



Semester System Syllabus  
of

M.Sc. in Bio-Medical Laboratory Science and Management

1ST UGC INNOVATIVE PROGRAMME

VIDYASAGAR UNIVERSITY

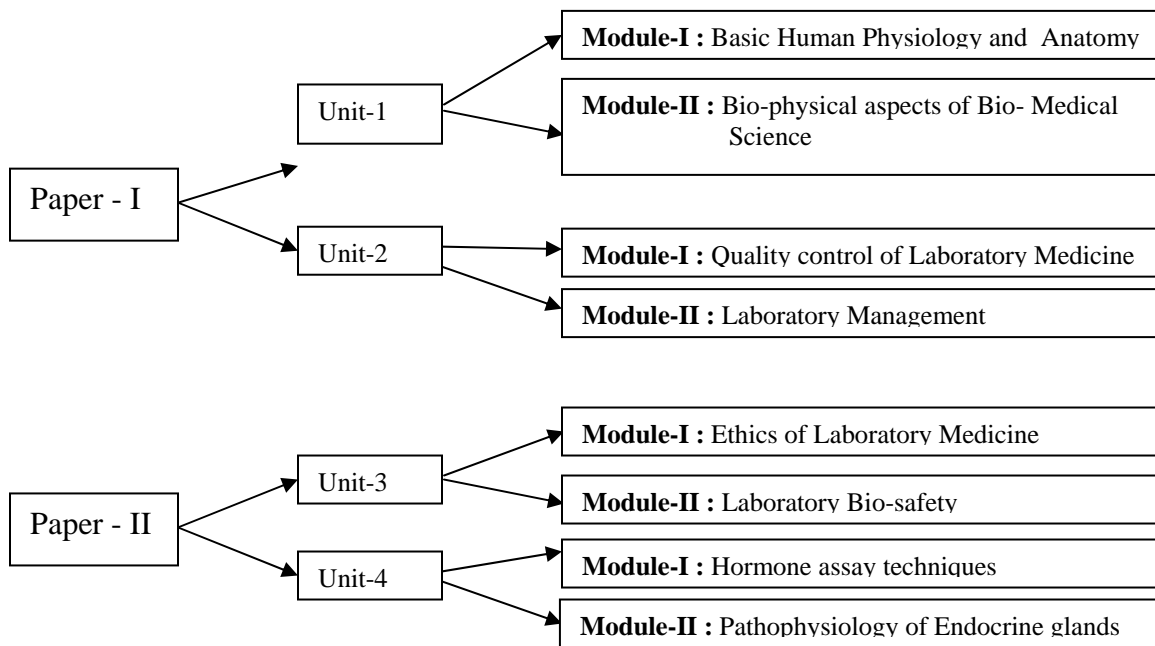
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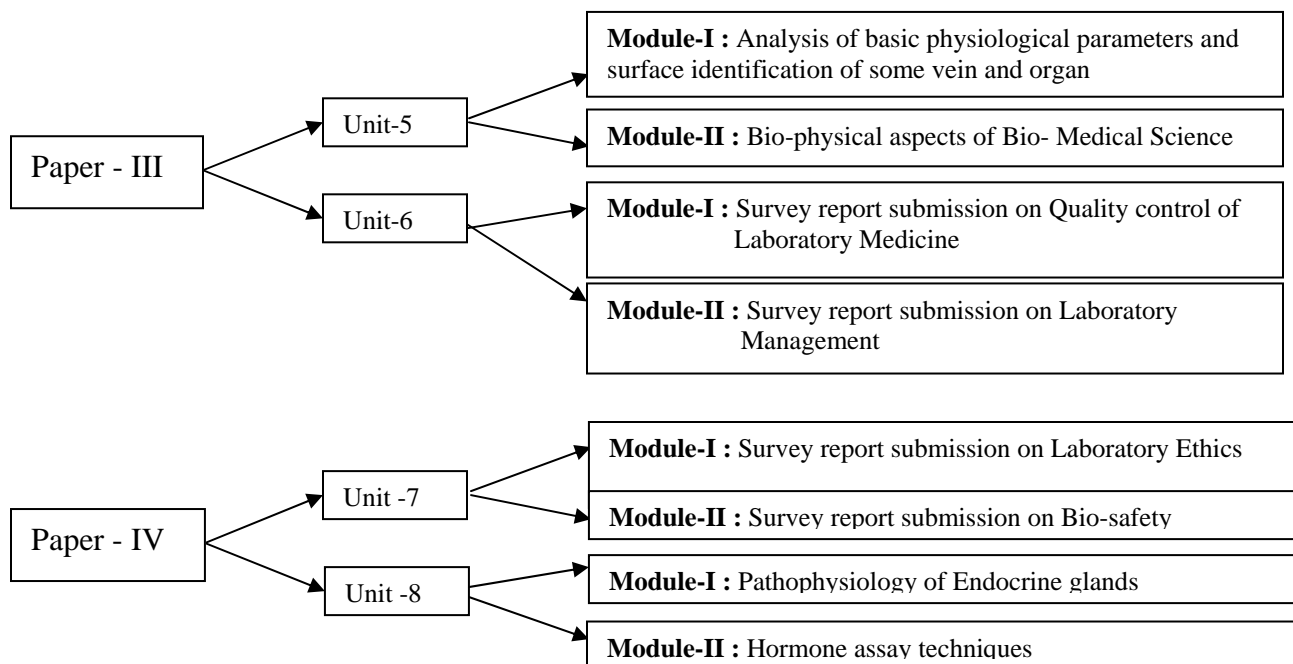
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**Syllabus in semester system of M.Sc. in Bio-Medical Laboratory Science and Management**

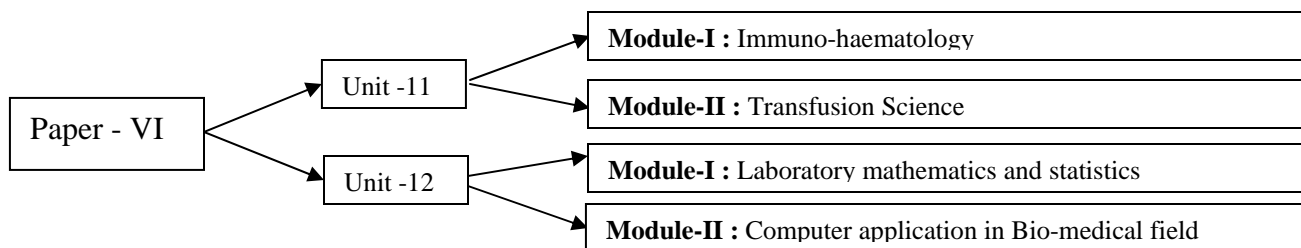
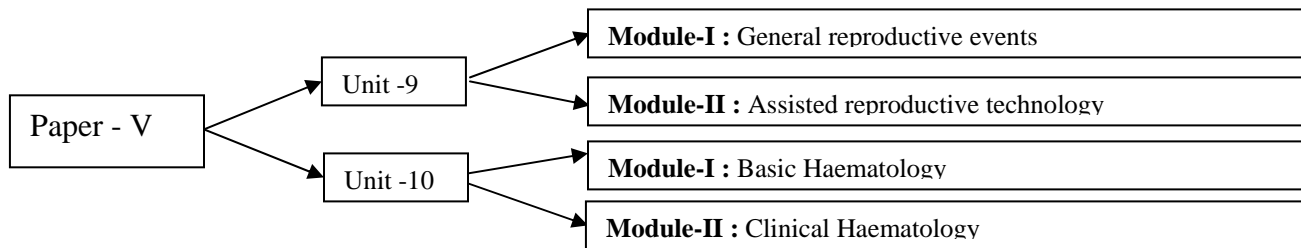
***1st Semester (Theoretical) Each Module contain 25 marks (Total - 200 marks)***



