;">Immune system and health part I: (15 L)</p> <p>Immune response to infectious diseases</p> <p>3.1 Immune response to Prions,</p> <p>3.2 Immune response to viral infections- HIV/AIDS-HIV and the immune system-InfluenzaAvianH5N1.</p> <p>3.1 Immune response to Bacterial diseases- Difference in the Immune response to extracellular and intracellular bacteria : Diphtheria, Tuberculosis 3.4 Microbial ways of evading immune system.</p> | 1 |
| <p>UNIT IV</p> <p style="text-align: center;">Recent advances in immunology (15 L)</p> <p>4.1Recent advances in Innate immunity including receptors involved and signalling system. Physiological & immunological barriers.</p> <p>4.2 the cellular players :Phagocytic cells, Lymphocytic cells, DCs.</p> <p>4.3 The innate immune response: Inflammation, Acute Phase Reaction</p> <p>4.4 Molecular basis of diversity of immunoglobulin molecules.</p> <p>4.5 Multigene organization of Ig genes.</p> <p>4.6 Variable-Region Gene Rearrangements.</p> <p>4.7 Mechanism of Variable-Region DNA Rearrangements.</p> <p>4.8 Generation of antibody diversity.</p> <p>4.9 Manipulations of the immune response</p> | 1 |

PRACTICALS : SIPSMICP3 SEMESTER 1 (60 Contact Hrs)

1. 1) Characterization of an organic molecule
2. Problem solving exercises in medical microbiology based on diseases caused by- HIV, MOTT, Chickengunia, Helicobacter, Vibrio cholerae 0139.
3. Diagnosis for HIV
 - CD4 lymphocyte count for AIDS
 - ELISA for AIDS,
1. Diagnosis for MOTT
2. Acid fast staining for MOTT
3. Mono - Spot Test for diagnosis of Chickengunia (Demonstration expt.)
4. Diagnosis for V.c.0139
 - Cholera red test, String test, Oxidase test, Biochemical tests, & isolation on TCBS medium for identification of Vibrio cholerae 0139.
 - serological diagnosis for V.c.0139 using specific monotypic antisera Diagnosis for Helicobacter pyolari
5. HPSA (Helicobacter pyolari) detection from stool sample. (Demonstration expt.) (kit method)
6. Study of virulence factors-Phagocytosis & Phagocytic index
7. Collection of human blood & separation of mononuclear cells by ficoll hypaque density gradient centrifugation,
8. Counting of viable cells by trypan blue.

REFERENCES :

Unit I

1. Clinics in laboratory medicine, Emerging Infections and their causative agents. September 2004 vol. 24 no. 3.
2. Basic lab methods in medical bacteriology, WHO Geneva.
2. Textbook of Microbiology 8th edition 2009-Ananthnarayan & Paniker-University press
3. Medical laboratory technology by Godkar.
4. Handbook of Epidemiology- W. Ahrens, I. Pigeot Springer- Verlag Berlin Herdelberg (2005).
5. Epidemiology for Public Health Practice- Robert H Friis & Thomas A. Sellers 3rd edition Jones & Bartlett publishers.
6. Textbook of preventive and Community medicine- Park & Park.
7. Infectious disease surveillance by Nikuchia Nikanatha Blackwell Publishing 2005.

Unit II 1. Principles of epidemiology in public health practices 3rd edition

(www.cdc.gov/training/productsU30T/ss1000)

Unit III

1. Immunology – Essential and Fundamental, Sulabha Pathak and Urmi Palan. 3rd edition Capital publishing company.
2. Immunology- Kuby 6th edition W. H. Freeman and company- New York.
3. The Elements of immunology- Fahim Halim Khan- Pearson Education.
4. Immunology an introduction- 4th edition- Ian R. Tizard-Thomson.

Unit IV

1. Immunology – Essential and Fundamental, Sulabha Pathak and Urmi Palan. 3rd edition Capital publishing company.
2. Immunology- Kuby 6th edition W. H. Freeman and company- New York.
3. The Elements of immunology- Fahim Halim Khan- Pearson Education.
4. Immunobiology –the immune system in health and disease 6th ed.-Janeway.Travers.GS. References for Practicals:

1. Medical laboratory technology- by Godkar.
2. Immunology-Essential & Fundamental-Sulbha Phatak & Urmi Palan-3rd edition Capital Publishing Company.
3. Clinical immunology – Principle & Practice 3rd ed. 2008 (Part -11 –clinical diagnostic immunology)
4. Bailey & Scott's – diagnostic microbiology 11th edition – Betty Forbes.
5. Koneman's Color Atlas & Text book of Diagnostic Microbiology 6th ed.

