

## B. Voc. (Medical Laboratory Technology) in association with Medanta-The Medicity NSQF Level-4&5

### 1. Syllabus

| First Semester<br>Subjects                             | Credits                            | Syllabus   |
|--|------------------------------------|--|
| 1. Fundamentals of<br>Medical Laboratory<br>Technology | Theory-2<br>Practical-1<br>Total-3 | <p><b>Objectives</b></p> <p>To purpose of the course is to provide fundamental knowledge and exposure to the concepts, theories and practices in the field of Laboratory Technology</p> <p><b>Learning Outcomes</b></p> <p>By the end of this course:</p> <ul style="list-style-type: none"> <li>• The student demonstrates an understanding of the processes of Laboratory Technology.</li> <li>• Identify the basic functions, and management challenges in the Laboratories.</li> </ul> <p><b>Learnings:</b></p> <ol style="list-style-type: none"> <li>1. Basic laboratory principles</li> <li>2. Code of conduct of medical laboratory personnel.</li> <li>3. Organization of clinical laboratory and role of medical laboratory technician</li> <li>4. Safety measures</li> <li>5. Medical laboratory professional - professionalism in laboratory workers, code of conduct, communication between physician and lab technician</li> </ol> |

6. Common glassware in clinical laboratory.
7. Cleaning, care and maintenance of glassware.
8. Calibration of pipettes and other volumetric apparatus.
9. Laboratory instruments.
  - Microscopes-Principles, parts, use, care and maintenance of Light microscope, Electron microscope, Fluorescent microscope, Dark ground microscope, Phase contrast microscope etc
  - Centrifuge
  - Water bath
  - Refrigerators
  - Autoclave
  - Hot air oven
  - Mixer
  - Water distillation apparatus.
10. General approach to specimen collection, transport and disposal.
11. Anticoagulants- E.D.T.A, Dipotassium salts of EDTA Double oxalate, single oxalate, sodium citrate. Sodium Fluoride.
12. Preparation of solution: Normal solution, Buffer solution, Percent solution, normal saline, Molar solution.
13. Preparation of Normal saline
14. Methods of measuring liquids, weighting solids.
15. Clinical Laboratory records.
16. Modern Laboratory set up.
17. Quality control in clinical laboratories, basic outline

**Books Recommended**

|                  |   |  |
|------------------|---|--|
|                  |   | <p>KI Mukherjee: Medical Lab Technology (Tata Mc Graw Hill)<br/>P.D. Godkar: Textbook Of Medical Lab Technology (Balani Publishing House)</p>  |
| 2. Human Anatomy | <p>Theory-5<br/>Practical-2<br/>Total-7</p> | <p><b>Objective:</b></p> <ul style="list-style-type: none"> <li>- Knowledge about basic anatomical structure (Gross) of human body</li> <li>- Knowledge about working of the Anatomy Laboratory</li> <li>- Knowledge about various anatomical procedures</li> </ul> <p><b>Learnings:</b></p> <p><b>Anatomy (Theory)</b></p> <ol style="list-style-type: none"> <li>1. General Anatomy             <ol style="list-style-type: none"> <li>a) Cell - structure &amp; function</li> <li>b) Tissue – Epithelium, Connective, Sclerous, Muscular, Nervous</li> <li>c) Lymphatic System</li> </ol> </li> <li>2. Systemic: Basic Features of: a) Cardiovascular system; b) Respiratory system; c) Digestive system; d) Excretory system; e) Genital (Male &amp; Female) system; f) Nervous system</li> </ol> <p><b>Anatomy (Practical)</b></p> <ol style="list-style-type: none"> <li>1. Identification and description of all anatomical structures.</li> <li>2. The learning of Anatomy is by demonstration only through dissected parts, slides, models, charts etc.</li> <li>3. Demonstration of dissected parts (upper extremity, lower extremity, thoracic &amp; abdominal viscera, face and brain).</li> <li>4. Demonstration of skeleton - articulated and disarticulated.</li> </ol> <p><b>Books Recommended</b></p> |

