

MNPE-09425068494

In Collaboration with

**Karnataka State Open
University**

Manasagangotri, Mysore-6

**Syllabus of
Master of Science in Microbiology
(M.Sc. Microbiology)**

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Master of Science in Microbiology (M.Sc. Microbiology) Program Structure (Face to Face)

Code	Course Title	Credits
1st Semester		
MSM-101	Human Anatomy	3
MSM -102	Human Physiology	3
MSM -103	Clinical Bio Chemistry	3
MSM -104	Histopathology	3
MSM -105	Introductory Biology	3
MSM – 106	Communication and Soft Skills	3
MSM -107	Practical	3
	Total Credits	21

Code	Course Title	Credits
2nd Semester		
MSM -201	General Bacteriology	3
MSM -202	Immunology	3
MSM -203	Hematology	3
MSM -204	Basic Cellular Pathology	3
MSM -205	Practical	3
	Total Credits	15

Code	Course Title	Credits
	3rd Semester	
MSM -301	Systematic Bacteriology	3
MSM -302	Applied Microbiology	3
MSM -303	Microbial Molecular Genetics	3
MSM -304	Molecular Biology	3
MSM -305	Practical	3
	Total Credits	15

Code	Course Title	Credits
	4th Semester	
MSM -401	Virology	3
MSM -402	Mycology	3
MSM -403	Parasitology	3
MSM -404	Research Methodology & Techniques	3
MSM -405	Practical	3
	Total Credits	15

SEMESTER I

MSM-101: Human Anatomy

Total Credit :3

Block1

Unit 1

- 1-Introduction of anatomy and Histology,
- 2-Elementary Histology of cell,
- 3-Tissues of the body organs and system,

Unit 2

- 1- Elementary Anatomy and Histology of Skeletal System.
- 2- Development of bones, types of bones,
- 3- Micro-anatomical and gross structure of bones,

Unit 3

- 1- Osteology of human skeleton and various movement of joints.
- 2- Muscular System Structure and type of muscles in human body, important muscles and their group action.
- 3- Circulation System Structure of heart and blood vessels, Systemic circulation, pulmonary circulation, Portal circulation, and coronary circulation.

Unit 4

- 1- Lymphatic System Lymph vessels, Lymph nodes and Lymphoid organs, their structure and functions.
- 2- Digestive System Gastrointestinal tract and associated glands (Salivary Glands, Liver, Pancreas etc).
- 3- Respiratory System Trachea, Lungs including other air passages.

Block 2

Unit 1

- 1-Urinary System Kidney, urethra and urinary bladder etc.
- 2-Endocrine System -Thyroid glands, Parathyroid glands, Adrenal glands and Pituitary glands.
- 3-Female and Male reproductory organs System.

Unit-2

- 1- Skin and its appendages,
- 2- Special sense organs: Eye, Ear, Nose Taste buds, Subcutaneous sense organs.
- 3- Nervous System: Brain, Spinal cord and peripheral nerves.

Unit –3

Respiratory Organs:

- Nasopharynx
- Or pharynx
- Larynx
- Trachea
- Bronchi
- Lungs (and their lobular segments)

Unit-4

- 1- Surface Markings of the Body:
 - Nine regions of the abdomen
 - Four quadrants of the Hip
- 2- Introduction of different Vital Organs:

Block 3

Unit 1

Respiratory Organs:

- Nasopharynx
- Or pharynx
- Larynx
- Trachea

Unit 2

- Bronchi
- Lungs (and their lobular segments)
- Thoracic cavity
- Pleura and Pleural cavity

Unit 3

Circulatory Organs

- Anatomical position of the heart
- Pericardium of the heart
- Chambers of the heart

Unit 4

- Great vessels of the heart
- Valves of the heart

MSM-102: Human Physiology

Total Credit : 3

Block 1

Unit 1

- 1- Introduction Physiology
- 2- Brief description of Physiology
- 3- Terms used in Physiology
- 4- System of the body

Unit 2

- 1- The body fluids
- 2- Tissue fluids exchange
- 3- Odema and Swelling

Unit 3

- 1- Cell structure
- 2- Cell division
- 3- Function of Cell
- 4- Reproduction

Unit 4

Brief Description

- 1- Ear
- 2- Nose
- 3- Eyes

Block 2

Unit 1

- 1- Introduction of Tissue
- 2- Function of Tissues
- 3- Types of Tissue
- 4- Introduction of Cartilages

Unit 2

- The important physico-chemical laws applied to physiology
- 1- Diffusion
 - 2- Osmosis
 - 3- Bonding
 - 4- Filtration
 - 5- Dialysis
 - 6- Surface Tension
 - 7- Adsorption
 - 8- Colloid

Unit 3

- 1- Neuron and its function, spinal cord and reflex action,
- 2- sensory end organs and sensory path ways, cerebral cortex and motor path ways.
- 3- Maintenance of posture and locomotion, automatic nervous system, Physiology of vision, hearing test and olfaction.

Unit4

- 1- Types of muscles, innervations of muscles,
- 2- Neuromuscular transmission,
- 3- Mechanism of muscular contraction.

Block 3

Unit 1

Cardiovascular System

- 1- Anatomy and Physiology of Heart,
- 2- Define and function of Veins and arteries in the circulatory system
- 3- Circulation-systematic and pulmonary (In brief).
- 4- Brief review of chamber of Heart- the cardiac cycle

Unit 2

Digestive System

- 1- Physiology and Anatomy of mouth, pharynx, stomach, small intestine, large intestine, Absorption of food and its excretion.
- 2- Role of Bile in Digestion and Excretion
- 3- Brief description of Liver and function

Unit 3

Respiratory System

- 1- Brief description of Larynx, Trachea and
- 2- Brief description of Lungs.
- 3- Respiratory movement and rate of Respiration

Unit 4

Urinary System

- A) Structure and functions of Kidney, Uretures, Bladder, Urethra and Nephron.
- B) Composition of normal urine.
- C) Related Diseases- Cystitis, Nephritis, Pyelonephritis
- D) Disorder of micturition, renal failure, uraemia

MSM-103: Clinical Biochemistry

Total Credit: 3

Block 1

Unit 1

- 1- Laboratory management and planning,
- 2- Reception and recording of specimens, Cataloging and indexing,
- 3- Maintenance of laboratory records.