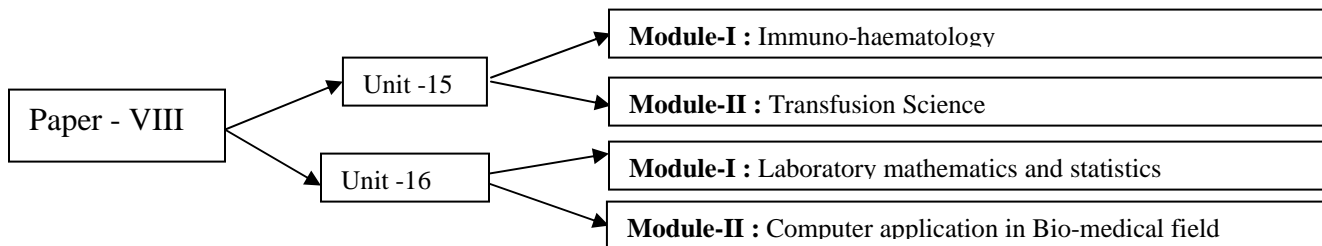
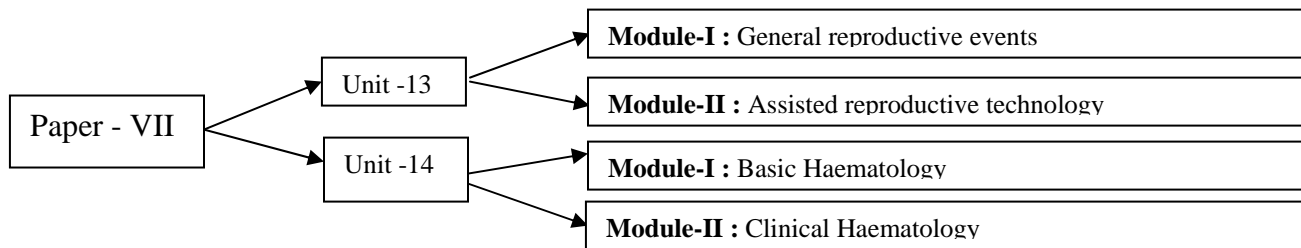
***1st Semester (Practical) Each Module contain 25 marks (Total - 200 marks)***



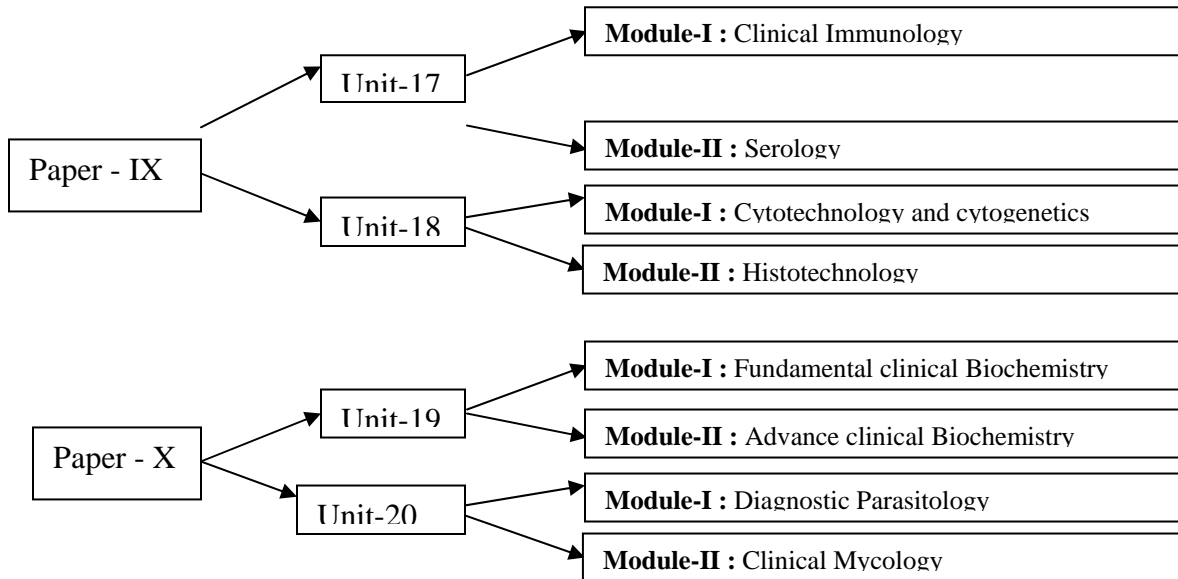
**2nd Semester (Theoretical) Each Module contain 25 marks (Total - 200**



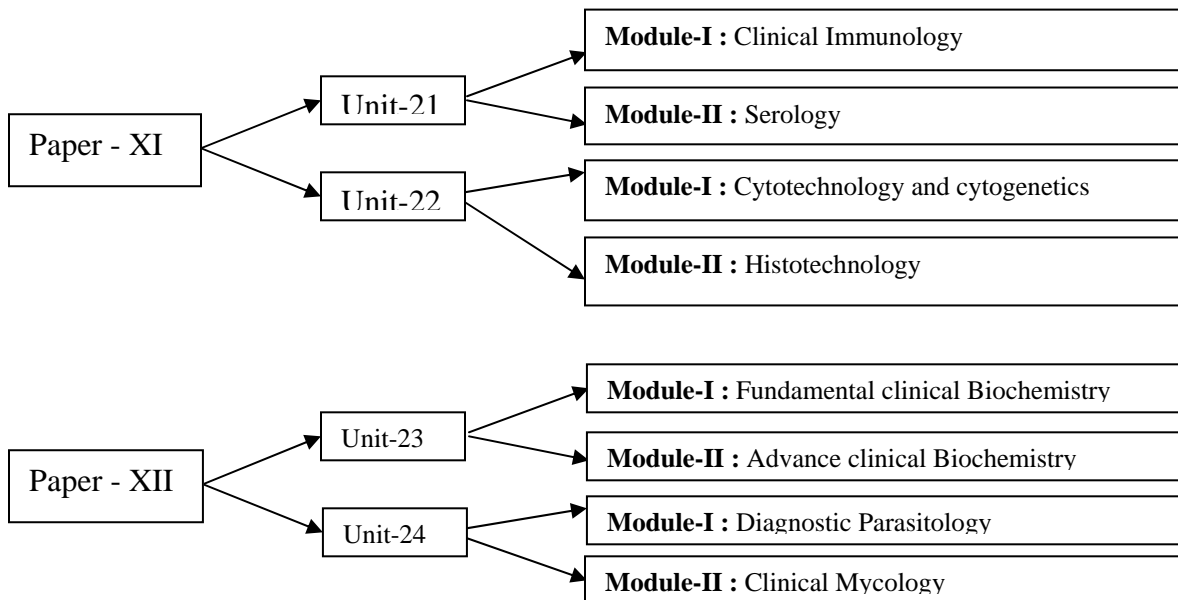
**2nd Semester (Practical) Each Module contain 25 marks (Total - 200 marks)**



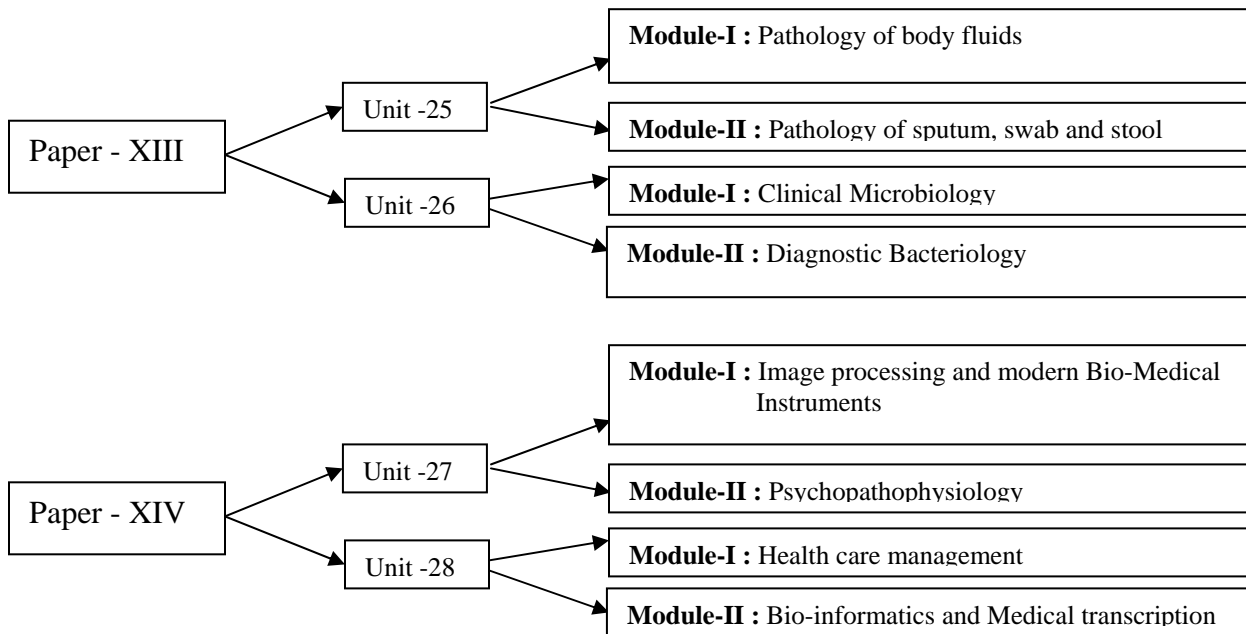
**3rd Semester (Theoretical) Each Module contain 25 marks (Total - 200 marks)**



