St. Xavier's College – Autonomous Mumbai

M.Sc. Syllabus For 2nd Semester Courses in Microbiology (January 2015 onwards)

Contents:

Title: CELL BIOLOGY **Course: MS. MIC. 2.01**

LEARNING OBJECTIVES

1. Understand the structure and function of cell organelles involved in energy generation
2. Understand various aspects of cell division and cell communication
3. Understand developmental biology and stem cells

Number of lectures: 60

UNIT 1: CELL BIOLOGY: ENERGY-CONVERTING ORGANELLES, CYTOSKELETON, AND CELL JUNCTIONS **15 LECTURES**

LEARNING OBJECTIVES

1. Understand the structure and function of the energy producing organelles and the cytoskeletal filaments
2. Study aspects of Cell Junctions and Cell Adhesion

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1. Mitochondria **2L**

- Structure
- Electron-transport chains and proton pump

2. Chloroplasts **2L**

- Structure
- Energy capture from sunlight

3. Cytoskeleton **7L**

- Cytoskeletal filaments
- Microtubules
- Microfilaments, Actin regulation
- Intermediate filaments
- Molecular motors
- Cell behavior

4. Cell Junctions and Cell adhesion **4L**

- Extracellular matrix (ECM): components and ECM examples- Basal lamina and connective tissue ECM
- Types of cell-ECM junctions
  - i. Focal adhesions
  - ii. Hemidesmosomes
- Types of cell-cell junction
  - i. Adherens junction
  - ii. Desmosomes
  - iii. Tight junction
  - iv. Gap junction

- Cell-cell junctions in plants –plasmodesmata.

UNIT 2: CELL COMMUNICATION **15 LECTURES**

LEARNING OBJECTIVES

Understand principles of Cell communication

1. General Principles of Cell communication **2L**

- Extracellular signal molecules
- Intracellular signaling Proteins
- Classes of cell-surface receptor proteins

2. Signaling through G-protein-coupled cell surface receptors **5L**

- G-protein relay signals
- c-AMP and Protein Kinases
- Inositol Phospholipid Signaling Pathway
- Intracellular mediators and their effects

3. Signaling through enzyme coupled cell surface receptors **6L**

- Receptor Tyrosine Kinases
- Ras
- MAP kinase
- PI-3 kinase
- TGF
- Bacterial chemotaxis

4. Signaling in plants **2L**

- Receptor Serine / Threonine kinases
- Role of ethylene
- Phytochromes

UNIT 3: CELL CYCLE, CELL DEATH AND CELL DIVISION **15 LECTURES**

LEARNING OBJECTIVES

1. Understand the concepts of cell division and cell death
2. Study aspects of germ cells and fertilization

1. Mechanism of cell division **6L**

- Cell cycle and cell cycle control system
- S-phase
- Mitosis
- Cytokinesis
- Control of cell division and cell growth

2. Apoptosis **4L**

- Programmed cell death
- Extrinsic Pathway of apoptosis
- Intrinsic Pathway of apoptosis

3. Germ cells and fertilization **5L**

- Overview of Sexual Reproduction
- Meiosis
- Eggs
- Sperm
- Fertilization

UNIT 4: DEVELOPMENTAL BIOLOGY AND STEM CELLS 15 LECTURES

LEARNING OBJECTIVES

1. Understand the types of stem cells and ethics involved in their use
2. Understand the development of multicellular organisms

1. Stem cells **5L**

- Types of stem cells
  - i. Embryonic stem cells
  - ii. Adult stem cells
  - iii. Induced pluripotent stem cells
- Applications of stem cells in
  - i. Regenerative medicine
  - ii. Cancer therapy
- Ethical considerations of stem cell therapy

