Syllabus For B.Sc. in Medical Microbiology (BMM) Academic Programme

Duration : 3 years

B.Sc. in Medical Microbiology (BMM) First Year Human Anatomy & Physiology Subject Code : BMM-101 Min. Hrs - Theory : 100 Hrs & Practical : 100 Hrs.

THEORY

HUMAN ANATOMY :

1. General Anatomy

- a) Cell structure & function
- b) Tissue
 - Epithelium
 - Connective
 - Sclerous
 - Muscular
 - Nervous
- c) Lymphatic System

2. Systemic

Basic Features of :

- a) Cardiovascular system
- b) Respiratory system
- c) Digestive system
- d) Excretory system
- e) Genital (Male & Female) system
- f) Nervous system

HUMAN PHYSIOLOGY

- 1. Cell : Structure & function.
- 2. Blood
 - a) Blood cells
 - b) Haemoglobin
 - c) Blood groups
 - d) Coagulation Factors
 - e) Anaemia & Immunoglobulins

3. Cardiovascular system

Heart rate, cardiac cycle, cardiac output, blood pressure, hypertension, radial pulse

4. Respiratory System

- a) Ventilation
- b) Functions
- c) Lungs Volumes and capacities

5. Gastrointestinal System

Process of digestion in various parts

6. Endocrinology

- a) List of Endocrine Glands
- b) Hormones : Their secretion and functions (in brief)

7. Excretion system

- a) Structure of nephron
- b) Urine formation

8. Central Nervous System

- a) Parts
- b) Sliding Filament Theory
- c) Neuro Muscular Junction
- d) Wallerian Degeneration
- e) Motor Nervous system
 - Upper motor neuron system
 - Lower motor neuron system
- f) Sensory nervous system
- g) Sympathetic Nervous system
- h) Parasympathetic nervous system
- 9. Skin Function & Structure

10. Muscular System

Classification of muscles & their functions

11. Special Senses - Eye & ear (in brief)

PRACTICAL

HUMAN ANATOMY

- 1. Identification and description of all anatomical structures.
- 2. The learning of Anatomy is by demonstration only through dissected parts, slides, models, charts etc.
- 3. Demonstration of dissected parts (upper extremity, lower extremity, thoracic & abdominal viscera, face and brain).
- 4. Demonstration of skeleton articulated and disarticulated.

HUMAN PHYSIOLOGY

- 1. Measurement of pulse, blood pressure
- 2. Elicitation of Reflexes & jerks.
- 3. Identification of blood cells by study of peripheral blood smear.

GENERAL PATHOLOGY & GENERAL MICROBIOLOGY Subject Code : BMM-102

Min. Hrs - Theory : 100 Hrs & Practical : 100 Hrs.

GENERAL PATHOLOGY

1. Cell Injury and Cellular Adaptations.

- a) Normal Cell
- b) Cell Injury- types of cell injury, etiology of cell injury, morphology of cell injury, cellular swelling (in brief).
- c) Cell death : types- autolysis, necrosis, apoptosis & gangrene.
- d) Cellular adaptations-atrophy, hypertrophy, hyperplasia & dysplasia.

2. Inflammation

- a) Acute inflammation vascular event, cellular event, inflammatory cells.
- b) Chronic Inflammation general features, granulomatous inflammation, tuberculoma.

3. Haemodynamic Disorders :

Oedema, hyperemia, congestion, haemorrage, circulatory disturbances, thrombosis, ischaemia & infarction.

4. Neoplasia :

Definition, how does it differ from hyperplasia, difference between benign tumor and malignant tumor.

5. Healing

Definition, different phases of healing, factors influencing wound healing.

GENERAL MICROBIOLOGY

- 1. General characters and classification of Bacteria.
- 2. Characteristics of Bacteria

Morphology- Shape, Capsule, Flagella, Inclusion, Granule, Spore.

3. Growth and Maintenance of Microbes

Bacterial division, Batch Culture, Continuous culture, bacterial growth- total count, viable count, bacterial nutrition, oxygen requirement, CO₂ requirement, temperature, pH, light.

4. Sterilization and Disinfection.

Physical agents- Sunlight, Temperature less than 100^oC, Temperature at 100^oC, steam at atmospheric pressure and steam under pressure, irradiation, filtration. Chemical Agents- Alcohol, aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.