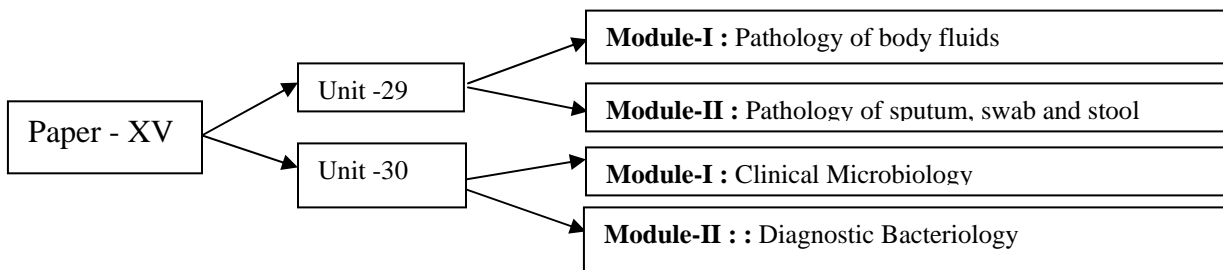
**3rd Semester (Practical) Each Module contain 25 marks (Total - 200 marks)**



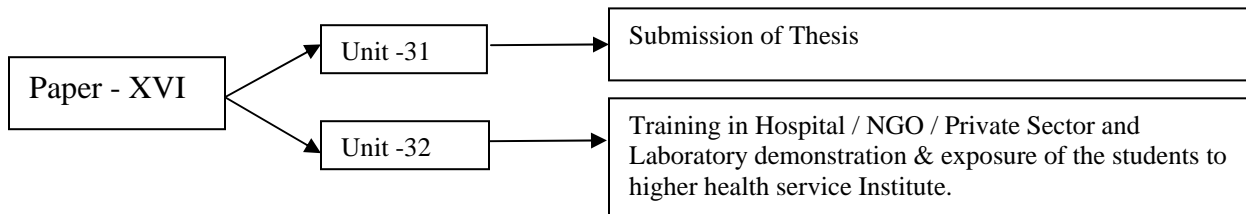
**4th Semester (Theoretical) Each Module contain 25 marks (Total - 200 marks)**



**4th Semester (Practical) Each Module contain 25 marks (Total - 100 marks)**



**4th Semester (Thesis & Training) Each Unit contain 50 marks**



## Syllabus in semester system of M.Sc. in Bio-Medical Laboratory Science and Management

### *1<sup>st</sup> Semester (Theoretical)*

#### *Paper – I*

#### *(Unit – 1)*

<b>Module – I :</b>	<b>Basic Human Physiology, pathophysiology and Anatomy</b>	<b>Full Marks - 25 (30 hrs Lectures)</b>
	<ol style="list-style-type: none"><li>1. Basic concept of different physiological systems of human subjects</li><li>2. Physical performance and its assessment.</li><li>3. Growth pattern and its anthropometrics assessment</li><li>4. Pathophysiology of obesity</li><li>5. Deviation of blood pressure homeostasis (hypertension and hypotension), Atherosclerosis &amp; cardiovascular diseases.</li><li>6. Blood glucose homeostasis and its deviation</li><li>7. Uric acid metabolism and gout</li><li>8. Oxidative stress and homeostasis and its deviation</li><li>9. Cellular apoptosis and necrosis. Cancer cells and its markers</li><li>10. Basic concept of Anatomy in different systems with special reference to surface anatomy, location of veins, visceral organs.</li></ol>	

<b>Module – II :</b>	<b>Bio-physical aspects of Bio- Medical Laboratory Science</b>	<b>Full Marks – 25 (30 hrs Lectures)</b>
	<ol style="list-style-type: none"><li>1. Dilution and strength of solution</li><li>2. pH meter and pH – determination</li><li>3. Buffers</li><li>4. Important precautions taken during various reagent preparation</li><li>5. Enzyme kinetics</li><li>6. End point reactions methods. Assessing linearity of a method.</li><li>7. Rate of reaction: Visible kinetic method and UV kinetic method, Fixed point and Two point kinetics.</li><li>8. Dialysis &amp; Ultra filtration.</li><li>9. Beer's law and Lambert's law and its application. Scanning in UV and IR.</li><li>10. Different types of microscopes – physical principles</li><li>11. Radiation hazards</li></ol>	

#### *Paper – I*

#### *(Unit – 2)*

<b>Module – I :</b>	<b>Quality control of Laboratory Medicine</b>	<b>Full Marks – 25 (30 hrs Lectures)</b>
	<ol style="list-style-type: none"><li>1. Quality Control of the product, chemicals, reagent.</li><li>2. Good, reliable, authentic report.</li><li>3. Total quality management framework of laboratory</li><li>4. Essential elements of Quality Assurance Programme</li><li>5. Internal Quality control: control of pre-analytical variables, control of analytical variables, laboratory precision, accuracy &amp; sensitivity, validation of methods</li><li>6. Reference materials and calibrating definitive methods.</li><li>7. Sources of variation in laboratory test results. Systemic and random errors.</li><li>8. Quality control charts: Levy-Jenning chart, Cusum chart and Gaussian curve.</li><li>9. Internal and external factors for quality control assurance.</li><li>10. Reference values</li></ol>	

**Module – II :****Laboratory Management****Full Marks – 25  
(30 hrs Lectures)**

1. Various types of laboratories
2. Standard Bio-Medical Laboratory set up.
3. Management to the client, patient, physician, administrative authority
4. Marketing management and economics related to Bio-medical laboratory science
5. Management by objectives-Cost benefit analysis, cost effective analysis, cost accounting, input-output analysis, system analysis, network analysis including PERT (Programme evaluation and review techniques) and CPM (Critical path method), PPBS (Planning programme budgeting system), work sampling, decision monitoring.
6. Cost of conformance & non-conformance.
7. Principles of management of employees relations
8. Good laboratory management practices
9. Improvement of laboratory operation
10. Signage system in laboratory and hospital

***Paper – II******(Unit – 3)*****Module – I :****Ethics of Laboratory Medicine****Full Marks – 25  
(30 hrs Lectures)**

1. Co-operation and working relationship with other health professionals
2. Confidentiality of patient information and test result
3. Dignity and privacy of patient
4. Responsibility from acquisition of the specimen to the production of data
5. Accountability for quality and integrity of clinical laboratory services
6. Institutional ethical committee and its role
7. Health & Medical surveillance
8. Laboratory ethics of Bio-Safety.
9. Code of good and safe laboratory practice for support staff and responsibilities of the workers regarding Bio-safety.
10. ISO rules for laboratory medicine.

**Module – II :****Laboratory Bio-Safety****Full Marks – 25  
(30 hrs Lectures)**

1. Set up of a laboratory on the basis of safety priority and Laboratory Biosafety Guidelines.
2. Laboratory Biosafety Level Criteria (BSL-1-4).
3. Handling, transfer and shipment of specimen. Decontamination and disposal. Treatment and disposal technologies for health-care waste.
4. Disinfections and sterilization. Chemical disinfections.
5. Wastes management, life cycle of bio-medical wastes.
6. Reduce recycle and reuse of wastes, technology used for bio-medical wastes treatment and disposal.
7. Chemical, electrical, fire and radiation safety. Safety organization
8. General Safety checklist
9. Hazardous properties of instruments and Laboratory chemicals. Laboratory first-aid measures and kit.
10. Safety equipments. Safety sign.

