

## SEMESTER-II

### DICIPLINE SPECIFIC COURSE (DSC) – 5

#### Medical Microbiology and Parasitology (MMP)

#### PG- MB (08) - S2-T3

#### Course outcomes:

After successfully completing this course, students will be able to:

**CO1:** Students will gain good knowledge on Types, stages of infection, process of infection. Mechanism of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts.

**CO2:** Students will also get knowledge on Morphological characteristics, Pathogenesis and Laboratory diagnosis of various pathogenic micro-organisms

**CO3:** Students will learn about pathogenic bacteria pathogenic fungi , Parasites ,Helminths

**CO4:** Students will also learn about New emerging infections like *Streptococcus suis*;community associated Methicillin resistant *Staphylococcus aureus* (MRSA), *Bordetella pertussis*, *Clostridium difficile*, Multi drug resistant tuberculosis.

#### UNIT-I: - Infection

**Infection:** Definition, Types, stages of infection, process of infection.

**Establishment of pathogenic microorganisms:** Entry, spread and tissue damage. Mechanism of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts, Aggresssins and toxins.

#### UNIT-II: - Bacteriology

**Pathogenic Bacteria:** Morphological characteristics, Pathogenesis and Laboratory diagnosis including rapid methods of following pathogenic bacteria;

*Klebsiella pneumoniae*; *Proteus Vulgaris*; *Clostridium perfringes*; *Shigella dysenteriae*,*Pseudomonas aeruginosa*:  
*Vibrio Cholerae*;, *Corynebacterium diphtheriae*

#### UNIT-III: - Mycology and Parasitology

**Pathogenic Fungi:** Morphological characteristics, pathogenesis and laboratory diagnosis of following pathogenic fungi;-

*Microsporium*; *Trichophyton*; *Histoplasma capsulatum*; *Blastomyces dermatitidis*; *Candida albicans*; *Cryptococcus neoformans*; *Pneumocystis carinii*.

**Parasites:** *Entamoeba histolytica*; *Giardia Lamblia*; *Leishmania donovani*.

**Helminths:** *Taenia saginata*; *Taenia solium*; *Hymenolepis nana*; *Schistosoma haematobium*

#### UNIT-IV: - New emerging Infections

**New emerging infections:** -*Streptococcus suis*; *community associated Methicilin resistant Staphylococcus aureus* (MRSA), *Bordetella pertussis*, , H1N1, *Multi drug resistant tuberculosis*. *Candida auris*, *Vancomycin resistant enterococci*

**DICIPLINE SPECIFIC COURSE (DSC) –6**  
**Immunology and Immunodiagnostics (IID)**

**PG-MB (08) - S2-T4**

**Course outcomes:**

**CO1:** Students will be able to understand the Overview of the Immune system, Cells involved in immune system, brief concept of Hematopoiesis and about immune cells.

**CO2:** Students will gain detail knowledge on Complement System, Inflammation, Cell Mediated Immunity Antibody-Dependent cell mediated cytotoxicity T-Cell dependent and T-cell independent defense mechanisms. Students will also get knowledge on Transplantation Immunology

**CO3:** Students will understand the concepts of Immunodeficiency disorders, autoimmune diseases in detail.

**CO4:** Students will learn about different immunodiagnostic techniques like Radioimmuno assay, ELISA, Immunofluorescence

**UNIT-I: - Overview of the Immune system and CMI**

**Cells involved in Immune system:** Hematopoiesis, Lymphocytes, mononuclear phagocytes, Antigen presenting cells, Granulocytes.

**Lymphoid organ:** Lymphatic system, Primary and Secondary lymphoid organs.

**Complement System:** Pathways of complement activation, regulation of complement system, Biological functions of complement system.

**Inflammation:** Intracellular cell adhesion molecules, Mechanism of cell migration, Inflammation. Pathways of antigen processing and presentation.

**Cell Mediated Immunity:** General properties of effector T cells, Cytotoxic T Cells, Natural Killer cells, Antibody-Dependent cell mediated cytotoxicity. T-Cell dependent and T-cell independent defense mechanisms.