Unit 2

- 1- Knowledge of calibration and volumetric glass wares the underlying principles, care and use of analytical balance, electrical balance,
- 2- Photoelectric colorimeters, flame Photometer, PH meter, Absorptionmeter, Visual
- 3- Colorimeters, Spectrometers, and Electrophoretic apparatus.

Unit 3

- 1- Stiring and cleaning of glass wares knowledge of common types of pipettes, Flasks, Funnels, other glass waes and Kipp's apparatus etc.
- 2- Anticoagulants, collection and preservation of specimens.
- 3- Basic knowledge of Physical Chemistry: Atom, molecule, valency, ion, atomic weight, molecular weight, acid, base salt-acidimetry and alkalimetry, reduction, and ionization. Basic knowledge of element, metals and non-metals, their compound and salts, organic solvents, cobohydrates, fats, protein, aminoacids, urea, uric acid and enzyme, indicators.
Symbols of molecular weight of somecommonly used compounds-Acetric acid, Amonium Hydroxide, clcium chloride copper Sulphate hydrochloric acid Nitric acid sodium carbonate sodium chloride, Sodium Hydroxide, Sulphuric acid, carbon, Cholride, Hydrogen, Oxygen, Nitogen, Phosphorus, Pottasium Silver, Sodium and Sulpher.

Unit 4

- 1- Molar Normal and Abnormal solutions, PH buffer solutions acid Preseration of common solutions, Gravimetric and Volumetric methods, Electrophoresis.
- 2- Chemical Examination of Urine for Protin, Sugar, Blood, Ketone bodies, Bile Pigment and salt, Urobillinogen, Calcium Chloride etc Preparation of solutions,
- 3- Principle, Specimen, Procedure Calculation, normal value of each tests.

Block -2

Unit 1

1- Preparation of Protein free

Filtrate, Liver function test:

Serum Bilirubin (Direct, Indirect & Total)

SGOT, SGPT, ALP, S.PROTEIN, S.ALBUMIN, SERUM GLOBULIN

d.Serum

S.albumine.SGI

obulin.

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2-Lipids:

1 Serum Cholesterol

3- Glucose Metabolism.: Blood sugar fasting and post prandial-(Toluidine methods folin –wu and Glucose oxidase methods)

b .Glucose Tolerance test

c. Urine Glucose.

Unit 2

1- Carbohydrate.: nomenclature, classification and properties.

2- Amino acid : Classification, Essential and nonessential amino acids

3- Protein : Definition, classification and structure

Unit 3

1- Mechanism of Glycolysis and its regulation.

2- Mechanism of Glycogenesis

3- Mechanism of Glyconeogenesis.

Unit 4

1- Mechanism of Krebs's and Cori's cycle.

2- Mechanism of Blood sugar regulation and glycosuria.

3- Glucose tolerance test.

Block 3

Unit 1

1- Deamination and Transamination of Protein.

2- Urea formation.

3- Creatine Metabolism.

Unit 2

- 1- Definition and importance of β oxidation of fatty acid.
- 2- Function and clinical importance of Triglycerol.
- 3- Function and importance of calcium.

Unit 3

- 1- Blood: composition, Function and separation of Plasma protein, Blood coagulation
- 2- Chemistry and function of hemoglobin including porphyrin, and bilirubin metabolism.
- 3- Metabolic disorders: Dialysis

Unit 4

- 1- Structure and function of purine and pyrimidine.
- 2- Role of nucleic acid in genetic engineering.
- 3- Metabolism of Purine synthesis.

MSM-104: Histopathology

Total Credit :3

Block 1

Unit 1

- 1- Introduction of Histopathology
- 2- Reception
- 3- Registration

Unit 2

- 1- Fixation of Specimen before grossing
- 2- Fixatives – their merit and demerit
- 3- Grossing of specimen

Unit 3

- 1- Labeling of tissues
- 2- Decalcification
- 3- Manual processing schedule

Unit 4

- 1- Dehydration
- 2- Clearing
- 3- Impregnation

Block 2

Unit 1

- 1- Brief description of Automatic tissue changers
- 2- Autotechnicon processing schedule
- 3- Replacement of processing fluid

Unit 2

- 1- Embedding of tissue specimens
- 2-Trimming of block

Unit 3

- 1- Define Microtome
- 2- Types of Microtome's
- 3- Types of Knives
- 4- Sharpening of knives

Unit 4

- 1- Preparation of section
- 2- Section cutting
- 3- Frozen Section
- 4- Staining Procedure

Block 3

Unit 1

Routine staining procedures

- 1- Method of staining when hematoxylin is used
- 2- Preparation of Harri's Alum hematoxylin
- 3- Preparation of mayer's hematoxylin

Unit 2

- 1- Counter stain for hematoxylin stain
- 2- Z.N. stain for AFB
- 3- Crystal violet amyloid stain

Unit 3

- 1- Introduction of Cytology
- 2- Three important application of Gynaecological Cytology
- 3- Advantage of the procedure of the FNAC
Limitations

Unit 4

- 1- Define fine needle aspiration cytology
- 2- Requirement for the FNAC
- 3- Aspiration of intrathoracic masses (Lung, Liver, Prostatic)

MSM-105: Introductory Biology

Block 1

Unit 1

1. Nature and Scope of Biology
2. Basis and origin of life, Living and non – living common features of life process.
3. Energy Transformation.

Unit 2

1-Kingdoms of life, or Biological Classification, species and population,
2-Biotic community, Biosphere.

3-Cell as a unit of life : Prokaryotic and Eukaryotics cell, Plant and animal cell,

Unit3

1-cell structure, membrane organization and cell organelles.

2- Cell function, cell division mitosis and meiosis, cell cycle .

3-Introduction to Bio Molecules: Structure and properties of mono, oligo and poly Saccharides
Structure and properties of fatty acids, glycerolipids, phospholipids, glycolipids,
steroids.

Unit 4

1-Structures and Properties of amino acids peptides and protein.

2-Structure and properties of purines, Pyrimidines, nucleosides, nucleotides,
polynucleotides,

3- Ribonucleic acids and Deoxyribonucleic acids, nucleoprotein complexes.

4. Metabolism: Introduction of Respiration and Photosynthesis.

Block 2

Unit-1

1-Evidence of Origin of Life, -

2-Staneley-Miller Experiment

3-,Lamarkism,Darwinism,

Unit2-

1- Discovery of Antibiotic

2- History of Antibiotic- Penicillin,

3- Application of Antibiotics in Medical field.