|                     |                                    | <table border="1"> <thead> <tr> <th>S.No.</th> <th>Author name</th> <th>Name of the textbook</th> <th>Edition</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>B.D. Chaurasia</td> <td>Human Anatomy</td> <td>5 (Vol) 6<sup>th</sup> edition-2001; CBS Publishers &amp; Distributors</td> </tr> <tr> <td>2.</td> <td>Inderbir Singh</td> <td>Textbook of Anatomy</td> <td>3 (Vol) 2<sup>nd</sup> edition-1999 Jaypee Brothers Medical Publishers</td> </tr> <tr> <td>3.</td> <td>Inderbir Singh</td> <td>Textbook of Neuroanatomy</td> <td>5<sup>th</sup> edition-1999, Jaypee Brothers Medical Publishers</td> </tr> <tr> <td>4.</td> <td>Inderbir Singh</td> <td>Textbook of Human Histology</td> <td>3<sup>rd</sup> edition-1997, Jaypee Brothers Medical Publishers</td> </tr> <tr> <td>5.</td> <td>Inderbir Singh</td> <td>Textbook of Human Osteology</td> <td>3<sup>rd</sup> edition-1997, Jaypee Brothers Medical Publishers</td> </tr> <tr> <td>6.</td> <td>Anne M.R. Agur</td> <td>Grant's Atlas of Anatomy</td> <td>10<sup>th</sup> edition 1999 Lippincott Williams &amp; Wilkins</td> </tr> <tr> <td>7.</td> <td>Derek Field</td> <td>Anatomy-Palpation &amp; Surface Markings</td> <td>3<sup>rd</sup> edition-2001, Butterworth Heinemann</td> </tr> <tr> <td>8.</td> <td>Jamiewar &amp; Abraham</td> <td>Imaging atlas of Human Anatomy</td> <td>1<sup>st</sup> edition-1998 Thomas Press Ltd.</td> </tr> </tbody> </table> | S.No.   | Author name | Name of the textbook | Edition | 1. | B.D. Chaurasia | Human Anatomy | 5 (Vol) 6 <sup>th</sup> edition-2001; CBS Publishers & Distributors | 2. | Inderbir Singh | Textbook of Anatomy | 3 (Vol) 2 <sup>nd</sup> edition-1999 Jaypee Brothers Medical Publishers | 3. | Inderbir Singh | Textbook of Neuroanatomy | 5 <sup>th</sup> edition-1999, Jaypee Brothers Medical Publishers | 4. | Inderbir Singh | Textbook of Human Histology | 3 <sup>rd</sup> edition-1997, Jaypee Brothers Medical Publishers | 5. | Inderbir Singh | Textbook of Human Osteology | 3 <sup>rd</sup> edition-1997, Jaypee Brothers Medical Publishers | 6. | Anne M.R. Agur | Grant's Atlas of Anatomy | 10 <sup>th</sup> edition 1999 Lippincott Williams & Wilkins | 7. | Derek Field | Anatomy-Palpation & Surface Markings | 3 <sup>rd</sup> edition-2001, Butterworth Heinemann | 8. | Jamiewar & Abraham | Imaging atlas of Human Anatomy | 1 <sup>st</sup> edition-1998 Thomas Press Ltd. |
|---------------------|------------------------------------|--|---|-------------|----------------------|---------|----|----------------|---------------|---|----|----------------|---------------------|---|----|----------------|--------------------------|--|----|----------------|-----------------------------|--|----|----------------|-----------------------------|--|----|----------------|--------------------------|---|----|-------------|--------------------------------------|---|----|--------------------|--------------------------------|--|
| S.No.               | Author name                        | Name of the textbook   | Edition   |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |
| 1.                  | B.D. Chaurasia                     | Human Anatomy  | 5 (Vol) 6 <sup>th</sup> edition-2001; CBS Publishers & Distributors     |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |
| 2.                  | Inderbir Singh                     | Textbook of Anatomy  | 3 (Vol) 2 <sup>nd</sup> edition-1999 Jaypee Brothers Medical Publishers |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |
| 3.                  | Inderbir Singh                     | Textbook of Neuroanatomy   | 5 <sup>th</sup> edition-1999, Jaypee Brothers Medical Publishers        |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |
| 4.                  | Inderbir Singh                     | Textbook of Human Histology  | 3 <sup>rd</sup> edition-1997, Jaypee Brothers Medical Publishers        |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |
| 5.                  | Inderbir Singh                     | Textbook of Human Osteology  | 3 <sup>rd</sup> edition-1997, Jaypee Brothers Medical Publishers        |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |
| 6.                  | Anne M.R. Agur                     | Grant's Atlas of Anatomy   | 10 <sup>th</sup> edition 1999 Lippincott Williams & Wilkins             |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |
| 7.                  | Derek Field                        | Anatomy-Palpation & Surface Markings   | 3 <sup>rd</sup> edition-2001, Butterworth Heinemann                     |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |
| 8.                  | Jamiewar & Abraham                 | Imaging atlas of Human Anatomy   | 1 <sup>st</sup> edition-1998 Thomas Press Ltd.                          |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |
| 3. Human Physiology | Theory-4<br>Practical-2<br>Total-6 | <p><b>Objective</b><br/>Knowledge about basic physiological functions of human organ systems</p> <p><b>Learnings:</b></p> <p><b>Physiology (Theory)</b></p>  |   |             |                      |         |    |                |               |   |    |                |                     |   |    |                |                          |  |    |                |                             |  |    |                |                             |  |    |                |                          |   |    |             |                                      |   |    |                    |                                |  |

|                                     |                         |  |
|-------------------------------------|-------------------------|--|
|                                     |                         | <ol style="list-style-type: none"> <li>1. Cell : Structure &amp; function</li> <li>2. Blood: a) Blood cells; b) Haemoglobin; c) Blood groups; d) Coagulation Factors; e) Anaemia &amp; Immunoglobulins</li> <li>3. Cardiovascular system: Heart rate, cardiac cycle, cardiac output, blood pressure, hypertension, radial pulse</li> <li>4. Respiratory System: a) Ventilation; b) Functions; c) Lungs Volumes and capacities</li> <li>5. Gastrointestinal System: Process of digestion in various parts</li> <li>6. Endocrinology: a) List of Endocrine Glands; b) Hormones : Their secretion and functions (in brief)</li> <li>7. Excretion system: a) Structure of nephron; b) Urine formation</li> <li>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</li> <li>9. Skin - Function &amp; Structure</li> <li>10. Muscular System: Classification of muscles &amp; their functions</li> <li>11. Special Senses - Eye &amp; ear (in brief)</li> </ol> <p><b>Physiology (Practical)</b></p> <ol style="list-style-type: none"> <li>1. Measurement of pulse, blood pressure.</li> <li>2. Elicitation of Reflexes &amp; jerks.</li> <li>3. Identification of blood cells by study of peripheral blood smear.</li> </ol> <p><b>Books Recommended</b></p> |
| 4. Basic English and Basic Computer | Theory-1<br>Practical-1 | <p><b>Objective:</b><br/>The objective of this course is to develop basic English speaking knowledge and fundamental</p>   |

