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

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|---|---|
| **1st Semester (Theoretical)- Each paper contains 50 marks** | |
| PAPER-101 | Physiological and Bio-physical aspects of Bio-Medical Science |
| PAPER-102 | Total Quality Management |
| PAPER-103 | Ethics & Bio-safety |
| PAPER-104 | Pathophysiology of Endocrine System |
| **1st Semester (Practical)- Each paper contains 50 marks** | |
| PAPER-105 | Physiological and Bio-physical aspects of Bio-Medical Science |
| PAPER-106 | Total Quality Management |
| PAPER-107 | Ethics & Bio-safety |
| PAPER-108 | Pathophysiology of Endocrine System and Hormone assay techniques. |
| **2nd Semester (Theoretical)- Each paper contains 50 marks** | |
| PAPER-201 | Reproductive Agents and Assisted Reproductive Technology |
| PAPER-202 | Haematology |
| PAPER-203 | Immunology and Transfusion Science |
| PAPER-204 | Computer applications and Statistics |
| **2nd Semester (Practical)- Each paper contains 50 marks** | |
| PAPER-205 | Reproductive Events and Assisted reproductive technology |
| PAPER-206 | Haematology |
| PAPER-207 | Immunology and Transfusion Science |
| PAPER-208 | Computer Applications and Statistics |

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| 3rd Semester (Theoretical)- Each paper contains 50 marks | |
|---|---|
| PAPER-301 | Immunology and Serology |
| PAPER-302 | Cytogenetics and Histotechnology |
| PAPER-303 | Clinical Biochemistry |
| PAPER-304 | Parasitology and Mycology |
| **3rd Semester (Practical)- Each paper contains 50 marks** | |
| PAPER-305 | Immunology and Serology |
| PAPER-306 | Cytotechnology and Histotechnology |
| PAPER-307 | Clinical Biochemistry |
| PAPER-308 | Parasitology and Mycology |
| **4th Semester (Theoretical)- Each paper contains 50 marks** | |
| PAPER-401 | Pathology |
| PAPER-402 | Microbiology and Bacteriology |
| PAPER-403 | Molecular Techniques in Laboratory Science |
| PAPER-404 | Clinical Research and Bio-informatics |
| **4th Semester (Practical)- Each paper contains 50 marks** | |
| PAPER-405 | Pathology |
| PAPER-406 | Microbiology and Bacteriology |
| **4th Semester (Thesis & Training) )- Each paper contains 50 marks** | |
| PAPER-407 | Submission of Thesis |
| PAPER-408 | Training programme in hospital/NGO |

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

### 1st Semester (Theoretical)

### Paper – 101

### Physiological and Bio-physical aspects of Bio- Medical Science

**Full Marks - 50**

**(60 hrs Lectures)**

1. Basic concept of different physiological systems of human subjects
2. Physical perfomance and its assessment.
3. Growth pattern and its anthropometrics assessment
4. Pathophysiology of obesity
5. Deviation of blood pressure homeostasis (hypertension and hypotension), Atherosclerosis & cardiovascular diseases.
6. Blood glucose homeostasis and its deviation
7. Uric acid metabolism and gout
8. Oxidative stress and homeostasis and its deviation
9. Cellular apoptosis and necrosis. Cancer cells and its markers
10. Basic concept of Anatomy in different systems with special reference to surface anatomy, location of veins, visceral organs.
11. Dilution and strength of solution
12. pH meter and pH – determination
13. Buffers
14. Important precautions taken during various reagent preparation
15. Enzyme kinetics
16. Rate of reaction: Visible kinetic method and UV kinetic method, Fixed point and Two point kinetics.
17. Dialysis & Ultra filtration.
18. Beer's law and Lambert's law and its application.
19. Different types of microscopes – physical principles of Light Microscope, Dark-Field Microscope, Phase contrast Microscope, Electron Microscope – Principal, Preparative techniques, Microscope care.
20. Radiation hazards

### Paper – 102

### Total Quality Management

**Full Marks – 50**
**60 hrs Lectures)**

1. Quality Control of the product, chemicals, reagent.
2. Good, reliable, authentic report.
3. Total quality management framework of laboratory
4. Essential elements of Quality Assurance Programme
5. Internal Quality control: control of pre-analytical variables, control of analytical variables, laboratory precision, accuracy & sensitivity, validation of methods.
6. Reference materials and calibrating definitive methods.
7. Sources of variation in laboratory test results. Systemic and random errors.
8. Quality control charts: Levy-Jenning chart, Cusum chart and Gaussian curve.
9. Internal and external factors for quality control assurance.
10. Reference values

