

b. & c. Sequential organisation of contents and their division

The areas of study in Microbiology will include General Microbiology, Systemic Microbiology including Bacteriology, Immunology, Mycology, Virology, Rickettsia, Chlamydia, Parasitology and Applied microbiology in relation to infections and diseases of various systems of the body.

A) GENERAL MICROBIOLOGY: (n=10)

No	Topic of lecture	Must know (MK)	Desirable to know (DK)	Hrs
1.	Introduction and Historical background	Definitions: Medical Microbiology, pathogen, commensal, symbiont etc. To cover Anton van Leewenhoek, Pasteur, Lister, Koch, Flemming etc. In History: Scope to cover the importance of Med. Microbiology on diagnosis and prevention of infectious diseases.	Micro-organisms as models in Molecular Biology and Genetic engineering.	1
2.	Morphology of bacteria and Classification	Bacterial cell and its organelles, morphological classification, methods of studying bacteria, staining methods & their principles Grams & Zeil Nelson staining, their importance in presumptive diagnosis, negative staining, dark ground illumination, phase contrast and fluorescent microscopy, briefly about electron microscopy. Principles and applications of all microscopes.		1
3.	Physiology of bacteria including growth requirements & metabolism	Nutrition, respiration (anaerobic & aerobic) and growth of bacteria, growth curve, physical factors influencing growth. Culture media: Definition, classification and application.	Important constituents of culture media.	1
4.	Sterilization	Definition of sterilization, disinfection, asepsis, antiseptics. Ubiquity of bacteria, modes of killing microbes and preventing them, factors determining selection of the mode, factors adversely affecting sterilization. Enumeration of physical methods of sterilization including principle & their application.	Working and efficacy testing of autoclave, inspissator and hot air oven. Central Sterile Supply Department (CSSD) – concept only.	1
5.	Disinfectants	Asepsis and antisepsis, modes of Action of chemical agents on microbes. Phenols, Halogens, Aldehydes, Acids, Alcohol, heavy metals, oxidizing agents etc. Universal biosafety precautions.	Dyes, soaps and detergents. Concentration and contact time.	1
6.	Waste disposal	Definition of waste, classification, segregation, transport and disposal.		1

7.	Bacterial genetics and drug resistance to antimicrobial agents.	Introduction – codon, lac operon, mutation, transformation, transduction & conjugation, R factor, mode of action of antimicrobials on bacteria, mechanism of drug resistance and antimicrobial susceptibility tests, steps taken to minimize emergence of resistant strains (Antibiotic policy, formulation),		1
8.	Host parasite relationship and bacterial infections	Commensal, pathogenic and opportunistic organisms, their pathogenic factors and modes of transmission. Microbial factors: spores, capsule, toxins, enzymes, intracellular parasitism, antigenic variation & extrinsic factors etc. leading to establishment of infection. Types of infection: primary, secondary, general, local, natural, nosocomial, iatrogenic, zoonotic.		1
9.	Normal flora	Introduction – various sites, types and role		1
10.	Methods of identification of bacteria. Diagnosis of infectious diseases (direct and indirect)	Principles of laboratory diagnosis of infectious diseases. General procedures for collection transport, processing of specimens for microbiological diagnosis.	PCR, RIA, DNA probes.	1

B) IMMUNOLOGY: (n=12)

No.	Topic	Must know	Desirable to know	Hrs
1	Introduction	Definition of immunity, types of immunity, factors responsible, mechanism of innate immunity, active and passive immunity, local immunity.	Herd immunity	1
2	Antigens, HLA	Definition, types, antigen determinants, properties of antigen. MHC- concept, class- I, II & III functions, indication of typing, MHC restriction.	Nature of determinants, e.g. of haptens, e.g. of cross- reactive antigen.	1
3	Antibodies	Definition, nature, structure of immuno- Globulins, papain digestion, understand isotypic, allotypic and idiotypic markers, immunoglobulin classes, physical and biological properties of immunoglobins.,	Pepsin digestion, amino acid sequence, immunoglobulin domain, abnormal immunoglobins.	1
4	Serological reactions	Definition, characteristics, titre, sensitivity & specificity, antigen- antibody interaction- primary, secondary & tertiary, prozone phenomenon, principle, types and application of precipitation, agglutination, complement fixation, enzyme immunoassay, radioimmunoassay, immunofluorescence test, neutralization and opsonisation.	Techniques of precipitation and their uses, blocking antibodies, antiglobulin reactions, co-agglutination, in vitro test, techniques of EIA, IF & electron microscopy.	2
5	Immune response	Types, development, role of --thymus, bone marrow, lymph nodes & spleen, cells of lymphoreticular system, morphology and role	Lymphokines and their role, clonal selection, mechanism of	2