2. Development of multicellular organisms **10L**

- Universal Mechanisms of Animal cell development
- The Process of Development in Animals
  - i. The Embryonic Cleavage Divisions and Blastula Formation
  - ii. Gastrulation and Morphogenesis
- *Caenorhabditis elegans* and *Drosophila* as model organisms
- *Caenorhabditis elegans* : Development from the perspective of the individual cell
- Molecular Analysis of genes involved in *Drosophila* development
  - i. Maternal-Effect Genes
  - ii. Determination of the Dorsal-Ventral and Anterior-Posterior Axes Body Segmentation
  - iii. Specification of cell types
  - iv. Organ formation
- Homeobox Genes in other Organisms
- The Genetics of Flower Development in *Arabidopsis*
- Programmed Cell Death in Development
- Evo-Devo: The Study of Evolution and Development

CIA: Paper Presentation

References:-

Unit 1

1. Molecular Biology of the Cell – Albert, B.; Johnson, A; Lewis, J; Raff, M.; Roberts K. &Walter P; 5th ed, 2008, Garland Science, Taylor & Francis Group
2. Molecular Cell Biology - Lodish,H; Berk, A.; Kaiser, C.A. Krieger, M.; Bretscher, A; Ploegh, H.; Amon, A. and Scott, M., 7th edition, 2013,W.H Freeman & and Company , New York
3. The Cell: A Molecular Approach, Cooper, G.; Hausman, R., 5th edition, 2009, ASM Press

Unit 2

1. Molecular Biology of the Cell, Albert,B.; Johnson,A; Lewis,J; Raff,M.; Roberts K. &Walter P; 5th ed, 2008, Garland Science, Taylor & Francis Group
2. Molecular Cell Biology, Lodish, H; Berk, A.;Kaiser, C.A. Krieger, M.; Bretscher, A; Ploegh, H.; Amon, A. and Scott, M., 7th edition, 2013,W.H Freeman & and Company , New York
3. The Cell: A Molecular Approach, Cooper, G; Hausman, R, 5th edition, 2009, ASM Press
4. Genes X, Lewin, B., 2008,Jones and Bartlett Publishers
5. Molecular Biology of the Gene, Watson,J.D.; Baker,T.A.; Bell,S.P.; Gann,A.; Levine,M.; Losick,R.; 5th edition, 2007, Pearson Education

Unit 3

1. Molecular Biology of the Cell, Albert,B.; Johnson,A; Lewis,J; Raff,M.; Roberts K. &Walter P; 5th ed, 2008, Garland Science, Taylor & Francis Group
2. Molecular Cell Biology, Lodish,H; Berk,A.;Kaiser,C.A. Krieger,M.; Bretscher, A; Ploegh, H.; Amon, A. and Scott,M., 7th edition, 2013,W.H Freeman & and Company , New York
3. The Cell: A Molecular Approach, Cooper, G; Hausman, R, 5th edition, 2009, ASM Press
4. Genes X, Lewin, B., 2008,Jones and Bartlett Publishers
5. Molecular Biology of the Gene, Watson,J.D.; Baker,T.A.; Bell,S.P.; Gann,A.; Levine,M.; Losick,R.; 5th edition, 2007, Pearson Education

Unit 4

1. Stem Cells: Basics and Applications, Deb K., 2009, Tata McGraw Hill.
2. Molecular Biology of the Cell, Albert,B.; Johnson,A; Lewis,J; Raff,M.; Roberts K. &Walter P; 5th ed, 2008, Garland Science, Taylor & Francis Group
3. Principles of Genetics, D. Peter Snustad & Michael J. Simmons, 6th edition, 2012, John Wiley & Sons Inc.

Title: GENETICS AND BIOINFORMATICS **Course: MS. MIC. 2.02**

LEARNING OBJECTIVES

1. Understand the tools available for molecular biology
2. Understand the concepts of population genetics
3. Understand the applications of genetic technology and the ethics involved
4. Understand the use of bioinformatics for biological data analysis

Number of lectures: 60

UNIT 1: MOLECULAR TOOLS FOR GENETICS 15 LECTURES

LEARNING OBJECTIVES

Understand the significance of molecular tools used in recombinant DNA techniques

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1. Molecular tools for genetics 9L