5. Culture Media

Definition, uses, basic requirements, classification, Agar, Peptone, Transport Media, Sugar Media, Anaerobic Media, Containers of Media, Forms of Media

- 6. Staining Methods

 Simple, Grams staining, Ziehl-Neelsen staining or AFB staining, Negative Impregnation

 7. Collection and Transportation of Specimen
- General Principles, Containers, Rejection, Samples- Urine, Faeces, Sputum, Pus, Body fluids, Swab, Blood.
- Care and Handling of Labortory Animals
 Fluid, Diet, Cleanliness, Cages, ventilation, Temperature, Humidity, handling of Animals, Prevention of disease.
- **9. Disposal of Laboratory/Hospital Waste** Non-infectious waste, Infected sharp waste disposal, infected non-sharp waste disposal.

PRACTICAL

GENERAL PATHOLOGY

- 1. Components & setting of the Compound microscope.
- 2. Focusing of object.
- 3. Use of low & high power objectives of microscope.
- 4. Use of oil immersion lens.
- 5. Care and Maintenance of the microscope.
- 6. Different types microscopy -
 - Dark field microscopy
 - Fluorescence Microscopy
- 7. Electronic Microscopy in brief.

GENERAL MICROBIOLOGY

- 1. Preparation of swabs/sterile tubes & bottles.
- 2. Preparation of smear.
- 3. Staining.: Gram & Ziehl -Neelsen staining.
- 4. Identification of Culture Media.
- 5. Identification of instruments.
- 6. Identification of common microbes.

BASICS OF BIOCHEMISTRY, INSTRUMENTS & REAGENTS Subject Code : BMM-103

Min. Hrs - Theory : 100 Hrs & Practical : 100 Hrs.

THEORY

1. Chemistry of carbohydrates & their related metabolsim -

Introduction, definition, classification, biomedical importance & properties. Brief outline of meatbolism :

Glycogenesis & glycogenolysis (in brief), Glycolysis, citric acid cycle & its signifiance, HMP shunt & Gluconeogenesis (in brief), regulation of blood glucose level.

2. Amino acids - Definition, classification, essential & non essential amino acids.

3. Chemistry of Proteins & their related metabolism -

Introduction, definition, classification, biomedical importance Metabolism :

Transformation, Decarboxylation, Ammonia formation & transport, Urea cycle, metabolic disorders in urea cycle, catabolism of amino acids especially Phenylalanine, Tyrosine & Tryptophan, Creatine, Creatinine, Proteinuria.

4. Chemistry of Lipids & their related metabolism -

Introduction, definition, classification, biomedical importance, essential fatty acids. Brief out line of metabolism :

Beta oxidation of fatty acids, fatty liver, Ketosis, Cholesterol & it's clinical significance, Lipoproteins in the blood composition & their functions in brief, Atherosclerosis.

5. Enzymes -

Introduction, definition, classification, coenzymes, isoenzymes, properties, factors affecting enzyme action, enzyme inhibition, diagnostic value of serum enzymes - Creatinine kinase, Alkaline phosphatase, Acid phosphatase, LDH, SGOT, SGPT, Amylase, Lipase, Carbonic anhydrase etc.

6. Acid base balance concepts & disorders - pH, Buffers, Acidosis, Alkalosis

7. Hyperglycemia & hypoglycemia -

Diabetes mellitus - definition, types, features, gestation diabetes mellitus , glucose tolerance test, glycosurias,

Hypoglycemia & its causes

PRACTICAL

1- Introduction

Aim, basis, interpretation, safety in clinical biochemistry Laboratory.

2- Laboratory organisation

Instruments, glassware, sample collection & specimen labeling, routine tests, anticoagulants, reagents, cleaning of glassware, isotonic solution, standardization of methods, preparation of solution & interpretation of result, normal values.

- 3- Identification of Carbohydrates (qualitative tests).
- 3- Identification of Proteins (qualitative tests).
- 4- To study general properties of the enzyme (Urease) & Achromatic time of Salivary amylase.
- 5- Urine analysis normal & abnormal constituents of urine.
- 6- CSF & Semen Analysis Gross & Microscopic.
- 7- Glucose tolerance test & Glycosylated haemoglobin.
- 8- Centrifugation : Principle, types & applications.
- 9- Chromatography : Definition, types, RF value, description of paper chromatography & applications.
- 10-Uses, Care and Maintenance of various instruments of the laboratory.

QUALITY CONTROL AND BIOSTATISTICS Subject Code : BMM-104

Min. Hrs - Theory : 80 Hrs & Practical : 60 Hrs.

