

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



**SYLLABUS EFFECTIVE FROM: 2019-20
M. Sc. (BIOMEDICAL SCIENC)**

SEMESTER-II

PT02CBMC21: Medical Microbiology

Unit I

Basics in Medical Microbiology: Sources of infection, Modes of transmission, Factors predisposing to microbial pathogenicity, Types of infectious diseases, Prevention and Control of Hospital acquired infections. Immunoprophylaxis: Types of vaccines and schedule of vaccination. Recent advances in diagnostic microbiology: Automation, Nucleic acid based detection methods.

Unit II

Bacteriology: Morphology, Cultural Characteristics, Antigenic structures, Pathogenesis, Laboratory Diagnosis of following bacteria: *Staphylococcus*, *Streptococcus* including *Pneumococcus*, *Bacillus*, *Corynebacterium*, *Clostridium*, *Mycobacteria*, *Vibrios*, *E. coli*, *Salmonella*, *Shigella*, *Spirochaetes*, *Neisseria*,

Unit III

Virology: The Nature and classification of viruses, Morphology: virus structure and Virus replication. General properties, diseases caused, lab diagnosis and prevention of Pox, Herpes (HSV), Hepatitis (HAV & HAB), Picorna (Polio virus), Orthomyxo (Influenza), Paramyxo (Mumps and Measles), Rabdo (Rabies), Ebola, Zika and HIV virus. Viral vaccines and antiviral agents.

Unit IV

Parasitology & Mycology: **Parasitology:** Laboratory techniques in parasitology. Morphology, life cycle, laboratory diagnosis of following parasites
Parasites: Entamoeba, Giardia, Leishmania, Plasmodium, Helminths: Taenia, Ascaris, Wuchereriabancrofti, Schistosomes, Mycology: Morphology, diseases caused and lab diagnosis of: Opportunistic fungi -*Cryptococcus, Candida, Aspergillus*. Fungi causing Cutaneous mycoses-*Dermatophytes*, Subcutaneous mycoses -*Mycetoma*, Systemic mycoses-*Histoplasma*

References Books

1. Textbook of Microbiology: Surinder Kumar
2. Medical Parasitology: R. Karyakarte.
3. Text Books of Medical Laboratory Technology: P. B. Godkar.
4. A Text Book of Medical Microbiology: Anathanarayana & Panikar
5. A Text Book of Microbiology: P. Chakraborty
6. Parasitology: Chatterjee, KD
7. Medical Microbiology, A guide to Microbial Infections, Pathogenesis, Immunity, Laboratory Diagnosis and control: Danial Greenwood et al,
8. Textbook of medical mycology: Jagdish Chander
9. Understanding Viruses: Teri Shores
10. Biswas SB and Biswas A An Introduction to Viruses.

PT02CBMC22: Biomaterial and Tissue Engineering

Unit I

Biomaterials: Introduction-definition of biomaterials, applications of biomaterials, classification of biomaterials, Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials. Biological responses (extra and intra-vascular system). Surface properties of materials, physical properties of materials, mechanical properties.

Unit II

Types of implant materials:

- i. Metallic implant materials: Stainless steel, Co-based alloys, Ti and Ti-based alloys. Importance of stress-corrosion cracking, corrosion behavior and the importance of passive films for tissue adhesion.
- ii. Polymeric implant materials: types, general classification; some commonly used polymers: Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. (Classification according to thermosets, thermoplastics and elastomers). Importance of molecular structure, hydrophilic and hydrophobic surface properties, Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Biopolymers in controlled release systems. Synthetic polymeric membranes and their biological applications.
- iii. Ceramic implant materials: Definition of bioceramics. Common types of bioceramics: Aluminium oxides, Glass ceramics, Carbons. Bioresorbable and bioactive ceramics. Importance of wear resistance and low fracture toughness. Host tissue reactions: importance of interfacial tissue reaction (e.g. ceramic/bone tissue reaction).
- iv. Composite implant materials: different reinforcement materials, Composite theory of fiber reinforcement (short and long fibers, fibers pull out). Mechanics of improvement of properties by incorporating different elements.

Unit III

Tissue engineering Introduction, Stem cells, Morphogenesis, Generation of tissue in the embryo, Tissue homeostasis, Cellular signaling, Extracellular matrix as a biologic scaffold for tissue engineering, Scaffold fabrication, bioactive scaffold, Natural polymers in tissue engineering applications, Degradable polymers for tissue engineering.