|  |                                 |  |
|--|---------------------------------|--|
| <p>Science</p> <p>(NOT FOR UNIVERSITY EXAMINATION)</p> | <p>Total-2</p>                  | <p>computer operating skills among students for operational management of Medical Laboratories</p> <p><b>Learnings:</b></p> <p><b>ENGLISH</b> (Not for university Examination)</p> <ol style="list-style-type: none"> <li>1. Introduction: Study techniques, Organization of effective note taking and logical processes of analysis and synthesis, the use of the dictionary, enlargement of vocabulary &amp; effective dictation.</li> <li>2. Applied Grammar: Correct usage, the structure of sentences, the structure of paragraphs.</li> <li>3. Written Composition: Precise writing and summarising, writing of bibliography, enlargement of vocabulary.</li> <li>4. Reading and comprehension: Review of selected materials and express oneself in one's words, enlargement of vocabulary.</li> <li>5. The study of various forms of composition paragraph, essay, letter, summary, practice in writing.</li> <li>6. Verbal communication: Discussions and summarization, debates, oral reports, use in teaching.</li> </ol> <p><b>COMPUTER</b> (Not for university Examination)</p> <ol style="list-style-type: none"> <li>1. Basics of computer</li> <li>2. Hardwares and softwares</li> <li>2. Input and output devices</li> <li>3. Operating system – DOS, etc</li> <li>4. Internet-Email, social networking, application in medicine, browsing journals and article using internet.</li> </ol> |
| <p><b>Second Semester Subject</b></p>                  | <p><b>Credits</b></p>           | <p><b>Syllabus</b></p>   |
| <p>1. Medical Biochemistry</p>                         | <p>Theory-6<br/>Practical-4</p> | <p><b>Objectives:</b> Review of Chemistry as applicable to human biochemical systems: knowledge about chemical properties and standardization of various materials used in biochemical analysis.</p>   |

|  |          |   |
|--|----------|---|
|  | Total-10 | <p>Chemistry of molecules, enzymes, laboratory safety</p> <p><b>Learnings:</b></p> <p>BIOCHEMISTRY (THEORY)</p> <ol style="list-style-type: none"> <li>1. Chemistry of carbohydrates &amp; their related metabolism - Introduction, definition, classification, biomedical importance &amp; properties.<br/>Brief outline of metabolism: Glycogenesis &amp; glycogenolysis (in brief), Glycolysis, citric acid cycle &amp; its significance, HMP shunt &amp; Gluconeogenesis (in brief), regulation of blood glucose level.</li> <li>2. Amino acids - Definition, classification, essential &amp; non-essential amino acids.</li> <li>3. Chemistry of Proteins &amp; their related metabolism - Introduction, definition, classification, biomedical importance. Metabolism: Transformation, Decarboxylation, Ammonia formation &amp; transport, Urea cycle, metabolic disorders in urea cycle, catabolism of amino acids especially Phenylalanine, Tyrosine &amp; Tryptophan, Creatine, Creatinine, Proteinuria.</li> <li>4. Chemistry of Lipids &amp; their related metabolism - Introduction, definition, classification, biomedical importance, essential fatty acids. Brief outline of metabolism: Beta oxidation of fatty acids, fatty liver, Ketosis, Cholesterol &amp; its clinical significance, Lipoproteins in the blood composition &amp; their functions in brief, Atherosclerosis.</li> <li>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.</li> <li>6. Acid base balance concepts &amp; disorders - pH, Buffers, Acidosis, Alkalosis</li> <li>7. Hyperglycemia &amp; hypoglycemia - Diabetes mellitus - definition, types, features, gestation diabetes mellitus, glucose tolerance test, glycosurias, Hypoglycemia &amp; its causes</li> </ol> |
|--|----------|---|

### BIOCHEMISTRY (PRACTICAL)

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

#### Books Recommended

| S. No. | Author (s)          | Book Title                      | Publisher             |
|--------|---------------------|---------------------------------|-----------------------|
| 1.     | SHARMA AND PARASHAR | DICTIONARY OF BIOCHEMISTRY      | CBS PUBLISHER         |
| 2.     | HAROLD AND VARLEY   | PRACTICAL CLINICAL BIOCHEMISTRY |                       |
| 3.     | LAXMI AHUJA         | QUICK REVIEW IN BIOCHEMISTRY    | ASIA PRINTOGRAPH      |
| 4.     | ZUBAY               | BIOCHEMISTRY                    | WM.C. BROWN PUBLISHER |
| 5.     | ZUBAY               | STUDENTS SOLUTION GUIDE –       |                       |



|                                      |                                    |  |                      |                                    |                         |
|--------------------------------------|------------------------------------|--|----------------------|------------------------------------|-------------------------|
|                                      |                                    |  |                      | BIOCHEMISTRY                       |                         |
|                                      |                                    | 6.   | A.C. DEB             | FUNDAMENTALS OF BIOCHEMISTRY       | NEW CENTRAL BOOK AGENCY |
|                                      |                                    | 7.   | VARUN KUMAR MALHOTRA | HANDBOOK OF PRACTICAL BIOCHEMISTRY | JAYPEE BROTHERS         |
|                                      |                                    | 8.   | LAHINGER             | PRINCIPLES OF BIOCHEMISTRY         |                         |
|                                      |                                    | 9.   | MURRAY               | HARPER'S BIOCHEMISTRY              | TATA MC GRAW HILL       |
|                                      |                                    | 10.  | GOWEN LOCK           | PRACTICAL CLINICAL BIOCHEMISTRY    | CBS PUBLISHER           |
|                                      |                                    | 11.  | GUPTA                | PRACTICAL BIOCHEMISTRY             |                         |
|                                      |                                    | 12.  | SINGH                | PRACTICAL MANUAL BIOCHEMISTRYQ     | CBS PUBLISHER           |
|                                      |                                    | 13.  | HARPER               | ILLUSTRATED BIOCHEMISTRY           |                         |
|                                      |                                    | 14.  | KL MUKHERJEE         | MEDICAL LAB TECHNOLOGY             | TATA MC GRAW HILL       |
|                                      |                                    | 15.  | P.D. GODKAR          | TEXTBOOK OF MEDICAL LAB TECHNOLOGY | BALANI PUBLISHING HOUSE |
| 2. Introduction to General Pathology | Theory-3<br>Practical-1<br>Total-4 | <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>- The student will be able to explain the basic nature of disease processes from the standpoint of causation, epidemiology, natural history, and the structural and functional abnormalities.</li> <li>- The student will be able to devise likely diagnoses from clinical scenarios by recognizing key manifestations of congenital, hemodynamic, inflammatory, infectious, metabolic, environmental, and neoplastic diseases</li> </ul> |                      |                                    |                         |

### Learnings

#### GENERAL PATHOLOGY (THEORY)

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; 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, haemorrhage, 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 PATHOLOGY (PRACTICAL)

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.

