2nd Semester

CONCEPTS IN IMMUNOLOGY

Subject Code: MMBLS1-201 **L T P C** **(Duration: 60hrs)**
3 1 0 4

Course Objective:
This module is a general introduction to the human immune system.

Course Outcomes:
Describe all the cells and organs of the immune system.
Describe the properties of antigens and adjuvants.
Distinguish between the structure of MHC and antigen presenting mechanisms of our immune system.
Distinguish between the pathways of the complement system and its consequences on eliminating pathogens from our body.

Unit-1 **15 hrs**
Types of immunity: innate and acquired. Acute-phase response and its mechanism. Types and properties of immune cells, heterogeneity of lymphoid cells, T-cell subsets and surface markers, TCR, BCR, Null cells, Monocytes.

Unit-2 **15hrs**
Primary and secondary lymphoid organs-Thymus, spleen, lymph nodes, lymphatic system, mucosal-associated lymphoid tissue (MALT), lymphocyte traffic. Characteristic properties of antigens, adjuvants,

Unit-3 **15hrs**
T-dependent and T-independent antigens, recognition of antigens by T-cell and role of MHC. Antigen-antibody interactions, affinity and avidity, high and low affinity antibodies, immunoglobulins, classes and structure, complement fixing antibodies.

Unit-4 **10hrs**
Various types of immunodiffusion and immunoelectrophoretic procedure, Immunoblot, ELISA, RIA, agglutination of pathogenic bacteria, hemagglutination and hemagglutination inhibition.

Unit-5 **5hrs**
Complement cascade. Types of hypersensitivity reactions, autoimmune disorders, their underlying molecular mechanism, etiology, diagnostic, prognostic and prophylactic aspects.

Books Recommended:

- Kuby, J. (1992), Immunology, W.H. Freeeman, USA.
- Paul, W.E (1991), Immunology: Recognition and Respones W.H. Freeman, New York.
- Playfair, J.H.L. (1992), Immunology at a Glance (5th Ed), Blackwell Scientific publication,Oxford.
- Roitt IM, Brostoff J, Male DK (2001) Immunology, Mosby Inc, UK.
Janeway CA, Trevors P, Walport M, Schlomhick M (2001), Immuno Biology. The Immune System in Health and Disease, 5th Edition, Garland Publication, USA

CLINICAL & MEDICAL MICROBIOLOGY

Subject code: MMBLS1-202 **L T P C** **(Duration: 60hrs)**
3 1 0 4

Course Objective:
This module is a general introduction to clinical and medical microbiology.

Course Outcomes:
Student will be able to learn various microorganism associated disease

Unit-1 **15 hrs**
Microorganisms and Diseases: spread of disease in populations, reservoirs of infection (human, animal, and non-living reservoirs), portals of entry and portals of exit, modes of transmission (contact, vehicles, vectors).

Unit-2 **15 hrs**
Collection transport, storage and examination of clinical specimens, preliminary processing of biological samples: Stool, blood, urinary and gastro-intestinal tract. Factors affecting virulence of microorganisms.

Unit-3 **15hrs**
Normal microbial residents of human body, distribution and occurrence of normal flora in different body parts such as skin, respiratory tract, gastrointestinal tract and genitourinary tract. Clinical features, laboratory diagnosis, treatment and prevention of viral diseases: Influenza, Hepatitis, polio, Dengue, zika and AIDS;

Unit-4 **10 hrs**
Clinical features, laboratory diagnosis, treatment and prevention of bacterial diseases: Diarrhea, Pneumonia, Diphtheria, Meningitis, Tuberculosis, Typhoid, Gas gangrene, botulism and tetanus

Unit-5 **5 hrs**
Clinical features, laboratory diagnosis, treatment and prevention of parasitic and fungal diseases: Amoebiasis, Trypanosomasis, leishmaniasis and Malaria. Mycoses: dermato-mycosis, cryptococcosis, candidiasis, aspergillosis, zygomycosis.

Books Recommended:

- Medical Microbiology by C.G.A. Thomas, 1988. Baillion Tindall, London.
- Essential of Medical Microbiology by R. Bhatia and R.L. Ichhpujani, 1994. Jaypee Brothers Medical Pub. (p) Ltd. New Delhi.
- Medical Microbiology by Mims, Playfiar, Roitt, Wakelin and Williams, 1993, Mosbyyear Book Europe Ltd. U.K.
- Mackie and Mc Cartney Practical Medical Microbiology (Ed.) Geranld College, J. Fraser, A.G., Marmoin, B.P. and Simmons, A. 1996. Churchill Divingstone.
- Microbiology: Concepts and Applications by Pelczar, Chan and Krieg, 1993. Mc Graw Hill, Inc. U.S.A.