Unit IV

Basic Biology Of Stem Cells: Stem Cells : Introduction, hematopoietic differentiation pathway Potency and plasticity of stem cells, sources, embryonic stem cells, hematopoietic and mesenchymal stem cells, Stem Cell markers, FACS analysis, Differentiation, Stem cell systems- Liver, neuronal stem cells, Types & sources of stem cell with characteristics: embryonic, adult, haematopoetic, fetal, cord blood, placenta, bone marrow, primordial germ cells, cancer stem cells induced pluripotent stem cells.

Reference Books

1. Tissue Engineering: Bernhard O Palsson, Sangeeta N. Bhatia.
2. Fundamentals of Tissue Engineering and Regenerative Medicine: Meyer, U.; Meyer, Th.; Handschel, J.; Wiesmann, H.P .
3. Science and Engineering: J B Park, Biomaterials.
4. Biomaterials: Sujata V. Bhat

PT02CBMC23: Immunology

Unit I

Innate and adaptive immunity: role of cells, receptors and proteins in innate immunity, ubiquity of the innate system. Cells and organs of the immune system: Hematopoiesis, primary and secondary lymphoid organs. Complement: components of the system, activation, regulation, biological consequences and deficiency diseases. Inflammation and anti-inflammatory agents.

Unit II

Antigens and antibodies: properties of immunogens, haptens, epitopes, structure and classes of immunoglobulins, biological activities and effector functions, monoclonal antibodies and

abzymes. Antibody diversity: models, organization of Ig genes, mechanism of gene rearrangement, generation of diversity; expression, synthesis and class switching, antibody engineering. Production of polyclonal and monoclonal antibodies: Principles, Techniques and applications Antigen-antibody interactions: Agglutination and precipitation techniques, Radio Immunoassay, ELISA, Immunofluorescence assays: Fluorescence activated cell sorter (FACS) technique, Cytotoxicity assay, Cytokines assays: ELISA and ELISPOT

Unit III

Major histocompatibility complex and antigen presentation: MHC- organization, inheritance,

genes, molecules and peptide binding, expression, disease susceptibility, immune responsiveness, self MHC restriction, cytosolic and endocytic pathway for antigen processing. T-cell receptor, T-cell maturation, activation and differentiation: TCR- genetic organization and rearrangement of genes, TCR-complex, peptide binding, thymic selection, activation and differentiation of T cells. Generation, activation and differentiation of B cells: B cell maturation, activation and proliferation, germinal centers, regulation of the responses.

Cell mediated cytotoxicity: Effector T cells, cytotoxic T cells, NK cells, ADCC.

Unit IV

Hypersensitivity reactions: classification and types of hypersensitivity reactions.

Immune tolerance and autoimmunity: establishment and failure of tolerance, autoimmune diseases, mechanisms for the induction, animal models, treatment.

Transplantation immunology: basis and manifestation of graft rejection, immunosuppressive therapy, immune tolerance. Experimental systems in immunology.

Reference Books

1. Kuby immunology: Owen, J. A., Punt, J., & Stranford, S.
2. Janeway's Immunobiology: Murphy, K., & Weaver, C.
3. Immunology: Male, D., Brostoff, J., Roth, D., & Roitt,
4. Cellular and molecular immunology: Abbas, A. K., Lichtman, A. H., & Pillai, S.

PT02EBMC21: Molecular Medicine

Unit I

Genome Biology: Genome anatomy, Human Genome project, Bioinformatic analysis of human genome, genome variation, personalized medicine, DNA Genetic Testing, OMIC technologies

Unit II

Molecular and Cellular Physiology : History of Molecular Medicine, Recombinant DNA Products in health and diseases, Gene Transfer, Regenerative Medicine, fundamentals of cytometry, Cell based therapy

Unit III

Biochemical and molecular basis of pathogenesis, clinical course, diagnosis and treatment of diseases: Liver diseases like jaundice, hepatitis, fibrosis, necrosis and cirrhosis; Haemoglobinopathies, other anemias, plasma protein abnormalities; Multifactorial diseases. Like Diabetes, Atherosclerosis and Arthritis; Thyroid disorders, infertility and neurodegenerative disorders including Alzheimer's and Parkinson's disease.