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Unit-3

1-Val-Helmont's Experiment.

2-Difference between Living and Nonliving Cell,
4- Viruses ,

Unit-4

1-Prokaryotic Cells
2- Eukaryotic cell
3-Cell organelle –Structure and Function

Block -3

Unit-1

1-Discovery of Cell, their history.
2-Unit of measurement of cell
3-Plasma membrane.

Unit-2

1-Introduction of Biomolecule
2-Isomerism
3-Hydrophobic and Hydrophilic bond

Unit-3

1-History and Definition of Carbohydrate :
2-Classification of carbohydrate
3-Structure of Carbohydrate.

Unit-4

1-Definition of Amino acid –
2- Essential and Nonessential Amino acid
3-Polypeptide chain.

MSM-106: Communication & Soft Skills

Total Credit :3

Block-1

UNIT I

1. Parts of Speech
2. Punctuation
3. Vocabulary Building

UNIT2

1. Phonetics
2. Introduction for Communication Skills
3. Need for Communication Skills

UNIT 3

1. Office Management, types of correspondence
2. Receipt and Dispatch of Mail
3. Filing Systems

UNIT 4

1. Classification of Mail
2. Role and function of correspondence, MIS
3. Managing Computers.

Block-2

UNIT 1

1. Types of Letters-Formal / Informal
2. Importance and Function
3. Drafting the Applications

UNIT 2

1. Elements of Structure
2. Preparing the Resume
3. Do's & Don'ts of Resume, Helpful hints.

UNIT3I

1. Importance of Presentation skills
2. Capturing Data
3. Voice and Picture Integration

UNIT 4

1. Guidelines to make Presentation Interesting
2. Body Language
3. Voice Modulation

Block-3

UNIT 1

1. Audience Awareness
2. Presentation Plan
3. Visual Aids

UNIT 2

1. Forms of Layout
2. Styles of Presentation.
3. Oral representation

UNIT 3

1. Types of Interview
2. Preparing for the Interviews
3. Attending the Interview

UNIT 4

1. Interview Process
2. Employers Expectations
3. General Etiquette, dressing sense, postures & Gestures

MSM-107: Practical

Block-1

Unit 1

- Identification of bones skull,
- Identification of upper limb.
- Identification of lower limb.

Unit 2

- Collection of Venous Blood
- Collection of Capillary Blood
- Making of thin & thick smear
- Staining procedure of smear (field stain, Leishman's stain, and giemsa's stain) for DLC

Unit 3

- Determine Hemoglobin by Sahli's and Cyanmet Hemoglobin method
- Determine Total leucocyte count
- Determine RBC count
- Determine Platelet count

- Determine ESR by westergren's method, wintrobe's method and PCV by wintrobe's method

Unit 4

Operation of clinical equipments

- Microscope, Centrifuge, incubator, Hot air oven, autoclave, colorimeter, hot plate with magnetic stirrers, water bath and vortex shaker

Block 2

Unit 1

Urine Analysis

- Determine sugar in urine (Benedict's test)
- Determine bile salt and bile pigment
- Determine albumin
- Determine occult blood in urine
- Determine urobilinogen in urine

Unit 2

- Qualitative estimation of occult blood in stool
- Procedure of Ph- Reaction of stool
- Preparation of stool specimen slide for microscopic examination
- Identification of ova and cyst

Unit 3

Staining technique

- Sputum for a AFB stain (Ziehl – Neelsen stain)
- Gram stain
- Identification of Gram positive and Gram negative organism

Unit 4

- Identification of normal and abnormal sperm
- Collection of semen specimen
- Determination of fructose in semen

Block-3

Unit-1

1. Study of parts of Compound Microscope
2. Study of mitosis in onion root tip and animal cell (grasshopper)
3. Study of meiosis in onion flower buds, and testis of grasshopper.

Unit-2

- 1- Assay writing.
- 2- Letter writing.
- 3- Project writing.

Unit-3

- 1- Study of cyclosis in leaf cell of Hydrilla, or Tradescantia and in Paramecium.
- 2- Study of cell wall components (cellulose, lignin, suberin and mucilage).
- 3- Study of mitochondria by staining with a Janus Green.
- 4- Study of specimens and their identification with reason - Bacteria, Oscillator, Spirogyra, Rhizopus, mushroom/bracket fungi, yeast, liverwort, moss, fern, Pinus, one monocotyledon, one dicotyledon and lichens.

Unit-4

- 1- Study of characters of specimens and identification with reason - Amoeba, Hydra, Liver - Fluke, Ascaris, Leech, Earthworm, Prawn, Silk moth honey bee, snail, Starfish, Dogfish, Rohu, Frog, Lizards, Pigeon/ any other bird and rabbit/ any other mammal.
- 2- Study of squamous epithelium, muscle fibres, nerve cells and mammalian blood film through temporary/permanent slides.
- 3- Study of external morphology of earthworm, cockroach, frog and rat through models

SEMESTER II

MSM-201: General Bacteriology

Total Credit :3

Block-1

Unit-I

1. Cell Structure
Morphology, Stainings, detailed structure in comparison to Eucaryotic Cell, Bacterial anatomy.
2. Microscopy
Various optical methods available for viewing microorganisms and their application,
3. Overview of microbial world Classification.

Unit-2

- 1-Basic Principles and classification systems.
- 2-Growth, survival of microorganisms
 - growth curve
 - growth parameters
- 3-Survival of micro organisms in natural environment.

Unit-3

- 1-Role of antimicrobial agents
- 2-Cultivation of Micro organisms
- 3-Growth requirements

Unit-4

- 1-sources of metabolic energy
- 2-Bacterial nutrition
- 3-methods of cultivation

Block-2

Unit-1

- 1-Microbial Metabolism
- 2-Metabolism of bio synthesis and growth.
- 3-Bio synthesis pathway

Unit-2

- 1-Energy yielding metabolism
- 2-Regulation of Glycolysis.
- 3- Regulation of TCA.

Unit-3

- 1-Mutation
- 2-conjugation
- 3-genetic mechanism of drug resistance

Unit -4

- 1-Genetic engineering
- 2-Destruction of micro organism.
- 3-sterilization and disinfection-antimicrobial agents

Block-3

Unit-1

- .1-General principles in Diagnostic Microbiology
- 2-collection and handling of various samples
- laboratory safety
- 3-Antimicrobial susceptibility and assays

Unit 2

- 1- Lab animal an introduction.
- 2- Sterlization of glass ware .
- 3- Sterlization of Media.