THEORY

QUALITY CONTROL

- Introduction to Quality control.
- Total quality management framework.
- Quality laboratory processes, Quality assurance, Quality assessment, Quality control, Quality planning and Quality improvement.
- Costs of conformance and non conformance, appraisal costs, prevention costs.
- Internal quality control, basic steps, sources of error and their correction methods, CAPA corrective action & preventive action.
- Sources of variation in laboratory results.
- Quality control charts, Levy- Jennings and Cusum charts.
- External quality control.
- Quality control programme, intrinsic and extrinsic and random errors.
- Current trends in laboratory accreditation, ISO certificate, West guard Rules.

BIOSTATISTICS

- 1. **Introduction**: Meaning, definition, characteristics of statistics. Importance of the study of statistics, Branches of statistics, Statistics and health science, Parameters and Estimates, Variables and their types, Measurement scales.
- 2. **Tabulation of Data**: Basic principles of graphical representation, Types of diagrams histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, Normal probability curve.
- 3. **Measures of Central Tendency**: Need for measures of central Tendency, Definition and calculation of **Mean** ungrouped and grouped, interpretation and calculation of Median-ungrouped and grouped, Meaning and calculation of Mode, Geometric mean & Hormonic mean, Guidelines for the use of various measures of central tendency.
- 4. Measures of Dispersion : Range, mean deviation, standard deviation & variance.
- 5. **Probability and Standard Distributions:** Meaning of probability of standard distribution, the binominal distribution, the normal distribution, Divergence from normality skewness, kurtosis.
- 6. **Correlation & regression :** Significance, correlation coefficient, linear regression & regression equation.
- 7. Testing of Hypotheses , Level of significance, Degrees of freedom.
- 8. Chi-square test, test of Goodness of fit & student t-test.
- 9. **Analysis of variance & covariance:** Analysis of variance (ANOVA), what is ANOVA? Basic principle of ANOVA, ANOVA technique, Analysis of Co variance (ANACOVA)
- 10. **Sampling:** Definition, Types- simple, random, stratified, cluster and double sampling. Need for sampling - Criteria for good samples, Application of sampling in community, Procedures of sampling and sampling designs errors.

PRACTICAL

QUALITY CONTROL

1. Demonstration of various methods of quality control.

BIOSTATISTICS

- 1. Calculation of Mean, Median & Mode.
- 2. Calculation of Variance and Standard Deviations.
- 3. Graphical representation of Laboratory data.

B.Sc. in Medical Microbiology (BMM) Second Year

HEAMATOLOGY, IMMUNOLOGY & BLOOD TRANSFUSION Subject Code : BMM-201 Min. Hrs - Theory : 100 Hrs & Practical : 100 Hrs.

THEORY

HEAMATOLOGY

1. Hematological Disorders

•	Classification of Anem	ia :	Morphological & Etiological
•	Iron Deficiency Anemi	a :	Distribution of body iron. Iron absorption
			causes of iron deficiency, lab findings.
•	Megaloblastic Anemia	:	Causes, Lab findings.
•	Hemolytic Anemia	:	Definition, Causes, Classification & Lab findings.

2. Basic Hematological Techniques

- Preparation of specimen collection material.
- Collection of blood specimen : various methods of collection.
- Haemolysis of blood.
- Separation of serum.
- Separation of plasma.
- Changes in blood on Keeping.
- Maintenance of specimen identification.
- Transport of the specimen.
- Effect of storage on Blood Cell morphology.
- Universal precautions.

3. Coagulation and Bleeding Disorders (in brief)

IMMUNOLOGY

- 1. Immunity
- Definition and classification
 - General Principles of Innate & Acquired Immunity.
- 2. Immune Response Humoral immunity & cell mediated immunity.
- 3. Antigen Definition, classes, properties.
- 4. Antibodies/Immunoglobulins Definition, Properties, Sub types of Immunoglublines
- 5. Antigen/Antibody Reaction/Serological Refractions -
- 6. Features of antigen/antibody Reaction
 - Precipitation
 - Agglutination
 - Complement fixation test
 - Neutralization
 - Opsonization
 - Immune adherence
 - Immuno fluorescence
 - Immuno electron Microscopic test

7. Structure and functions of Immune System

- Parts of Immune system
- T/B cells, other cells & their functions
- 8. Hyper sensitivity Reactions
- General Principles of different types of hypersensitive reactions i.e., type 1, 2, 3, 4.
 Auto immune disorders

9. ELISA

BLOOD TRANSFUSION

- 1. Blood group system, Blood grouping & cross matching
- 2. Transfusion reactions
- 3. Preparation and use of blood components.