**UNIT-II: - Cancer and transplantation immunology.**

**Cancer:** Origin and Terminology, Malignant Transformation of cells, oncogenes and cancer induction, Tumor Antigens, Immune surveillance theory, Tumor evasion of the Immune system, Cancer Immunotherapy

**Tolerance:** Central and peripheral tolerance to self antigens, Mechanism of induction of natural tolerance

**Transplantation Immunology:** Immunological basis of Graft Rejection, Role of MHC Complex, Mechanism of Graftrejection. Immunosuppressive therapy: General and specific. Clinical Transplant.

**UNIT-III: - Immune Dysfunction**

**Immunodeficiency disorders:** - Phagocytic cell defect (Chediak-Higashi syndrome); B-cell deficiency (Bruton's X-linked hypogammaglobulinemia); T-cell deficiency disorder (DiGeorge Syndrome); Combined B-cell & T-cell deficiency disorder (SCID-Severe combined immunodeficiency diseases, **Autoimmunity and autoimmune diseases:**-General Consideration, Etiology, Clinical Categories, Dignosis and Treatment. RA (Rheumatoid arthritis); SLE (Systemic Lupus Erythematosus); Mysthenia

gravis; Grave's disease; Goodpasture syndrome, .

**Hypersensitivity :-** Type I, Type II, Type III & Type IV

**UNIT-IV: - Immunodiagnostics**

**Concept of Affinity and Avidity, Zone of equivalence**

**Precipitation reactions:** Immunodiffusion,

**Agglutination reactions:** Bacterial Agglutination, Hemagglutination, Passive agglutination, Reverse passive agglutination and agglutination inhibition.

**Immunodiagnostic techniques:** Radioimmuno assay, ELISA, Chemiluminiscenceimmuno assay, Complement fixation test, Immunofluorescence, Immunoelectron microscopy.

## DICIPLINE SPECIFIC ELECTIVE (DSE) – 2

### Microbial Metabolites (MMT) PG- MB (08) - S2-T2

#### Course outcomes:

**CO1:** Students will be able to understand the important aspects of General account of metabolites, secondary metabolites. Classification, structure and mode of action of secondary metabolites. Plants secondary metabolites: Digitoxine, Salicylic acid, Mycotoxins-Aflatoxin, Ochratoxin, Patulin.

**CO2:** Students will gain good knowledge on the structure and function of a variety of drugs used to control the growth of microorganisms and they will understand the mechanism of action of different drugs like Aminoglycosides, Carbapenems, Microlids, Nitrofurans.

**CO3:** Students will also get knowledge on the structure and function of Hemoglobin, Myoglobin, Melanin and bile pigments. Microbial pigments: Bacteriochlorophylls, Carotenoids of prokaryotes, rhodopsin and accessory pigments (Pulcherrimin, indigoidin, voalecin) Defensive role of pigments.

**CO4:** Knowledge on role of vitamins in life, structure, function and chemistry of different vitamins : Retinol (vitamin A), Riboflavin (vitamin B2), Cyanocobalamin (Vitamin B12) and ascorbic acid (vitamin C) will help students to understand the mechanism of deficiency diseases.

**CO5:** The knowledge gained from this course will be helpful for students while facing the interviews in pharmaceutical industries.

#### UNIT-I:- Overview of metabolites

**Metabolites:** General account of metabolites, secondary metabolites. Classification, structure and mode of action of secondary metabolites. Plants secondary metabolites: Digitoxine, Salicylic acid, Mycotoxins-Aflatoxin, Ochratoxin, Patulin.

**Microbial biopolymers:** chitin, Xanthan, dextran, Gellan, Pullulan, curdlan and hyaluronic acid.

**Polyamines:** Brief outline and functions of polyamines. Synthesis of linear polyamine-putrescine, cadaverine, spermidine and spermine.

#### UNIT-II :- Antimicrobial drugs: Secondary metabolites

**Antibiotics:** History and discovery of antibiotics, Antibiotic resistance, Mechanisms of antibiotic resistance.

**Structure and mode of action of antibiotics:** Aminoglycosides (Amikacin), Carbapenems (Imipenim), macrolids (Azithromycin), Nitrofurans (nitrofurantoin), Penicillins (Amoxicillin), Quinolones (gatifloxacin/Ciprofloxacin), Sulphonamides (sulfamethoxazole), Tetracyclines (doxycyclines), Chloramphenicol, Fucanazole.