- Labeled tracers (autoradiography, phosphorimaging, liquid scintillation counting, non-radioactive tracers)
- Overview of Nucleic acid hybridization, In situ hybridization, DNA sequencing, Restriction mapping
- Mapping and quantifying transcripts (S1 mapping, primer extension, run-off transcription)
- Measuring transcription rates in vivo (Nuclear run – on transcription, reporter gene transcription), Assaying DNA –protein interactions (filter binding, gel mobility shift, DNase and DMS footprinting, knockouts)

2. Rational Mutagenesis 4L

- Oligonucleotide directed mutagenesis - with M13
- Oligonucleotide directed mutagenesis - with plasmid DNA
- PCR amplified oligonucleotide directed mutagenesis
- Random mutagenesism - with degenerate oligonucleotide primer
- Random mutagenesis - with nucleotide analogues
- Error-prone PCR
- DNA shuffling
- Mutant proteins with unusual amino acids

3. Variations/ Modifications of PCR 2L

- PCR
  Hot- Start, Multiplex, Nested, RT-PCR, Broad Range, arbitrarily primed, Quantitative, Real time

UNIT 2: POPULATION GENETICS 15 LECTURES

LEARNING OBJECTIVES

1. Understand the concepts involved in population genetics and epigenetics
2. Learn the application & analysis based on concepts of population genetics

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1. Population genetics 7L

- Population and gene pool
- Genotypic and Allelic frequencies
- Calculation of Genotypic frequencies and Allelic frequencies for autosomal and X linked loci
- Problems – calculation of allelic and genotypic frequencies
- Hardy-Weinberg Law, genotypic frequencies at HWE
- Implications of the H-W Law
- H-W proportions for multiple alleles
- X-linked alleles
- Testing for H-W proportions and problems
- Genetic ill effects of in-breeding
- Changes in the genetic structure of populations
  i. Mutation
  ii. Migration and gene flow
  iii. Genetic drift
  iv. Natural selection
  v. Simple problems based on the natural forces

2. Epigenetics 8L

- The Nucleosome: Chromatin's Structural Unit
- Higher order chromatin structure
- Histone : Modifications and Epigenetic Information
- Chromatin Remodelling
- Silencing of gene expression
- Genomic imprinting, Dosage compensation

UNIT 3: APPLICATIONS AND ETHICS OF GENETIC TECHNOLOGY 15 LECTURES

LEARNING OBJECTIVES:

1. Understand molecular mapping of human genes
2. Understand diagnosis and therapy of genetic disorders
3. Understand concepts of recombinant DNA technology
4. Understand the ethical issues concerning the use of recombinant DNA technology

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1. Mapping Human Genes at the Molecular Level 2L

- RFLPs as Genetic Markers

- Linkage Analysis Using RFLP - Huntington's diseases, Cystic fibrosis
- Positional Cloning: The Gene for Neurofibromatosis
- The Candidate Gene Approach: The Gene for Marfan Syndrome
- Fluorescent in Situ Hybridization (FISH) Gene Mapping

2. Genetic Disorders: Diagnosis and Screening **3L**

- Prenatal Genotyping for Mutations in the β- Globin Gene
- Prenatal Diagnosis of sickle-Cell Anemia
- Single Nucleotide Polymorphisms and Genetic Screening
- DNA Microarrays and Genetic Screening

3. Treating Disorders with Gene Therapy **4L**

- Gene Therapy for Severe Combined Immunodeficiency (SCID) - Overview
- Problems and Failures in Gene Therapy
- The Future of Gene Therapy: New Vectors and Target-Cell Strategies
- Ethical Issues of Gene Therapy

4. DNA Fingerprints **2L**

- Minisatellites (VNTRs) and Microsatellites (STRs)
- Forensic Applications of DNA Fingerprints

5. The Human Genome Project **2L**

- An overview
- The Ethical, Legal, and Social Implications (ELSI) Program

6. Pharmacogenetics and toxicogenomics **2L**

UNIT 4: BIOINFORMATICS **15 LECTURES**

LEARNING OBJECTIVES

1. Understand and access various types of data relating to molecular biology available on internet portal
2. Understand the concept of sequence alignment of biological macromolecules