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11. Various types of laboratories
12. Standard Bio-Medical Laboratory set up.
13. Management to the client, patient, physician, administrative authority
14. Marketing management and economics related to Bio-medical laboratory science
15. 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.
16. Cost of conformance & non-conformance.
17. Principles of management of employees relations
18. Good laboratory management practices
19. Improvement of laboratory operation
20. Signage system in laboratory and hospital

**Paper – 103**

## Ethics & Bio-safety

**Full Marks – 50**

**(60 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.
11. Set up of a laboratory on the basis of safety priority and Laboratory Biosafety Guidelines.
12. Laboratory Biosafety Level Criteria (BSL-1-4).
13. Handling, transfer and shipment of specimen. Decontamination and disposal. Treatment and disposal technologies for health- care waste.
14. Wastes management, life cycle of bio-medical wastes.
15. Reduce recycle and reuse of wastes, technology used for bio-medical wastes treatment and disposal.
16. Chemical, electrical, fire and radiation safety. Safety organization
17. General Safety checklist
18. Hazardous properties of instruments and Laboratory chemicals. Laboratory first-aid measures and kit.
19. Safety equipments. Safety signs.

**Paper – 104**

## Pathophysiology of Endocrine System

**Full Marks – 50**

**(60 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.

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8. Assay of hormone by RIA.
9. Radiolabelling of hormones.
10. Recording of results. Interpretation.
11. 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. Inforamtion on pituitary-adrenocortical axis feedback system: Pathophysiology. Information on pancreatic-hormones, regulation, function, disorders.
12. Dynamic Test on pituitary gonadal activities, thyroid activities, adrenal activities, pancreatic activities.
13. Hormonal disorders in diabetes mellitus- its types- symptoms, cause, management.
14. Diabetes insepidus- cause, symptoms and management.
15. Hypertension- Cause, symptoms and management. Obesity - Cause, symptoms and management.
16. Hypogonadism - Cause, symptoms and management. Sterility- Hypertension- Cause, symptoms and management.
17. Goiter - Cause, symptoms and management. Adrenocortical syndromes- Cause, symptoms and management. Growth hormone diseases.

## 1st Semester (Practical)

### Paper-105

### Physiological and Bio-physical aspects of Bio- Medical Science

**Full Marks – 50**

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
12. Strength determination of sample by titration. Acidometry and Alkalimetry
13. Unknown concentration measurement from standard curve
14. Standard curve preparation
15. Standardization of pH meter
16. Standardization of an endpoint reaction method
17. pH- determination by pH meter. Buffer preparation
18. Scanning in UV and IR
19. Standardization of distilled water
20. Selection of a filter to determine the intensity of different coloured solution and identification of peak absorption
21. Experiment on dialysis using dialysis bag.

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**Paper-106**

**Full Marks-50**

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

**Paper-107**

**Full Marks-50**

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

**Paper – 108**

**Full Marks – 50**

**Pathophysiology of Endocrine System**

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 T3 andT4 in ELISA reader
7. Assay of Testosterone, $E_2$, Progesterone in ELISA reader
8. Programming in Gamma counter for hormone
9. Standard curve in Gamma counter
10. Hormone assay in Gamma counter
11. Interpretation of results of LH, FSH, testosterone ,estradiol and PRL from same serum sample( As per sex)
12. Interpretation of results of TSH and $T_3$ / $T_4$from same serum sample
13. Quantification of blood iodine for the assessment of thyroid
14. Interpretation of results of insulin and C-peptide from same serum sample
15. Interpretation of results of ACTH and cortisol from same serum sample
16. Assesment of obesity by the estimation of lipid profile
17. Assesment of hypertension by the estimation of cholesterol
18. Assesment of atherosclerosis
19. Evaluation of autoimmune disorder in relation to pathophysiology of endocrine gland
20. Immuno endocrine evaluation with special reference to cytokines / growth factor

## 2nd Semester (Theoretical)

**Paper – 109**

**General and assisted reproduction** **Full Marks - 50**

1. Spermatogenesis
2. Qualitative and quantitative study of spermatogenesis
3. Hormonal control of spermatogenesis
4. 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.
5. Hypoosmolarity test of sperm
6. Ogenesis ,Ovulation and its hormonal control.
7. Menstrual cycle and its biochemical model explanation. Cycle abnormalities
8. Implantation and its molecular aspect, role of blastocyst in implantation, disorder in implantation.
9. Contraceptives: General, immunological and emergency contraceptives
10. Gamet bank and cryopreservation

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11. Superovulation techniques.
12. Placenta and pregnancy maintenace, Endometriosis
13. Sperm viability
14. 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
15. Leukocyte count in semen's
16. Acrosome testing
17. Detection of rape by police department-acid phosphatase study.
18. Assisted reproductive technology (ART)
19. Causes of male and female infertility
20. Process of IUI, IVF, GIFT, ICSI - Limitation – advantages and disadvantages.
21. Process of super grade quality of sperm collection in ART.