#### UNIT-III:-Pigments as secondary metabolites

Structure and function of Hemoglobin, Myoglobin, Melanin and bile pigments. Microbial pigments: Bacteriochlorophylls, Carotenoids of prokaryotes, rhodopsin and accessory pigments (Pulcherrimin, indigoidin, voalecin) Defensive role of pigments.

#### **UNIT-IV:-Microbial vitamins**

Characteristics of fats and water soluble vitamins.

**Structure, function and chemistry of:** Retinol (vitamin A), Riboflavin (vitamin B<sub>2</sub>),  
Cyanocobalamin (Vitamin B<sub>12</sub>) and ascorbic acid (vitamin C).

#### **Deficiency diseases in humans:**

Xerophthalmia, BeriBeri, Pellagra, Scurvy, Keratomalacia, osteoporosis, Osteomalacia, Cheilosis,  
Glossitis, Pernicious anemia and Erythrocytopenia.

## DICIPLINE SPECIFIC ELECTIVE (DSE) – 2

### Microbial Methods for Environment Management (MMEM) PG- MB (08) - S2-T1

#### Course outcomes:

**CO1:** Students will be able to understand the microbial changes induced by organic and inorganic pollutants, factors influencing the eutrophication process and control of eutrophication. Students will also know about the concept of biodeterioration, biodeterioration of woods and pharmaceutical products.

**CO2:** Students will understand the important things about the concept and consequences of Biomagnification of chlorinated hydrocarbons and pesticides.

**CO3:** Students will learn about biotransformations of metals and metalloids, mercury transformations, biotransformation of pesticides such as hexachlorobenzene.

**CO4:** Students will learn about the important branch of microbiology viz: Geomicrobiology in which they would gain detailed understanding of bioleaching of ores, leaching techniques and applications.

**CO5:** Students will understand the concept of Bioremediation, its types and applications. Biomarker gene (antibiotic and heavy metal resistance genes, ice nucleation genes), Bioreporter genes. This knowledge will be helpful for students during their research as the bioremediation approach is having great demand in research.

#### **UNIT-I: - Eutrophication, Biodeterioration and Biomagnification**

**Eutrophication:** Microbial changes induced by organic and inorganic pollutants, factors influencing eutrophication process and control of eutrophication.

**Biodeterioration:** Definition and concept of biodeterioration, biodeterioration of woods and pharmaceutical products.

**Biomagnification:** concept and consequences, Biomagnifications of chlorinated hydrocarbons and pesticides.

#### **UNIT-II: - Biotransformation and Bioleaching, Biodegradation**

**Biotransformations:** Concept of metals and metalloids, mercury transformations, biotransformation of pesticides such as hexachlorobenzene.

**Bioleaching:** Bioleaching of copper and uranium, leaching techniques and applications.

**Biodegradation:** Biodegradation of plastics, Xenobiotics (naphthalene, Polycyclic aromatic hydrocarbons (PAHs))

**Bioremediation :** Concept, its types and applications. Biomarker gene (antibiotic and heavy metal resistance genes, ice nucleation genes), Bioreporter genes. Environmental impact of steel production, Effects of heavy metals on environment.

#### **UNIT-III: - Pollution Management**

Waste water management using activated sludge, aerated lagoons, trickling filter, rotary biological contractors, fluidized bed reactors, stabilization ponds. Significance of waste water treatment processes.

#### **UNIT-IV: - Global Environmental Problems**

Current scenario and Causes of Global warming and climate change: -ozone depletion, UV-B, green house effect, acid rain, their impact and biotechnological approaches for management. Acid mine drainage and associated problems.