### Books Recommended

|  |   |  |
|--|---|--|
| <p>3. Introduction to General Microbiology</p> | <p>Theory-3<br/>Practical-1<br/>Total-4</p> | <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>- To introduce basic principles and application relevance of clinical disease for students who are in preparation for Laboratory Technicians. The content of this course includes etiological agents responsible for global infectious diseases.</li> </ul> <p><b>Learnings</b></p> <p>GENERAL MICROBIOLOGY (THEORY)</p> <ol style="list-style-type: none"> <li>1. General characters and classification of Bacteria.</li> <li>2. Characteristics of Bacteria: Morphology - Shape, Capsule, Flagella, Inclusion, Granule, Spore.</li> <li>3. Growth and Maintenance of Microbes: Bacterial division, Batch Culture, Continuous culture, bacterial growth- total count, viable count, bacterial nutrition, oxygen requirement, CO<sub>2</sub> requirement, temperature, pH, light.</li> <li>4. Sterilization and Disinfection: Physical agents- Sunlight, Temperature less than 1000C, Temperature at 1000C, steam at atmospheric pressure and steam under pressure, irradiation, filtration. Chemical Agents- Alcohol, aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.</li> <li>5. Culture Media: Definition, uses, basic requirements, classification, Agar, Peptone, Transport Media, Sugar Media, Anaerobic Media, Containers of Media, Forms of Media</li> <li>6. Staining Methods: Simple, Grams staining, Ziehl-Neelsen staining or AFB staining, Negative Impregnation</li> <li>7. Collection and Transportation of Specimen: General Principles, Containers, Rejection, Samples- Urine, Faeces, Sputum, Pus, Body fluids, Swab, Blood.</li> <li>8. Care and Handling of Laboratory Animals: Fluid, Diet, Cleanliness, Cages, ventilation, Temperature, Humidity, handling of Animals, Prevention of disease.</li> <li>9. Disposal of Laboratory/Hospital Waste: Non-infectious waste, Infected sharp waste disposal, infected non-sharp waste disposal.</li> </ol> |
|--|---|--|

|                                      |                                    |   |
|--------------------------------------|------------------------------------|---|
|                                      |                                    | <p>GENERAL MICROBIOLOGY (PRACTICAL)</p> <ol style="list-style-type: none"> <li>1. Preparation of swabs/sterile tubes &amp; bottles.</li> <li>2. Preparation of smear.</li> <li>3. Staining: Gram &amp; Ziehl-Neelsen staining.</li> <li>4. Identification of Culture media.</li> <li>5. Identification of instruments.</li> <li>6. Identification of common microbes.</li> </ol> <p><b>Books Recommended</b></p>  |
| <b>Third Semester<br/>Subject</b>    | <b>Credits</b>                     | <b>Syllabus</b>   |
| 1. Haematology & Coagulation Studies | Theory-6<br>Practical-3<br>Total-9 | <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>- Knowledge about Blood and its various components, identification and analysis</li> </ul> <p><b>Learnings</b></p> <p>HEMATOLOGY &amp; COAGULATION STUDIES (THEORY)</p> <ol style="list-style-type: none"> <li>1. Hematological Disorders: a. Classification of Anemia : Morphological &amp; etiological; b. Iron Deficiency Anemia : Distribution of body Iron, Iron Absorption, causes of iron deficiency, lab findings; c. Megaloblastic Anemia : Causes, Lab findings; d. Hemolytic Anemia : Definition, causes, classification &amp; lab findings; e. Bone Marrow : Cell composition of normal adult Bone marrow, Aspiration, Indication, Preparation &amp; Staining, Special Stain for Bone Marrow -Periodic Acid Schiff, Sudan Black, Myeloperoxidase; f. Leukemia : Classification, Blood Picture, Differentiation of Blast Cells.</li> <li>2. Basic Hematological Techniques: a) Characteristics of good technician; b) Preparation of</li> </ol> |

specimen collection material; c) Lab. request form; d) Basic steps for drawing a blood specimen by veinipuncture. Complications of veinipuncture; e) Patient after care; f) Specimen rejection criteria for blood specimen; g) Hemolysis of blood; h) Blood collection by skin puncture (Capillary Blood); i) Arterial puncture; j) Deciding specimen types and selection of Anticoagulant- EDTA, Citrate, Oxalate, Heparin, sodium fluoride; k) Separation of serum; l) Separation of plasma; m) Changes in blood on keeping; n) Maintenance of specimen identification; o) Transport of the specimen; p) Effect of storage on Blood Cell Morphology; q) Universal precautions

3. Hemostasis - Definition, Basic concept and principle, Basic steps involved in Hemostasis.

4. Coagulation: a) Basic Physiology, coagulation factors; b) Mechanism of blood coagulation; c) Extrinsic Pathway; d) Intrinsic Pathway; e) Regulators of blood coagulation.

5. Testing of blood coagulation: a) Bleeding Time, Duke's method; b) Clotting Time- Capillary tube method & Lee white's method; c) PT, aPTT, TT; d) Clot retraction time; e) Determination of fibrinogen.

6. Quality Assurance for routine Hemostasis Laboratory; a) Introduction; b) Sample collection technique (Phlebotomy); c) Sample preparation, Anticoagulant used, Importance of use of Sodium Citrate.