		of T subsets, NK cells, B cells, plasma cells and macrophages, B & T cell activation, antigen processing and presentation, primary and secondary immune response, principle and uses of monoclonal antibodies, factors affecting antibody production, CMI-definition, types, role of T cell and macrophages, definition of immune tolerance and mechanism of tolerance.	immunoregulation, theories of antibodies formation, techniques of monoclonal antibody formation, detection of CMI, types of immunotolerance.	
6	Complement	Definition, synthesis, pathways, activation, role & biological functions, components, measurement.	Regulation of complement activation, complement deficiency	1
7	Hypersensitivity	Definition, classification, difference between immediate and delayed reaction, mechanism of anaphylaxis, manifestations of anaphylaxis, types of anaphylaxis, atopy, e.g. of anaphylactic reaction, tests for anaphylaxis, mechanism and e.g. of type-II & type-III reactions, mechanism & types of delayed hypersensitivity.	Desensitization in anaphylaxis, type V reaction, ADCC, Schwartzman phenomenon.	1
8	Autoimmunity	Definition, mechanism, classification, pathogenesis.		1
9	Transplantation & tumour immunology	Types of transplants, mechanism of transplant rejection, prevention of graft rejection, GVH reaction, IR to tumours, tumour antigens, mechanism of IR to tumours.	Type of tumour antigens, immune surveillance.	1
10.	Immuno-Deficiency	Classification, examples, laboratory tests for detection, manifestations.		1

C) SYSTEMIC BACTERIOLOGY: (n=21)

Pathogenesis includes:

- Infectious agent - MK
- Habitat - MK
- Source / reservoir - MK
- Mode - MK
- Infective dose - MK
- Multiplication, spread - MK
- Clinical features, pathology - MK
- Complications - MK
- Virulence factors - MK
- Immunological response - DK

**MK- Must know*

**DK- Desirable to know*

Laboratory diagnosis:

- MK
- Specimen selection -MK
- Collection -MK
- Transport -MK
- Primary smear, hanging drop -MK
- Selection of media -MK
- Pathogenicity testing -MK
- Anti microbial drug susceptibility testing-MK
- Serological interpretation -MK

Key to the abbreviations used in the table below:

A- Classification, **B-** Morphology, **C-** Culture and isolation, **D-** Biochemical reactions, **E-** Viability, **F** -Virulence, **G-** Diseases, **H-** Antigens, **I-** Pathogenesis, **J-** Laboratory diagnosis, **K-** Prevention and control, **L-** Immune response

No	Topic/ hours	A	B	C	D	E	F	G	H	I	J	K	L
1	Staphylococci (1 hour)	MK	MK	DK	DK	MK	MK	MK	DK	MK	MK	MK	-
2	Streptococci Pneumococci (1 hour)	MK	MK	BA-MK, DK	DK	MK	MK	MK	MK	MK	MK	MK	DK
3	Neisseria (1 hour)	DK	MK	DK	DK	MK	MK	MK	DK	MK	MK	MK	-
4	C.diphtheriae (1 hour)	DK	MK	DK	-	MK	MK	MK	-	MK	MK	MK	DK
5	M.Tuberculosis (1 hour)	MK	MK	LJ,Growth Time MK	DK	MK	MK	MK	MK	MK	MK	MK	DK
6	Atypical mycobacteria (1hour)	MK	MK	DK	DK	MK	MK	MK	-	MK	MK	MK	-
7	M.leprae (1 hour)	MK	MK	Isolation-MK	-	MK	MK	MK	MK	MK	MK	MK	MK

8	Bacillus Methods of anaerobiosis & classification. Non sporing anaerobes (1 hour)	MK	MK	MK	DK	MK	MK	MK	-	MK	MK	MK	-
9	Clostridium welchii, tetani, botulinum (1 hour)	MK	DK	MK	-	-	-	MK	-	-	MK	-	-
10	Enterobacteriaceae (1 hour)	MK	MK	DK	DK	MK	MK	MK	DK	-	MK	-	-
11	Salmonella typhi (1 hour)	MK	MK	DK	DK	MK	MK	MK	DK	-	MK	-	MK
12	Shigella (1 hour)	MK	MK	DK	DK	MK	MK	MK	DK	-	MK	-	-
13	Vibrio & Campylobacter (1 hour)	MK	MK	DK	DK	MK	MK	MK	-	-	MK	-	-
14	Pseudomonas (1 hour)	-	MK	DK	DK	MK	MK	MK	-	-	MK	-	-
15	Other GNB (1 hour)	List only	MK	DK	-	-	MK	-	-	-	MK	-	-
16	Newer bacteria (1 hour)	List only	MK	DK	-	-	-	-	-	-	MK	-	-
17	Spirochete (1 hour)	MK	MK	DK	-	MK	-	MK	-	-	MK	-	DK
18	Actinomycosis & Nocardia (1 hour)	DK	MK	DK	-	-	-	-	-	-	MK	-	-
19	Rickettsia (1 hour)	MK	MK	-	-	-	-	-	-	-	MK	-	-
20	Chlamydia & Mycoplasma (1 hour)	MK	MK	-	-	-	-	-	-	-	MK	-	-
21	Bacteriology of air, water, milk and food (1 hour)	-	-	MK	DK	MK	MK	MK	-	MK	MK	MK	-