## DICIPLINE SPECIFIC COURSE (DSC) –7

### PRACTICAL-III PG- MB (08) - S2-P1

#### Course outcomes:

- CO1:** students will be able to perform different staining techniques.
- CO2:** Students will learn about isolation of pathogens from clinical samples.
- CO3:** Students will learn conventional and rapid methods of isolation and identification of pathogenic bacteria, fungi and parasites
- CO4:** Students will learn Antibiotic sensitivity testing by various methods

1. Growth curve of bacteria/yeast by spectrophotometric turbidity measurement
2. Determination of biological oxygen demand (BOD) in waste water.
3. Determination of chemical oxygen demand (COD) in waste water.
4. Bacterial degradation of aromatic compounds.
5. Membrane Filtration Technique for *Fecal Streptococci*
6. Conventional and rapid methods of isolation and identification of following pathogenic bacteria and fungi

**Bacteria:** *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumonia*, *Proteus vulgaris*, *Proteus mirabilis*, *Salmonella typhi*, *Salmonella paratyphi*, *Shigella dysenteriae*, *Shigella flexneri*, *Pseudomonas aeruginosa*, *Vibrio cholerae*. {Any five}

**Fungi:** *Candida albicans*, *Cryptococcus neoformans*, *Microsporum*, *Trichophyton*, *Histoplasma capsulatum*. [Any one]

7. Antibiotic sensitivity testing by various methods
  - a) Kirby-Bauer's disc diffusion method.
  - b) Well plate method.
  - c) E-strip method for MIC testing.



## DICIPLINE SPECIFIC COURSE (DSC) –8

### PRACTICAL-IV

#### PG- MB (08) - S2-P2

#### Course outcomes:

After successfully completing this course, students will be able to:

- CO1:** Students will learn principles & methods of diagnostic immunology
- CO2:** students will be able to perform the immunodiffusion technique.
- CO3:** students will be able to perform the technique of immunoelectrophoresis.
- CO4:** Students will be able to perform the technique of Enzyme linked immunosorbent assay (ELISA)

#### Diagnostic immunologic principles and methods of followings:-

- 1) Total Leucocyte count (TLC)
- 2) Differential Leucocyte count (DLC)
- 3) Immunodiffusion
- 4) Immunoelectrophoresis
- 5) Blood grouping
- 6) Widal [slide and tube] tests.
- 7) TRUST [Toludine Red Unheated Serum Test]
- 8) Pregnancy test.
- 9) ELISA [Enzyme Linked Immunosorbent Assay]
- 10) RPR [Rapid Plasma Reagin] Test
- 11) Estimation of Hemoglobin by Sahli's Method

## List of recommended books

- The Biochemistry of copper By:JackPeisach,PhillipAisen.
- Biochemistry:- By Rex Montgomery.
- Lehninger Principles of BiochemistryBy:-David L. Nelson and Cox
- Metabolic Pathways By:-David M.Greenberg.
- Harper's BiochemistryBy:RobertK.Myrray.
- Enzymes: By Trevor Palmer.
- Enzyme structure and mechanism By:AlanFersht.
- Methods in Enzymology By: S.Berger,A.Kimmel.
- Fundamentals of Enzymology By;N.Price,L.stevens.
- Immobilization of Enzymes and cells By:Gordon Bickerstaff.
- Industrial MicrobiologyBy:A.H.Patel
- Industrial MicrobiologyBy:L.E.Casida.
- Food Microbiology.By:WilliamC.Frazier,DennisC.Westhaff.
- Prescott and Dunns Industrial microbiology.By;Gerald Reed.
- Basic Food Microbiology.By:Georgej.banwart.
- Medical Microbiology.By:G.F.Brooks,J.S.Butel,S.A.morse.
- Text book of Microbiology.By:Ananthanarayan and Panikar.
- Medical Microbiology.By:B.S.Nagoba and A.Pichare.
- Clinical Microbiology and Infection control.By;Elaine Larson.
- Bacterial Pathogenesis;Molecular and cellular mechanism.By;CamilaLocht and Michel Simonet.
- Medical Microbiology.By:David Greenwood.
- Medical Microbiology.By:J.P.Dugaid.
- Small Dnatumorviruses.By:Kevin Gaston.
- Viruses and Interferon;currentresearch.By:KarenMossam
- Lentiviruses and Macrophages:Molecular and Cellular intereactions.By:Moiradesporf.
- The Biology of Animal viruses.By;C.A.mims.
- Animal virology.By:DavidBaltimore,A.Huang,c.fox
- Oncogenic viruses and host cell genes.By:E.Kurstak,KarlMaramorosch.
- Bacterial and Bacteriophage Genetics.By:EdwardA.Birge.
- Molecular Genetics of Bacteria.By:J.W.Dale.
- Molecular Biology of the gene.By:J.D.Watson,N.h.Hoppkins,J.W.Roberts,J.A.Steitz&A.M.Weiner.
- Microbial Genetics.By:Maloy{T.A}.Jones and Bartlett publications.
- Mobile DNA.By;NancyCraig,MartinGelletallan,lambowitz.
- Methods of General and Molecular biotechnology.By:Philip Gerhardt ASM publication.
- Recombinant DNA.By;Watson J.D. Essentials of Molecular Biology.By:Malcimski.
- Molecular genetics of Bacteria.By:Larry,Synder and Wendy Champness.

