

SENIOR SCHOOL CURRICULUM

2017-18

MEDICAL DIAGNOSTICS

Introduction

Objectives of Introducing Medical Diagnostics Course in Schools.

1. To help students understand the organization of Hospitals, Research labs, Diagnostic labs.
2. To equip students with the skills needed to work in a hospital or a diagnostics lab.
3. To impart skills to students that enables them to work in manufacturing units for diagnostic reagents.
4. To develop skills and ability to assist qualified experts in health care, diagnostics and related fields.
5. To develop ability and skill among students; to understand, analyze and assist the analytical, research and development work in drug labs and various pharmaceuticals.
6. To develop the technical skills to handle the equipment and apparatus of the lab.
7. To help students learn various analytical and investigative procedures and techniques used in medical labs and hospitals.

CLASS–XI ELECTIVE ANATOMY & PHYSIOLOGY (741) THEORY

Time: 3 Hours

Unit–1

Marks: 60

20

A. Anatomy & Physiology of Human Body

- Human Body.
- Definition.
- Anatomical terms.
- Structure.
- Cell.
- Tissues.
- Glands and membranes.
- Physiology.
- Functions.
- Disorders.
- Causative Factor.
- Blood components, normal concentrations and its functions, Factors affecting the normal concentration.

B. Sensory Organs

- Eye, Ear, Nose, Tongue and Skin – Structure.
- Eye, Ear, Nose, Tongue and Skin – Functions & Disorders.

C. Skeletal System

- Human Skeleton-Identification, Classification and Functions of.
 - 1) Bones.
 - 2) Joints.
 - 3) Muscles.
- Types of Muscles & their functions.
- Mechanism of contraction Difference between 3 types of muscles Electro myography & mechanical recording of muscle contraction.
- Locomotion Diseases of muscles Dystrophies.
- Enzymes – changes in different.
- Diseases of muscles.

D. Nervous System

- Brain & Spinal cord Spinal nerves – segments Meninges, Blood supply to Brain Division of nervous system.
- Nerve fibers – types, functions, injuries, impulses & velocity.

Unit–2

20

A. Cardiovascular System

- The Heart Chambers Blood.
- Vessels – Arteries and Veins Lymphatic, Pulmonary & systematic circulation.
- Lymphoid System – nodes and its importance.
- Chambers & Functions.
- Heart rate and the significance.

- Cardiac cycle.
- HR factors.
- ECG – Machine, Recording.
- Abnormalities – types Causative Factors Reporting & Interpretation.

B. Respiratory System

- Respiratory Organs.
- Larynx & Trachea Thoracic Lungs.
- Functions & Disorders.
- Respiration-Mechanism- Inspiration, Expiration Gas exchange mechanism.
- Lung surfactant–compliance.
- Lung volume and capacity Respiratory Exercises Artificial Respiration-Basis & Techniques.

Unit–3

20

A. Digestive System

- Digestive Organs.
- Pharynx, esophagus Stomach and Intestines Liver & Pancreas Peritoneum.
- Functions & Disorders.
- Pharynx, esophagus Stomach and Intestines Liver & Pancreas Peritoneum.

B. Endocrine System

- Glands.
- Location.
- Glands & Hormones.
- Functions & Disorders.

C. Genito Urinary System

- Genito Urinary Organs.
- Kidney, Ureter, bladder, Urethra, Catherisation Female Reproductive System Male Reproductive System.
- Functions & Disorders.
- Nephron & Kidneys.
- Filtration and formation of urine.
- Uremia – Dialysis, Artificial kidney Male & Female reproductive system Secondary sex characteristics.
- Sex hormones and their functions Spermatogenesis – Sperm count of normal morphology, mortality Menstrual cycle – Ovulation.
- Tests of Ovulation’s – Pregnancy Changes in pregnancy Part urition lactation Family Planning methods.

PRACTICAL

Time: 2 Hours

Marks: 40

Unit–1

20

A. Anatomy & Physiology of Human Body

- Slides of primary tissues/cells.
- Glands & Membranes.

B. Sensory Organs

- Eye, Ear, Nose, Skin & Tongue.
- Apparatus, Examination & Investigation - Eye, Ear, Nose, Skin & Tongue.
- Colour Vision.
- Use of Stethograph.
- Parts of Sphygmomano meter.
- Stethoscope, papillary reflexes.
- Recording of Blood pressure.