D) MYCOLOGY: (n=4)

No	Topic	Must know	Desirable to know	Hrs
1	Introduction to Mycology	Nature of fungus (definition, differences with bacteria), characteristics of fungi, common terminologies, brief account of types of sporulation and morphological classification of fungi. Methods of identification, Infections produced, Lab Diagnosis, processing of skin, hair and nail,	Growth requirements, ecological, medical and industrial importance of fungi (brief account).	1
2	Agents of Superficial mycosis	Enumerate, predisposing factors, morphological features, Lab. Diagnosis	Colony characteristics of dermatophytes	1
3	Subcutaneous mycosis	Enumerate, predisposing factors, Mycetoma, Rhinosporidiosis, Pathogenesis, Lab. Diagnosis	-	1
4	Systemic mycosis Opportunistic fungal infections	Classification, predisposing factors, Candida, Cryptococcus, Histoplasma morphology, pathogenesis, lab. Diagnosis Classification, predisposing factors, Mucor, Aspergillus, Pneumocystis carinii	Cultural characteristics	1

E) VIROLOGY: (n=12)

Morphology, pathogenesis, laboratory diagnosis, prevention and control for all viruses (Must know).

No	Topic of lecture	Must know	Desirable to know	Hrs
1	General Virology	Size, shape, symmetry, structure, resistance, multiplication, properties and classification of viruses, pathogenesis, bacteriophages, concept of virions	-	1
2	Laboratory diagnosis of viral infections	Collection of samples, transport, cultivation and methods of diagnosis	-	1
3	Viral immunity	Viral immunity, interferon, viral vaccines	-	1
4	Pox viruses	Small pox and Molluscum	-	1
5	DNA viruses	Papova, Adeno, Herpes viruses (Herpes simplex, Varicella zoster, CMV, EBV)	-	1
6	Respiratory viruses	Orthomyxo and Paramyxoviruses, Ag shift and drift	Rhinoviruses	1
7	Picornaviruses	Polio, Cocksackie, Enteroviruses, Viruses causing diarrhoea – Rota viruses, Immunity (polio)	-	1
8	Hepatitis viruses	Hepatitis viruses, immunity and laboratory diagnosis	-	1
9	Arboviruses	Dengue, KFD, Japanese encephalitis – definition, classification, enumeration in India, Pathogenesis, laboratory diagnosis and control	-	1
10	Rhabdoviruses	Rabies	-	1

11	Slow and Oncogenic viruses	Characteristics of slow virus infections, pathogenesis and laboratory diagnosis and viruses associated with it	-	1
12	Retroviruses	HIV/AIDS, Immunity, USP	-	1

F) PARASITOLOGY: (n=11)

Must know –

- Geographical distribution
- Habitat
- Morphology (different stages) found in human beings
- Life cycle
- Pathogenesis
- Laboratory diagnosis
- Treatment
- Control
- Immunoprophylaxis

No	Topic of lecture	Must know	Desirable to know	Hrs
1	Introduction to medical Parasitology	Parasites: their nature, classification, and explanation of terminologies, epidemiology, emerging parasitic infections, (pathogenicity and laboratory diagnosis)		1
2	E. histolytica	Amoebic infections		1
3	Free living amoebae and flagellates	Free living amoebae, PAME, Giardia & Trichomonas		1
4	Hemoflagellates	L. donovani: life cycle, morphology, pathogenicity, and lab. Diagnosis etc.	Brief account of Trypanosomes	1
5	Malaria	Malarial parasites: life cycle, morphology, pathogenicity, laboratory diagnosis etc.		1
6	Misc. Pathogenic protozoa	Toxoplasma,	Cryptosporidium, Isospora, B.coli	1
7	Cestodes	Taenia saginata & solium, Echinococcus granulosus, life cycle, morphology, pathogenicity and laboratory diagnosis.	Brief mention of other cestodes	1
8	Trematodes	Schistosomiasis: life cycle, morphology, pathogenicity & lab diagnosis.	Brief account of Fasciola hepatica	1
9	Intestinal Nematodes	A. duodenale, A. lumbricoides, E. vermicularis, T. tritura	brief mention of S. stercoralis, life cycle, morphology laboratory diagnosis	2
10	Tissue Nematodes	W. bancrofti, D. medinensis, in brief T. spiralis		1

TUTORIALS (APPLIED MICROBIOLOGY) : (n=26)

Regular tutorials, student seminars & symposia shall be conducted in addition to lectures.