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1. Study of biological databases with examples **3L**

- Types of databases
  i. Primary
  ii. Secondary
  iii. Sequence
  iv. Structure
  v. Metabolic (KEGG)
- Biological data retrieval
- Study of data formats

2. Nucleotide sequence analysis **6L**

- Pairwise alignment and scoring matrices
- Multiple sequence alignment
- Phylogenetic analysis
- Sequence logo (WebLogo) and consensus sequences
- Analysis of plasmids and other vectors using a software

3. Protein analysis **4L**

- Using 3D structure viewers (Rasmol, PDB)
- CATH and SCOP classification

4. Reference management software **2L**

- Making a reference library
- Adding references from the library into a word document

CIA: Assignment

References:

Unit 1:

1. Molecular Biology, R. F. Weaver, 4th edition, 1999 McGraw-Hill
2. Molecular Biotechnology: Principles and Applications of Recombinant DNA, Bernard R. Glick, Jack J. Pasternak, 4/e (2010), ASM Press
3. Recombinant DNA, J.D. Watson, 2nd edition, 1992, Scientific American Books
4. Principals of Genetics, Snustad & Simmons, 6th edition, 2012, John Wiley & Sons Inc
5. Genetics: A Conceptual Approach, Benjamin Pierce 3rd edition , 2008, W. H. Freeman & Co
6. Concepts of Genetics, Klug & Cummings, 7th edition, 2007, Pearson Education

Unit 2:

1. Chromatin and Gene Regulation Mechanisms in Epigenetics, Bryan M. Turner, 2001 Blackwell Science.
2. Molecular Biology of the Gene, Watson, Baker, Bell, Gann, Levine, Losick, 5th edition, 2007, Pearson Education
3. iGenetics, A Molecular Approach, Russell, P.J., 3rd edition, 2010, Pearson International Edition
4. Concept of Genetics, William S. Klug & Michael R. Cummings, 7th edition, 2007, Pearson Education

Unit 3:

1. Concept of Genetics, William S. Klug & Michael R. Cummings, 7th edition, 2007, Pearson Education
2. Recombinant DNA, J.D. Watson, 2nd edition, 1992, Scientific American Books
3. iGenetics, A Molecular Approach, Russell, P.J., 3rd edition, 2010, Pearson International Edition

Unit 4:

1. Bioinformatics and Functional Genomics, Pevsner J., May 2009, Wiley-Blackwell
2. Introduction to bioinformatics, Attwood T.K., Parry- Smith D.J., Phukan Samiron, Pearson Education 2007

Title: MICROBIAL BIOCHEMISTRY II **Course: MS. MIC. 2.03**

LEARNING OBJECTIVES

1. Understand various methods of analytical biochemistry
2. Understand enzyme kinetics, regulation and mechanism of enzyme action
3. Understand the metabolism of one and two carbon compounds
4. Understand the biosynthesis of macromolecules

Number of lectures: 60

UNIT 1: ANALYTICAL BIOCHEMISTRY **15 LECTURES**

LEARNING OBJECTIVES

Study the purification techniques and analytical methods for bio molecules

1. Extraction, purification and analysis of proteins, carbohydrates and lipids. 15L

- General methods of extraction
- Purification methods and determination of purity
- Mass determination
  i. Ultracentrifuge
  ii. MS
- Structure determination
  X-ray diffraction
- Imaging techniques for protein localization
- Qualitative and quantitative analysis

UNIT 2: ENZYMOLOGY **15 LECTURES**

LEARNING OBJECTIVES

1. Understand the basic aspects of enzyme kinetics
2. Study the regulation of enzymes with specific examples
3. Study the catalytic mechanism of action of enzymes
4. Understand enzyme bioinformatics