***Paper – II******(Unit – 4)*****Module – I :****Hormone assay techniques****Full Marks – 25  
(30 hrs Lectures)**

1. Techniques followed in hormones assay and different types of standard curve used in immunoassay.
2. Different types of ELISA and steps for antibody coating, enzyme conjugate preparation, second antibody preparation. Testing of hormone by ELISA.
3. Chemiluminescence's assay, Electrochemoluminance, Fluorescence Immunoassay (FIA).
4. Intra-assay and inter-assay co-efficient of hormones assay.
5. Sensitivity and cross-reaction specificity.
6. Standard curve plotting. Interpretation.
7. Different steps of RIA.
8. Assay of hormone by RIA.
9. Radiolabelling of hormones.
10. Recording of results. Interpretation.

**Module – II :**

**Pathophysiology of Endocrine glands**

**Full Marks – 25  
(30 hrs Lectures)**

1. Endocrine glands  
Information on pituitary- gonadal axis, feedback system, function, pathophysiology (male and female).  
Information on pituitary-thyroid axis, feedback system, function, goiter and goitrogens – its pathophysiology.  
Information on pituitary-adrenocortical axis feedback system:  
Pathophysiology.  
Information on pancreatic-hormones, regulation, function, disorders.
2. Dynamic Test on pituitary gonadal activities.
3. Dynamic Test on pituitary-thyroid activities.
4. Dynamic Test on pituitary- adrenal activities.
5. Dynamic Test on pancreatic activities.
6. Hormonal disorders in diabetes mellitus- its types- symptoms, cause, management.
7. Diabetes insipidus- cause, symptoms and management.
8. Hypertension- Cause, symptoms and management. Obesity - Cause, symptoms and management.
9. Hypogonadism - Cause, symptoms and management. Sterility- Hypertension- Cause, symptoms and management.
10. Goiter - Cause, symptoms and management. Adrenocortical syndromes- Cause, symptoms and management. Growth hormone diseases.

***Paper – III (Practical)***

***(Unit – 5)***

**Module – I : Analysis of basic physiological parameters and surface identification of some vein and organ**

**Full Marks – 25**

**(30 hrs Experimental Work)**

1. Blood pressure and heart rate measurement in different posture and exercise.
2. Measurement of BMI
3. Analysis of body surface area
4. Determination of PFI
5. Estimation of blood glucose(Manual Method)
6. Measurement of uric acid
7. Estimation of Catalase and Superoxide dismutase in serum
8. Assay of lipid peroxidation
9. Measurement of reduced glutathione and oxidized glutathione in blood
10. Estimation of glutathione peroxidase and glutathione reductase in blood
11. Surface identification of vein and organ

**Module – II :**

**Bio-physical aspects of Bio- Medical Science**

**Full Marks – 25  
(30 hrs Experimental Work)**

1. Strength determination of sample by titration. Acidometry and Alkalimetry
2. Standardization of pH meter, photometer/spectrophotometer.
3. pH-determination by pH meter. Buffer preparation.
4. Scanning in UV and IR.
5. Standardization of distilled water.
6. Selection of a filter to determine the intensity of different coloured solution.and identification of peak absorbtion
7. Determination of unknown concentration of a coloured solution by photometric method.
8. Standardization of an endpoint reaction method.
9. Standard curve preparation.
10. Unknown concentration measurement from standard curve.
11. Experiment on dialysis using dialysis bag.

***Paper – III (Practical)***

***(Unit – 6)***

**Module – I :**

**Full Marks – 25**

**Survey report submission on Quality control of Laboratory Medicine and viva on the same report**

**Module – II :**

**Full Marks – 25**

**Survey report submission on Laboratory Management and viva on the same report**

***Paper – IV (Practical)***

***(Unit – 7)***

**Module – I :**

**Full Marks – 25**

**Survey report submission on Ethics of Laboratory Medicine and viva on the same report**

**Module – II :**

**Full Marks – 25**

**Survey report submission on Bio-safety and viva on the same report**

***Paper – IV (Practical)***

***(Unit – 8)***

**Module – I :   Hormone assay techniques**

**Full Marks – 25**

**(30 hrs Experimental Work)**

1. Instrument used in hormone assay
2. Programme in ELISA reader for hormone assay
3. Intra assay & Inter assay variation & cross reaction in hormone assay
4. Standard curve plotting
5. Assay of FSH, TSH, LH, GH, Insulin in ELISA
6. Assay of T<sub>3</sub> and T<sub>4</sub> in ELISA reader
7. Assay of Testosterone, E<sub>2</sub>, Progesterone in ELISA reader
8. Programming in Gamma counter for hormone
9. Standard curve in Gamma counter
10. Hormone assay in Gamma counter

**Module – II : Pathophysiology of Endocrine glands**

**Full Marks – 25  
(30 hrs Experimental Work)**

1. Interpretation of results of LH, FSH, testosterone, estradiol and PRL from same serum sample (As per sex).
2. Interpretation of results of TSH and T<sub>3</sub> / T<sub>4</sub> from same serum sample.
3. Quantification of blood iodine for the assessment of thyroid.
4. Interpretation of results of insulin and C-peptide from same serum sample.
5. Interpretation of results of ACTH and cortisol from same serum sample.
6. Assessment of obesity by the estimation of lipid profile.
7. Assessment of hypertension by the estimation of cholesterol.
8. Assessment of atherosclerosis
9. Evaluation of autoimmune disorder in relation to pathophysiology of endocrine gland
10. Immuno endocrine evaluation with special reference to cytokines / growth factor

**2<sup>nd</sup> Semester (Theoretical)**

**Paper – V**

**(Unit – 9)**

**Module – I : General reproductive events**

**Full Marks - 25  
(30 hrs Lectures)**

1. Spermatogenesis  
Qualitative and quantitative study of spermatogenesis.
2. Hormonal control of spermatogenesis.
3. Method of semen collection and physical, microscopic and biochemical examination semen, sperm count, sperm motility, sperm morphology, fructose estimation of semen, acid phosphatase of semen. Hypoosmolarity test of sperm.
4. Oogenesis, Ovulation and its hormonal control.
5. Menstrual cycle and its biochemical model explanation. Cycle abnormalities
6. Implantation and its molecular aspect, role of blastocyst in implantation, disorder in implantation.
7. Contraceptives: General, immunological and emergency contraceptives
8. Gamet bank and cryopreservation.
9. Superovulation techniques.
10. Placenta and pregnancy maintenance, Endometriosis

**Module – II : Assisted reproductive technology**

**Full Marks – 25  
(30 hrs Lectures)**

1. Sperm viability

2. Testing for antibody coating of spermatozoa, Immunobead test, Mixed antiglobulin reaction test, Sperm cervical mucous Interaction capillary tube test, Measurement of reactive oxygen species generated by sperm suspensions, Assessment of neutral alpha glucosidase, Zinc , Leukocyte count in semen's.
3. Acrosome testing
4. Detection of rape by police department-acid phosphatase study.
5. Assisted reproductive technology (ART)
6. Causes of male and female infertility
7. Process of IUI- Limitation – advantages and disadvantages.
8. Process of IVF- Limitation – advantages and disadvantages.
9. Process of GIFT- Limitation – advantages and disadvantages
10. Process of ICSI- Limitation – advantages and disadvantages
11. Process of super grade quality of sperm collection in ART.

**Paper – V**

**(Unit – 10)**

**Module – I :**

**Basic Haematology**

**Full Marks - 25**

**(30 hrs Lectures)**

1. Introduction to haematology, homeostasis and coagulation
2. Basic concept of haematopoietic system. Components of blood and their functions – Cellular part & acellular part.
3. Basic concept of erythropoiesis, leucopoiesis & thrombocytosis – abnormality in WBC count, abnormality in platelet count.
4. Homeostasis of blood coagulation. Basic mechanism of blood coagulation. Anti coagulants – their roles.
5. Hemoglobin – chemistry, synthesis and factor regulation its synthesis, Types of Hemoglobin, and hemoglobin measurement by hemoglobin meter and Colorimeter.
6. Specimen collection and laboratory preparation in hematology.
7. Blood sample collection by pricking method and from brachial vein in Adult and in children.
8. Anticoagulant, used for collection of blood samples – merits and demerits of different anticoagulants.
11. Cleaning of laboratory glassware in hematology.
12. Haemoglobinopathies and blood cancer.