7. Role in Diseases, Bleeding disorders: a) Platelet disorder – Thrombocytopenias-causes including aplastic anemia; b) DIC; c) ITP; d) Hemophilia

#### HEMATOLOGY & COAGULATION STUDIES (PRACTICAL)

1. Basic requirements for hematology laboratory.

2. Glasswares & Equipments for Hematology.

4. Anticoagulant vial preparation.

5. Complete Blood Counts.

6. Determination of Hemoglobin.

|                        |                                    |   |
|------------------------|------------------------------------|---|
|                        |                                    | <p>7. TRBC Count by Hemocytometers.<br/>8. TLC by Hemocytometer.<br/>9. Differential Leukocyte count.<br/>10. Determination of Platelet Count; ESR by wintrobes &amp; Westergeren's method; PCV by Wintrobes<br/>11. Erythrocyte Indices- MCV, MCH, MCHC.<br/>12. Reticulocyte Count; Absolute Eosinophil Count.<br/>13. Precautions to prevent hemolysis; Clot Retraction Time<br/>14. Storage of blood specimens<br/>15. Bleeding time &amp; clotting time estimation; Prothrombin time estimation; aPTT (activated partial thromboplastin time) estimation</p> <p><b>Books Recommended</b></p>   |
| 2. Cyto-Histopathology | Theory-6<br>Practical-3<br>Total-9 | <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>- The students are made to learn the techniques of receiving proper processing of clinical, cytological, and histological specimens. The student will gather basic understanding of handling and processing specimens</li> </ul> <p><b>Learnings</b></p> <p>CYTO-HISTOPATHOLOGY (THEORY)</p> <ol style="list-style-type: none"> <li>1. Introduction to Histopathology, exfoliative Cytology.</li> <li>2. Basic steps for Tissue Processing- Fixing, Embedding, Microtomy, Staining, Mounting, methods of decalcifications.</li> <li>3. Laboratory requirements for Histopathology &amp; Cytology - Chemicals &amp; Reagents</li> <li>4. Equipments - Microscope, Microtome -Types, Uses, Parts, different types of microtome knives, care &amp; maintenance. Automated tissue processor - components, working &amp; precautions during use,</li> </ol> |

|                                    |                |  |
|------------------------------------|----------------|--|
|                                    |                | <p>Tissue floating bath.</p> <p>5. Staining Methods -</p> <ol style="list-style-type: none"> <li>a. Hematoxylin &amp; Eosin stain, Hematoxylin - Types, methods of preparation, staining, Eosin - Method of preparation.</li> <li>b. Reticulin stain</li> <li>c. PAP staining- components &amp; methods.</li> </ol> <p>6. Museum Techniques</p> <ol style="list-style-type: none"> <li>a. The mounting of pathological specimens - Introduction., Preparation of specimen, Fixation of specimen- Kaiserling solution-1 &amp; Kaiserling solution-2</li> <li>b. Precaution taken for the Fixation of Specimens.</li> <li>c. Storage of Specimens.</li> <li>d. Mounting of Museum Specimens.</li> <li>e. Routine Mounting of Specimens.</li> <li>f. Filling and Scaling.</li> </ol> <p>CYTO-HISTOPATHOLOGY (PRACTICAL)</p> <ol style="list-style-type: none"> <li>1. Parts of microtome</li> <li>2. Tissue processing</li> <li>3. H&amp;E staining</li> <li>4. PAP staining</li> </ol> <p><b>Books Recommended</b></p> |
| <b>Fourth Semester<br/>Subject</b> | <b>Credits</b> | <b>Syllabus</b>  |
| 1. Clinical                        | Theory-6       | <b>Objective</b>   |

|                     |                                |   |
|---------------------|--------------------------------|---|
| <p>Biochemistry</p> | <p>Practical-3<br/>Total-9</p> | <ul style="list-style-type: none"> <li>- To learn basic outline of metabolic processes as applicable to organ systems, and fundamentals of medical biotechnology, immunochemistry and composition, functions of various body fluids</li> </ul> <p><b>Learnings</b></p> <p>CLINICAL BIOCHEMISTRY (THEORY)</p> <p>1- Photometry: Definition, laws of photometry, absorbance, transmittance, absorption maxima, instruments, parts of photometer, types of photometry–colorimetry, spectrophotometry, flame photometry, fluorometry, choice of appropriate filter, measurements of solution, calculation of formula, applications.</p> <p>2- Water &amp; Mineral Metabolism: Distribution of fluids in the body, ECF &amp; ICF, water metabolism, dehydration, mineral metabolism, macronutrients (principal mineral elements) &amp; trace elements.</p> <p>3- Liver Functions &amp; their Assessment: Based on: 1- Carbohydrate metabolism 2-Protein metabolism 3- Lipid metabolism</p> <p>4-Measurements of serum enzyme levels 4-Bile pigment metabolism, Jaundice, its types and their biochemical findings.</p> <p>4- Renal Function Tests: Various Tests, GFR &amp; Clearance</p> <p>5- Immunodiffusion Techniques, Radioimmunoassay &amp; ELISA: Principles &amp; Applications.</p> <p>6- Electrophoresis - Principle, Types &amp; Applications.</p> <p>7- Polymerase Chain Reaction - Principle &amp; Applications</p> <p>8- Autoanalysers - Principle &amp; Applications</p> <p>9- Vitamins Fat &amp; water-soluble vitamins, sources, requirement, deficiency disorders &amp; biochemical functions.</p> <p>10- Cardiac Profile - In brief Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases</p> <p>11- Different methods of Glucose Estimation: Principle advantage and disadvantage of different</p> |
|---------------------|--------------------------------|---|