Unit-3

- 1- Ag-Ab intraction reaction.
- 2- ELISA
- 3- RIA.

Unit-4

- 1- Precipitation reaction.
- 2- Agglutination reaction.
- 3- Operation of Autoclave.

MSM-202: Immunology

Total Credit :3

Block 1-

Unit 1

- 1-Immune response : Type of Immunity, Antigens and haptens.
- 2-Anatomy of Lymphoid organs; primary and secondary Lymphoid organs.
- 3-ImmunogLobulin Structure, function and synthesis, memory ceLLs Lymphocyte differentiation..

Unit 2

- 1-BioLogy of compLement systems : structure and function of MHC cLass I & II moLecuLes.
- 2-Antigen recognition and presentation, ceLL mediated immune responses.
- 3-Hypersensitivity reactions; Immune suppression and Immune ToLerance immune disorders, TranspLanation.

Unit 3

1-Antigen - IsoLation, purification and characterization of various antigens and haptens from pathogens and other bioLogical moLecules by biophysical and chemical and affinity separation methods.

2- Production of antibodies, purification of antibodies,

3-Quantitation of immunoglobulin by RID, EID and nephLometry.

Unit 4

1-Purification of mononuClear from peripheral bLood; isoLation and characterization of T ceLL subsets; B

cells and macrophages.

2-Fluorescent Activated cell sorter (FACS); Mitogen and Antigen induced LymphoproLiferation assay.

3-Cell mediated LymphoLysis; Mixed Lymphocyte reaction.

4-Assessment of deLayed hypersensitivity reactions; Macrophage cuLtures.

Block 2-

Unit 1

1- Cells and Organs Of the immune system.

2- Innate and Adaptive immunity.

3- Basic structure of Antibodies.

Unit -2

1- Antibody binding site, Antibody mediated effector functions.

2- Antibody classes and Biological Activity.

3- Antigenic Determinnants on immunoglobulins.

Unit-3

1- Cell of the immune system : MononuClear ceLLs and granuLocytes, Lymphocytes and their subsets

2- RoLe of compleMent system in immune responses.

3- Hybridoma and monocLonaL antibody production.

Unit-4

1-Immuno-diagnosis and AppLications of monocLonaL antibodies in biomedical research; human monoclonal antibodies,

2-CataLytic antibodies; compleMent fixation test; assessment of immune complex in tissues.

3-T-cell Receptor:

Block 3

Unit 1

- 1- Hematopoiesis
- 2- Cells of the immune system.
- 3- Organ of the immune system.

Unit 2

- 1- Infection and immunity.
- 2- Soluble molecule and membrane associated receptors.
- 3- Cell type of Innate immunity.

Unit 3

- 1-Isolation of antibody through different method.
- 2- Describe Isotype, Allotype, Idotype.
- 3-Multigene Organization of Ig Genes

Unit-4

- 1-Cytotoxic T cells and their mechanism of action,
- 2-NK cells and mechanism of target cell destruction.
- 3-Vaccine technology including DNA vaccines; identification of T & B epitopes for vaccine developments,
- 4-Immune technology and infectious diseases. Immunoscreening of recombinant Library.

MSM-203: Hematology

Total Credit :3

Block 1

Unit 1

- Introduction of Clinical Hematology
- Apparatus & Instruments used in Hematology Lab
- Definition of Blood
- Composition of Blood & their functions

Unit 2

- Hematopoiesis
- Leucopoiesis
- Erythropoiesis
- Thrombopoiesis
- Normal sites and site for poiesis
- Life span of RBC, WBC & Platelet

Unit 3

- Collection of Blood – Collection of capillary & Venous Blood
- Difference between Venous and Capillary Blood
- Types of Anticoagulants
- Hematological values for normal adults

Unit 4

Estimation of Hemoglobin

- Define Hemoglobin
- Functions of Hemoglobin
- Types of Determination in Laboratory
- Working principle of Hemoglobin by different methods.
- Normal value
- Physiological and Pathological variation of Hemoglobin
- Causes of Anemia

Block 2

Unit 1

Estimation of Total Leucocyte count

- Definition
- Composition of Turke's fluid (WBC Diluting Fluid)
- Reagents and Materials required
- Procedure and calculation
- Normal value and clinical significance

Unit 2

Total Red Blood Cell Count

- Principle
- Composition of Hayem's Fluid (RBC diluting Fluid)
- Apparatus and materials
- Procedure and calculation
- Observation and Results
- Normal value, Physiological and Pathological variation

Unit 3

The packed Cell Volume (PCV, Hematocrit, HCT)

- Define PCV
- Principle
- Apparatus and Material
- Procedure
- Observation and Results
- Normal value and clinical significance

Unit 4

Erythrocyte Sedimentation Rate (ESR)

- Introduction of ESR
- Principle
- Apparatus and Material
- Procedure

- Observation and Results
- Normal value and clinical significance
- Causes of Rapid increase and Rapid Decrease of ESR

Block 3

Unit 1

Normal Blood Standard (Absolute corpuscular values and indices)

- Relevance
- Apparatus & Materials
- Calculation
- Mean Corpuscular Hemoglobin
- Mean Corpuscular Volume
- Mean Corpuscular Hemoglobin
- Mean Corpuscular Hemoglobin concentration
- Normal values and clinical significance

Unit 2

- Making of Peripheral Blood Smear
- Staining of thin & thick Blood film
- Type of Staining & their composition
- Requirements for staining procedure
- Morphology of RBCS, WBCS, Platelets (Normal and Abnormal)

Unit 3

Test for sickle Cell anemia

- Principle
- Material and reagent
- Method
- Microscopic examination

Unit 4

Brief Description

- Leukemia
- Anemia
- Sickle Cell Anemia
- Hemophilia

MSM-204: Basic Cellular Pathology

Total Credit :3

Block 1

Unit 1

Urine Analysis

- Composition of Urine
- Collection of Urine Specimen
- Preservation of Urine
- Additional information

Unit 2

- Physical examination of Urine
- Chemical examination
- Microscopic examination
- Clinical significance
- Pregnancy test

Unit 3

Stool Analysis

- Composition of stool
- Specimen collection
- Precautions after collection
- Inspection of stool (Physical examination)