**Paper –110**

**Haematology** **Full Marks - 50**

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.

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.

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

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**Paper – 111**

**Immuno-haematology &Transfusion Science** **Full Marks -50**

1. Basic concept and principles of immunohaematology
2. Antigen, antibody, hapten and super antigen
3. Ig classification
4. Antigens and antibodies in blood
5. Blood group, types of blood groups and its principle
6. ABO blood group, sub types, H antigen, Rh- typing, MN group
7. Determination blood groups by immunological test
8. Blood transfusion in total or in fractionated part
9. Conditions for blood transfusion
10. Basic principle followed for blood transfusion
11. Disorder due to mismatched blood transfusion and Erythroblastosis foetails
12. Transmission of diseases in relation to blood transfusion (HIV, Jaundice - Hepatitis- B/C, Malaria etc.)
13. Importance of blood test before marriage to check the transmission of haemolytic diseases in next generation
14. Collection, processing of blood for transfusion and container for blood collection
15. Anticoagulant solution used in blood collection, Screening of donor for blood collection, transportation of blood after collection and storage of blood
16. Laboratory procedure in blood transfusion, Anti human globulin test, Cross matching
17. Antibody screening test & cold agglutination test

**Paper-112**

**Computer, statistics & Bioinformatics** **Full Marks – 50**

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

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.

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## 2nd Semester(Practical) Paper-113

**General and assisted reproductive events** **Full Marks - 50**

1. Sperm count in ejaculated semen nad 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)
1. Acrosomal status evaluation
2. $EC_{50}$ 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 – 114

**Haematology** **Full Marks - 50**

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.
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 glycocylated 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.

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## Paper – 115

**Immuno-haematology & Transfusion Science** **Full Marks - 50**

1. Separation of plasma and serum
2. Blood grouping and Rh typing
3. Reagent preparation of blood banking and demonstration of blood bank
4. Detection of Thalasemia by paper electrophoresis/ Hb-s
5. Osmotic fragility test
6. Giemsa stain of blood films (thick and thin) for detection of malarial parasite
7. Preparation of packed red cells
8. Cross matching test in blood blank: saline tube & Coomb's cross matching
9. Compatibility test by saline tube method
10. Qualitative test for the recognition of Rho antigen on human RBC and determination of Rho typing by slide method
11. Serum grouping test
12. Coomb's direct & indirect test in blood blank
13. Quantitative determination of anti-D antibody titer

## Paper – 116

**Computer, statistics & Bioinformatics** **Full Marks - 50**

1. Slope determination of a standard curve.
2. Heamatology mathematics on the basis of collected data.
3. Use of 2 cycle, 2-3 cycles, 2-4 cycles log and semi log gap 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

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 PLOTER 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.

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## 3rd Semester (Theoretical)

### Paper-117

**Clinical Immunology & Serology** **Full Marks - 50**

1. Principle of immunological reaction.
2. Immunoelectrophoresis, counter immunoelectrophoresis, Rocket immunoelecterophoresis and nephalometry etc. 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 immunosupression.
7. Vaccination-schedule
8. Transplantational immunology
9. Immunology of tumor formation.
10. Cytokines , Lymphokines, Interleukine, Growth factor.
11. Hybridoma technology

1. Laboratory procedures in serology
2. Collection, preparation of specimen
3. Application of different types of ELISA
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 erythemetosus, 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 – 118

**Cytotechnology and Histotechnology** **Full Marks - 50**

1. Laboratory equipments for cytology

2. 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

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

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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 haematoxylene & eosin, special stain preparation, Weigert's iron haematoxylene, trichrome stain, phosphotungstic acid haematoxylene 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