- Molecular biology. By; F. Weaver. WCB/MCGraw Hill.
- Molecular Biology of Gene. Watson et al, Benjamin-cumminas, USA.
- Molecular Biotechnology. Glick-1994.
- Genetic Engineering By: Sandya Mitra.
- Environmental Microbiology By: Ralph Mitchell, John Wiley and Sons. Inc.
- Environmental Biotechnology By: C.F. Froster and D.A. John Wase, Elis Horwood.
- Biocatalysis and Biodegradation: Microbial Transformation of organic compounds. 31 y: Lawrence P. Wacekett.
- A manual of environment Microbiology. By: Christon J. Hurst, ASM publication.
- Biodegradation and bioremediation Academic press BY: San Diego.
- Biotechnology in the sustainable environment, Plenum press, NY
- Basic principles of Geomicrobiology. By: A.D. Agate.
- Environmental Microbiology By: R.M. Maier, I.C. Papper and C>P> Gerba.
- Methods in Microbiology: Lynch and Hobbie.
- Experimental Microbial Ecology. By: Arosison Academic Press.
- Advances in Applied microbiology. By: D. Pearlman academic press.
- Microbiology of Extreme environments, edited by Clive Edward, Open University press, Milton Keynes.
- Principles of Biochemistry. By: Donald J. Voet, Judith G. Voet, Charlotte W. Pratt.
- Brock Biology of Microorganisms. By: John M. Martinko.
- Introduction to Genetic analysis. By; Griffiths, Wessler. Lewontin, Gelbart, Suzuki, Miller.
- Biophysical Chemistry VOL: I, II, III;
- The conformation of biological macromolecules. By; Cantor and Schimmel. Hans-Peter schmauder, Michael Schweizer, Lilian M. Schweizer.
- Ecology, Theories and applications. By: Peter Stiling.
- Environmental Science working with the Earth. By: Miller.
- Genetics A Molecular Approach. By: Peter J. Russell.
- Culture of Animal Cells; a manual of basic technique. By: R. IAN Freshney.
- Molecular Biology. Robert F. Weaver.
- Microbial Biotechnology, Principles and Applications. Lee Yuan Kun.
- Microbial Biotechnology, Fundamentals of Applied Microbiology. By: Alexander N. Glazer. Hiroshi Nikaido.
- Process Biotechnology Fundamentals. By: S N Mukhopadhyay.
- Textbook of Organic Medicinal and Pharmaceutical Chemistry. By: Jaime N. Delgado William A. Remers.
- Kuby Immunology By: Kindt, Goldsey, Osborne.
- Immunology By: Roitt, Brostoff, male.
- Immunology By: David Male, Jonathan Brostoff, DAVID B ROTH, Ivan Roitt.
- The elements of Immunology By: Fahim Halim Khan.
- Immunology By: Richard A. Goldsby, Thomas J Kindt, Barbara A. Osborne, Janis Kuby.
- Fundamental immunology William E. Paul.
- Biophysical Chemistry By: Upadhaya Upadhyaya Nath.
- Biostatistics and Microbiology: A Survival manual Daryl S. Paulson Springer
- CSIR-NET LIFE SCIENCES Sure success Series: B.L. Chaudhary, Kailash Chaudhary, Arun Chaudhary: New Age International Publishers
- Food processing Handbook: Edited by James G. Brenon (Wiley-VCH)

- Advances in Microbial physiology: Robert K.Poole
- Pharmaceutical Microbiology : Reddy A.Venkateswara
- Fundamental Agricultural Microbiology: K.R.Aneja
- Water & waste water technology (3<sup>rd</sup> edition): Mark J hammer & Hommer, Jr prentice hall at indiaptltd.Newdelhi.