C. Skeletal System

- Bones and corresponding joints.
- Muscles.
- Use of Knee hammer.

D. Nervous System

- Spinalcord & external features of Brain.
- Internal structureof Brain.
- Examination of reflexes.

Unit-2

10

A. Cardiovascular System

- Heart and Major blood vessels.
- Use of Treadmill, Medsprier.
- ECG machine.
- Aspiration of heart and lungs.

B. Respiratory System

- Larynx, trachea, lungs.
- Apparatus & investigations.
- Bronchoscopy.

Unit-3

10

A. Digestive System

- GIT & Major glands.
- Investigations.

B. Endocrine System

- Endocrine glands.
- Endoscopy.

C. Genito Urinary System

- Kidney, Urinary bladder & Urethra Male & Female reproductive system.
- Placenta.
- Investigations.

CLASS–XI ELECTIVE DIAGNOSTIC RADIOLOGY (742) THEORY

Time: 3 Hours

Marks: 60

Unit–1: X-Ray Imaging

20

1. **Introduction to Radiology – X Ray, Ultrasound, MRI, CT, PET, Radiographic Analysis and X-Ray Imaging**
 - Discovery of x-rays.
 - Properties - production.
 - X - rayspectrum.
 - Bremsstrah lung and characteristic x - rays- x - raytube.
 - Coolidge tube.
 - Tube design.
 - Line focus principle.
 - Space charge effect.
 - Tube cooling-modern x-ray tubes.
 - Stationary anode.
 - Rotating anode.
 - Grid controlled x-ray tubes.
 - Heel effect, off focus radiation.
 - Tube insert and housing-tube rating-quality and intensity of x-rays.
 - Factors in fluencing them.
 - Image storing & Spot film devices.
 - Radio graphic films.
 - Principles of Fluoroscopy.
 - Fluoroscopic screens/Tables.
 - Film cassette construction & application.
 - Image in tensifier construction & application/types & advantages.
 - Radiographic film processing.
 - Use of contrast.
 - Magnification of images.
2. **Effects and Control of Scattered Radiation**

- Production & significance of scattered radiation.
- Filters & beam limiting devices.
- Grid.
- Structure & materials.
- Grid ratio.
- Types of Grids.
- Grid cassettes.
- Medical Terminology.
- Assessment.

Unit-2: Dark Room Technique

20

1. Film Materials

- Introduction- Electromagnetic spectrum visible spectrum.
- Structure of the film - Spectral sensitivity, green technology, basic film types, films for specialized use.

2. Safe Light and Storage of Films

- Principle of operation, factors, affecting a felight performance, Storage of unprocessed film, storing, radiographs, fire hazards in film stores.

3. Photo Chemistry

- Theory of latent image formation.
- Introduction, the concept of development.

4. Development

- Nature of development, constitution of developing solution, development, time, factors affecting the use of developer.

5. Fixing

- Constitution of the fixing solution, factors affecting the use offixer, replenishment, regeneration of fixing solution, silver recovery- rinsing washing & drying.

6. Viewing & Identification of X-Ray films

- Radiation Protection.
- Hazards of radiation.
 - Time, distance & shielding concept in ration protection.
- Shielding materials.
- Radiation surveillance indignantic & the rapeutic radiation installations.
- Regulatory board & its recommendations.
- Radiation detectors.
- Ion Chambers.
- G. Mcounters.
- Scintillation counters.

- Assessment.

Unit-3: Patient Care & Radiological Positioning

20

1. Introduction to Patient Care

- Clinical responsibility.
- Legal responsibility, Hospital & the radiographer.

2. General Patient Care

- Patient transfer technique.
- Turning the patient (patient conditions, Mechanic safety).
- Restraint techniques - Trauma, Pediatric, Geriatric, Physically handicapped, disturbed patients, an aesthetized patient, moving chair & stretcher patients.
- Specific patient conditions.
- Tubes & catheters, Nasogastric, chest, Urinary, intravenous.
- Oxygen & other (Cast surgical & cardiac) Alcoholic, bedpans & urinals.
- Security of patient properties. Patient, inpatient.
- General comfort & reassurance for the patient.
- Assessment.