PRACTICAL

HEAMATOLOGY

- 1. Haematological tests : Complete blood counts (Haemoglobin, TLC, DLC), ESR.
- 2. Morphology of red blood cells.

IMMUNOLOGY

- 1. WIDAL Test
- 2. VDRL Test,
- 3. RA Test
- 4. CRP Test
- Pregnancy Test & HIV Test

BLOOD TRANSFUSION

1. Blood grouping & Cross Matching.

SYSTEMIC BACTERIOLOGY Subject Code : BMM-202 Min. Hrs - Theory : 80 Hrs & Practical : 80 Hrs.

THEORY

Study of -

Staphylococcus, Streptococcus, Pneumococcus, Neisseira gonorrhoea, Neisseira meningitis, Cornybacterium diptheriae, Mycobaterium, Clostridium, E.coli, H. pylori, Klebsiella, Salmonella, Proteus, Pseudomonas, Vibrio & Spirochaetes with reference to their :

- Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & lab diagnosis.

PRACTICAL

- 1. Culture techniques
- 2. Culture media
- 3. Preparation of media
- 4. Identification of media & their uses
- 5. Culture methods & identification of common bacteria on media.
- 6. Antibiotic sensitivity testing.

PARASITOLOGY

Subject Code : BMM-203

Min. Hrs - Theory : 60 Hrs & Practical : 60 Hrs.

THEORY

- 1. Definition parastism, HOST, Vectors etc.
- 2. Classification of Parasites
- 3. Phylum Protozoa- general Pathogenic and non pathogenic protozoa.
- 4. Phylum Nemathelminths/Round words (Nematoda)
- 5. Phylum Platyhelminths class-Cestoda, class-Trematoda
- 6. Lab diagnosis of parasitic infections.

Protozoa :

1. Intestinal Amoebae

- a. E. Histolytica : Life cycle, Morphology, Disease & Lab Diagnosis
- b. E. coli : Life cycle, Morphology, Disease & Lab Diagnosis

- 2. Flagellates of intestine/genitalia
 - a. Giardia lamblia : Life cycle, Morphology, Disease & Lab Diagnosis
 - b. Trichomonas vaginalis : Life cycle, Morphology, Disease & Lab Diagnosis
- **3.** Malarial Parasite
 - a. Plasmodium vivax : Life cycle, Morphology, disease & lab diagnosis
 - b. Differences between P. vivax, P. malaria, P. falcipaum & P.ovale.

Nematodes :

Intestinal Nematodes :

- a. Ascaris : Life cycle, Morphology, disease & lab diagnosis
- b. Brief discussion about Enterobius vermicularis (Thread worm) and Ancylostoma duodenale (Hook worm)

Tissue Nematodes :

W. Bancrofti - Life cycle, Morphology, Disease & Lab Diagnosis

Phylum Platyhelminths

- a. Cestodes T. solium, T. saginata & E. granulosus.
- b. Trematodes S. haematobium & F. hepatica.

PRACTICAL

• Stool examination.

Identification of different ova & cysts in stool samples.

CLINICAL BIOCHEMISTRY Subject Code : BMM-204

Min. Hrs - Theory : 100 Hrs & Practical : 100 Hrs.

THEORY

- Photometry-Definition, laws of photometry, absorbance, transmittance, absorption maxima instruments, parts of photometer, types of photometry–colorimetry, spectrophotometry, flame photometry, fluuorometry, choice of appropriate filter, measurements of solution, calculation of formula, applications.
 Water & Mineral Metabolism-Distribution of fluids in the body, ECF & ICF, water metabolism, dehydration, mineral metabolism, macronutrients (principal mineral elements) & trace elements.
 Liver Functions & their Assessment.
 - Based on: 1- Carbohydrate metabolism 2-Protein metabolism 3- Lipid metabolism 4-Measurements of serum enzyme levels 4-Bile pigment metabolism, Jaundice, its types and their biochemical findings.
- 4- Renal Function Tests-Various Tests, GFR & Clearance
- 5- Immunodiffusion Techniques, Radioimmunoassay & ELISA-Principles & Applications.
- 6- Electrophoresis -Principle, Types & Applications.
- 7- Polymerase Chain Reaction -Principle & Applications
- 8- Autoanalysers -Principle & Applications

9- Vitamins-

Fat & water soluble vitamins, sources, requirement, deficiency disorders & biochemical functions.