M.Sc. Microbiology Detail Syllabus Semester II

SIPSMIC-21

| Course Code | Title | Credits |
|-----------------|---|-----------|
| SIPSMIC-21 | Cell Biology & Virology (60L) | 04 |
| Unit I: | (15L) VIROLOGY (Animal Viruses) | |
| | <p>1.1 Animal Viruses : Influenza viruses : Classification, Clinical features, replication, genetic variation, Treatment and Surveillance (4L)</p> <p>1.2 Rabies virus, epidemiology, Pathogenesis, Immunity, Management of human rabies, Viral life cycle, genetic variation. (3L)</p> <p>1.3 Pox virus ; Clinical features, Structure of virus, replication, Vaccinia, orthopox virus, variola virus. (4L)</p> <p>1.4 Herpes Virus : Clinical signs and symptoms, varicella Zoster virus, Epstein-Barr virus, Cytomegalovirus, Life cycle, laboratory diagnosis, treatment (4L)</p> | 01 |
| Unit II: | (15L) VIROLOGY IN RELATION TO HUMAN HEALTH | |
| | <p>2.1) Human Immunodeficiency Virus : transmission, epidemiology, life cycle, prevention, Diagnosis.(4L)</p> <p>2.2) Hepatitis Virus : Clinical features, epidemiology, Laboratory diagnosis, life cycle, Genetic diversity, prevention (3L)</p> <p>2.3) New reemerging viruses, Evolution and adaptation, ecological factors, climate variability, human factors- social behavior, exposure to zoonotic diseases, human movement (4L)</p> | 01 |

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| <p>2.4) Prions and Viroids, - CJD, BSE, Viruses and Cancer – retrovirus, DNA tumor virus, adeno virus, HCC (5L)</p> | |
| <p>Unit : III (15L) CELL BIOLOGY(Cell division & Cell Cycle)</p> <p>3.1 Mechanism of cell division : M-phase, Mitosis, Cytokines (3L)</p> <p>3.2 Cell cycle and Programmed cell death : Control system, intracellular control of cell cycle events, Apoptosis, extracellular control of cell growth and apoptosis (5L)</p> <p>3.3 Cell Junctions and cell adhesion : Anchoring, adherence junctions, Desmosomes, Gap junctions, cell-cell adhesion, Cadherins (3L)</p> <p>3.4 Development of multicellular organisms: Animal cell development, <i>Caenorhabditis elegans</i>, <i>Drosophila</i> signaling genes, gradient of nuclear gene regulatory protein, Dpp and Sog set up, Neural development (4L)</p> | <p>01</p> |
| <p>Unit : IV CELL BIOLOGY(Cell Communication) (15L)</p> <p>4.1 Germ cells and fertilization, Meiosis, sex determination in mammals, eggs, sperm, fertilization (4L)</p> <p>4.2 Cell communication : Extracellular signal molecules, nitric oxide gas signal, classes of cell-surface receptor proteins (5L)</p> <p>4.3 Signaling through enzyme linked cell surface receptors : Docking sites, Ras , MAP kinase, PI-3 kinase, TGF (3L)</p> <p>4.4 Signaling in plants : Serine / Threonine kinases, role of ethylene, Phytochromes (3L)</p> | <p>01</p> |

PRACTICALS : SIPSMICP-21

SEMESTER II (60 Contact Hrs.)

- 1) Egg inoculation and cultivating animal virus in embryonated egg. Demonstration (04)**
- 2) Cultivation of macrophage cell lines and study of cell viability (06)**
- 3) Study of Mitosis. (06)**
- 4) Study of Meiosis (06)**
- 5) Estimation of NO (Nitric Oxide) produced by Macrophages. (08)**
- 6) Study of Phagocytosis using bacterial culture / yeast cells (04)**
- 7) Study of Cell membrane integrity using uptake of neutral red. (04)**
- 8) Writing Research Paper –w.r.t. Techniques used to study cell cycle. (06)**
- 9) Review on Cell – Cell communication. (06)**
- 10) Assignment on Animal viruses – Epidemiology, Transmission (06)**
- 11) Presentation of Assignment – Cell Biology (04)**

REFERENCES :

- 1. Chemistry of Viruses – Knight C. Springer Verlag. NY**
- 2. Bacterial and Bacteriophage Genetics – Edward Birge**
- 3. Understanding Viruses – Teri Shors. Jones and Bartlett pub.**
- 4. Cell Movements : from Molecules to Motility- Bray Garland Pub. NY.**
- 5. General Virology – Luria**
- 6. Introduction to Plant Virology – BOS, I. Longman, London, NY.**
- 7. Animal Virology – Fenner and White. Academic Press. NY**
- 8. Microbial and Plant Protoplasts – Perberely**
- 9. Molecular Biology of The Cell – Albert, Johnson, Lewis, Raff, Roberts**
- 10. Molecular Cell Biology. Lodish , Birk, and Zipursky. Freeman**
- 11. Principles of Virology –Flint, Enquist, Racaniello and Skalka, Vol I & II**
- 12. Virology – Delbecco and Giasberg. Harper and Ravi Pub. NY.**