PRACTICAL

Time: 2 Hours

Marks: 40

Unit-1: X-Ray Imaging

10

- X-Ray Tubes.
- Stationary & Rotation Anode.
- X-ray Consolestation (Demo of KV, MA and exposure time settings).
- Procedures to reduce Scattered Radiation.
- Focus Principle.
- Grids.
- Screen.
- Image intensifiers.
- Use of contrast materials.

Unit-2: Dark Room Technique

10

- Images to ring devices.
- Film cassette construction.
- Duplicating a film.
- Spectrum.
- Films types - Specialized use.
- Operation, storage.
- Photo chemistry.

- Development.
- Fixing.
- Radiation protection, counters.
- Assessment.

Unit-3: Radiological Positioning

20

- Patient transfer technique.
- Turning the patient.
- Restraint techniques - Trauma, Pediatric, Geriatric, Physically handicapped, disturbed patients, an anesthetized patient, moving chair & stretcher patients.
- Tubes & catheters, Nasogastric, chest, Urinary, intravenous, oxygen & other (Castsurgical & cardiac) Alcoholic, bed pans & urinals.
- Assessment.

CLASS-XII ELECTIVE LABORATORY MEDICINE-II (741) THEORY

Time: 3 Hours

Marks: 60

Unit-1: Investigation Urine & Faces Analysis

10

- Introduction.
- Maintenance & Equipments of Pathology Lab.
- Preparation of Reagents.
- Urine.
- Formation and composition.
- Collection Preservation Gravity & PH.
- Examination-Physical.
- Examination- Chemical.
- Sugar.
- Ketone Bodies, Bile.
- Blood, Crystals.
- Parasites & Abnormal Cells.
- Feces-Formation, Physical & Chemical Examination.
- Preparation of stool sample for microscopic examination.
- Sputum Examination.
- Assessment.

Unit-2: Body Fluids

10

- Body Fluids.
- Cerebro spinal fluid. Synovial fluid and Pleural fluid Pericardial fluids Peritoneal fluids.

- Other fluids collected transudate or exudates.
- Semen Analysis–Collection, Physical & Chemical examination.
- Sperm count – Microscopic examination & Motility.
- Assessment.

Unit–3: Process & Investigations

10

- Reagents – Preparation and their uses.
- Personnel care and protection Disposal of Bio-Medical waste Smear Making.
- Staining Methods.
- Osmotic fragility test.
- Differential Counts.
- Cell counts – RBC, WBC, and Platelets Eosinophil & Reticulocyte count ESR.
- LE Cell.
- Haemopoiesis – Erythrocytes Hemoglobin – Estimation Packed Cell Volume, Indices Hematocrit and Red cell indices Anemia.
- Leukocytes.
- Coagulation Factors.
- Coagulation disorders – Bleeding & Clotting Time.
- Bone marrow study.
- Assessment.

Unit–4: Blood Bank & Transfusion

10

- Blood Bank.
- Material & equipment Reagents – preparation Protocols.
- Storage & Preservation.
- Records in Blood bank.
- ABO System.
- Subgroups in ABO System.
- Practical importance of Other blood groups.
- Rh System.
- Antibody titers.
- Blood grouping techniques Problems in blood grouping Donor Motivation.
- Donors election & Registration.
- Blood Collection.
- Storage, Preservation & Processing of blood.
- Quality control.
- Investigation of transfusion, reactions.
- Grouping & cross matching Direct and Indirect Coombs test Mandatory Test.
- Assessment.

Unit–5: Lab Process

10

- Materials, Equipment & Techniques.
- Biopsy, Autopsy.
- Collection, Preservation & Labeling of Slides, Blocks, Specimens.
- Techniques.
- Grossing Methods.
- Fixatives.
- Processing of the tissues including Bone.
- Embedding Section Cutting Staining & Mounting Special Stains.
- Preservation of reports & records.
- Assessment.

Unit-6: Cytology

10

- Techniques Equipment & Procedures – FNAC, Imprints smear.
- Vaginal & Buccal smear, Swabs.
- Staining procedure and Mounting.
- Preparation of fluids for Cytological Examination.
- Immuno histo chemistry.
- Assessment.