Unit IV

Cancer Biology : Development, Aging and Cancer, Genomic instability in Cancer, Molecular diagnosis of cancer, molecular medicine in targeted therapy of cancer, Drug resistance in cancer, Pharmacogenomics

Reference Books

1. Molecular Medicine Genomics to Personalized Healthcare: Ronald J Trent.
2. Teitz's Fundamentals of Clinical Chemistry: Burtis, C. A. & Ashwood, E. R,
3. Biochemical Basis of Diseases: Cohn R. M. and Roth K. S.
4. Biochemistry in Clinical Practice: Williams D. L. and Marks V.
5. Clinical Chemistry: Marshall W. J.
6. Basic Pathology: Robbinand Kumar
7. Text book of Biochemistry with Clinical Correlations: Devlin T. M

PT02EBMC22: Clinical and Applied Physiology

Unit I

Physiology of nervous and muscular system: Basic principles of Neurophysiology: components of Nervous system- CNS, PNS, ANS; diseases of nervous system; Physiology of Muscular System: basic anatomy of muscular system, functions of muscular system and diseases of muscular system

Unit II

Physiology of circulation: Structure and functions of heart, Physiology of cardiac muscle, Cardiac cycle, Rhythmical excitation of heart, Regulation of heart pumping, Control of excitation and conduction in heart. Physical characteristics and basic theory of circulation, Capillary fluid exchange, interstitial fluid and lymph flow. Circulatory regulation: Local control of blood flow by tissues and humoral regulation, Nervous regulation of circulation; blood components and functions; diseases of heart and circulation

Unit III

Physiology of Urinary and Reproductive Systems: Structure and functions of kidneys, structure and function of reproductive systems, diseases of renal systems; diseases of reproductive systems

Unit IV

Physiology of Endocrine glands: An overview of human endocrine system, hormones of the endocrine system, diseases of endocrine glands

Reference Books

1. Hall J. E., Guyton & Hall Text Book of Medical Physiology,
2. Barrett K E., Barman S. M., Boitano S., Brooks H. L., Ganong's Review of Medical Physiology, McGraw-Hill Medical
3. Tortora G. J., Derrickson B. H., Principles of Anatomy and Physiology,

PT02EBMC23: Bio-Safety and Biomedical Waste Management.

Unit I

Waste disposal management, Hospital waste management, Biosafety- regulatory frame work for GMOs, bioethics and its socio economic impact, Hazards associated with poor health care waste management

Unit II

Characterization of medical waste- Bio-medical wastes (Management and Handling) Rules, 1998, Amendments and guidelines, segregation, packaging, storage, transport of infectious waste. Techniques of Biomedical waste management. Health and safety rules. Protocols, issues and challenges in transportation of Biomedical waste.

Unit III

Treatment method- Autoclave, Hydroclave, Microwave, Chemical Disinfection, Solidification and stabilization, Bioremediation, Thermal Conversion Technologies, accumulation and storage of hazardous waste, land disposal of hazardous waste, other treatment and disposal method. Common Hazardous Waste Treatment facilities (TSDF).

Unit IV

Biomedical waste management rule: Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options, Standards For Treatment and Disposal Of Bio-Medical wastes, Standards for autoclaving of bio-medical waste, standards of microwaving, standards for deep burial, standards for efficacy of chemical disinfection, standards for dry heat sterilization, standards for liquid waste,

Reference Books

1. Biomedical Waste Management: R. Radharisham
2. Hospital Waste Management's-A guide for self assessment and review: Shishir Basarkar
3. Biomedical Waste Disposal: Anantpreet Singh and Sukhjit Kaur
4. Medical Waste Management and Disposal: V. J. Landrum

PT02CBMC24: Practical based on PT02CBMC21 and PT02CBMC22

1. Serial Dilution and Pour Plate method for isolation and enumeration of microorganisms
2. Isolation of bacteria by Streak Plate Method and Spread Plate Method
3. Simple Staining (Monochrome Staining)
4. Negative Staining
5. Metachromatic Granule Staining
6. Spirochete Staining
7. Gram's Staining
8. Endospore Staining
9. Cell Wall Staining
10. Capsule Staining
11. 1478Preparation of media and Sera
12. Primary cell culture
13. Preparation of established cell line
14. MTT assay (Animal cell culture)
15. Synthesis of Biomaterial
16. Mechanical characterization of Biomaterial
17. Thermal characterization of Biomaterial
18. Microstructure analysisof Biomaterial
19. Corrosion studies of metallic implant
20. Determination of Viscosity of biomaterial by rheological studies

PT02CBMC25: Practical based on PT02CBMC23 and PT02EBMC21

1. ABO and Rh typing of blood cells
2. Rocket Immuno electrophoresis.
3. To perform RPR test
4. To perform sandwich Dot ELISA test for antigen.
5. To learn the technique of Redial Immunodiffusion.
6. To perform double immune diffusion by using ouchterlony method
7. WIDAL test
8. Hb estimation
9. Blood glucose estimation
10. Demonstration of Micro plate reader
11. Genomic DNA isolation from Blood
12. DNA elution
13. Transformation of plasmid DNA by using CaCl_2 .
14. Introduction to genome sequence database
15. Protein and DNA sequence database
16. Visit to hospital.
17. Estimation of Urea by DAM method.
18. Estimation of Triglyceride by GPO method.