Unit 4

- Chemical examination of stool
- Microscopic examination
- Abnormal consistency and expected reasons
- Abnormal color and possible reasons

Block 2

Unit 1

Semen Analysis

- Introduction of Semen
- Collection of Semen Specimen
- Precautions during collection
- Storages of Semen

Unit 2

- Physical examination of Semen
- Chemical examination
- Microscopic examination
- Morphology of normal and abnormal sperm

Unit 3

- Introduction of CSF
- Composition
- Collection and processing of CSF specimen
- Important precautions

Unit 4

- Physical examination of CSF
- Chemical examination
- Microscopic examination
- Clinical Significance

Block 3

Unit 1

Sputum Analysis

- Composition of Sputum
- Collection of sputum specimen
- Preservation

Unit 2

- Physical examination of urine
- Staining Bacteria in a culture by Gram's Staining Method
- AFB staining method
- Microscopic examination

Unit 3

Give the clinical condition, abnormal finding in sputum

- A) Quantity
- B) Color
- C) Consistency & appearance
- D) Odour

Unit 4

Write the normal, abnormal finding & clinical significance of following cells in sputum

- A) Neutrophils
- B) Lymphocytes
- A) Eosinophils
- D) Erythrocytes

MSM-205 : Practical

Total Credit : 3

Block-1

Unit-1

- 1- Staining of Peripheral blood film ,the differential leucocyte.
- 2- Isolation of antigen.
- 3- Isolation of Antibody.

Unit-2

- 1- Operation of Polymerase Chain Reaction.
- 2- Operation of Gel Doc instrument.
- 3- Operation of Spectrophotometer.

Unit-3

- 1- Pregnancy test.
- 2- Ag-Ab reaction
- 3- Precipitation reaction.

Unit-4

- 1- Agglutination reaction
- 2- Operation of Paper Chromatography.
- 3- Operation of Thin Layer Chromatography

Block-2

Unit-1

- 1- Isolation of antibiotic producing microorganism from soil.
- 2- Use of alginate for cell immobilization.
- 3- Detection of coli—for determination of purity of potable water.

Unit-2

- 1- Determination of COD/BOD for a sewage sample.
- 2- Determination of the efficiency of removal of air. Pollutant by using air samples.
- 3- Test for the degradation of aromatic hydrocarbon by bacteria.

Unit-3

- 1- Collection of Plant's leaves.
- 2- Preservation of raw material for Tissue culture.
- 3- Preparation of homogenized tissue.

Unit-4

- 1- Transfer of Bacterial colony.
- 2- Formation of replica plate.
- 3- Isolation of single cell.

Block -3

Unit-1

- 1- Preparation of fissure culture medium for plants
- 2- Preparation of single cell suspension from spleen or thymus & plants.
- 3- Protoplast fusion

Unit-2

- 1- Cell counting
- 2- cell viability .
- 3- Callus Propagation,

Unit-3

- 1- organogenesis,
- 2- transfer of plant to soil.

- 3- Blood film preparation and identification of cells.

Unit-4

- 1- . Separation of serum proteins by electrophoresis.
- 2- Study of antigen and antibody interaction by double diffusion method.
- 3- Study of antigen and antibody interaction by immuno-electrophoresis.
- 4- Study of antigen and antibody interaction by counter-current immuno-electrophoresis.

SEMESTER III

MSM-301: Systematic Bacteriology
: 3

Total Credit

Block-1

Unit-1

- 1- Culturing environmental samples (air-exposure plates and simple swabbing).
- 2- Gaining proficiency with the microscope.
- 3- Simple and differential staining methods including gram, capsule, acid-fast and endospore stains.

Unit-2

- 1- Basic pure culture procedures including transfer techniques and streak plates.
- 2- The plate count method.
- 3- Microbial count of hamburger – “total” and gram-negative.

Unit-3

- 1- Introduction to nutritional requirements and bacteriological media.
- 2- Requirements of certain bacteria for growth factors.
- 3- Alteration of bacterial characteristics due to changes in the environment.

Unit-4

- 1- Aerobic respiration and fermentation and their role in the test for “oxygen relationship” as per the Bergey’s Manual definitions;
- 2- correlation of oxygen relationship designations with related physiological processes in bacteria.
- 3- A study of the bacterial growth curve with determination of the growth rate of an *E. coli* culture.

Block-2

Unit-1

- 1- Microscopic and cultural methods for the determination of bacterial motility.
- 2- Anaerobic respiration as demonstrated by the test for nitrate reduction.
- 3- **Characterization, Differentiation and Identification of Bacteria:** Comparative morphology and physiology of selected species and an introduction to base sequencing and phylogenetic trees.

Unit-2

- 1- Detection and isolation of mutants and recombinants.

- 2- Quantitation of bacteriophages and use of bacteriophages to assist bacterial identification.
- 3- Determination of susceptibility of bacteria to various antibiotics.

Unit-3

- 1- Principles of enrichment and isolation of bacteria from natural sources.
- 2- Consideration of microbial cycling of elements – particularly N, C, S and O.
- 3- Isolation of antibiotic-producing, endospore-forming and nitrogen-fixing bacteria from soil.

Unit-4

- 1- Isolation of anoxygenic photosynthetic bacteria from water samples.
- 2- Anoxygenic phototrophy with a comparison to oxygenic phototrophy.
- 3- How to write a formal lab report and present a poster.

Block-3

Unit-1

- 1- Examination of lactic acid bacteria including those involved in yogurt and sauerkraut production.
- 2- Brief study of *Staphylococcus*, *Streptococcus* and *Neisseria* including their isolation and the tests
- 3- for hemolysis, coagulase and oxidase.

Unit-2

- 1- Isolation and identification of enteric bacteria including the use of serology in the identification of *Salmonella*. (Clinical procedures are emphasized along with the use of correct and current taxonomic terminology.)
- 2- Basic principles concerning pH-based differential media and the formulation of such media to distinguish certain physiological types of bacteria.
- 3- Method of serial dilution.

Unit-3

- 1- **Quantitative Microbiology II:** The Most Probable Number (MPN) method.
- 2- Bacteriological examination of water: Quantitation of “total” bacteria; enrichment, detection,
- 3- isolation and identification of coliforms.