**Module – II :**

**Clinical Haematology**

**Full Marks – 25**

**(30 hrs Lectures)**

1. Automation in haematology
2. Separation of cellular and a cellular components (plasma and serum).
3. Routine hematological tests – Hb. Conc. Haematocrit, T.C. & D.C. of Leucocytes. Total count of erythrocytes, determination of erythrocyte indices – MCV, MCH, MCHC, Reticulocyte count, platelets count, ESR.
4. Bleeding disorders & Important routine coagulation test i.e., prothrombin time, partial thromboplastin time, thrombin time for the determination of bleeding disorders. Determination of clotting time, bleeding time, clot retraction and lyses time.
4. Special hematological test – glycosylated hemoglobin, G6PD deficiency anemia, L.E cell preparation, estimation of fetal hemoglobin , hemoglobin electrophoresis, fragility test of blood cells, preparation of bone marrow smear, peroxides test, alkaline phosphates test, red cell pyruvate kinase test (for reticulocytosis); tests for Hemophilia, Anemia, iron and total iron binding capacity (TIBC), plasma haemoglobin, intravascular haemolysis, hepatoglobin and hemolytic anaemia. Naked Eye Single Tube Red Cell Osmotic Fragility test (NESTROF test), acidified serum test and sucrose lysis test (for paroxysmal nocturnal haemoglobinuria). Plasma recalcification time, protamine sulphate test, determination of fibrinogen and its significance.
5. Laboratory reports preparation & interpretation of laboratory findings in hematology and Relevant parameters for an interpretation of laboratory finding in hematology
  6. Determination of haemograms.
  7. Haematology histograms.
  8. Haemolytic diseases of the newborn, Idea about thalasemia and sickle cell anemia.
  9. Genetic basic of thalasemia and its heredity management of thalasemia.

10. Genetic basic of sickle cell anemia, its heredity, management of sickle cell anemeia.

**Paper – VI**

**(Unit – 11)**

**Module – I :**

**Immuno-haematology**

**Full Marks - 25  
(30 hrs Lectures)**

1. Basic concept and principles of immunohaematology
2. Antigen, antibody, hapten and super antigen
3. Ig classification.
4. Antigens and antibodies in blood.
5. Stages of immunological reaction and concept of titer.
6. Blood group, types of blood groups and its principle
7. ABO blood group, sub types, H antigen
8. Serum grouping & Rh- typing
9. MN group
10. Determination blood groups by immunological test.

**Module – II :**

**Transfusion Science**

**Full Marks – 25  
(30 hrs Lectures)**

1. Blood transfusion in total or in fractionated part.
2. Conditions for blood transfusion.
3. Basic principle followed for blood transfusion.
4. Disorder due to mismatched blood transfusion and Erythroblastosis foetails.
5. Transmission of diseases in relation to blood transfusion (HIV, Jaundice - Hepatitis-B/C, Malaria)
6. Importance of blood test before marriage to check the transmission of haemolytic diseases in next generation.
7. Collection, processing of blood for transfusion and container for blood collection.
8. Anticoagulant solution used in blood collection, Screening of donor for blood collection, transportation of blood after collection and storage of blood.
9. Preparation and use of blood components. Routine laboratory procedure in blood transfusion, Anti human globulin test, Cross matching
10. Antibody screening test & cold agglutination test

**Paper – VI**

**(Unit – 12)**

**Module – I :**

**Laboratory mathematics and statistics**

**Full Marks - 25  
(30 hrs Lectures)**

1. Dilutions-mathematical basis of samples.
2. Strength of solution-Conversion-Mathematical approach.
3. Logarithms
4. Colorimetry- Mathematical approach
5. Graphs- Mathematical approach
6. Medical statistics: mean, median, mode, SD, SEM, probability, t-test, null hypothesis, co-relation, chi-square, ANOVA, Duncun's test.
7. Selection of appropriate methods for statistical analysis of collected parameters of biological samples.
8. Haematological mathematics.
9. Enzymatic calculation-Mathematical approach
10. Reasearch methodology

**Module – II :**

**Computer application in Bio-medical field**

**Full Marks – 25**

**(30 hrs Lectures)**

1. Basic idea of computer- Computer Hardware, Software, Operating system, Computer operation
2. Basic idea about MS Word & MS Excel
3. Basic idea about MS Power Point to submit data in a representable manner.
4. Clinical data analysis, presentation through computer, data storage and database formation, data bank.
5. Use of software for cell count, cell diameter measurement.
6. Use of software for computerized photomicrograph system.
7. Use of software for UV-spectrophotometer.
8. Statistical analysis of data in computer using software.
9. Use of internet in Bio-medical Laboratory Science
10. Common trouble shooting during computer operation.

**2<sup>nd</sup> Semester (Practical)**

**Paper – VII**

**(Unit – 13)**

**Module – I :**

**General reproductive events**

**Full Marks - 25**  
**(30 hrs Experimental Work)**

1. Sperm count in ejaculated semen and quality assessment
2. Sperm motility & viability test.
3. Sperm nuclear chromatin decondensation test
4. Hypoosmotic swelling test
5. Anti sperm antibody testing
6. Sperm mitochondrial activity index test
7. Sperm membrane enzyme testing
8. Ovulation determination by oral body temperature and graphical representation
9. Quantification of hCG (Medico legal aspects)

**Module – II :**

**Assisted reproductive technology**

**Full Marks – 25**

**(30 hrs Experimental Work)**

1. Acrosomal status evaluation
2. EC<sub>50</sub> determination of spermicidal agent
3. Fertility power of sperm (Acrosome testing)
4. Collection of super grade quality of sperm for ART.
5. Biochemical antioxidant enzyme assay of sperm pellet.
6. Biochemical assay of Glutathione-S-transferase of sperm pellet.
7. Biochemical assay of free radicals in sperm pellet.
8. Fructose determination in semen.
9. Acid phosphatase in semen.
10. Rape-test.

**Paper – VII**

**(Unit – 14)**

**Module – I :**

**Basic Haematology**

**Full Marks - 25**  
**(30 hrs Experimental Work)**

1. Blood film preparation & its staining, identification of different types of leucocytes.
2. Collection of blood samples from vein.
3. Determination of ESR

4. Determination of haemoglobin concentration by haemoglobinometer and by colorimetric method.
5. Determination of haematocrit, experiments on T.C. & D. C.,
6. Determination of MCV, MCH, ESR and MCHC.
7. Quantification of reticulocytes and thrombocytes.
8. Determination of clotting time and bleeding time,
9. Determination of clot retraction, prothrombin time, thrombin time and lyses time
10. Determination of APTT, PTT.

**Module – II :**

**Clinical Haematology**

**Full Marks – 25  
(30 hrs Experimental Work)**

1. Blood analysis by automatic analyzer, only demonstration.
2. Estimation of different types of haemoglobin & plasma haemoglobin.
3. Determination of G-6-PD.
4. Detection of iron in prepared smear. Determination of iron and total iron binding capacity (TIBC) in serum.
5. Hemoglobin electrophoresis (Demonstration) including glycosylated Hb.
6. Preparation of bone marrow smear and its staining and identification of mega karyocytes..
7. Plasma recalcification time, Determination of fibrinogen, Protamine sulphate test.
8. Leukemia and Sickle cell anemia detection.
9. T-cell, B-cell preparation
10. Red cell pyruvate kinase assay.
11. Naked Eye Single Tube Red Cell Osmotic Fragility test (NESTROF test), Acidified serum test and sucrose lysis test.

***Paper – VIII***

***(Unit – 15)***

**Module – I :**

**Immuno-haematology**

**Full Marks - 25  
(30 hrs Experimental Work)**

1. Separation of plasma and serum.
2. Blood grouping and Rh typing: with antisera, tube method
3. Reagent preparation of blood banking and demonstration of blood bank.
4. Detection of Thalasemia by paper electrophoresis/ Hb-s;
5. Test for Spherocytosis,
6. Osmotic fragility test.
7. Giemsa stain of blood films (thick and thin) for detection of malarial parasite
8. Filarial parasite, and abnormality in W. B. C. count
9. Leukemia, different type of anaemia
10. Disorders in platelet.