Course code: SIPSMIC-22

(Microbial Genetics)

Semester II

| Course Code | Title | Credits |
|--|--------------------------|---------|
| SIPSMIC-22 | Microbial Genetics (60L) | 04 |
| <p>Unit I Viral genetics, gene transfer [15L]</p> <p>1.1 Viral genetics [5L]</p> <p>A. Mapping the Bacteriophage genome.</p> <p>i. Phage phenotypes</p> <p>ii. Genetic recombination in phages</p> <p>iii. Genetic fine structure mapping</p> <p>iv. Deletion mapping</p> <p>B. Genes within genes : Bacteriophage Φ X174</p> <p>C. Constructing phage vectors- phage display vectors, suicide vectors, combining phage vectors and transposons</p> <p>1.2 Gene Transfer [10L]</p> <p>A. Drug resistance and gene transfer in bacteria.</p> <p>B. Genetic exchange in Bacteria – An overview</p> <p>C. Mutant phenotypes in bacteria</p> <p>D. Basic test for transformation, conjugation and transduction</p> <p>E. Transformation:</p> <p>i. The transforming principle</p> <p>ii. Natural competency</p> <p>iii. Process of natural transformation- <i>Bacillus subtilis</i> (in detail)</p> <p>iv. Overview of transformation in <i>Streptococcus pneumoniae</i> & <i>Haemophilus influenzae</i></p> <p>v. Artificial transformation</p> <p>vi. Transformation and gene mapping</p> <p>F. Conjugation:</p> <p>i. Discovery of conjugation</p> <p>ii. F factors and R factors</p> | | 01 |

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| <ul style="list-style-type: none"> iii. The conjugation machinery and transfer of DNA iv. F⁺ X F⁻ mating v. Hfr formation and conjugation vi. Formation of F primes and transfer from one cell to another vii. Genetic uses of F' viii. Gene mapping using Hfr crosses and 50% rule. ix. Mapping closely linked genes x. Mobilization of nonconjugable plasmids by xi. Conjugation from prokaryotes to eukaryotes <p>G. Transduction:</p> <ul style="list-style-type: none"> i. Discovery ii. Generalized transduction iii. P1 as model of generalized transduction iv. Specialized transduction- λ phage as model system v. LFT & HFT lysate Making merodiploids with specialized transducing phage Moving mutations from plasmids to specialized transducing phage to chromosome | |
| <p>Unit II: Transposable genetic elements, genetic basis of cancer(15L)</p> <p>2.1 Transposable genetic elements [6L]</p> <p>A. Transposable Elements in Prokaryotes : An Overview</p> <p>The medical Significance of Bacterial Transposons</p> <p>B. Transposable Elements in Eukaryotes</p> <p>Ac and Ds Elements in Maize</p> <p>P Elements and Hybrid Dysgenesis in Drosophila</p> <p>Mariner, an Ancient and Widespread Transposon</p> <p>C. Retrotransposons</p> <p>Retroviruslike Elements</p> <p>Retroposons</p> <p>D. The Genetic and Evolutionary Significance of Transposable Elements</p> <p>Transposons and Genome Organization</p> <p>Transposons and Mutation</p> <p>Rearrangement of Immunoglobulin Genes</p> <p>Evolutionary Issues Concerning Transposable Elements</p> | <p>01</p> |

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| <p>2.2 Genetic basis of cancer [9L]</p> <p>A. A Common Killer</p> <p>B. Cancer: A Genetics Disease The Many Forms of Cancer Cancer and the Cell Cycle A Genetics Basis for Cancer</p> <p>C. Oncogenes Tumor-Inducing Retroviruses and Viral Oncogenes Cellular Homologs of Viral Oncogenes: The Proto-Oncogenes Mutant Cellular Oncogenes and Cancer Chromosome Rearrangement and Cancer</p> <p>D. Tumor Suppressor Genes Inherited Cancers and Knudson’s Two-Hit Hypothesis Cellular Roles of Tumor Suppressor Proteins</p> <p>E. Genetic Pathways to Cancer</p> | |
| <p>Unit III: Developmental genetics (15L)</p> <p>3.1 Developmental genetics [5L]</p> <p>A. Cloning Experiments</p> <p>B. The Genetics of Pattern Formation in Drosophila</p> <p>C. Homeobox Genes in other Organisms</p> <p>D. The Genetics of Flower Development in Arabidopsis</p> <p>E. Programmed Cell Death in Development</p> <p>F. Evo-Devo: The Study of Evolution and Development</p> <p>3.2The genetic control of animal development [10L]</p> <p>A. Stem Cell Therapy: A Brave New World?</p> <p>B. The Process of Development in Animals</p> <p>i. Oogenesis and fertilization</p> <p>ii. The Embryonic Cleavage Divisions and Blastula Formation</p> <p>iii. Gastrulation and Morphogenesis</p> <p>C. Genetic Analysis of Development in Model Organisms</p> <p>i. Drosophila as a Model Organism</p> <p>ii. Caenorhabditis as a model organism</p> | <p>01</p> |