Unit-4

- 1- Systematic Study of microbes of medical Importance
 - a) Gram +ve cocci
 - b) Gram -ve cocci
 - c) Gram +ve Bacilli
 - d) Gram -ve Bacilli
 - e) *Vibrio cholera*
 - f) *Brucella*
 - g) *Haemophilus*
 - h) *Bordetella*
 - i) *Spirochaetes*

j) Anaerobic Bacteria, etc.

2- Study of the morphology I cultural, biochemical and other biological properties and characteristics of above said medically important Bacteria.

3- The mechanism of virulence and pathogenesis and pathology.

4- The disease caused by them epidemiology treatment prevention and control.

MSM-302: Applied Microbiology

Total

Credit : 3

Block 1

Unit- 1

1-General characteristics & classification of bacteria according to Bergey's manual of systematic bacteriology.

2-Nutritional requirements & physical conditions necessary for cultivation of bacteria,

3-Properties of bacteriological media and its types,.

Unit 2

1-Milestone in Microbiology- Recent development and future trends.

2- Anatomy of Prokaryotes & Eukaryotes-Morphology-ultrastructure of Bacteria, Fungi,

3- Anatomy of Algae, Protozoa and Viruses.

Unit 3

1-Classification of bacteria on the basis of their nutritional requirements,

2-Transport of substances across membranes.

3-Procedure and principle involved in gram's staining, acid fast staining, flagella staining, endospore staining.

Unit 4

1-Definition of growth, mathematical expression of growth, measurement of growth field;

2-Synchronous growth, continuous culture,

3-Effect of environmental factor on growth.

Block 2

Unit 1

1-Historical background of Microbiology.

2-Origin of Life.

3-Microorganism and the Evolution of the earth.

Unit 2

1- Binomial System, Taxonomic Ranks.

2- Phenetic classification and Bergey,s Manual .

3- Viruses:-properties and classification .

Unit 3

- 1- Virus purification and Assay.
- 2- Detail Morphological structure of virus.
- 3- Bacteriophage.

Unit 4

- 1-Rhizosphere, phylloplane & role of microorganism in productivity of ecosystem.
- 2-Interaction between microorganism, and with plants and animals.
- 3-Biogeochemical cycle. Microbes & bio-deterioration.

Block 3

Unit 1

- 1- Plant virus.
- 2- Viruses of Fungi and Algae.
- 3- Animal Viruses.

Unit 2

- 1- Cytological infections and cell damage
- 2- Insect Virus.
- 3- Viroids and Prions.

Unit 3

- 1- Morphology of Mycoplasma.
- 2- Mycoplasma causing Plant and Human disease.
- 3- Mycoplasma virus.

Unit 4

- 1- Nomenclature and Numerical nomenclature of Bacteria.
- 2- Shape and arrangement of Bacterial cell.
- 3- Bacterial recombination:- Transformation, Conjugation, Transduction.

MSM-303: Microbial molecular genetics

:3

Total Credit

Block-1

Unit 1

- 1- Principles of microbial genetics : basic procedure and terminology,

- 2- Establishment of crosses, selection and classification of variations, and cis—trans complementation.
- 3- Genome organization in bacteria,

Unit 2

- 1- Genome organization in viruses .
- 2- Genome organization in eukaryotic microorganisms.
- 3- Nucleic acid replication.

Unit-3

- 1- Genetic analysis of bacteria (including Cyanobacteria and actinomycetes.)
- 2- Gene transfer—transformation, conjugation, transduction.
- 3- methods of gene mapping.

Unit-4

- 1- Extra-chromosomal genetic elements and their inheritance.
- 2- Genetic analysis of bacteriophages including cyanophages.
- 3- Genetic mechanisms in algae, yeast and moulds.

Block-2

Unit 1

- 1- Origin and mechanism of variations in microbes.
- 2- Gene-protein relationship:transcription,
- 3- Translation,

Unit-2

- 1- Genetic code.
- 2- Regulation of gene expression.
- 3- Genetic engineering; recombinant DNA, restriction endonucleases, vectors,

Unit-3

- 1- Principles of gene cloning, shot-gun.
- 2- Genomic and cDNA cloning.
- 3- criteria for the expression of recombinant DNA.

Unit-4

- 1- Characterization of recombinant DNA (Genetic, immunochemical and nucleic acid hybridization methods).
- 2- Sequencing of nucleic acids (Sanger's and Maxam and Gilbert's methods),
- 3- Applications of genetic engineering in medicine,

Block-3

Unit 1

- 1- Applications of genetic engineering in agriculture and industry.
- 2- Overview of course. The beginnings of molecular biology

3- The structure of DNA

Unit-2

- 1- Genome organization: From nucleotides to chromatin.
- 2- Study of body tissues- Epithelial tissue, connective tissue including bone and cartilage, muscular tissue
- 3- Study of various systems- Circulatory system, alimentary system, digestive system

Unit-3

- 1- Respiratory system
- 2- Microscopy - Working principle, maintenance and applications of various types of microscopes - Dark ground microscope,
- 3- Polarizing microscope, phase contrast microscope, Interference microscope, U.V. light microscope, micrometry

Unit-4

- 1- Metachromasis and Metachromatic dyes
- 2- Haematoxylin stain, its importance in histology. Stains,
- 3- cytological preparation with special emphasis on MGG, PAPANTICOLOU stains. Special stains like PAS, Mucicarmine, Alcian blue, Schmorl, Acid phosphatase

MSMB-304: Molecular Biology

:3

Total Credit

Block-1

Unit 1

- 1- Discovery & definition of transposons, simple transposons (IS elements),
- 2- Composite transposons (Tn3, Tn5, Tn9, Tn10), Ac/Ds elements in maize, P elements in drosophila,
- 3- Retxotransposons, mechanisms of transposition.

Unit 2

- 1- Structure, classes & function of RNA.
- 2- RNA transcription and processing in Eukaryotes.
- 3- prokaryotes genetic code and protein synthesis .

Unit 3

- 1-The operon concept regulatory gene, promoter gene, operator gene and structural gene,
- 2-Role of CAMP and CRP in gene expression, catabolite repression, inducer, repressor corepressor.
- 3-Brief account of Eukaryotic gene expression (Britson & Davidson model).

Unit 4

- 1-Physical and Chemical Basis of Mutation:
- 2-Mechanism of mutagenesis, Mutation of DNA & protein levels.
- 3-Recombination in Bacteria - Transformation, transduction and conjugation,
- 4- Mechanism of gene transfer and application.