**Module – II :**

**Transfusion Science**

**Full Marks – 25  
(30 hrs Experimental Work)**

1. Fractionation of different blood in components.
2. Preparation of platelet rich plasma.
3. Preparation of cryoplasma,
4. Preparation of packed red cells,
5. Cross matching test in blood blank: saline tube & Coomb's cross matching
6. Compatibility test by saline tube method
7. Qualitative test for the recognition of Rho antigen on human RBC and determination of Rho typing by slide method.
8. Serum grouping test
9. Coomb's direct & indirect test in blood blank.
10. Quantitative determination of anti-D antibody titer.

**Paper – VIII**

**(Unit – 16)**

**Module – I :**

**Laboratory mathematics and statistics**

**Full Marks - 25**

**(30 hrs Experimental Work)**

1. Slope determination of a standard curve.
2. Hematology mathematics on the basis of collected data.
3. Use of 2 cycle, 2-3 cycles, 2-4 cycles log and semi log graph papers.
4. Application of mathematics in gastric acid measurement.
5. Application of mathematics in renal function test.
6. Application of mathematics in liver function test.
7. Application of mathematics in the determination HOMA and insulin resistance.
8. Application of statistics in Bio-Medical Science for test of significance by student 't' test.
9. Application of statistics in Bio-Medical Science for test of significance by ANOVA.
10. Application of statistics in Bio-Medical Science for test of co-relation

**Module – II :**

**Computer application in Bio-medical field**

**Full Marks – 25**

**(30 hrs Experimental Work)**

1. Use of operating system-different commands.
2. MS-Word- use in report writing, tabulation of clinical data
3. MS-Excel- Data storage, analysis, presentation of data through bar diagram
4. MS-Power Point-Seminar presentation
5. Computer graphics using laboratory data.
6. Cell number count, cell size measurement in a specific field by using soft ware in computer.
7. Use of Statistical package (STATISTICA, ORIGIN, SIGMA PLOTTER etc.) in computer.
8. Use of software for cell count, cell diameter measurement.
9. Use of software for computerized photomicrograph system.
10. Use of software for UV-spectrophotometer.

**3<sup>rd</sup> Semester (Theoretical)**

**Paper – IX**

**(Unit – 17)**

**Module – I :**

**Clinical Immunology**

**Full Marks - 25**

**(30 hrs Lectures)**

1. Principle of immunological reaction.
2. Immunoelectrophoresis, counter immunoelectrophoresis, Rocket immunoelectrophoresis and nephelometry etc.
3. Western blot, southern blot and northern blot. Immunoturbidimetry
4. Principles of sero-diagnostic test: precipitation, flocculation, agglutination, neutralization, coagulation, coagglutination, microtitration, and complement fixation etc.
5. Modern immunologic techniques, antigen antibody reaction, complements,
6. Hypersensitive reactions, and immunosuppression.
7. Vaccination-schedule
8. Transplantational immunology
9. Immunology of tumor formation.
10. Cytokines , Lymphokines, Interleukine, Growth factor.
11. Hybridoma technology

**Module – II :**

**Serology**

**Full Marks – 25**

(30 hrs Lectures)

1. Laboratory procedures in serology
2. Collection, preparation of specimen
3. Application of different types of ELISA, Fluorescence microscopy, Western Blot, PCR in Serodiagnosis and alorhythm of serological tests of a disease.
4. Different Serological screening and confirmative test for syphilis (STS).
5. WIDAI test for salmonell typhi and CRP test, RA test,
6. Serological tests for Lupus erythematosus, helicobacter pylori, tuberculosis and dengue.
7. Serodiagnosis of streptococcal Antistreptolysis O (ASO) test, streptozyme test.
8. Different Serodiagnostic test for AIDS (HIV1 & HIV-2). Serodiagnostic test for Hepatitis
9. ToRCH Panel, Rubella, Toxoplasmosis, Trypanosomiosis, Leishmaniasis.
10. Intradermal hyper sensitively test, Montoux test, Toxoplasmin, Histoplasmin, Blastomysin, Casoni's test.

**Paper – IX**

**(Unit – 18)**

**Module – I :**

**Cytotechnology and cytogenetics**

**Full Marks - 25**

**(30 hrs Lectures)**

1. Laboratory equipments for cytology
2. Lightmicroscopy, Phase contrast Microscope, Electron Microscopy – Principal, Preparative techniques, Plastic Embedding Media and Techniques.
3. Microscope- types and care.
4. Vacuum embedding bath, automated tissue processor. Specimen preparation in cytotechnology. Stains & staining technique in cytology.
5. Manual components for tissue staining and automated tissue stainer.
6. Chromosome isolation and grouping. Chromosome staining, karyotyping, gene expression and regulation. Gene mutation. Cytogenetical basis of inborn error of metabolism.
7. Cytotechnology – Process of collection, fixative, Errors of cytology, PAP stain. Museum Technology for pathology. Health Hazards in cytology Lab.
8. Immunofluorescence Cytotechnology. Flow cytometry.
9. Immunopathology of lymphomas. Cell fraction isolation, DNA, RNA quantification.
10. Immunocytochemistry in pathology and Immunocytopathology of routine histopathology
11. Molecular pathology and In-situ hybridization

**Module – II :**

**Histotechnology**

**Full Marks – 25**

**(30 hrs Lectures)**

1. Laboratory equipments for histology
2. Fixatives, types, composition, merits & demerits, limitation in use of fixative in specific case. Dehydration – mechanism, importance & care/ ethyl, Isopropyl alcohol. Clearing agents – types, merits & demerits. Infiltration, impregnation – importance. Embedding – importance and care. Section cutting, honing technique, stropping and its technique.
3. Technique of section cutting, problems in section cutting, preparation of histological slide and mounting. Canadabalsam / Natural DPX, semi synthetic frozen section. Synthetic glycerin.
4. Stains & staining technique in histology: Preparation of haematoxyline & eosin, special stain preparation, Weigert's iron haematoxyline, trichrome stain, phosphotungstic acid haematoxyline technique (PTAH). Reticule stain, Verhoetis stain, Congo red stain, Sudden – IV stain, PAF stain.
5. Techniques followed in routine HE staining and some special staining like PAS, trichome staining, papanocholou staining. Staining of bone and calcified tissue. Nissl body's Toudine blue.
6. Frozen section techniques, freezing of tissue and freezing microtomy. Staining of frozen section by PAS, Sudan – IV, Sudan block B stain, Oil red O stain.
7. Microwave technology to histology
8. Microorganism staining in tissue section – Zieh Neelsen (ZN) staining M. Bacillus,  
Fluorescent method for M. Bacillus  
Crystal violet acetate method for Helicobacter  
Warthin-Starry method for spirochetes  
Hexamine silver for Fungi  
Giemsa stain for parasites
9. Ninhydrine-schif method for aminogroup, Millon reaction for tyrosine, Performic-Alcian Blue for disulfide linkage, Fecelgen nuclear reaction for DNA and Methyl green-Pyronin method for RNA

10. Automation in histotechnology. Automatic tissue processing, techniques, care, limitation. Automatic tissue staining, techniques, care and limitation
11. Immunohistotechnology and Immunofluorescence Histotechnology.