1. Enzyme kinetics **5L**

- Kinetics of one substrate reactions
  Equilibrium assumptions
  Steady state assumptions
  Lineweaver-Burk, Hanes- Woolf, Eadie- Hofstee equations and plots
- Kinetics of enzyme inhibition.
  Competitive, non-competitive and uncompetitive inhibition
- Effect of changes in pH and temperature on enzyme catalysed reaction
- Kinetics of two substrate reactions
- Pre steady state kinetics

- Problem solving

2. Enzyme catalysis **5L**

- Catalytic mechanisms
  i. Acid–Base Catalysis
  ii. Covalent Catalysis
  iii. Metal Ion Catalysis
  iv. Electrostatic Catalysis
  v. Catalysis through Proximity and Orientation Effects
  vi. Catalysis by Preferential Transition State Binding
- Type examples, catalytic mechanisms and testing –
  Serine proteases and Lysozyme
- Problem solving.

3. Enzyme regulation **3L**

- Allosteric enzyme- general properties, Hill, Adair, MWC and KNF models.
- Covalent modification by various mechanisms.
- Regulation by proteolytic cleavage- blood coagulation cascade.
- Regulation of multi-enzyme complex- Pyruvate dehydrogenase
- HIV enzyme inhibitors and drug design
- Problem solving

4. Enzyme Bioinformatics **2L**

- Data bases
- Sequence analysis, applications
- Enzyme function studies
- Enzyme docking

UNIT 3: METABOLISM OF ONE AND TWO CARBON COMPOUNDS
15 LECTURES

LEARNING OBJECTIVES

Understand the metabolism of one and two carbon compounds

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1. Metabolism of one carbon compounds **11L**

- **Methylotrophs**
  i. Oxidation of methane, methanol, methylamines
  ii. Carbon assimilation in methylotrophic bacteria and yeasts
- **Methanogens**
  i. Methanogenesis from H_2, CO_2, CH_3OH, HCOOH, methylamines
  ii. Energy coupling and biosynthesis in methanogenic bacteria
- **Acetogens**
  Autotrophic pathway of acetate synthesis and CO_2 fixation
- **Carboxidotrophs**
  Biochemistry of chemolithoautotrophic metabolism

- **Cynogens and cynotrophs**
  Cynogenesis and cyanide degradation

2. Metabolism of two-carbon compounds **4L**

- **Acetate**
  i. TCA and Glyoxylate cycle, modified citric acid cycle
  ii. Carbon monoxide dehydrogenase pathway and disproportionation to methane
- **Ethanol**
  Acetic acid bacteria
- **Glyoxylate and glycolate**
  i. Dicarboxylic acid cycle
  ii. Glycerate pathway
  iii. Beta hydroxyaspartate pathway
- **Oxalate as carbon and energy source**

UNIT 4: BIOSYNTHESIS AND ITS REGULATION **15 LECTURES**

LEARNING OBJECTIVES

1. Understand the biosynthesis of amino acids, ribonucleotides and fatty acids, its link to other metabolic pathways and its regulation
2. Understand the biosynthesis of components of gram positive and gram negative cell wall: peptidoglycan and LPS

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1. Biosynthesis of aminoacids: **5L**

- Ammonia incorporation through glutamine synthetase and its regulation
- Overview of aminocid families grouped by metabolic precursors
- Biosynthesis of aminoacids from oxaloacetate
- Link to the TCA cycle
- Anaplerotic reactions

2. Biosynthesis of ribonucleotides and deoxyribonucleotides **3L**

- The de novo pathway
- Regulation by feedback mechanisms
- Recycling via the salvage pathway

3. Biosynthesis of saturated fatty acids and PHB **4L**

- Biosynthesis of Palmitate
- Regulation of fatty acid synthesis
- Biosynthesis of PHB
- Overview of production of eicosanoids, membrane lipids and cholesterol from fatty acids

4. Biosynthesis of peptidoglycan and LPS **3L**

CIA: Tests

References: -

Unit 1

1. Principles of Biochemistry, Horton, R. and Moran, L., 5th edition, 2011, Prentice Hall
2. Biochemistry, Mathew, Van Holde and Ahern , 3rd edition , 1999, Pearson Education
3. Principles of Biochemistry, Zubay, G., 4th edition, 1998, Wm.C. Brown Publishers
4. Principles of Biochemistry, Lehninger A.L., Cox and Nelson, 4th edition, 1994, CBS publishers and Distributors Pvt. Ltd.