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 phosphatase estimation
18. Acid phosphatase estimation
19. Serum sodium estimation
20. Serum potassium estimation

|   |   |  |
|---|---|--|
|   |   | <p>21. Serum chloride estimation<br/>22. CK-NAC estimation</p> <p><b>Books Recommended</b></p>   |
| <p>2. Microbiology<br/>(Bacteriology,<br/>Mycology, Virology)</p> | <p>Theory-6<br/>Practical-3<br/>Total-9</p> | <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>- To learn the processing, identification, culture, cultivation, and handling samples of various pathogens like parasites, bacteria, fungi and viruses.</li> <li>- To understand and prevent biological hazards associated with such pathogens</li> </ul> <p><b>Learnings</b></p> <p>MICROBIOLOGY (THEORY)</p> <p>SYSTEMIC BACTERIOLOGY</p> <p>Study of - Staphylococcus, Streptococcus, Pneumococcus, Neisseria gonorrhoea, Neisseria meningitis, Corynebacterium diphtheriae, Mycobacterium, Clostridium, E.coli, Klebsiella, Salmonella, Proteus, Pseudomonas, Vibrio &amp; Spirochaetes with reference to their :</p> <ul style="list-style-type: none"> <li>- Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused &amp; lab diagnosis.</li> </ul> <p>MYCOLOGY</p> <ul style="list-style-type: none"> <li>- Morphology and Structure of fungi</li> <li>- Classification of fungi</li> <li>- Nutrition and cultivation of fungus</li> <li>- Cutaneous &amp; Sub cutaneous and Systemic Mycosis (in brief)</li> <li>- Lab diagnosis of fungal Infections</li> </ul> |

|  |  |   |
|--|--|---|
|  |  | <p>- Opportunistic fungal infections</p> <p><b>VIROLOGY</b></p> <ul style="list-style-type: none"> <li>- General characters of viruses</li> <li>- Classification of viruses</li> <li>- Lab diagnosis of viral infections</li> <li>- Cultivation of viruses</li> <li>- Bacteriophages.</li> <li>- Retro viruses - HIV, Hepatitis virus , Pox virus ,</li> <li>- Picorna virus - Polio</li> <li>- Orthomyxo virus - Influenza</li> <li>- Arbo virus - Chikungunya, Dengue</li> <li>- Herpies and Adeno virus</li> </ul> <p><b>PRACTICAL</b></p> <p><b>SYSTEMIC BACTERIOLOGY</b></p> <ol style="list-style-type: none"> <li>1. Culture Techniques</li> <li>2. Composition of culture media</li> <li>3. Preparation of media</li> <li>4. Identification of media &amp; their uses</li> <li>5. Culture methods &amp; identification of common bacteria on media.</li> <li>6. Antibiotic sensitivity testing.</li> </ol> <p><b>MYCOLOGY &amp; VIROLOGY</b></p> <ol style="list-style-type: none"> <li>1. Culture Media used for fungus.</li> <li>2. Fungal culture</li> <li>3. Methods of lab diagnosis &amp; virus.</li> </ol> |
|--|--|---|

| Fifth Semester<br>Subject  | Credits                            | Books Recommended  |
|--|------------------------------------|--|
| 1. Microbiology<br>(Immunology,<br>Serology and<br>Parasitology) | Theory-6<br>Practical-3<br>Total-9 | <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>- To learn the processing, identification, culture, cultivation, and handling samples of various pathogens like parasites, bacteria, fungi and viruses.</li> <li>- To understand and prevent biological hazards associated with such pathogens</li> </ul> <p><b>Learnings</b><br/>MICROBIOLOGY &amp; IMMUNOLOGY (THEORY)</p> <p>IMMUNOLOGY &amp; SEROLOGY</p> <ol style="list-style-type: none"> <li>1. Immunity - Definition and classification               <ul style="list-style-type: none"> <li>- General Principles of Innate &amp; Acquired Immunity.</li> </ul> </li> <li>2. Immune Response - Humoral immunity &amp; cell mediated immunity.</li> <li>3. Antigen - Definition, classes, properties.</li> <li>4. Antibodies/Immunoglobulins - Definition, Properties, Sub types of Immunoglobulins</li> <li>5. Antigen/Ab Reaction/Serological Refractions -</li> <li>6. Features of antigen/antibody Reaction-               <ul style="list-style-type: none"> <li>- Precipitation</li> <li>- Agglutination</li> <li>- Complement fixation test</li> <li>- Neutralization</li> <li>- Opsonization</li> </ul> </li> </ol> |

- 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 hypersensitivity reactions i.e., type 1, 2, 3, 4.
  - Auto immune disorders
- 9. ELISA
- 10. Vaccination - Schedule & Vaccines

#### PARASITOLOGY

1. Definition - parastism, HOST, Vectors etc.
  2. Classification of Parasites.
  3. Phylum Protozoa- general Pathogenic and non-pathogenic protozoa.
  4. Phylum Nematelminths/Round words (Nematoda) .
  5. Phylum Platyhelminths - class-Cestoda, class-Trematoda.
  6. Lab diagnosis of parasitic infections.
- Protozoa :
- i. Intestinal Amoebae
    - a. E. Histolytica : Life cycle, Morphology, Disease & Lab Diagnosis
    - b. E. coli : Life cycle, Morphology, Disease & Lab Diagnosis
  - ii. Flagellates of intestine/genitalia
    - a. Giardia lamblia : Life cycle, Morphology, Disease & Lab Diagnosis
    - b. Trichomonas vaginalis : Life cycle, Morphology, Disease & Lab Diagnosis

|  |  |   |
|--|--|---|
|  |  | <p>iii. Malarial Parasite</p> <p>a. Plasmodium vivax : Life cycle, Morphology, disease &amp; lab diagnosis</p> <p>b. Differences between P. vivax, P. malaria, P. falciparum &amp; P. ovale.</p> <p>Nematodes :</p> <p>Intestinal Nematodes :</p> <p>a. Ascaris : Life cycle, Morphology, disease &amp; lab diagnosis</p> <p>b. Brief discussion about Enterobius vermicularis (Thread worm ) and Ancylostoma duodenale (Hook worm)</p> <p>Tissue Nematodes :</p> <p>W. Bancrofti - Life cycle, Morphology, Disease &amp; Lab Diagnosis</p> <p>Phylum Platyhelminths</p> <p>a. Cestodes - T. solium, T. saginata &amp; E. granulosus. (in brief)</p> <p>b. Trematodes - S. haematobium &amp; F. hepatica (in brief)</p> <p><b>PRACTICAL</b></p> <p><b>IMMUNOLOGY &amp; SEROLOGY</b></p> <ul style="list-style-type: none"> <li>• WIDAL Test</li> <li>• VDRL Test,</li> <li>• RA Test</li> <li>• CRP Test</li> <li>• Pregnancy Test &amp; HIV Test</li> </ul> <p><b>PARASITOLOGY</b></p> <ul style="list-style-type: none"> <li>• Stool examination.</li> <li>• Identification of different ova &amp; cysts in stool samples.</li> </ul> <p><b>Books Recommended</b></p> |
|--|--|---|

