



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

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

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

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 performance 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

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. Information 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 insipidus- 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.

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 and T4 in ELISA reader
7. Assay of Testosterone, E₂, 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 T₃ / T₄ 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. Assessment of obesity by the estimation of lipid profile
17. Assessment of hypertension by the estimation of cholesterol
18. Assessment 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. Oogenesis, 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

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 foetals
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.

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. EC50 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 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 – 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. Hematology 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
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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.

3rd Semester (Theoretical)

Paper-117

Clinical Immunology & Serology

Full Marks - 50

1. Principle of immunological reaction.
 2. Immuno-electrophoresis, counter immuno-electrophoresis, Rocket immuno-electrophoresis and nephelometry 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 immunosuppression.
 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 erythematosus, helicobacter pylori, tuberculosis and dengue.
 7. Serodiagnosis of streptococcal Antistreptolysin O (ASO) test, streptozyme test.
 8. Different Serodiagnostic test for AIDS (HIV1 & HIV-2). Serodiagnostic test for Hepatitis
 9. ToRCH Panel, Rubella, Toxoplasmosis, Trypanosomiasis, 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

- 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 halogenated hydrocarbons, imipramine, salicylates, digoxin, caffeine,

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 erythematosus
 8. Helicobacter pylori and titer estimation
 9. Mycobacterium tuberculosis
 10. Montoux test.

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.

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. haemolyticus*, *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; Dysentery 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

- 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 synovial 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.

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