PRACTICAL

Time: 2 Hours

Marks: 40

Unit-1: Urine & Feces Analysis

7

- Introduction.
- Maintenance & Equipment of Pathology Lab.
- Preparation of Reagents.
- Urine.
- Formation and composition.
- Collection Preservation Gravity & PH.
- Examination–Physical Examination - Chemical Sugar.
- Ketone Bodies.
- Bile, Blood, Crystals.
- Parasites & Abnormal Cells.
- Feces–Formation, Physical & Chemical Examination Preparation of stool sample for microscopic examination Sputum Examination.
- Assessment.

Unit-2: Body Fluids

7

- Body Fluids.
- Cerebrospinal fluid, Synovial fluid.

- Pleural fluid.
- Pericardial fluids.
- Peritoneal fluids.
- Other fluids collected transudate or exudates.
- Semen Analysis – Collection, Physical & Chemical examination.
- Sperm count – Microscopic examination & Motility.
- Assessment.

Unit-3: Hematology Process & Investigations

7

- Smear Making Staining Methods Osmotic fragility test.
- Differential Counts.
- Cell counts – RBC, WBC, Platelets.
- ESR.
- LE Cell.
- Hemoglobin – Estimation.
- Hematocrit and Red cell indices.
- Coagulation disorders – Bleeding & Clotting Time.
- Bone marrow study – Demo.
- Assessment.

Unit-4: Blood Bank & Transfusion

7

- Blood Bank.
- ABO Blood grouping – cell and serum grouping.
- Rh typing.
- Anti body titers.
- Blood grouping techniques – Other methods.
- Donor selection & Registration – Demo.
- Blood Collection – Demo.
- Storage, Preservation & Processing of blood – Demo.
- Quality control Demo.
- Investigation of Transfusion, reactions.
- Cross matching.
- Direct and Indirect Coombs test.
- Mandatory Test – Screening Tests – Demo.
- Assessment.

Unit-5: Histopathology Lab Process

6

- Histopathology.
- Introduction.
- Materials, Equipment & Techniques.

- Biopsy, Autopsy.
- Collection, Preservation & Labeling of Slides.
- Blocks, Specimens Techniques.
- Grossing Methods.
- Fixatives.
- Processing of the tissues including Bone.
- Embedding.
- Section Cutting.
- Staining & Mounting.
- Special Stains.
- Preservation of reports & records.
- Assessment.

Unit-6: Cytology

6

- Cytology.
- Techniques Equipment & Procedures – FNAC.
- Imprintssmear, Vaginal & Buccalsmear, Swabs.
- Staining procedure and Mounting.
- Preparation of fluids for Cytological Examination.
- Immuno histo chemistry.
- Assessment.

CLASS-XII ELECTIVE

CLINICAL BIOCHEMISTRY & MICROBIOLOGY-II (742)

THEORY

Time: 3 Hours

Marks: 60

Unit-1: Concepts Instruments & Procedures

10

- Introduction - scope of biochemistry and clinical biochemistry objectives and scheme of clinical biochemistry teaching.
- Basic Biochemistry - over view of biomolecules, biochemical transformations. Biochemical organization of cell, tissues, organs and human organism.
- Ethics and Discipline - Laboratory ethics and discipline. Patient management, Reception, Registration, Biochemical parameters investigations, protocols, documentation.
- Hazards and safety - physical, chemical and biological hazards, self & patient & equipment safety. Disposal of laboratory waste and the hazardous material.
- First Aid Measures.
- Instruments, Principles & Procedures: Basis, uses, parts, installation, glass ware & plastic ware – colorimeters, balances, centrifuges, refrigerators, hot air ovens, water baths, thermometers, vortex, mixers, magnetic stirrers, UV lamp.

- Cleaning & Maintenance of Equipment.
- Assessment.

Unit-2: Investigations Separation Procedures & Analysis

10

- Separation techniques: basic principles, different types, general techniques and clinical applications of different types of electrophoresis and chromatography.
- Automation: Basic Principles, different components and general principles of usage and applications.
- Calcium and Phosphorus: Outlines of mineral metabolism. Principles of estimation of serum calcium and inorganic phosphate and their clinical importance.
- Urine Proteins: requirements of quantisation of proteins in the urine. Different samples used Principles of samples collection, preservation and analysis.
- Lipoproteins: Principles of estimation of different lipo protein fractions of lipase, & LDH.
- Acid-Base balance.
- Immuno assays.
- Sample identification and labeling.
- Types and mechanisms of actions of various anti coagulants and preservatives used Principles of Spectrophotometry and Turbidoemetry.
- Quantitative analysis.
- Calorimetry- applications in clinical biochemistry.
- Units of measurement.
- Assessment.