Unit 2

1. Biochemistry, Berg J.M.,Tymoczko J.L. and Stryer L., 7th edition,2012, W. H. Freeman and co.
2. Biochemistry, Voet D. and Voet J.G.,4th International student edition,2011, John Wiley and sons.
3. Biochemistry- A Problem Approach, Wood W. B. Wilson J.H., Benbow R.M. and Hood L.E.2nd edition,1981, The Benjamin/ Cummings Pub.co.
4. Biochemical calculations, Segel I.R., 2nd edition, 2004, John Wiley and Sons
5. Fundamentals of Enzymology, Price N.C. and Stevens L. 3rd edition,1999 Oxford University Press.

Unit 3

1. Microbial Biochemistry, Cohen. G.N., 2nd edition, 2011, Springer
2. Biotechnology H.J. Rehm and G. Reed (ed.), Volume 6a. , 1984, Biotransformations, Verlag and Chemie
3. Bacterial metabolism, Gottschalk, G., 2nd edition, 1985, Springer-Verlag

Unit 4

1. Principles of Biochemistry, Lehninger A.L., Cox and Nelson, 4th edition, 1994, CBS publishers and Distributors Pvt. Ltd.
2. The physiology and biochemistry of prokaryotes, White D., 4th edition, 2011, Oxford University Press.

Title: MEDICAL MICROBIOLOGY **Course: MS. MIC. 2.04**

LEARNING OBJECTIVES

1. Study significant emerging/reemerging infections and the microbial pathogens involved
2. Understand basic principles of Epidemiology
3. Understand clinical research and modern diagnostics

Number of lectures: 60

UNIT 1: ADVANCES IN MEDICAL MICROBIOLOGY- BACTERIAL

15 LECTURES

LEARNING OBJECTIVES:

Study some significant bacterial pathogens and their associated emerging/ re-emerging infections with special emphasis on advances in diagnostics, prophylactic measures, therapeutics and epidemiology

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1. **Study of significant bacterial emerging/re-emerging infections-** with emphasis on advances in diagnostics, therapeutics and epidemiology **15L**
   - Listeriosis
   - VRE (Vancomycin Resistant Enterococci)
   - Leptospirosis
   - Drug resistant Tuberculosis
   - MOTT (Mycobacteria Other Than TB)
   - Cholera caused by *V.cholerae* 0139
   - Conditions caused by *Helicobactor pylori, Campylobacter* and MRSA

UNIT 2: ADVANCES IN MEDICAL MICROBIOLOGY- NON-BACTERIAL

15 LECTURES

LEARNING OBJECTIVES

Study some significant non-bacterial pathogens and their associated emerging/ re-emerging infections with special emphasis on advances in diagnostics, prophylactic measures, therapeutics and epidemiology

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1. **Study of significant non-bacterial emerging/re-emerging infections -** with emphasis on advances in diagnostics, prophylactic measures, therapeutics and epidemiology **15L**
   - Dengue
   - AIDS
   - SARS
   - Chickungunya
   - Hepatitis non A infection
   - Swine flu

- Ebola
- Malaria

UNIT 3: EPIDEMIOLOGY OF INFECTIOUS DISEASES 15 LECTURES

LEARNING OBJECTIVES

1. Get familiar with the history of epidemiology of infectious diseases
2. Get an overview of the principles of epidemiology
3. Know the measurements of risk
4. Understand the significance of public health surveillance and the methods used

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1. Historical aspects-definition 1L

2. Descriptive Epidemiology-aims and uses 2L

3. Epidemiological principles 4L

- Herd immunity
- Carrier status
- Co-evolution of host-parasite
- Control of epidemics
    i. Methods directed against reservoir
    ii. Methods directed against transmission
    iii. Pathogen eradication