|   |   |   |
|---|---|---|
| <p>2. Transfusion medicine &amp; Immuno-haematology</p> | <p>Theory-6<br/>Practical-3<br/>Total-9</p> | <p><b>Objective</b></p> <ul style="list-style-type: none"> <li>- To understand diseases spreading through blood grouping, identification of donor, collection of blood from a donor, its prevention and long term storage</li> <li>- To learn selective preparation of various blood components</li> </ul> <p><b>Learnings</b></p> <p>TRANSFUSION MEDICINE &amp; IMMUNO-HEMATOLOGY (THEORY)</p> <p>1. Blood Grouping</p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Human Blood Group system</li> <li>• ABO Subgroups</li> <li>• Red Cell Antigen</li> <li>• Natural Antibodies</li> <li>• Rh System</li> <li>• Rh Antigens &amp; Rh Antibodies</li> <li>• Hemolytic Disease of Newborn &amp; Prevention</li> <li>• Principal of Blood grouping, antigen-antibodyreaction.</li> <li>• Agglutination, Haemagglutination, Condition required for antigen antibody reaction.</li> <li>• Blood grouping techniques, Cell grouping, Serum grouping.</li> <li>• Methods for ABO grouping. Slide &amp; Tube Method, Cell grouping, Serum grouping, Rh grouping by slide &amp; tube method.</li> <li>• Difficulties in ABO grouping.</li> <li>• Rouleaux formation, how it interfere with Blood grouping.</li> <li>• Auto agglutinins.</li> <li>• Antiserum used in ABO test procedures, Anti –A, Anti-B Anti- AB Antiserum.</li> </ul> |
|---|---|---|

- Inheritance of the Blood groups.
  - Control, A&B Cells preparation, Auto control.
  - Medical applications of Blood groups.
2. Blood Transfusion
- Principal & Practice of blood Transfusion.
  - Blood Transfusion service at District level.
  - Guide lines for the use of Blood, Appropriate use of Blood, Quality Assurance.
  - Antilogous Blood Transfusion practices.
  - Objectives of Quality Assurance in Blood Transfusion services, Standard operating procedures for usage, donation & storage of blood, screening of donor, compatibility testing, safety, procurement of supplies.
3. Blood Donation
- Introduction
  - Blood donor requirements
  - Criteria for selection & rejection
  - Medical history & personal details
  - Self-exclusion.
  - Health checks before donating blood.
  - Screening for TTI.
4. Blood Collection
- Blood collection packs.
  - Anticoagulants.
  - Taking & giving sets in Blood transfusion.
  - Techniques of collecting blood from a doctor.
  - Instructions given to the donor after blood donation.
  - Adverse donor reaction.



|  |  |   |
|--|--|---|
|  |  | <p>5. Testing Donor Blood</p> <ul style="list-style-type: none"> <li>• Screening donor's blood for infectious agents - HIV, HCV, HBV, Trepanoma palladium, Plasmodium, HTLV.</li> <li>• Bacterially contaminated Blood.</li> </ul> <p>6. Blood Donor Records</p> <ul style="list-style-type: none"> <li>• Blood donation record book.</li> <li>• Recording results.</li> <li>• Blood donor card.</li> </ul> <p>7. Storage &amp; Transport</p> <ul style="list-style-type: none"> <li>• Storage of blood.</li> <li>• Changes in blood after storage.</li> <li>• Gas refrigerator.</li> <li>• Lay out of a blood bank refrigerator</li> <li>• Transportation.</li> </ul> <p>8. Maintenance of Blood Bank Records</p> <ul style="list-style-type: none"> <li>• Blood bank temperature sheet.</li> <li>• Blood bank stock sheet.</li> <li>• Blood transfusion request form.</li> </ul> <p>9. Compatibility Testing</p> <ul style="list-style-type: none"> <li>• Purpose</li> <li>• Single tube compatibility techniques using AHG reagent.</li> <li>• Emergency compatibility testing.</li> <li>• Difficulties in cross matching.</li> <li>• Labeling &amp; Issuing cross- matched blood.</li> </ul> <p>10. Blood Components</p> <ul style="list-style-type: none"> <li>• Collection of blood components for fractional transfusion.</li> </ul> |
|--|--|---|

|   |                                    |  |
|---|------------------------------------|--|
|   |                                    | <ul style="list-style-type: none"> <li>• Platelets packed Red Cell, Platelet rich Plasma, Platelets concentrate.</li> <li>• Preparation of concentrated (packed) Red cells.</li> <li>• Techniques of preparation.</li> </ul> <p>11. Blood Transfusion Reactions</p> <ul style="list-style-type: none"> <li>• Investigation of a Transfusion reaction.</li> <li>• Hemolytic transfusion reaction.</li> <li>• Actions to take when transfusion reaction occurs.</li> </ul> <p>PRACTICAL</p> <ul style="list-style-type: none"> <li>• Blood grouping &amp; Cross Matching</li> </ul> <p><b>Books Recommended</b></p>      |
| <b>Sixth Semester<br/>Subject</b>   | <b>Credits</b>                     | <b>Syllabus</b>  |
| 1. Advanced Clinical Biochemistry (including endocrinology & tumor markers) | Theory-6<br>Practical-3<br>Total-9 | <p><b>Objective:</b> To understand organization, functioning of routine emergency clinical laboratory, basic concepts of automation, other equipments, blood gas analyzer, flame photometer, ELISA reader, organ function assessment by biochemical tests etc.</p> <p><b>Learnings</b></p> <p><b>THEORY</b></p> <p>ENDOCRINOLOGY</p> <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Difference between hormones and enzymes.</li> <li>3. Classification of hormones.</li> <li>4. Regulation and general mechanism of action of hormones.</li> <li>5. Pituitary gland &amp; hypothalamus</li> </ol> |