MICROBIAL GENETICS

Subject code: MMBLS1-203 **L T P C** **(Duration: 60 hrs)**
3 1 0 4

Course Objective:
To make aware the students regarding various cell organelles and their functioning with special stress on human chromosome

Course Outcomes:
Exhibit a knowledge base in genetics, cell and molecular biology, and anatomy and physiology. Demonstrate the knowledge of common and advanced laboratory practices in cell and molecular biology

Unit-1 **15 hrs**
Organization of prokaryotic and eukaryotic genome: Chromatin and chromosomes, nucleosomes. Basic concept of epigenetics and its significance

Unit-2 **15hrs**
Mutants and their role in microbial genetics, types of mutants, fluctuation test, genetic analysis with mutants and gene mapping, linkage and multifactor crosses and complementation, Reversion and suppression.

Unit-3 **15 hrs**
Transposable elements: types and mechanism of transposition, significance. Phage Mu. Generalized recombination: Molecular mechanism and proteins involved in recombination

Unit-4 **5hrs**
Transformation: competence factors and DNA uptake, significance. Transduction: generalized and specialized transduction, and their mechanism. Phage λ: gene organization, lytic and lysogenic phase.

Unit-5 **10hrs**
Conjugation: F-factor, Hfr strain and interrupted mating Bacterial plasmids; types, control of copy number and incompatibility, fertility factors, Resistance factor

Books Recommended:

- Friefelder, D., Maloy, S.R. and Cronan, J.E. 1994. Microbial Genetics, IInd Edition. Jones and Barlett Publishers.
- Genes IX, Lewin, Benjamin 2007, CBS Publishers and Distributors
- Malacinski, G.M. &Friefelder, D. 1993. Essentials of Molecular Biology, IInd Edition. Jones and Bartleet Publishers.
- Synder, L. and Champness W. 1997. Molecular Genetics of Bacteria, ASM Press.
- Stent G.S. &Calender, R. 1986. Molecular Genetics 2nd Edition, CDS Publishers.

MOLECULAR BIOLOGY & GENETIC ENGINEERING

Subject code: MMBLS1-204 **L T P C** **(Duration: 60hrs)**
3 1 0 4

Course Objective:
To make the students understand molecular biology and genetic engineering

Course Outcomes:
Describe the structure and salient features of DNA and RNA
Explain the Chromatin structure and organization in Eukaryotes and prokaryotes
Distinguish the process of replication in prokaryotes as well as eukaryotes
Explain the process of DNA damage and various DNA repair mechanisms**.**

Unit-1 **15 hrs**
Nucleic acids: Structure and functions of DNA, denaturation and renaturation of DNA (melting curve and Tm value of DNA); Isolation and sequencing of DNA; Replication of DNA : De novo replication, topoisomerases, helicase, DNA polymerases, nick translation, discontinuous replication (Okazaki fragments), primase, covalent extension mode of replication, bidirectional replication.

Unit-2 **15hrs**
Transcription: transcription signals, promoters, open promoter complex, intrinsic and Rho-dependent terminators, RNA polymerases; types of RNA molecules and their role in gene expression;

Unit-3 **15hrs**
Translation: components involved, t-RNA as adapter, genetic code and its salient features, Wobble hypothesis, overlapping genes, polyribosomes.

Unit-4 **5hrs**
Regulation of gene activity: transcriptional regulation, positive and negative regulation, inducible and repressible operon, lac operon, trp operon and attenuation, auto regulation, posttranscriptional control, Feedback inhibition and allosteric control.

Unit-5 **10hrs**
Molecular cloning; techniques and their importance, cloning vectors; properties and uses, selection and characterization of clones, gene probes, labeling. PCR; principle, types and role in molecular biology Bioinformatics; proteomics and genomics studies and their significance.

Books Recommended:

- Friefelder, D. 1987. Microbial Genetics. Narosa Publication.
- Friefelder, D., Maloy, S.R. and Cronana, J.E. 1994, Microbial Genetics, IInd edition, Jones and Barlett Publishers.
- Malacinski, G.M. &Friefelder, D. 1993. Essentials of Molecular Biology, IInd Edition. Jones and Bartlett Publishers.
- Synder, L. and Champness, W., 1997. Molecular Genetics of Bacteria, ASM Press.
- Primrose, S.B. Twyman, R.M. and Old, R.W., 2001. Principles of gene manipulation, Sixth edition, Blackwell Science Ltd., UK.