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| <p>D. Genetic Analysis of Development Pathways</p> <ul style="list-style-type: none"> i. Sex Determination in Drosophila ii. Sex Determination in Caenorhabditis <p>E. Molecular Analysis of Genes Involved in Development</p> <p>F. Maternal Gene Activity in Development</p> <ul style="list-style-type: none"> i. Maternal-Effect Genes ii. Determination of the Dorsal-Ventral and Anterior-Posterior Axes in Drosophila Embryos <p>G. Zygotic Gene Activity in Development</p> <ul style="list-style-type: none"> i. Body Segmentation ii. Specification of Cell Types iii. Organ Formation | |
| <p>Unit IV: Applications and ethics of genetic technology [15L]</p> <p>4.1 Mapping Human Genes at the Molecular Level</p> <p>RFLPs as Genetic Markers</p> <p>Linkage Analysis Using RFLPs</p> <p>Positional Cloning: The Gene for Neurofibromatosis</p> <p>The Candidate Gene Approach: The Gene for Marfan Syndrome</p> <p>Fluorescent in Situ Hybridization (FISH) Gene Mapping</p> <p>4.2 Genetic Disorders: Diagnosis and Screening</p> <p>Prenatal Genotyping for Mutations in the β- Globin Gene</p> <p>Prenatal Diagnosis of sickle-Cell Anemia</p> <p>Single Nucleotide Polymorphisms and Genetic Screening</p> <p>DNA Microarrays and Genetic Screening</p> <p>Genetic Testing and Ethical Dilemmas</p> <p>4.3 Treating Disorders with Gene Therapy</p> <p>Gene Therapy for Severe Combined Immunodeficiency (SCRID)</p> <p>Problems and Failures in Gene Therapy</p> <p>The Future of Gene Therapy: New Vectors and Target-Cell Strategies</p> <p>Ethical Issues and Gene Therapy</p> <p>4.4 DNA Fingerprints</p> <p>Minisatellites (VNTRs) and Microsatellites (STRs)</p> <p>Forensic Applications of DNA Fingerprints</p> | <p>01</p> |

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| <p>4.5 Genome Projects Use Recombinant DNA technology</p> <p>The Human Genome Project: An overview</p> <p>The Ethical, Legal, and Social Implications (ELSI)</p> <p>Program After the Genome Projects</p> <p>4.6 Biotechnology is an Outgrowth of Recombinant DNA Technology</p> <p>Insulin Production by Bacteria</p> <p>Transgenic Animal Hosts and Pharmaceutical Products</p> <p>Transgenic Crop Plants and Herbicide Resistance</p> <p>4.7 Marshalling recombinant DNA technology to fight AIDS</p> | |
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PRACTICALS : SIPSMICP- 22 (60 Contact Hrs)

List of practicals for semester II

- 1) Transformation
- 2) Conjugation, zygotic induction
- 3) Transduction
- 4) Identification of phage nucleic acid
- 5) Curing of plasmids
- 6) Study of transposable elements
- 7) Isolation of host range mutants
- 8) Problems on gene transfer mechanisms
- 9) Problems on viral genetics
- 10) Cancer genetics- visit to ACTREC

References:

1. Watson, Baker, Bell, Gann, Levine, Losick, "Molecular Biology of the Gene", Fifth Edition, Pearson Education (LPE)
2. Trun, Trempy, "Fundamental Bacterial Genetics", Blackwell Publishing
3. Russell, P.J., "iGenetics- A Molecular Approach", Third Edition, Pearson International Edition
4. Snustad & Simmons, "Principals of Genetics", Third Edition, John Wiley & Sons Inc
5. Watson, Gilman, Witkowski, Zoller, "Recombinant DNA", Second Edition, Scientific American Books
6. Klug & Cummings, "Concepts of Genetics", Seventh Edition, Pearson Education (LPE)
7. Pierce, B.A., "Genetics- A Conceptual Approach", Second Edition, W. H. Freeman & Co
8. Lewin, B., "Genes-IX", Jones and Bartlett Publishers