10- Cardiac Profile -

In brief Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases

11- Different methods of Glucose Estimation-

Principle advantage and disadvantage of different methods. 12- Different methods of Cholesterol Estimation-

Principle, advantage and disadvantage of different methods.

PRACTICAL

(By Colorimeter / Spectrophotometer)

- 1. Blood urea estimation
- 2. Serum creatinine estimation
- 3. Serum uric acid estimation
- 4. Serum total protein estimation
- 5. Serum albumin estimation
- 6. Serum globulin estimation
- 7. Serum glucose estimation
- 8. Total cholesterol estimation
- 9. HDL cholesterol (direct) estimation.
- 10. LDL cholesterol (direct) estimation
- 11. Triglyceride estimation
- 12. Serum Bilirubin total estimation
- 13. Serum Bilirubin direct estimation
- 14. Serum amylase estimation
- 15. Serum GOT (AST) estimation
- 16. Serum GPT (ALT) estimation
- 17. Alkaline phostase estimation
- 18. Acid phosphatase estimation
- 19. Serum sodium estimation
- 20. Serum potassium estimation
- 21. Serum chloride estimation
- 22. CK-NAC estimation

B.Sc. in Medical Microbiology (BMM) Third Year

MYCOLOGY & VIROLOGY

Subject Code : BMM-301

Min. Hrs - Theory : 80 Hrs & Practical : 80 Hrs.

THEORY

MYCOLOGY

- Morphology and structure of fungi.
- Classification of fungi.
- Nutrition and cultivation of fungus.
- Cutaneous & Sub cutaneous and Systemic Mycosis.
- Lab diagnosis of fungal Infections.
- Opportunistic fungal infections.

VIROLOGY

- General characters of viruses.
- Classification of viruses.
- Lab diagnosis of viral infections.
- Cultivation of viruses.
- Bacteriophages
- Retro viruses HIV, Hepatitis virus, Pox virus.
- Picrona virus Polio.
- Orthomyxo virus Influenza.
- Arbo virus Chikungunya, Dengue.
- Herpies and Adeno virus.

PRACTICAL

- Culture Media used for fungus.
- Fungal culture
- Methods of lab diagnosis of viruses.

APPLIED MICROBIOLOGY

Subject Code : BMM-302

Min. Hrs - Theory : 60 Hrs & Practical : 60 Hrs.

THEORY

- 1. Urinary tract infections
- 2. Nosocomial infections
- 3. Pyrexia of unknown origin
- 4. Immunization

PRACTICAL

- 1. Assignment of Microbiology
- 2. Antimicrobial senstivity testing
- 3. Slit smear preparation
- 4. Culture & sensitivity, innoculation techniques of different specimens

AUTOMATION IN MEDICAL MICROBIOLOGY Subject Code : BMM-303

Min. Hrs - Theory : 60 Hrs & Practical : 100 Hrs.

THEORY

- 1. Automation Introduction, meaning, advantages, history
- 2. Precipitation assays
 - a. Double diffusion method (ouchterlony techniques)
 - b. Counter immunoelectrophoresis
 - c. Radial immunodiffusion
 - d. Quantitative immunoelectrophoresis
 - e. Immunonephelometry
 - f. Immunoelectrophoresis
 - g. Immunofixation (immunoblotting)
 - h. Western blot

- 3. Assay based on agglutination
 - a. Bacterial agglutination
 - b. Hemagglutination
 - c. Agglutination of inert particles coated with antigen or antibody.
- 4. Tests based on complement fixation.
- 5. Test based on immunofluoresence
 - a. Immunofluoresence tests in microbiology
 - b. Qunatitative immunofluoresence assay
 - c. Immunofluorescence tests for the detection of auto-antibodies
 - d. Immunofluorescence tests to detect tissue fixed antigen-antibody complex.
 - e. Flow cytometry-surface staining, cytoplasmic staining, DNA-analysis, sorting
 - f. Radio immunoassay
 - g. Enzyme immunoassay
- 6. Cell culture- primary, secondary and those using established cell lines.
- 7. Latest trends in Automation, Biochips, Lab on a chip (LoC), Nanosensors- advantages and disadvantages, PCR and its clinical applications.

PRACTICAL

Various experiments using ELISA, PCR, Semi-Autoanalyzer or fully automated analyzer