4. Measures of risks: 4L

- Frequency measures
- Morbidity frequency measures
- Mortality frequency measures
- Natality(birth) measures
- Measures of association
- Measures of public health impact

6. Public health surveillance: 4L

- Purpose and characteristics
- Identifying health problems for surveillance
- Collecting data for surveillance
- Analyzing and interpreting data
- Disseminating data and interpretation
- Evaluating and improving surveillance

UNIT 4: CLINICAL RESEARCH & MODERN DIAGNOSTICS 15 LECTURES

LEARNING OBJECTIVES

1. Get familiar with the guidelines, ethical aspects and regulatory requirements with respect to clinical research

2. Get an overview of the clinical research methodologies and management
3. Understand the statistics used in clinical research
4. Acquire knowledge of advanced techniques used in diagnosis

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1. Introduction to Clinical Research **10L**

- What is a clinical trial, history, phases and need.
- Good Clinical practice Guidelines
- Ethical aspects of Clinical Research
- Regulatory Requirements in clinical research
- Clinical Research Methodologies, Statistics and Management
- Case studies

2. Modern Diagnostic Methods **5L**

- Advances in Molecular and Immunological Techniques
- Microarrays
- Advances in Fluorescence Technology

CIA: Presentation

References:-

Unit 1 & 2

1. Clinics in laboratory medicine, Emerging Infections and their causative agents. September 2004 vol. 24 no. 3.
2. Textbook of Microbiology, Ananthanarayan & Paniker, 9th edition, 2013, University press
3. Koneman's color Atlas & Textbook of Diagnostic Microbiology, Winn, C. W., Allen, D. S., Janda, M. W., Koneman, W. E., Schreckenberger, C. P., Procop, W. G. and Woods, L. G., 6th edition, 2005, Lippincott Williams & Wilkins.

Unit 3

1. Principles of epidemiology in public health practices 3rd edition www.cdc.gov/training/products/ss1000
2. Basic lab methods in medical bacteriology, WHO Geneva.
3. Medical Laboratory Technology, Godkar, P. & Godkar, D., 2nd edition, 2006, Bhalani Publishing House.
4. Handbook of Epidemiology- Ahrens, W., Pigeot, I., 2005 Springer- Verlag Berlin Herdelberg.
5. Epidemiology for Public Health Practice- Friis, H. R., & Sellers, A. T., 4th edition, 2009, Jones & Bartlett publishers.
6. Park's Textbook of Preventive and Social Medicine, Park, K., 16th edition, 2000, M/S Banarsidas Bhanot
7. Infectious disease surveillance, Nikuchia, N., 2005, Blackwell Publishing.

Unit 4

1. Fundamentals of clinical trials, 4th edition, Friedman, L. M., Furberg, C. D., DeMets, D. L., 2010, Springer.

2. Handbook for good clinical research practice (GCP): Guidance for implementation, World Health Organization, 2002.
3. Ethical guidelines for biomedical research on human participants, Indian Council of Medical Research, New Delhi, 2006.
4. Guidelines for good clinical laboratory practices, Indian Council of Medical Research, New Delhi, 2008.
5. Textbook of clinical trials, Machim, D., Day, S. and Green, S., 2nd edition, 2007, John Wiley & Sons.
6. Management of Data in Clinical Trials, McFadden, E., 2nd edition, 2007, John Wiley & Sons.
7. Koneman's color Atlas & Textbook of Diagnostic Microbiology, Winn, C. W., Allen, D. S., Janda, M. W., Koneman, W. E., Schreckenberger, C. P., Procop, W. G. and Woods, L. G., 6th edition, 2005, Lippincott Williams & Wilkins.