Block-2

Unit 1

- 1- Jumping gene, Transposon, IS element.
- 2- Transcription and Translational controls.
- 3- Protein localization: synthesis of secretory and membrane protein.

Unit 2

- 1- Mutation: Spontaneous mutation , Induced mutation,.
- 2- Genetic Code: Basis of Cryptanalysis, Codon assignment,
- 3- WOBBLE HYPOTHESIS

Unit 3

- 1- Antibiotic and Protein Synthesis.
- 2- Regulation of Gene action
- 3- Post-transcriptional Control.

Unit 4

- 1-Regulation of gene action in Eukaryotes.
- 2- Translational Control.
- 3-Hormonal Control of gene Culture.

Block-3

Unit 1

- 1- Numerical change in Chromosome: Aneuploidy, Monosomy, Nullisomy

- 2- Euploidy: Monoploidy and haploidy
- 3- Origin and production of Haploids

Unit 2

- 1-Polyploidy: Autopolyploidy, Allopolyploidy.
- 2- Segmental allopolyploids
- 3-Inborn errors of Metabolism in Man.

Unit 3

- 1- Eye transplantation in *Drosophila*.
- 2- Biochemical mutation in *Neurospora*
- 3- Calculation of Mutation Rates and frequencies.

Unit-4

- 1- Biochemical mutations and Biosynthetic Pathways.
- 2- Mutation and Nucleotide sequence in nucleic acids.
- 3- Effect of radiation on nucleotides sequence.

MSM-305: Practical
Credit :3

Total

Block -1

Unit-1

- 1- Isolation of industrially important microorganism for microbial processes.
- 2- Determination of thermal death point (TDP) and thermal death time (TDT) of microorganism for design of a sterilizer.
- 3- Comparative study of Ethanol production using different substrate .

Unit-2

- 1- Packing and sterilization of glass ware for cell culture.
- 2- Preparation of media and reagent for culture.
- 3- Primary culture technique for chicken embryo fibroblast

Unit-3

- 1- Isolation and Cultivation of lymphocytes.

- 2- Isolation of animal tissue.
- 3- Preparation of animal cell line.

Unit-4

- 1- Maintain cell line.
- 2- Preservation of Bacteria in mineral oil
- 3- Slant formation

Block -2

Unit-1

- 1- Cotton plugging
- 2- Data representation.
- 3- Estimation of carbohydrate in a given sample.

Unit-2

- 1- Collection of blood sample.
- 2- Formulation of drug.
- 3- Sub culturing

Unit-3

- 1- Selection in cell line development.
- 2- Storage of animal cell line.
- 3- Pipetting

Unit-4

- 1- Swabbing
- 2- Capping
- 3- Flaming

Block -3

Unit-1

- 1- Sterilization of media
- 2- Handling Dishes and Plates.
- 3- Uses of Liquid Nitrogen

Unit-2

- 1- Preparation of suspension culture.
- 2- Preparation of ECM.
- 3- Preparation of Screw caps.

Unit-3

- 1- Sterilization filter assemblies.
- 2- Preparation of BSS
- 3- Preparation of medium from 1 x STOCK.

Unit-4

- 1- Preparation of medium from 10 x STOCK.
- 2- Preparation of medium from powder.
- 3- Preparation of customized medium

SEMESTER IV

MSM-401: Virology

:3

Total Credit

Block-1

Unit –1

- 1-General morphology and ultra structure of Viruses:
- 2- Capsids- Helical Symmetry, icosahedral symmetry and complex symmetry.
- 3-Envelope: Glycoprotein and matrix protein

Unit – 2

- 1- Viral genome: their types and structure
- 2-Cultivation of Viruses in embryonated eggs, experimental animals and cell culture:
- 3- Primary and secondary cell culture, suspension cell culture and monolayer cell cultures.

Unit – 3

- 1-Assays of viruses: physical and chemical methods of assays (protein nuclei acid, radioactivity traces, electrons microscopy,
- 2-Plaque method, pock counting method, end point method and infectivity of plant viruses).
- 3-Serological methods: haemagglutination haemagglutinationinhibition, complement fixation, immunofluorescence assays (IFA)

Unit – 4

- 1- ELISA,
- 2- RIA.
- 3- Plant viruses: Recent advances in classification of plant viruses

Block-2

Unit-1

- 1-Life sciences and other details of TMV Virus.
- 2--Life sciences and other details of mosaic virus,
- 3-Life sciences and other details of potato virus X

Unit-2

- 1-General idea about cyanophages, actinophages and mycoviruses.
- 2-Bacteriophages: Classification, Morphology and ultrastructure
- 3-One step growth curve (Latent period, eclipse period and burst size)

Unit-3

- 1-Life cycle: Lytic and Lysogenic cycles of bacteriophages
- 2-Animal viruses; classification and nomenclature
- 3-Life cycles and other details of DNA viruses: herpes, adeno and

Unit-4

- 1-Life cycles and other details of SV40
- 2-Life cycle and other details of RNA viruses: Retroviruses, oncogenic viruses and lentiviruses
- 3-Life cycle and other details of HIV), picorna, ortho myxo and paramyxo.

Block-3

Unit-1

- 1- Introduction to Viruses.
- 2- Classification based on symptomatology.
- 3- Classification based on chemical,physical and biological properties.

Unit-2

- 1- Infection of Host cells.
- 2- Viral pathogenesis.
- 3- General transmission routes for viruses.

Unit-3

- 1- Host immune response.
- 2- Viral Vaccines.
- 3- Retroviruses.

Unit-4

- 1- Life cycle and other details of Hepatitis viruses.
- 2- - Life cycle and other details of Herpes viruses.
- 3- - Life cycle and other details of Varicell-zoster virus.

MSM-402: Mycology

Credit :3

Total

Block-1

Unit-1

- 1- Introduction of Fungi.
- 2- Classification of Fungi
- 3- Growth and isolation of fungi.

Unit-2

- 1- Superficial mycosis and dermatophytes.
- 2- Laboratory Diagnosis.
- 3- Systematic Mycoses.

Unit-3

- 1- Terms applied to Fungi.
- 2- Different type of microconidia.
- 3- Spore formation.

Unit-4

- 1- Basic morphological classification of clinically important Fungi.
- 2- Parasitic Fungi.
- 3- Biochemical and Other tests for Fungi.