ENVIRONMENTAL MICROBIOLOGY

Subject code: MMBLS1-205 **L T P C** **(Duration: 45hrs)**
3 0 0 3

Course Objective:
This module is a general introduction to the environmental microbiology and basic terminology.

Course Outcomes:
Describe the concept of microbial ecology.
Describe the various types of microbiology.

Unit-1 **10 hrs**
Define the concept of Environment, Microenvironment, Microbial Ecology and Biosphere. Enumeration and estimation of microbial biomass. Sample collection and handling.
The significance of cell number methods for enumerating microbes, biomass and activities, viable cell count procedures, biochemical and molecular based approaches for measurement of microbial biomass/activity.

Unit-2 **10hrs**
Air microbiology: Atmospheric layers and their micro flora. Sources of microorganism in the air, concept of air sampling and enumerating the air micro flora. Microorganism as Air pollutants. Significance of air microbiology.

Unit-3 **10 hrs**
Soil microbiology: Soil Composition and Microorganisms in Soils. Rhizosphere and rhizospheric effect. Microbial mobilization and immobilization of carbon within the biosphere. The nitrogen cycle: general aspects of nitrogen cycling. Ammonification and ammonia assimilation, nitrification, nitrate reduction and nitrogen fixation. The phosphorus cycle.

Unit-4 **10hrs**
Microbiology of water: forms of water, aquatic environment, physico-chemical conditions in aquatic environment, substrate for microbial growth. Abundance, distribution and survival of microorganisms in different layers of water. Purification of waste waters and communal sewage by aerobic processes. Activated sludge process, Trickling filter process, Rotating Biological Contactors, lagoon process. Purification of waste waters by anaerobic processing

Unit-5 **5hrs**
General concept of Microbial Interactions: positive, negative and neutral interactions: Parasitism: ecto and endo parasitism, concept of hyperparasitism, Temperate bacteriophage, Predation, Neutralism, Commensalism, Amensalism, Competition, Mutualism and Symbiosis.

Books Recommended:

- Microbial Ecology Fundamentals and applications, Atlas. R.M. and Bartha, M. (1981). Addison-Wesley, Philippines.
- Principles of Microbial Ecology: Brock, T.D. (1966). Prentice hall, USA.
- Environmental Microbiology, Grant, W.D. and Long P.E. (1981). Blackie, London.
- Microbial Ecology, Campbell, R. (1977). Blackwell Scientific, London.
- Sodhi, G. S. (2005). Fundamental concepts in environment chemistry. Narosa Publishing House Pvt. Ltd. New Delhi.

LAB TECHNIQUES IN CLINICAL MICROBIOLOGY & IMMUNOLOGY (PRACTICAL)

Subject code: MMBLS1-206 **L T P C** **(Duration: 4hrs/week)**
0 0 4 2

Practical

- Anaerobic culture method
- Principles of automated methods for diagnostic microbiology
- Isolation of pure cultures and preservation techniques
- Drug susceptibility testing by various methods
- Diagnostic immunologic principles and methods
  Precipitation method
  Agglutination method
  ELISA method
  Immunodiffusion
  Immunoelectrophoresis
  Widal test
  Haemagglutination
- Separation of serum protein by electrophoresis
- Separation and characterization of lymphocytes from blood.
- Demonstration of lymphocyte sub population. Blood tests – TC, DC and ESR. Estimation of blood haemoglobin.
  Determination of blood groups and Rh typing.
  Acid-fast staining of mycobacteria (stained/permanent slides).
  Isolation and identification of medically important bacteria (*E. coli, Klebsiella, Pseudomonas, Staphylococcus and Streptococcus*) by cultural, microscopic and biochemical tests.

APPLIED MICROBIOLOGY (PRACTICAL)

Subject code: MMBLS1-207 **L T P C** **(Duration: 6 hrs/week)**
0 0 6 3

Practical

- Bacterial spore staining
- Lactophenol-Cotton blue mounting of fungi
- Oligodynamic action of metals
- Isolation and quantification of bacteriophages from sewage
- Symptomatic observation of plant virus infection.
- Estimation of chlorophyll in virus-infected and non-infected leaves
- Preparations of buffers and pH measurement of buffers
- General reactions of monosaccharides and specific reactions of individual sugars (glucose, fructose, galactose and ribose)
- General reactions of amino acids (solubility, ninhydrin reaction)

- Specific reactions for different amino acids - Xanthoproteic reaction, Millon's test, Glyoxylic reaction
- Pauly's test, nitroprusside test and Ehrlich's test
- General reactions (solubility) and tests of fatty acids, glycerol and terpenes
- Tests for unsaturation
- Titration of fatty acids
- Titration curve of an amino acid and calculation of pK and pI values 16. Quantification of monosaccharide.