**Paper –X**

**(Unit – 19)**

**Module – I :**

**Fundamental clinical Biochemistry**

**Full Marks - 25**

**(30 hrs Lectures)**

1. Basic concept of physiology and biochemistry of the body.
2. Biochemical changes in the body under pathological condition.
3. Specimen processing for biochemical analysis
  - a. Preparation of serum specimen for biochemical analysis.
  - b. Preparation of protein free filtrate.
  - c. Processing for urine for biochemical analysis.
4. Titrimetry
5. Photometry-flame photometry, atomic absorption photometry.
6. Colorimetry-visible spectrophotometer, UV spectrophotometer.
7. Electrochemistry-colorimetry, potentiometry.
8. Chromatography-(PC, TLC, CC, HPLC, FPLC, GC and Fraction collector).
9. PCR – Principle, procedure, and biological application
10. Electrophoresis-(paper electrophoresis, gel electrophoresis)
11. Enzymes for cardiac diseases

**Module – II :**

**Advance clinical Biochemistry**

**Full Marks – 25**

**(30 hrs Lectures)**

1. Routine biochemical test
  - a. Determination blood glucose (Glucose-oxidase method).
  - b. Determination of total protein in serum.
  - c. Serum albumin, blood urea (Oxime method), S. creatinine, Alb. Globulin ratio, alkaline phosphatase (alkaline picrate method), uric acid (phosphotungstate method) (Kit method in available cases), blood bilirubin (Malloy & Evelyn method), serum triglyceride (Colorimetric method), blood, HDL cholesterol (Modified Lepter method, kit method), LDL, VLDL, serum calcium, potassium, chloride, sodium, phospholipid. Determination of serum and plasma bicarbonate.
2. Enzyme assay in clinical biochemistry-SGOT/SGPT/ACP/ALP/  $\gamma$ -GT/ LDH/Amylase/CPK.
3. Liver function test in response to different types of liver disease.
4. Renal function test and GFR.
5. Gastric function test.
6. Pancreatic function test.
7. Cardiac function test.
8. General screening for alcohol, methanol and acetone – toxicity assesment.
9. Determination of carbon monoxide– toxicity assesment
10. Screening of drug like phenothiozine derivative, acetaminophens carbamazepine, ethosuximide, Phenobarbital, phenytoin, pyrimidine. Chloral hydrate and halogeanted hydrocarbons, impramine, salicylates, digoxin, caffeine, dyphylline, cyclosporine
11. Screening of heavy metals- Hg, As, Fl, Pb and Li.

**Paper –XI**

**(Unit – 20)**

**Module – I :**

**Diagnostic Parasitology**

**Full Marks - 25**

**(30 hrs Lectures)**

1. Collection, handling and processing of faecal specimens.

2. Laboratory techniques in paracitological investigation of stool & Occult blood test
3. Lab Records and Reporting of results of stool examination.
4. Sending of faecal specimen for referral services.
5. Staining of faecal smears and blood films.
6. Processing of specimens other than stools i.e. sputum, urine, urogenital swab.
7. Laboratory identifications of human parasites (protozoa, helminthes).
8. Techniques for the measurements of the size of parasite eggs.
9. Morphological characters of common parasitic protozoa
10. Identifying characters of various helminthes
11. Laboratory diagnosis of Filaria infections, blood fluke infections and trichomoniasis

**Module – II :**

**Clinical Mycology**

**Full Marks – 25  
(30 hrs Lectures)**

1. Quality control in clinical mycology
2. Introduction to paracitic fungi – different types of fungi with morphology
3. Staining procedure
4. Specimen collection for the study of paracitic fungi
5. Culture media for mycotic agents
6. Skin scrapping, nails, hair, sputum, pus, exudates, CSF.
7. Laboratory diagnosis of mycotic infection.
8. Laboratory diagnosis of dermatomycosis
9. Laboratory diagnosis of subcutaneous mycosis systemic mycosis.

**3<sup>rd</sup> Semester (Practical)**

**Paper – XI**

**(Unit – 21)**

**Module – I :**

**Clinical Immunology**

**Full Marks - 25**

**(30 hrs Experimental Work)**

1. Precipitation, agglutination and coagulation.
2. SRID,
3. Ouchterlony Double diffusion,
4. Immunoelectrophoresis.
5. Estimation of IgG, IgA, IgM.
6. Qualitative indirect enzyme immunoassay for the detection of serum antinuclear antibodies.
7. Tumor markers, Cancer markers: CEA- $\alpha$ -fetoprotein, CA-125, CA-19, CA-15, PAS-Free / Total.
8. Immunoturbidometric analysis of biomolecules.
9. Practicals on Western blot.
10. Practicals on Southern blot.
11. Practicals on Northern blot.

**Module – II :**

**Serology**

**Full Marks – 25**

**(30 hrs Experimental Work)**

1. RPR and titer estimation
2. WIDAL test and titer estimation,
3. ASO test and titer estimation,
4. RA test and CRP test and titer estimation,
5. AIDS test and Hepatitis profile
6. TORCH panel
7. Dengue & Lupus erythematosus
8. Helicobacter pylori and titer estimation
9. Mycobacterium tuberculosis
10. Montoux test.

**Paper – XI**

**(Unit – 22)**

**Module – I :**

**Cytotechnology and cytogenetics**

**Full Marks - 25**

*(30 hrs Experimental Work)*

1. Cytological fixatives and stain and their preparation.
2. Preparation of given percentage of alcohol from commercially available ethyl alcohol.
3. Preparation of specimen for cytological evaluation, processing.
4. Fixation staining, papanicolaon staining techniques, Crystal violet staining.
5. Orchin (sex chromosome)
6. Identifying characteristics of benign and malignant cells.
7. DNA, RNA isolation
8. Cell fractionation
9. Preparation of red cell suspension.

**Module – II :**

**Histotechnology**

**Full Marks – 25**

*(30 hrs Experimental Work)*

1. Fixation of tissue –Preparation of different fixative.
2. Sharpening of the microtome knife
3. Decalcification of calcified tissue.
4. Dehydration of tissue-preparation of graded alcohol- clearing of fixed tissue, and embedding-paraffin block preparation / gelatin, cellodin water soluble wax.
5. Section cutting in microtome and freeze drying techniques for section cutting in cryocut.
6. Stain preparation- haematoxylin, types, eosin , trichrome stain, phosphotungstic acid, iron haematoxyleane, PAS stain, Prussian blue stain, gram staining, acid fast staining, sudden-III and IV stain. Vanu Gisen stain, Pearl stain(for FC), Purpurin / Vonkosa stain(Bone in tissue calcification), Reticulin
7. Staining techniques using above stains.
8. Immuno histotechnology
9. Immuno fluorescence histotechnology.

**Paper – XII**

**(Unit – 23)**

**Module – I :**

**Fundamental clinical Biochemistry**

**Full Marks - 25**

*(30 hrs Experimental Work)*

1. Preparation of plasma and serum for biochemical analysis, preparation of protein free filtrate from blood.
2. Determination of blood glucose (glucose oxidase method)
3. Determination of total protein in serum (Biuret method).
  - a. Determination of serum albumin/globulin.
  - b. Determination of blood urea (Oxime method) and by kit method.
  - c. Determination of creatinine in blood serum (Alkaline picrate method & by using kit).
  - d. Determination of uric acid in serum by phosphatungstate method and by using kit.
  - e. Determination of serum bilirubin by colorimetric method and by using kit.
  - f. Determination of serum triglyceride by colorimetric method and by using kit.



**4<sup>th</sup> Semester (Theoretical)**

**Paper – XIII**

**(Unit – 25)**

**Module – I :**

**Pathology of body fluids**

**Full Marks - 25**

**(30 hrs Lectures)**

1. Excretory system
2. Physiology of urine formation, Normal composition of urine, Collection of urine Specimen.
3. Types of urine specimen, preservation of urine.
4. Biochemical analysis of urine
5. Routine examination of urine- physical, microscopic examination of urine specimen.
6. Determination of Urinary haemosiderin
7. Routine examination of stool.
8. Chemical test of urine (for Glucose, protein, ketone, bilirubin, urobilinogen, blood)
9. Laboratory examination of miscellaneous body fluids (pleural fluid, pleural effusion, peritoneal fluid, peritoneal effusion).
10. Collection and processing of CSF and its laboratory investigation. Types of meningitis and in CSF pictures.
11. Laboratory investigation serous fluid, synovial fluid and gastric juice

**Module – II :**

**Pathology of sputum, swab and stool**

**Full Marks – 25**

**(30 hrs Lectures)**

1. Collection, handling and transfer of sputum, swab and stool.
2. Routine examination of sputum
3. Microbiological examination of sputum
4. Examination of urogenital swab
5. Examination of throat and mouth specimen.
6. Examination of feces
7. Examination of rectal swab
8. Examination of pus from wounds, abscesses, burns and sinuses
9. Examination of ear discharge.
10. Examination of skin exudates from syphilis patient.