Unit-3: Functional Test & Profile

10

- Glucose tolerance test: Concept of tolerance tests. Definition, patient preparation, performance, reporting and interpretation of GTT.
- Liver functions tests: bilirubin, total proteins, albumin and prothrombin time, turbidity tests and serum enzyme estimations (SGPT, ALPA and GT).
- Kidney functions tests: Concept of clearance tests, Use of serum NPN substances creatinine clearance, concentration and dilution tests and urine examination.
- Gastric function tests: Principles of analysis of gastric juice, Concept of basal and maximal acid outputs, Principles of stimulation tests & tubeless gastric analysis.
- Thyroid function tests: Principles underlying estimations of various thyroid hormones and their interpretations.
- Profiles: Concepts of Profile testing.
- Cardiac Profiles.
- Lipid Profile.
- Assessment.

Unit-4: Fundamentals of Microbiology

10

- Personal Care.
- Infection Control.
- Sterilization Techniques - Autoclave, Hot air oven, Tyndallization & Pasteurization.
- Equipment – Handling & Maintenance.
- Assessment.

Unit-5: Bacteriology

10

- Bacteriology.
- Applied Anatomy and Physiology of the Bacterial Cell.
- Pathogenic organisms.
- Identification & Isolation of Staphylococcus, Streptococcus, Pneumococcus, Gonococcus, meningococcus, C. diphtheria, Mycobacterium tuberculae and M. Leprae, Clostridia, E. Coli, Klebsiella, Salmonella, Shigella, Proteus, Vibrio, Pseudomonas.
- Anthrax, Plague, Dengue, Japanese encephalitis.
- Assessment.

Unit-6: Mycology Immunology & Serology Parasitology Virology

10

- Introduction & Classification.
- Enumeration of pathogenic & opportunistic fungi.
- Introduction.
- Antigens, Antibodies & Reactions.
- Hypersensitivity.
- Introduction.
- Pathogenic parasites in blood, stool and urine.
- Viruses – Classification, Cultivation & Enumeration.
- Study of the laboratory animals – Sheep, Rabbit, Mice & Guinea Pig.
- Assessment.

PRACTICAL

Time: 2 Hours

Marks: 40

Unit-1: Instruments & Procedures

7

- Lab Equipment – Identification, Use & Cleaning of Glass & Plastic ware.
- Pipettes: Use of Pipettes/automated.
- Sample collection – Blood, urine and body fluids, Containers - Appropriate usage for different samples.
- Centrifuge – Preparation and separation of plasma, serum protein.
- Storage of sample.
- Filters - Filter Papers & Filtration.
- Drying of chemicals.
- Weighing – Appropriate Balances.
- Solutions – Preparation, Reagents - Preparation.
- Usage-Thermometer, Vortex Mixers & Magnetic Stirrers.
- Buffers.
- Colorimeters – Beer – Lambert’s Law Experiment.
- Assessment.

Unit-2: Investigations

7

- Glucose: Orthotoluidine and glucose oxidase methods.
- Urea: DAM method and urease Berthelot reaction.
- Serum Creatinine: Jaff's method end point and kinetic analyses modes.
- Serum total proteins: Biuret method.
- Serum Albumin: Dyebinding (BCG) method.
- Serum Bilirubin.
- Malloy Evelyn method, Vandenberg reaction.
- Total and conjugated bilirubin estimation.
- Amino transferases: AST and ALT – Reitman Frankel method.

Unit-3: Separative Procedures & Analysis

7

- Estimation of serum: sodium, potassium and Lithium by Flame.
- Photometer.
- Estimation of serum bicarbonate by titration method.
- Acid base parameters using blood gas analyzers.
- Estimation & Standardization of Glucose, Urea, Creatinine, Chloride, Proteins & Transaminases.
- Standardization of pipettes and photometric instruments – Demo and Analysis of Gastric juice, Demonstration of stimulations tests.
- Separation Techniques.
- Electrophoresis – serum proteins, hemoglobin – Demo.
- Paper chromatographic – aminoacids and carbohydrates – Demo.
- Oral glucose tolerance test.
- Estimation of 24 Marks urine proteins by turbid metric method.
- Assessment.