SIPSMIC-23 Microbial Biochemistry

THEORY: SEMESTER –II

| Course code | Title | Credits |
|--|-------------------------------------|----------|
| SIPSMIC23 | Microbial Biochemistry (60L) | 4 |
| UNIT I <p style="text-align: center;">ANALYTICAL BIOCHEMISTRY (15L)</p> <ol style="list-style-type: none"> 1. Determination of Molecular weights, Purity & length & volume of organic compounds (02) 2. Extraction, purification, application & analysis in General methods of : extraction : Salting out, use of organic solvents purification Chromatographic techniques composition determination: CD, NMR Mass determination: ultracentrifuge, GC, MS structure determination: X-ray Location: Confocal Spectroscopy (06) 3. Proteins (02) 4. Carbohydrates Methods of carbohydrate analysis (02) Lipid analysis (02) 5. Other organic compounds (01) Problem solving under all heads | | 1 |
| UNIT II <p style="text-align: center;">ENZYMOLGY (15 L)</p> <p>A. Enzyme kinetics: discovery of enzymes, Enzyme terminology, basic aspects of chemical kinetics, Kinetics of enzyme catalyzed reactions, enzyme inhibition (reversible and irreversible), Specific examples viz Effect of pH on enzyme activity – fumarase, enzyme action by x-ray crystallography, nerve gas and its significance, HIV enzyme inhibitors, and drug design. Problems</p> <p>B. Enzyme regulation: PFK as allosteric enzyme, general properties of allosteric enzymes, two themes of allosteric regulation, regulation by covalent modification, regulation by multienzyme complexes and multifunctional enzymes, specific example viz the blood coagulation cascade. Problems</p> <p>C. Mechanisms of enzyme catalysis: five themes that occur in discussing enzymatic reactions, detailed mechanisms of enzyme catalysis egs: serine proteases, ribonucleases, triosephosphate isomerase, lysozyme, lactate and alcohol dehydrogenases, catalytic antibodies. Problems</p> | | 1 |
| UNIT III <p style="text-align: center;">SIGNALLING & STRESS (15L)</p> <ol style="list-style-type: none"> 1. Introduction to two-Component Signaling Systems. 2. Response by facultative anaerobes to Anaerobiosis, Response to nitrate and nitrite, Response to nitrogen supply, Response to inorganic phosphate Supply. 3. Effect of oxygen and light on the expression of photosynthetic genes in purple photosynthetic bacteria, Response to osmotic pressure and temperature, response to potassium ion and external osmolarity, Response | | 1 |

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| <p>to carbon sources.</p> <p>4. Synthesis of virulence factors in response to temperature, pH, nutrient, osmolarity and quorum sensors, Chemotaxis, photoresponses, aerotaxis.</p> <p>5. Bacterial development and Quorum Sensing: Myxobacteria, Caulobacter, Sporulation in <i>Bacillus subtilis</i>, Competence in <i>Bacillus subtilis</i>, bioluminescence, Systems similar to LuxR / Lux I in Nonluminescent bacteria, Biofilms.</p> <p>6. Bacterial response to environmental stress: heat – shock response, repairing damaged DNA, the SOS response, oxidative stress.</p> | |
| <p>UNIT IV</p> <p style="text-align: center;">MICROBIAL DEGRADATION (15 L)</p> <p>1. Degradation of Aromatic and alicyclic compounds & important organisms: mixed culture & genetic manipulation.</p> <p>2. Common pathways of aromatic degradation: aerobic & anaerobic attack on aromatic ring.</p> <p>Aromatic & heterocyclic compounds with economical & ecotoxicological significance:- phenolic pesticides, terminal aromatic metabolites of pesticides, industrial pollutants-phthalic acid esters, ligosulfonates, surfactants, dyes & aromatics released during combustion.</p> <p>3. Biotransformation of aromatic compounds- Catabolism of naphthalene, Phenanthralene and Anthracene.</p> <p>4. Biotransformation of alicyclics, aliphatics, branched chain alkanes & alkenes and halogenated aliphatics.</p> | <p>1</p> |

PRACTICALS: PSMBP2P3 (60 Contact Hrs)
List of practicals for semester II

ANALYTICAL BIOCHEMISTRY

1. Differential extraction with buffers,
2. purification strategy
3. Purification and concentration by precipitation- by decrease of pH, decrease in ionic strength, salting out, organic solvents, organic polymers, denaturation
4. Aqueous- two phase partitioning

ENZYMOLGY

5. purification of an extracellular enzyme(β - amylase) by salting out and dialysis
6. Enzyme kinetics-effect of enzyme concentration, substrate concentration, pH , temperature and inhibitors on enzyme activity,
7. Demonstration of proteolytic activity
8. Determination of glucose isomerase present intracellularly in *Bacillus* sp.

SIGNALLING AND STRESS

9. Adaptation of *E. coli* to anaerobiosis
10. Chemotaxis of *Pseudomonas*
11. Effect of temperature and water activity on swarming of *Proteus*
12. Different bacteriolytic response associated with addition of lysozyme and salt.