Block-2

Unit-1

- 1- Histopathological studies of Fungal Infections.
- 2- Staining of Mycelia.
- 3- Isolation of fungi from water.

Unit-2

- 1- Reproduction in Fungi.
- 2- Life cycle of Neurospora.
- 3- Life cycle of Rizopus.

Unit-3

- 1- Life cycle of Asparagus.
- 2- Life cycle of Rhizoctonia.
- 3- Life cycle of Trichoderma.

Unit-4

- 1- Molecular application of Fungi
- 2- Role of Fungi in Food Technology.
- 3- Useful Fungi

Block-3

Unit-1

- 1- Life cycle of candida.
- 2- Life cycle of Nocardiosis.
- 3- Life cycle of mycoplasma.

Unit-2

- 1- Life cycle of Fusarium
- 2- Culture for Fungi.
- 3- Specific culture for Fusarium.

Unit-3

- 1-. Mycoses (all types)
- 2-. Laboratory diagnosis of mycotic diseases.
- 4- Immunity in fungal diseases and value of immuno diagnosis.

Unit-4

- 1- Role of mycotoxin
- 2- Antifungal agents
- 3- . Epidemiology of fungal diseases.

MSM-403: Parasitology

Credit :3

Total

Block-1

Unit-1

- 1-. General Principles of host parasite interactions .
- 2- Definitions of terms in this connection.
- 3- Morphology, life cycle and pathogenesis of the parasites listed below.

Unit-2

- 1- The students should know the medical importance, laboratory diagnostic methods, drugs used for therapy and Epidemiology.
- 2- Intestinal amoebae.
- 3- Free living pathogenic amoebae.

Unit-3

- 1- Intestinal and genital flagellates
- 2- Haemoflagellates
- 3- Ciliates of medical importance
- 4- Malarial parasite.

Unit-4

HELMINTHS

1.
Nemato
des (a)
Intestin
al (b)
Tissue

- 2- Cestodes infecting man
- 3- Larval infections in man.

Block-2

Unit 1

- 1 INTRODUCTION of parasitology
- 4- Importance of morphologic identification.
- 5- Intestinal protozoa of man

Unit 2

- 1- Morphology of different erythrocyte forms of plasmodia of man
- 2- Blood flagellates of man
- 3- Common intestinal round worms of man

Unit 3

- 1 Tape worm disease of man
- 2 Fluke disease of man
- 3 Identification of motile forms of flagellates

Unit 4

- 1- Identification of cysts of amoebae
- 2- Identification of cysts of flagellates
- 3- Microscopic examination of cysts

Block 3

Unit 1

- 1- Eosin stain for faecal trophozoites and cysts
- 2- Identification of cysts
- 3- Importance of cysts

Unit 2

- 1- Introduction of Intestinal helminth
- 2- Identification of eggs
- 3- Techniques for the collection and examination of eggs

Unit 3

- 1- Identification of adult helminthes
- 2- Teniques for concentrating parasites
- 3- Chmical test for occult blood in stool

Unit 4

- 1- Collection of stool specimen
- 2- Physical Examination of stool
- 3- Chemical Examination of stool

MSM-404: Research Methodology & Techniques

Total Credit

:3

Block-1

Unit-1

- 1-Introduction to Research:
- 2-Definition, Scope, Limitations, of Research
- 3- Types Of research.

Unit 2

- 1- Objectives of Research
- 2-Research Process
- 3-Research Designs

Unit 3

- 1-Data Collection: Secondary Data,
- 2-Primary Data,
- 3-Methods of Collection.

Unit 4

- 1-ScaLing Techniques: Concept, Types,
- 2-Rating scales & Ranking Scales
- 3-Scale Construction Techniques, Multi Dimensional caLing.

Block-2

Unit 1

- 1- Sampling Designs: Concepts, Types

- 2- Techniques of Sampling Design
- 3- Sample Size Decision

Unit 2

- 1 -Theory of Estimation and Testing of Hypothesis
- 2-Small & Large Sample Tests,
- 3-Tests of Significance based on t, F , Z test

Unit 3

- 1- Chi-Square Test.
- 2- Questionnaire. Designing
- 3 -Interviewing.

Unit 4

- 1- Tabulation,
- 2- Coding, Editing.
- 3- Interpretation and Report Writing.

Block-3

Unit-1

- 1-Formulation of Research problem
- 2-Charectstics of research and research worker.
- 3-Classification of research in relation to nature method and nature of data.

Unit 2

- 1- Location and crieteria of selecting a research problem.
- 2- Reson for surveying related literature.
- 3- Allied and critical literature.

Unit 3

- 1- Hypotesis
- 2- Significancs of Hypothesis.
- 3- Types of Hypothesis.

Unit 4

- 1- Historical research.
- 2- Survey studies: Tool of survey and case studies.
- 3- Philosophical studies: Meaning, step in critical studies.

MSM-405: **Practical**

Total Credit :3

Block-1

Unit-1

- 1- Isolation of fungi.
- 2- Culture technique for fungal growth.
- 3- Media for fungal growth.

Unit-2

- 1- Isolation of microorganism from soil
- 2- Isolation of microorganism from food stuff.
- 3- Isolation of microorganism from sewage water.

Unit -3

- 1- Pippeting
- 2- Heamoglobin test.
- 3- ESR.

Unit-4

- 1- Slide formation
- 2- Gram staining.
- 3- Acid Fast staining.

Block-2

Unit -1

- 1- Purification of antigens.
- 2- Purification of antibodies

Unit-2

- 1- Conjugation of antibodies
- 2- Labeling of antibodies.
- 3- ELISA

Unit -3

- 1- RIA

- 2- Isolation of enzyme.
- 3- Labeling of antibodies

Unit-4

1. TLC
2. DLC
3. Blood group

Block-3

Unit-1

- 1- Verification of Beer's law.
Determination of
absorption maximum.
- 2- Electrophoresis of Proteins - native and under denaturing conditions.

Unit-2

- 1- Amino acid and carbohydrate separations by paper and thin layer chromatography. Separation of blood cells by density gradient centrifugation.
- 2- Chromatographic method for separation of macromolecules. Separation of sub cellular organelles by differential centrifugation.

Unit-3

- 1- Electrophoresis of DNA - linear, circular and super coiled.
- 2- Isolation of DNA through Lysis Buffer

Unit-4

- 1- Operation of UV-Visible spectrophotometer.
- 2- Operation of IR Spectrophotometer.