Unit-4: Personal Care, Sterilization & Equipment

7

- Personal Care, Sterilization & Equipment cleaning the equipment and glass ware Universal precautions.
- Methods of Sterilization – Autoclave, Hot air oven.
- Tyndallization & Pasteurization, Filtration, Disinfection & Antiseptics.
- Sterilization of Syringes, Needles & Slides.
- Sterilization of Culture room & Work Benches.
- Maintenance of the Equipment – Indications & Contra – Indications for Sterilization in a equipment.
- Uses of equipment.
- Refrigerators.
- Deep Freezers.
- Incubators & Water baths Different microscopes Preparation of wire loops Preparation of Pasteure pipettes Preparation of smears.
- Assessment.

Unit-5: Bacteriology

6

- Staining procedures.
- Simple, Grams, Acid fast Albert, Fontana's Negative.
- India Ink & Negrosin.
- Hanging drop preparation.
- Preparation of media, pH adjustment, Sterilization, storage and disposal after use of Solid, liquid and special media.
- Disposal of specimens and contaminated material.
- Sample collection, labeling, registering and maintenance of records and statistics.
- Processing Techniques – Sputum, Blood, Urine & Stool, Pus, CSF. Swab – Wounds, Skin, Throat, Clippings, Spore, Strips.
- Assessment.

Unit-6: Mycology Immunology & Serology Parasitology

6

- Fungi – Identification, Collection & Labeling.
- Microscopy.
- KOH preparation.
- Staining methods & Culture methods.
- Lactophenol blue.
- Negative – Indian Ink Negrosin.
- Culture, Slide Culture.
- Collection of specimen.
- Labeling, separation of Sera and Storage.
- Inactivation of serum.
- VDRL Test – qualitative and semi-qualitative & quantitative.
- Widetest – principle and procedure.
- Latex tests – R.A. factor.
- Stool examination – saline, iodine staining & Concentration.
- Preservation of samples.
- Disposal of infected material.
- Peripheral blood smear preparation and staining techniques.
- Leishman, Giemsa's & JSB stain.
- Assessment.

LIST OF EQUIPMENTS REQUIRED TO IMPART TRAINING AT MEDICAL COLLEGE HOSPITAL, INSTITUTES

Minimum Requirements: (for a batch of 30 students)

- A. Basic Instruments.
- B. Instruments for Demonstrations.
- C. Reagents & Chemicals, Glassware.

A. Basic Instruments (Approx. Cost 5 lacs)

1.	Microscope with built in illumination.	Monocular	–	6
		Binocular	–	2
2.	Calorimeter.		–	1
3.	Photoelectric colourimeter.		–	1
4.	Incubator.		–	1
5.	Hot Air Oven.		–	1
6.	Autoclave.		–	1
7.	Simple Balance.		–	1
8.	Haemoglobinometer Colormetric.		–	1
9.	Single Pan Balance.		–	1
10.	Haemocytometer (Hellige).		–	10
11.	Water bath (Serological).		–	2
12.	Centrifuge Machine angle rotator with wintube adoptor, time & speed regulator.		–	2
13.	Innoculation Chamber Rotary.		–	1
14.	Microtome.		–	1
15.	ELISA Reader & Washer.		–	1
16.	Distillation Plant All Glass Double.		–	1
	Single Distillation.		–	1

B. Instruments for Demonstrations (Approx. Cost 10 lacs)

1.	Haematology Analyser (semi automated).		–	1
2.	Haematology Analyser (fully automated).		–	1
3.	Biochemistry Analysers (semi automated).		–	1
4.	Biochemistry (fully automated).		–	1
5.	ELISA Reader (automated).		–	1
6.	Electrophoresis Apparatus.		–	1
7.	Histo Kinett.		–	1
8.	Densitometer.		–	1
9.	Freezing Microtome.		–	1
10.	Tissue Processor.		–	1

- 11. McIntosh Apparatus for Anaerobic Culture. – 1
- 12. Laminar flow System. – 1

C. Reagents/Chemicals, Glass Wares

As per requirements of Diagnostic Laboratories for 40–50 samples per day.