MICROBIAL DEGRADTION

13. Microbial degradation of polycyclic aromatic hydrocarbons(PAHs)- enrichment, isolation and screening of bacteria
14. PAH degradation studies

15. Plasmid curing and determination of chemotaxis by drop assay method

References:

Theory:

Unit I:

Biochemistry 3rd edition, Mathew, Van Holde and Ahern , Pearson Education

Principles of Biochemistry, 4th edition, Zubey

Principles of Biochemistry, Horton and M., and Scrimgeour Pears Rawn

Principles of Biochemistry, Lehninger A.L., Cox and Nelson, CBS publishers and Distributors Pvt. Ltd. 1994

Unit II:

Principles of Biochemistry, Lehninger A.L., Cox and Nelson, CBS publishers and Distributors Pvt. Ltd. 1994

Biochemistry by Conn and Stumph

Unit III:

The physiology and biochemistry of prokaryotes , White D., Oxford University Press, 2000

Unit IV:

Biotechnology H.J. Rehm and G. Reed (ed.), Volume 6a. Biotransformations, Verlag and Chemie, 1984

Introduction to bacterial metabolism Doelle H.W., Academic Press, 1975 Microbial ecology , Atlas RM and Bartha, Addison Wesley Longman Inc. 1998.

Practical:

a. Laboratory manual in biochemistry by Jayaraman J. , New Age International Publishers

b. An introduction to practical biochemistry 3rd edition, David T Plummer, Tata McGraw Hill edition 1998

c. Experimental biochemistry –A student companion, Rao Beedu, S. Deshpande, IK international Pvt. Ltd.

d. Laboratory manual in biochemistry, Immunology and Biotechnology, Nigam A and Ayyagiri A. Tata McGraw Hill edition

e. Source of Experiments for teaching Microbiology, Primrose and Wardlaw

f. Microbial Physiology and Biochemistry Laboratory manual: A quantitative approach , David White

g. Principles and techniques of practical biochemistry, 4th edition, Wilson K. and Walker J.(Ed.) Cambridge University

SIPSMIC-24 Medical Microbiology & Immunology

| SIPSMIC24 | Medical Microbiology & Immunology (60L) | Credits |
|------------------|--|----------------|
| UNIT I | <p align="center">Advances in medical Microbiology : (15 L)</p> <p>Emerging Diseases :- Detailed Study of following infections including Etiology, Transmission, Pathogenesis, Clinical Manifestations, Lab. diagnosis, Prophylaxis, and Treatment. Dengue, Listeriosis, VRE (Vancomycin Resistant enterococci)Leptospirosis, Hepatitis non A , Swine flu, conditions caused by Campylobacter , and prions</p> | 1 |
| UNIT II | <p align="center">Clinical Research: (15 L)</p> <p>2.1 Introduction to Clinical Research. a. Good Clinical practice Guidelines b. Ethical aspects of Clinical Research c. Regulatory Requirements in clinical research d. Clinical Research Methodologies and Management e. Clinical Data Management and Statistics in Clinical Research. 2.2 Modern Diagnostic Methods: a) -Advances in Molecular and Immunological Techniques. b) -Microarrays. c) -Advances in Fluorescence Technology</p> | 1 |
| UNIT III | <p align="center">Immune system and Health : Part –II (15 L)</p> <p>3.1 Recent advances in immune tolerance a) -Central Tolerance b) -Peripheral Tolerance c) -Tolerance Induction d) -T-cell Tolerance e) -B-cell Tolerance f) -Incomplete Tolerance g) -Duration of Tolerance 3.2 Recent advances in autoimmunity a) -Interplaying Factors b) -Triggering Factors c) -Mechanisms of Damage d) -Organ Specific Autoimmune Diseases e) -Systemic Autoimmune Diseases f) -Animal Models for Autoimmune Diseases g) -Proposed Mechanisms for Induction of Autoimmunity h) -Treatment of Autoimmune Diseases 3.3 Transplantation & Transfusion Immunology a) -Antigens Involved in Graft Rejection b) -Allorecognition c) -Graft Rejection-Role of APC's & Effector Cells d) -Graft v/s Host Diseases e) -Immuno Suppressive Therapies f) -Blood Transfusion ABO & Rh Blood Groups</p> | 1 |