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 –119

### Clinical Biochemistry — Full Marks - 50

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
4. Preparation of serum specimen for biochemical analysis.
5. Preparation of protein free filtrate
6. Processing for urine for biochemical analysis.
7. Titrimetry
8. Photometry-flame photometry, atomic absorbption photometry.
9. Clorimetry-visible spectrophotometer, UV spectrophotometer.
10. Electrochemistry-clorimetry, potentiometry
11. Enzymes for cardiac diseases
12. Routine biochemical test
13. Determination blood glucose (Glucose-oxidase method)
14. Determination of total protein in serum.
15. Determination of 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 (Clorimetric method), blood, HDL cholesterol (Modified Lepter method, kit method), LDL, VLDL, serum calcium, potassium, chloride, sodium, phospholipid. Determination of serum and plasma bicarbonate
16. Enzyme assay in clinical biochemistry-SGOT/SGPT/ACP/ALP/ γ-GT/ LDH/Amylase/CPK.
17. Liver function test in response to different types of liver disease
18. Renal function test and GFR
19. Gastric function test
20. Pancreatic function test
21. Cardiac function test
22. General screening for alcohol, methanol and acetone – toxicity assessment
23. Determination of carbon monoxide– toxicity assessment
24. Screening of drug like phenothiozyne derivative, acetaminophens carbamazepine, ethosuximide, Phenobarbital, phenytoin, pyrimidine, Chloral hydrate and halogeanted hydrocarbons, impramine, salicylates, digoxin, caffeine,

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dyphylline, cyclosporine

25. Screening of heavy metals- Hg, As, Fl, Pb and Li.

**Paper -120**

**Parasitology & Mycology** **Full Marks - 50**

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

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 subcutenious mycosis systemic mycosis.

**3rd Semester(Practical) Paper – 121**

**Clinical Immunology & Serology** **Full Marks - 25**

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-α-fetoprotein, CA-125, CA-19, CA-15, PAS-Free / Total.
8. Immunoturbidometric analysis of biomolecules.
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 erythemetosus
8. Helicobacter pylori and titer estimation
9. Mycobacterium tuberculosis
10. Montoux test.

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**Cytotechnology and Histotechnology Full Marks -**

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.
8. Cell fractionation
9. Preparation of red cell suspension.

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 : 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. Determination of blood cholesterol by colorimetric method and by kit method.
5. Determination of phospholipids, LDL, VLDL by using kit and, HDL.
6. Determination of serum $Ca^{+1}$, $Na^{+}$, $K^{+}$, & $Cl^{-}$ by biochemical methōd, $HCO_3$
7. Determination of SGOT, SGPT, serum ACP, ALP, LDH, amylase and CPK by using kits and biochemical methods.

1. Experiments on glucose tolerance test.
2. Alcohol, methanol, acetone screening and drug screening in blood by biochemical method (as per theory)
3. Measurement of glycosylated haemoglobinc(colorimetric method).
4. Measurement of γ-GT level.
5. Special tests for different types of Liver diseases, renal diseases, gastric disorders and pancreatic disorders
6. Test for renal prostate specific antigen, acid phosphatase (prostatic fraction) and alkaline phosphatase.
7. Blood level of Hg, As, Fl, Pb and Li.

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8. Determination of carbon monoxide.
9. Screening of few drugs (as per theory).

**Paper – XII (Unit – 24)**

**Module – I : Diagnostic Parasitology Full Marks - 25**

1. Sterilization methods and cleaning / disposal of Laboratory wares.

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2. Preparation of culture media and culture techniques. Collection and handling of faecal specimens.
3. Laboratory techniques in parasitological investigation of stool & Occult blood test. Reporting of stool examination. Staining of faecal smears and blood films.
4. Morphological study and identifying characters of Trophozoites / Cysts of Protozoa and ova/larvae/ adult forms of pathogenic helminthes.
5. Laboratory methods for culture of blood / urine / stool / pus / sputum / C.S.F. / other specimens.
6. Techniques for the measurements of the size of parasite eggs
7. Morphological characters of common parasitic protozoa and Identifying characters of various helminthes
8. Laboratory diagnosis of Filaria infections, blood fluke infections and trichomoniasis.
9. Different staining methods and sputum examination for A.F.B.
10. Lab diagnosis of Mycotic infections including KOH preparation of skin scraping & Fungus culture

1. Quality control in clinical mycology
2. Introduction to parasitic fungi – different types of fungi
3. Specimen collection for the study of parasitic fungi
4. Culture media for mycotic agents
5. Staining procedure
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.

## 4th Semester(Theoretical)

## Paper – 125

**Pathology** **Full Marks - 50**

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, bilirunin, urobilinogen, blood

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

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 –126

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**Clinical Microbiology** **Full Marks - 50**

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. Morphological study, Staining procedure-gram staining, Acid fast staining, Albert staining and spore staining
5. Biochemical test for bacterial differentiation (*E. coli, S. haemoleticcus, Klebsyella, Staphylococcus, Streptococcus*)
6. Culture media and basic techniques in the preparation of culture media, Growth curve of bacteria, primary culture and secondary culture
7. Aseptic transfer of microbes
8. Quality control in microbiology
9. Systemic grouping of pathogenic bacteria
10. Identifying characteristics of common pathogenic bacteria
11. Preparation of culture media for pathogenic bacteria
12. Mycobacterial susceptibility test
13. Laboratory diagnosis of Haemophilus influenza; Pulmonary tuberculosis; Dysentry and Diarrhoea; Cholera; Renal infection and Gonorrhoea
14. Antibiotic sensitivity tests