6. Hormones of the Anterior Pituitary- Growth hormone, Prolactin, Gonadotropin, Follicle Stimulating hormone, Leuteinizing Hormone, Thyroid stimulating hormone (TSH), Adrenocorticotropic hormone (ACTH)
  7. Hormones of neurohypophysis- Oxytocin, Antidiuretic hormone (ADH)
  8. Hormones of the Thyroid gland- chemistry and normal physiology, Thyroid disorders-goiter, myxedema, autoimmune thyroiditis, tumors of the thyroid gland, hyperthyroidism, Graves disease, Calcitonin, Parathyroid Hormone (PTH)
  9. Adrenocortical hormones-synthesis and secretion, Aldosterone & its function, Addisons disease, Glucocorticoids & functions, Mineralocorticoids & functions, Cortisol & functions, Cushing's syndrome, Conn's syndrome.
  10. Adrenal medulla-metabolism of catecholamines
  11. Hormones of the gonads - Testosterone, Estrogens, Progesterone, their synthesis and functions. Human Chorionic Gonadotropin (HCG), hormone, menstrual cycle, Menopause
  12. Hormone of pancreas - Insulin- its metabolic effects on carbohydrates, fats & protein, control of insulin secretion, Glucagon- functions, metabolic effects, blood glucose regulation, Diabetes Mellitus, Somatostatin.
  13. Hormone of kidney - Renin
- TUMOR & CANCER MARKERS:**
1. Introduction.
  2. The Carcinogens-definition.
  3. Oncogene-definition Mechanism of action of Oncogenes (outline).
  4. Characteristics of growing tumor cells-general and morphological changes, biochemical changes.
  5. Tumor Markers Introduction and definition
  6. Clinical applications of tumor markers.
  7. Enzymes as tumor markers, Alkaline Phosphatase (ALP), Creatine kinase (CK), Lactate

dehydrogenase (LDH), Prostatic acid phosphatase (PAP), Prostate specific antigens (PSA).

8. Hormones as tumor markers (introduction of each type in brief).

9. Oncofetal antigens.

10. Alpha feto protein (AFP)

11. Carcino embryonic antigen (CEA)

12. Squamous cell carcinoma (SCC) antigen.

13. Carbohydrate markers (brief introduction of each type) CA 15-3, CA 125

14. Blood group antigen (brief introduction of each type) CA 19-9, CA 50, CA 72-4, CA 242

15. Bladder cancer markers (introduction in brief) - Bladder tumor antigen (BTA)

16. Fibrin- Fibrinogen degradation product (FDP).

17. Nuclear matrix protein (NMP22).

18. Biomarkers still in research (introduction in brief)- Telomeres, TRAP assay, hyaluronic acid and Hyaluronidase

### **PRACTICALS**

#### ENDOCRINOLOGY

Estimation of T3, T4, TSH, FSH, LH, hCG, Cortisol, Progesterone, Testosterone

#### TUMOR & CANCER MARKERS:

Estimation of Alpha feto proteins (AFP), Carcino embryonic antigen (CEA), CA- 125, Prostate specific antigen (PSA)

#### OTHER ELISA TESTS

Test for HIV, Hepatitis B (HBsAg), Hepatitis (HCV), Malaria antigen, Tuberculosis-IgG/IgM

### **Books Recommended**

|  |   |  |
|--|---|--|
| <p>2. Laboratory management;<br/>Automated Diagnostic techniques</p> | <p>Theory-6<br/>Practical-3<br/>Total-9</p> | <p><b>Objective:</b> The training of this subject is imparted in organizing various clinical laboratories and to learn procurement of chemical reagents and equipment, maintaining laboratory equipment, maintenance of stocks and inventory, recording results, interpretation, quality control and reproducibility.</p> <p><b>Learning Outcome</b><br/>AUTOMATION</p> <ol style="list-style-type: none"> <li>1. Automation - Introduction, meaning, advantages, history</li> <li>2. Continuous flow analyzers</li> <li>3. Single channel continuous flow analyzers-advantages, disadvantages</li> <li>4. Multi channel flow analyzers</li> <li>5. Discrete auto analyzers - basic features, types, semi automated, fully automated</li> <li>6. Batch analyzers</li> <li>7. Random access analyzers (RAA)</li> <li>8. Component steps in fully automated analyzers</li> <li>9. Auto analyzers based on immunoassay techniques, Micro particle enzyme immunoassay (MEIA)</li> <li>10. Various random access analyzers - Hitachi- 704, BM/Hitachi - 717</li> <li>11. Centrifugal analyzers, ASCA</li> <li>12. Dry chemistry analyzers</li> <li>13. Dimension RxL clinical chemistry system</li> <li>14. The Heterogeneous Immunoassay module components</li> <li>15. Beckman Array 360 system</li> <li>16. Mini Vidas analyzers</li> <li>17. Immulite automated immunoassay analyzers</li> <li>18. Latest trends in Automation, Biochips, Lab on a chip (LoC), Nanosensors advantages and disadvantages, PCR &amp; its applications.</li> </ol> |
|--|---|--|

### QUALITY LABORATORY MANAGEMENT

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

### PRACTICAL

#### CLINICAL BIOCHEMISTRY

(By Semiautoanalyzer / Fully automated analyzer)

1. Estimation of Cholesterol, HDL, LDL, Triglycerides, LDH, Glucose, Bilirubin (Total, Direct, Total + Direct), SGPT, SGOT, Acid Phosphatase, Alkaline Phosphatase, Iron, Creatinine, Urea, Uric acid, CK-MB, CK-NAC, Chlorides, Sodium, Potassium, Hexagon Troponin+, Phosphorus, TIBC, Albumin, Calcium, Hemoglobin, Magnesium, and Blood Urea Nitrogen.

### Books Recommended