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| <p>Potential Transfusion Hazards g) Transfusion Alternatives 3.4 Cancer immunology. a) -Cancer:Origin & Terminology b) -Malignant Transformation of Cells c) -Oncogenes & Cancer Induction d) -Tumors of the Immune System e) -Tumor Antigens f) -Tumor Evasion of the Immune System g) -Cancer Immuno Therapy</p> | |
| <p>UNIT IV Challenges in immune system (15 L) 4.1 Recent advances in vaccines a) -Challenges faced b) -HIV c) -Measles d) -T.B. 4.2 Immunodeficiency diseases a) -Primary Immunodeficiency b) -Defects in the Compliment System c) -Treatment Approaches for Immunodeficiency d) -Animal Models of Primary Immunodeficiency e) -Secondary Immunodeficiency & AIDS 4.3 Adversarial strategies to overcome immune response a) -microbial strategies in relation to the immune response b) -Inflammation Revisited c) -Protective Response Against Bacteria d) -The Habitat of Intracellular Bacteria e) -Immunity to Fungi f) -Immunity to Parasitic Infection</p> | 1 |

PRACTICALS (PSMBP2P4) (60 Contact Hrs)
List of practicals for semester II

Problem solving exercises in medical microbiology with appropriate tests for the diagnosis of diseases :

1.Rapid identification for Dengue virus(IgM &IgG)kit method “TULIP”

Immuno chromatography (Demonstration Experiment)

2.Diagnosis for VRE: Isolation using Bile Esculin agar, PYR test.

3. Diagnosis for VRE: AST.

4. Diagnosis for VRE: MIC using High Comb MIC Test.

5. Diagnosis for Leptospirosis: Spirochaete staining.

6. Diagnosis for Hepatitis Non- A:ELISA.

7. Diagnosis for Swine flu-H1N1:Heamagglutination & Heamagglutination inhibition test.

8.Immuno electrophoresis of proteins – Human serum

9. Determination of ABO & Rh – Antibody titre
10. Major & Minor cross matching of blood.
11. SRID: For detection of immune deficiency and Complement deficiency.
12. Students will have to submit an assignment on clinical trials

References:

Unit I

1. Clinics in laboratory medicine, Emerging Infections and their causative agents. September 2004 vol. 24 no. 3.
2. Textbook of Microbiology 8th edition 2009-Ananthnarayan & Paniker-University press 3. (Some more References to be cited.)

Unit II

- a.
 1. Textbook of clinical trials- editors David Machim, Simson Day & Sylvan Green-John Wiley & Sons.
 2. Management of Data in Clinical Trials- Eleanor McFadden M.A. - John Wiley & Sons.
 3. Clinical Trials- Issues and Approaches- Edited by Stanley H. Shapiro, Thomas A. Louis-Marcel Dekker Inc. New York.
- b.
 1. Immunology- Kuby 6th edition W. H. Freeman and company- New York.
 2. The Elements of immunology- Fahim Halim Khan- Pearson Education.
 3. Immunology an introduction- 4th edition- Ian R. Tizard-Thomson.
 4. Roitt's Essential Immunology 12th edition- Wiley- Blackwell.
 5. Koneman's color Atlas & Textbook of Diagnostic Microbiology 6th edition-Lippincott Williams & Wilkins

Unit III

- a.
 1. Immunology- Kuby 6th edition W. H. Freeman and company- New York.
 2. Immunology-Essential & Fundamental edited by Sulbha Pathak & Urmi Palan-3rd edition-Central Publishing Company.
 3. Immunology an introduction- 4th edition- Ian R. Tizard-Thomson.
- b.
 1. Immunology- Kuby 6th edition W. H. Freeman and company- New York.
 2. Immunology-Essential & Fundamental edited by Sulbha Pathak & Urmi Palan-3rd edition-Central Publishing Company.
 3. Immunology an introduction- 4th edition- Ian R. Tizard-Thomson.
 4. Roitt's Essential Immunology 12th edition- Wiley- Blackwell.
 5. The Elements of immunology- Fahim Halim Khan- Pearson Education.
 6. Immuno Biology-the immune system in health & disease-6th edition-Janeway, TraversGS
- c.
 1. Immunology- Kuby 6th edition W. H. Freeman and company- New York.
 2. The Elements of immunology- Fahim Halim Khan- Pearson Education.
 3. Immunology-Essential & Fundamental edited by Sulbha Pathak & Urmi Palan-3rd edition-Central Publishing Company.
- d.
 1. Immunology- Kuby 6th edition W. H. Freeman and company- New York.
 2. Immunology-Essential & Fundamental edited by Sulbha Pathak & Urmi Palan-3rd edition-Central Publishing Company.
 3. Immunology an introduction- 4th edition- Ian R. Tizard-Thomson.

4. Roitt's Essential Immunology 12th edition- Wiley- Blackwell.
5. The Elements of immunology- Fahim Halim Khan- Pearson Education

Unit IV

a.

1. Current Published papers on recent advances in relevant vaccines to be referred.

b.

1. Immunology- Kuby 6th edition W. H. Freeman and company- New York.
2. Roitt's Essential Immunology 12th edition- Wiley- Blackwell.

c.

1. Roitt's Essential Immunology 12th edition- Wiley- Blackwell.
2. The Pathogenesis of Infectious Disease- Cedric A . Mims.ELBS.