**Paper – XIII**

**(Unit – 26)**

**Module – I :**

**Clinical Microbiology**

**Full Marks - 25**

**(30 hrs Lectures)**

1. Basic rules for working in the diagnostic microbiology laboratory.
2. Specimen collection and handling. Laboratory records & reporting of results.
3. Safety regulation for the microbiology laboratory. Disposal of specimens after laboratory use.
4. Basic laboratory procedures of clinical microbiology.
5. Disinfections and sterilization. Microscope examination –techniques.
6. Morphological study, Staining procedure-gram staining, Acid fast staining and spore staining
7. Biochemical test for bacterial differentiation (*E. collie*, *S. haemoleticus*, Klebsyella, Staphylococcus, Streptococcus, Penicillin).
8. Culture media and basic techniques in the preparation of culture media, primary culture and secondary culture/inoculation tests for *M. tuberculosis*.
9. Aspective transfer of microbes.
10. Culture environment of microbes.
11. Quality control in microbiology.

**Module – II :****Diagnostic Bacteriology****Full Marks – 25  
(30 hrs Lectures)**

1. Systemic grouping of pathogenic bacteria
2. Identifying characteristics of common pathogenic bacteria
3. Preparation of culture media for pathogenic bacteria
4. Simple staining of microbes and some special like – Albert's Staining indenting characters of pathogenic bacteria.
5. Mycobacterial susceptibility test
6. Laboratory diagnosis of Haemophilus influenza
7. Laboratory diagnosis of Pulmonary tuberculosis
8. Laboratory diagnosis of Dysentery and Diarrhoea
9. Laboratory diagnosis of Cholera
10. Laboratory diagnosis of Renal infection and Gonorrhoea
11. Antibiotic sensitivity tests

**Paper – XIV****(Unit – 27)****Module – I : Image processing and modern Bio-Medical Instruments****Full Marks - 25****(30 hrs Lectures)**

1. X-ray, X ray beam, Grinds, Screen Cassate Film Processing , Dark room Technology MRI.
2. Principles of sonography and ultrasonography and its techniques.  
Application of sonography in specific condition, importance and interpretation.
3. Principle of endoscopy, its techniques. Application of endoscopy in clinical Condition , importance and its interpretation. Imaging process by ultra sonography
4. Principle of CAT scanning, its techniques. Application of CAT scanning in Clinical condition, importance and interpretation. C.T. scan
5. NMR( Nuclear magnetic resonance) and MRI( Magnetic resonance imaging)
6. Polygraph
7. Laparoscopy
8. Physiological basis of ECG & EEG. Recording method followed in ECG along with different leads. Laboratory investigation of ECG records and interpretation. Signification of ECG for prediction of cardiac condition.
9. Basic principle of Visible and UV Spectrophotometer
10. Basic principle of Centrifuge machine (ordinary, ultra and cold)
11. Basic principle of Semi auto/auto analyzer, spectrofluorometer, flame photometer, luminometer, Sonicator, Lyophilizer.ELISA reader, RIA counter, Flow cytometry and CASA device, Autoanalyser-basic principle, protocol of their use and their application in bio-medical science.

**Module – II :****Psychopathophysiology****Full Marks – 25  
(30 hrs Lectures)**

1. Interrelationship between neurobiology and Psychopathophysiology
2. Neurological manifestation of neuroendocrine disease, adrenal insufficiency, neuroimmunological dysfunctions, neurocardiac diseases.
3. Neurological manifestation hyper calcemic disorder, parathyroid dysfunction and hypertension.
4. Phychogenic amenorrhea
5. Phychoneuroimmunology
6. Disorder physis function-rage behaviour, hallucination. Disorder of sleep and consciousness-Somnolence, sleep rhythm reversal, akinetic mutusism, coma.
7. Erectile dysfunction and phychogenic disorders.
8. Neurobiological manifestation of manic patient.
9. Depression and its neurobiology.

10. Nerve-tissue induction. Angiography
11. EMG, Evoked potential, Epilepsy.

**Paper – XIV**

**(Unit – 28)**

**Module – I :**

**Health care management**

**Full Marks - 25  
(30 hrs Lectures)**

1. Healthcare information system
2. Sample registration system
3. Hospital record.
4. Disease registration, record linkage
5. Health manpower statistics
6. National health policy
7. Health planning and health system in India
8. Evaluation of health services tape
9. Medico legal problem
10. Health promotion strategy in different sector of community

**Module – II :**

**Bio-informatics and Medical transcription**

**Full Marks – 25  
(30 hrs Lectures)**

1. Introduction to database, biological databank and data security
2. Computer graphics and visualization
3. Chemoinformatics, genetic information flow and processing
4. Parasite bioinformatics
5. Techniques in genomics, proteomics and metabolomes and metabolic pathway engineering
6. Bioinformatics of human health
7. Complete skill assessment
8. Complete medical terminology and keyboarding, online keyboarding
9. Typing, transcribing and re-transcribing of any troublesome report
10. Turn-in for grading, complete timings and transcribe

**4<sup>th</sup> Semester (Practical)**

**Paper – XV**

**(Unit – 29)**

**Module – I :**

**Pathology of body fluids**

**Full Marks – 25  
(30 hrs Experimental Work)**

1. Methodology of urine collection-separate sample and 24 hours sample.
2. Physical examination of urine.
3. Microscopic examination of urine sediment.
4. Biochemical estimation of glucose in urine.
5. Biochemical estimation of protein and ketone in urine.
6. Biochemical estimation of bilirubin (Bile salt and boil pigment), urobilinogen in urine.
7. Determination of Urinary haemosiderin
8. Laboratory testing of CSF.
9. Laboratory testing of serous fluid.
10. Laboratory testing of synovial fluid and gastric juice.

**Module – II :****Pathology of sputum, swab and stool****Full Marks – 25  
(30 hrs Experimental Work)**

1. Collection, handling and transfer of sputum, swab and stool.
2. Routine examination of sputum
3. Microbiological examination of sputum
4. Examination of urogenital swab
5. Examination of throat and mouth specimen.
6. Examination of feces
7. Examination of rectal swab
8. Examination of pus from wounds, abscesses, burns and sinuses
9. Examination of ear discharge.
10. Examination of skin exudates from syphilis patient.

**Paper – XV****(Unit – 30)****Module – I :****Clinical Microbiology****Full Marks – 25  
(30 hrs Experimental Work)**

1. Sterilization of Glass goods, culture media and other materials
2. Culture environment for microbes and maintenance of culture.
3. Aspective transfer of microbes and different culture techniques. Culture media and basic techniques in the preparation of culture media, primary culture and secondary culture/inoculation tests for *M. tuberculosis*, *Salmonella typhi*, *Salmonella sigeli*, *C. tetani*, *N. gonococcus*, *S. aureus*
4. Morphological study of microbes
5. Staining procedure-gram staining, Acid fast staining and spore staining
6. Biochemical test for differentiation of *E. collie*,
7. Biochemical test for differentiation of *S. haemoleticcus*,
8. Biochemical test for differentiation of *Klebsyella*,
9. Biochemical test for differentiation of *Staphylococcus* and *Streptococcus*.
10. Biochemical test for differentiation of *M. tuberculosis*
11. Isolation and identification of microbes

**Module – II :****Diagnostic Bacteriology****Full Marks – 25  
(30 hrs Experimental Work)**

1. Identifying characteristics of common pathogenic bacteria
2. Preparation of culture media for pathogenic bacteria
3. Simple staining of microbes and some special like – Albert's Staining indenting characters of pathogenic bacteria.
4. Mycobacterial susceptibility test
5. Laboratory diagnosis of *Haemophilus influenza*
6. Laboratory diagnosis of Pulmonary tuberculosis
7. Laboratory diagnosis of Dysentery and Diarrhoea
8. Laboratory diagnosis of Cholera
9. Laboratory diagnosis of Renal infection
10. Laboratory diagnosis of Gonorrhoea
11. Antibiotic sensitivity tests

**Paper – XVI**

**(Unit – 31)**

***Submission of Thesis***

***Full Marks – 50***

***Paper – XV***

**(Unit – 32)**

***Full Marks – 50***

- 1. Training in Hospital / NGO / Private Sector (150 hrs)**
- 2. Laboratory demonstration & exposure of the students to higher health service/research institute – (50 hrs).**