Students must know:

- Micro-organisms causing diseases & pathological lesions
- Methods of collection & transportation of specimens
- Methods of laboratory diagnosis
- Serological response produced by organisms
- Interpretation of laboratory report

No	Topic of Tutorial	Hrs
1	Gastrointestinal infections (diarrhoea and dysentery) and their laboratory diagnosis	2
2	Upper respiratory tract infection (patch and sore throat) and their laboratory diagnosis	2
3	Lower respiratory tract infection (pneumonia, bronchitis, bronchiolitis etc.) and their laboratory diagnosis	2
4	Urinary tract infection and their laboratory diagnosis	2
5	Infections of the central nervous system (meningitis, encephalitis, brain abscess) and their laboratory diagnosis	2
6	Wound infections and pyogenic infections	2
7	Septicemia and laboratory diagnosis and PUO	2
8	Eye infections and their laboratory diagnosis	2
9	Sexually transmitted disease (STD) and their laboratory diagnosis (genital ulcerative disease)	2
10	Role of laboratory in cross infection, Nosocomial infections / outbreak / epidemic	2
11	Vehicles and vectors of communicable disease & zoonosis	2
12	Preventive inoculations, immunomodulation and immunotherapy	2

Suggested topics for integrated teaching:

- ◆ Tuberculosis and Leprosy
These topics may
- ◆ Pyrexia of Unknown Origin (PUO)
- ◆ Sexually Transmitted Diseases
- ◆ Hepatitis
- ◆ HIV / AIDS
- ◆ Malaria
- ◆ Diarrhoea and Dysentery

Note: Each topic may be allotted 3 hours.
be covered in 2nd and 3rd term of 2nd MBBS.

d. Term-wise distribution

First term (4 months)	Theory- 32 hours	Practical- 32 hours
Second term (5 ½ months)	Theory- 66 hours	Practical- 44 hours
Third term (4 months)	Theory- 48 hours	Practical- 32 hours
Total teaching hours	254 hours	

System-wise distribution

TERM	BROAD TOPICS	NO. OF CLASSES		TUTORIALS (2 hours)
		Lectures (1 hour)	Practicals (2 hours)	
First term	General Microbiology	10	28	-
	Systemic Bacteriology	18	24	-
Second term	Systemic bacteriology	3	19	-
	Immunology	12	4	-
	Virology	12	4	-
	Mycology	5	4	-
	Parasitology	11	24	-
	Applied microbiology	-	-	26
Third term	Applied microbiology	-	-	26

e. Practicals : Total hours, number & contents : (n=100)

No	Topic	Hrs
1.	Introduction to Microbiology, Microscopy and Micrometry.	4
2.	Morphology and physiology of bacteria and methods staining.	4
3.	Growth requirements of bacteria (media) and identification of bacteria (biochemical reactions).	4
4.	Scheme for laboratory diagnosis of infectious diseases and collection, storage and transport of microbiological specimens and laboratory animals.	4
5.	Sterilization- the physical agents. Sterilization- the chemical agents and method of waste disposal.	4
6.	Serological tests for diagnosis of microbial infections.	4
7.	Staphylococci and other gram-positive cocci.	4
8.	Streptococci and Pneumococci.	4
9.	Gram negative cocci	4
10.	C. diphtheriae and other gram positive non sporing bacilli	4
11.	Mycobacteria	4
12.	Spore bearing aerobic and anaerobic bacilli.	4
13.	Enteric gram-negative bacilli – lactose fermenters - E.coli etc	4
14.	Non lactose fermenters – Salmonella and Shigella	4
15.	V. cholerae and other Vibrio like organisms	4
16.	Other gram-negative bacilli including Pseudomonas, Proteus and hospital acquired infection.	4
17.	Spirochetes	4
18.	Actinomycetes, Nocardia and Fungi.	4
19.	Rickettsia, Chlamydia, Mycoplasma and Viruses	4
20.	Introduction to Parasitology and Protozoal infections (including Isospora & Cryptosporidium)	4
21.	Haemoflagellates	4
22.	Plasmodia and toxoplasma.	4
23.	Cystodes and trematodes	4
24.	Intestinal nematodes	4
25.	Extra-intestinal nematodes.	4

The number of practicals and lectures can be changed as per the needs.