MICROBIOLOGY **MS.MIC.2.PR**

Practicals semester II

CELL BIOLOGY **MS.MIC.2.01PR**

1. Mitosis in onion root tip
2. Meiosis in *Tradescantia*
3. Isolation of mitochondria and chloroplast
4. Understanding PubMed databases
5. Introduction to National Center for Biotechnology Information (NCBI)
6. Analysis of protein sequence from protein databases
7. Analysis of nucleotide sequence from nucleotide databases
8. Similarity search using the Blast and interpretation of the results
9. Getting the gene sequences by exploring and querying the nucleic acid databases
10. Pair-wise sequence alignment by using BLAST and ClustalW
11. Multiple sequence alignment by using ClustalW
12. Phylogenetic analysis using web tool
13. Tertiary protein structure analysis using Rasmol
14. Understanding of KytoEncyclopedia of Genes and Genome (KEGG) database for biological pathways, metabolism, cellular process, genetic information processing

CIA: Bioinformatics assignment

MOLECULAR BIOLOGY **MS.MIC.2.02PR**

1. Genomic DNA isolation
2. Primer designing
3. PCR
4. Restriction digestion
5. Ligation in a suitable vector for cloning
6. Transformation in bacteria
7. Plasmid isolation
8. Agaorose gel electrophoresis at each of the above stages.
9. Isolation of RNA
10. Conjugation in bacteria
11. Problems on population genetics

CIA: Molecular biology technique

BIOCHEMISTRY II **MS.MIC.2.03PR**

1. Purification of an extracellular enzyme (β-amylase) by salting out and dialysis.
2. SDS PAGE to be done at each stage of purification
3. Native PAGE and activity staining to be done at the end of purification step.
4. Enzyme kinetics-effect of enzyme concentration, substrate concentration, pH, temperature and inhibitors on enzyme activity with Amylase.
5. Demonstration of proteolytic activity
6. Determination of glucose isomerase present intracellularly in *Bacillus* sp.

CIA: Enzymology experiment

Paper 4:

MEDICAL MICROBIOLOGY AND MATHEMATICS MS.MIC.2.04PR

1. Case studies in epidemiology
2. Problem solving exercises in medical microbiology with appropriate tests for the diagnosis of diseases:
   i. Diagnosis by ELISA
   ii. Diagnosis for Swine flu-H1N1: Heamagglutination & Heamagglutination inhibition test
   iii. AFB staining
   iv. Diagnosis for *Vibrio cholerae 0139*- Cholera red test, String test, Oxidase test, Biochemical tests, & isolation on TCBS medium for identification of *Vibrio cholerae*
3. Mathematics in biology
   i. Limits, derivatives and integration
   ii. Vectors and matrices
   iii. Basic Algorithms

CIA: Diagnostic technique

References:

Paper 1:

1. Molecular Biology of the Cell – Albert,B.; Johnson,A; Lewis,J; Raff,M.; Roberts K. &Walter P; 5thed, 2008, Garland Science, Taylor & Francis Group
2. Molecular Cell Biology - Lodish,H; Berk,A.;Kaiser,C.A. Krieger,M.; Scott,M.; Bretscher,A; Ploegh,H.; and Matsudaira,P; 6th edition, W.H Freeman and Company
3. The Cell: A Molecular Approach, Geoffrey Cooper, Robert Hausman, 5thedition, 2009, ASM Press
4. Genes X, Lewin, B., 2008, Jones and Bartlett Publishers.
5. Molecular Biology of the Gene, Watson, Baker, Bell, Gann, Levine, Losick, 5th edition, Pearson Education
6. Bioinformatics and functional genomics, J. Pevsner, 2ndedition, 2009, Wiley-Blackwell publishers
7. Introduction to bioinformatics, T. Attwood, 1steidition, 2001, Benjamin Cummings publishers

Paper 2:

1. iGenetics- A Molecular Approach, Russell, P.J., 2010 Third Edition, Pearson International Edition
2. Molecular Biology of the Gene, Watson, Baker, Bell, Gann, Levine, Losick, Fifth Edition, Pearson Education (LPE)
3. Fundamental Bacterial Genetics, Trun, Trempy, 2004, Blackwell Publishing

4. Principles of Genetics, Snustad& Simmons, Third Edition, John Wiley & Sons Inc
5. Recombinant DNA, Watson, Gilman, Witkowski, Zoller, Second Edition, Scientific American Books
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