MODALITY OF ASSESSMENT

A. Theory Examination Pattern:

| A] INTERNAL EXAMINATION FOR THEORY (40%):- Per paper/ per semester | | TOTAL |
|--|----|-------|
| 1. PRESENTATION <ul style="list-style-type: none"> • Selection of topic, introduction, write up, references • Presentation with the use of ICT | 20 | 40 |
| 2. ASSIGNMENT <ul style="list-style-type: none"> • Selection of topic, introduction, write up, references | 20 | |
| B] EXTERNAL EXAMINATION - 60 % Per paper/ per semester | | |
| Semester End Theory Assessment | | |
| i. Duration - These examinations shall be of two and half hours duration. | | |
| ii. Theory question paper pattern :- | | |
| iii. There shall be five questions each of 12 marks. On each unit there will be one question & fifth one will be based on all the four units. | | |
| iv. All questions shall be compulsory with internal choice within the questions. Each question will be of 24 marks with options. | | |
| v. Questions may be sub divided into sub questions a, b, c & d only, each carrying six marks OR a, b, c, d, e & f only each carrying four marks and the allocation of marks depends on the weightage of the topic. | | |

Practical Examination Pattern

SEMESTER I

Practical examination will be held at the college / institution at the end of the semester. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination. In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head of the Department/ Co-ordinator of the department; failing which the student will not be allowed to appear for the practical examination.

A. Internal Examination: - There will not be any internal examination/ evaluation for practicals.

B. External (Semester end practical examination) per course:-

| <u>PAPER I</u> | | <u>PAPER II</u> | | <u>PAPER III</u> | | <u>PAPER IV</u> | | <u>TOTAL</u> |
|---------------------|--------------|---------------------|--------------|---------------------|--------------|---------------------|--------------|--------------|
| <u>Practical</u> | <u>Marks</u> | <u>Practical</u> | <u>Marks</u> | <u>Practical</u> | <u>Marks</u> | <u>Practical</u> | <u>Marks</u> | <u>Marks</u> |
| Major | 20 | Major technique | 30 | Major technique | 30 | Major | 20 | 200 |
| Minor | 10 | | | | | Minor | 10 | |
| Journal Viva 1 | 20 | Quiz 1 | 20 | Journal Viva 2 | 10 | Quiz 2 | 20 | |
| <u>Total</u> | 50 | <u>Total</u> | 50 | <u>Total</u> | 50 | <u>Total</u> | 50 | |

SEMESTER II

Practical examination will be held at the college / institution at the end of the semester. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head of the Department/ Co-ordinator of the department; failing which the student will not be allowed to appear for the practical examination.

| <u>PAPER I</u> | | <u>PAPER II</u> | | <u>PAPER III</u> | | <u>PAPER IV</u> | | <u>TOTAL</u> |
|---------------------|--------------|---------------------|--------------|---------------------|--------------|---------------------|--------------|--------------|
| <u>Practical</u> | <u>Marks</u> | <u>Practical</u> | <u>Marks</u> | <u>Practical</u> | <u>Marks</u> | <u>Practical</u> | <u>Marks</u> | <u>Marks</u> |
| Major | 20 | Major technique | 30 | Major technique | 30 | Major | 20 | 200 |
| Minor | 10 | | | | | Minor | 10 | |
| Journal Viva 1 | 20 | Quiz 1 | 20 | Journal Viva 2 | 10 | Quiz 2 | 20 | |
| <u>Total</u> | 50 | <u>Total</u> | 50 | <u>Total</u> | 50 | <u>Total</u> | 50 | |

**Overall Examination and Marks Distribution Pattern
Semester I**

| Course | SIPSMIC31 | | | SIPSMIC32 | | | SIPSMIC33 | | | SIPSMIC34 | | | Grand Total |
|-------------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-------------|
| | Internal | External | Total | Internal | External | Total | Internal | External | Total | Internal | External | Total | |
| Theory | 40 | 60 | 100 | 40 | 60 | 100 | 40 | 60 | 100 | 40 | 60 | 100 | 400 |
| Practicals | - | 50 | 50 | - | 50 | 50 | - | 50 | 50 | - | 50 | 50 | 200 |

Semester II

| Course | SIPSMIC41 | | | SIPSMIC42 | | | SIPSMIC43 | | | SIPSMIC44 | | | Grand Total |
|-------------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-------------|
| | Internal | External | Total | Internal | External | Total | Internal | External | Total | Internal | External | Total | |
| Theory | 40 | 60 | 100 | 40 | 60 | 100 | 40 | 60 | 100 | 40 | 60 | 100 | 400 |
| Practicals | - | 50 | 50 | - | 50 | 50 | - | 50 | 50 | - | 50 | 50 | 200 |