**Paper – 127**

**Modern Bio-Medical Instruments and Molecular techniques in laboratory Science**

**Full Marks - 50**

1. X-ray, X ray beam, Grinds, Screen Cassate Film Processing , Dark room Technology MRI
2. Principles of sonography and ultrasonography and its techniques
3. Application of sonography in specific condition, importance and interpretation
4. Principle of endoscopy, its techniques. Application of endoscopy in clinical condition, importance and its interpretation.
5. Imaging process by ultra sonography
6. Principle of CAT scanning, its techniques. Application of CAT scanning in Clinical condition, importance and interpretation. C.T. scan
7. NMR( Nuclear magnetic resonance) and MRI( Magnetic resonance imaging)
8. Polygraph
9. Laparoscopy
10. 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
11. Basic principle of Centrifuge machine (ordinary, ultra and cold)
12. 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
13. Fundamentals of emerging technologies in medical sciences- Melanoma Biopsies, Electronic Aspirin, Robotic Check-Ups, Stem Cell and Organ Therapy- Impact on world health
14. PCR –Principle, procedure and application for diagnosis of diseases
15. Southern, Northern and Western Blot- Principle, procedure and application
16. Mass Spectrometry- Principle, procedure and application for diagnosis of diseases
17. Modern techniques for laboratory diagnosis of pathogenic bacteria-mycobacterial , HIV and hepatic infections
18. Genomics, transcriptomics, proteomics and metabolomics - Principle and application for diagnosis of

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various diseases; Identification uncultured pathogens; DNA and Protein gel electrophoresis
19. Separation Methods -An introduction to chromatographic separation, Gas Chromatography, High Pressure Liquid Chromatography, UPLC and FPLC
20. Clinical applications of molecular biology for infectious diseases-immunological, biochemical, microscopic methods.

**Paper -128**

**Clinical Research** **Full Marks - 50**

1. Basics of Clinical Research
2. Basic terminology used in clinical research
3. New drug discovery process
4. Pre clinical toxicology: Carcinogenicity, Mutagenicity, Teratogenicity, Single dose and repeat dose toxicity studies, Reproductive toxicity
5. Pharmacokinetics
6. Biopharmaceutics
7. Types of clinical trials
8. Design and organization of phase-I, phase-II, phase-III, phase-IV trials
9. Various regulatory requirements in clinical trials
10. Schedule Y, ICMR guidelines etc.
11. Pre and post drug approval
12. Drug Regulatory Authorities- US-FDA, EU, DCGI, ICMR, ICH-GCP, SCHEDULE-Y, IPR, HIPPA, Patent
13. IND,NDA- Submission forms, submission process
14. Inspection and Audits-Regulatory Overview
15. Ethics Committee, IRB, DSMB
16. Pharmacovigilance - AE, SAE, ADR

## 4th Semester (Practical)

**Paper – 129**

**Pathology** **Full Marks – 50**

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 synuvial fluid and gastric juice
11. Collection, handling and transfer of sputum, swab and stool
12. Routine examination of sputum
13. Microbiological examination of sputum
14. Examination of urogenital swab
15. Examination of throat and mouth specimen
16. Examination of feces
17. Examination of rectal swab
18. Examination of pus from wounds, abscesses, burns and sinuses
19. Examination of ear discharge.

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20. Examination of skin exudates from syphilis patient

**Paper – 130**

**Clinical Microbiology** **Full Marks – 50**

1. Sterilization of Glass goods, culture media and other materials
2. Basic techniques in the preparation of culture media; primary culture and secondary culture
3. Aseptic transfer of microbes
4. Identification of number of bacteria present in a sample
5. Morphological study of microbes
6. Staining procedure-gram staining, Acid fast staining and spore staining
7. Biochemical test for differentiation of *E. coli,*
8. Biochemical test for differentiation of *Klebsiella* sp
9. Biochemical test for differentiation of *Staphylococcus* sp
10. Biochemical test for differentiation of *Streptococcus sp*
11. Preparation of culture media for pathogenic bacteria
12. Antibiotic sensitivity tests

**Paper – 131**

**Submission of Thesis** **Full Marks – 50**

**Paper –132** **Full Marks – 50**

1. Training in Hospital / NGO / Private Sector
2. Laboratory demonstration & exposure of the students to higher health service/research institute

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