

Raja Narendra Lal Khan Women's College (Autonomous)



**BACHELOR OF MEDICAL LABORATORY
TECHNOLOGY
(B.M.L.T.)**

**Under Graduate Syllabus
(Semester System)**

2019-2020

**Gope palace
PaschimMidnapore 721102
West Bengal**

Raja Narendra Lal Khan Women's College (Autonomous)

Bachelor Of Medical Laboratory Technology(B.M.L.T)

1ST Year Total marks (600)

for each unit: 50 (40+Internal Assessment)

No. Semester	Subject	Marks Allotted In Theoretical Part	Marks Allotted In Practical Part	Total
1st Semester	Communicative English Paper I, Unit 1	50	--	50
	Environment & Community Health (Theory), (Theory) Paper II, Unit 2	50	--	50
	Fundamentals of Medical Laboratory & Management (Theory) Paper III, Unit 3	50	--	50
	Assignment on Health and Medical Laboratory (Practical), Paper IV, Unit 4	--	50	50
	Human anatomy (Theory), Paper V, Unit 5.	50	--	50
	Human anatomy (Practical) Paper VI, Unit 6	--	50	50
	Total	200	100	300

No. Semester	Subject	Marks Allotted In Theoretical Part	Marks Allotted In Practical Part	Total
2nd Semester	Human Physiology Paper: VII, Unit: 7 (Theo)	50	--	50
	Human Physiology(Prac,) Paper: VIII, Unit 8	--	50	
	Biochemistry and Biophysics Paper IX, Unit: 9 (Theo)	50	--	50
	Biochemistry and Biophysics (Prac) Paper: X, Unit 10	--	50	50

	Medical Entomology, Parasitology & Virology, Paper: XI, Unit 11(Theo)	50	--	50
	Medical Entomology, Parasitology & Virology, (Prac) Paper: XII, Unit 12	--	50	50
	Total	150	150	300

2nd Year Total marks (600)

No. Semester	Subject	Marks Allotted In Theoretical Part	Marks Allotted In Practical Part	Total
3rd Semester	Immuno-Haematology, Paper: XIII, Unit 13(Theo)	50	--	50
	Immuno-Haematology (Prac) Paper: XIV, Unit 14	--	50	50
	Clinical Immunology, Paper: XV, Unit 15 (Theo)	50	--	50
	Clinical Immunology, (Prac), Paper: XVI, Unit: 16	--	50	50
	Serology, Paper: XVII, Unit: 17 (Theo)	50	--	50
	Serology (Prac), Paper: XVIII, Unit: 18	--	50	50
	Total	150	150	300

No. Semester	Subject	Marks Allotted In Theoretical Part	Marks Allotted In Practical Part	Total
4th Semester	Clinical Pathology and Oncopathology, Paper XIX, Unit 19(Theo)	50	--	50
	Clinical Pathology and Oncopathology, (Prac), Paper XX, Unit 20	--	50	50
	Clinical Bio-Chemistry, Paper:XXI, Unit21(Theo)	50	--	50

	Clinical Bio-Chemistry, (Prac), Paper XXII, Unit 22	--	50	50
	Cyto-Technology & Histotechnology, Paper: XIII, Unit 23(Theo)	50	--	50
	Cyto-Technology & Histotechnology, (Prac), Paper: XIV, Unit 24	--	50	50
	Total	150	150	300

No. Semester	Subject	Marks Allotted In Theoretical Part	Marks Allotted In Practical Part	Total
5 th Semester	Clinical Endocrinology, Toxicology and Andrology, Paper: XXV, Unit 25(Theo)	50	--	50
	Clinical Endocrinology, Toxicology and Andrology (Prac) Paper: XXVI, Unit 26	--	50	50
	Clinical Microbiology, Paper: XXVII, Unit 27(Theo)	50	--	50
	Clinical Microbiology (Prac), Paper XXVIII, Unit 28	--	50	50
	Blood transfusion and Blood bank, Paper: XXIX Unit 29(Theo)	50	--	50
	Blood transfusion and Blood bank, (Prac), Paper XXX, Unit 30	--	50	50
	Total	150	150	300

3rd Year Total marks (600)

No. Semester	Subject	Marks Allotted In Theoretical Part	Marks Allotted In Practical Part	Total
6th Semester	Research Methodology and Medical Statistics, Paper: XXXI, Unit 31(Theo)	50	--	50
	Research Methodology and Medical Statistics (Prac) Paper: XXXII, Unit 32		50	50
	Computer Application, Biomedical and Health Care system, Paper: XXXIII, Unit 33	50	--	50
	(Prac), Paper: XXXIV, Unit 34	--	50	50
	Project Preparation, Paper: XXXV, Unit-35	50	--	50
	Project Presentation ,Paper: XXXVI, Unit-36	--	50	50
	Total	150	150	300

Internship: 6 Months: Report submission & evaluation: 200 Marks-16 Credit

Total Marks- 2000 and Total Credit-160 (4credit=50marks)

Outcome of the Academic Programme

Bachelor of Medical Laboratory Technology (BMLT) degree is a three and half years (including six months internship) undergraduate course which offers candidates thorough knowledge about the laboratory equipment and laboratory diagnostic procedures. The course is helpful for students who wish to pursue a career in the management of laboratories, advancement in laboratories, and instrumentation. BMLT being one of the fastest growing fields in the healthcare sector, the demand for qualified professionals is growing every day for the treatment of rapidly growing diseases. Degree in BMLT helps to gain practical and technical knowledge for the right diagnosis and how to effectively run biochemical laboratories.

Program Objective: The main objective of the course is to train candidates in the management of operation theatre, effectively handle various medical equipment and expertise in applying medical standards. A Medical Laboratory Technologist should be disciplined and attentive. As fire is a bad master, likewise the chemicals in the laboratory are good servants but very bad masters. A Medical Laboratory Technologist should also have the ability to conduct research, finish tasks with speed as well as with accuracy, to handle stress, make analytical judgment, interpreting technical/scientific data, knowledge of laboratory instrumentation, mechanical ability and the ability to use computers. Technologists may also conduct research supervised by medical researchers, who are responsible for maintaining report accuracy and conducting complex tests. They generally have more training than a medical laboratory technician, who performs routine testing under stipulated conditions.

Job Prospects after completing BMLT degree: Medical technologists are an integral part of the medical profession. These professionals get involved in practical and technical work to aid correct diagnosis and effective functioning of Biochemical Laboratories. The career prospects in this field depend on the academic and technical skills of the technologist/technician. With adequate knowledge and experience, Medical Laboratory Technologists can advance to supervisory or management positions in laboratories and hospitals. They can also work as Laboratory manager/Consultant/supervisor, health care Administrator, Hospital Outreach coordination, laboratory information system Analyst/Consultant, educational consultant / coordinator etc. Additional opportunities are available in molecular diagnostics, molecular biotechnology companies and in vitro fertilization laboratories as well as in research labs.

Semester - I
Communicative English
Paper 1, Unit 1
Theory
Full Mark 50
CREDIT POINT: 4
Total Number of Hours: 60

1. Listening: Listening to the texts CDS.
2. Reading: Techniques of reading, Identifying the context & the central idea.
3. Writing: Rewriting a story from a point of view of different characters with given statements, Technical report writing, resume writing, An application writing for employment etc.
4. Basic Grammar: Vocabulary- distinction words having related meaning, Descriptive approaches, use of antonym. Grammar in spoken & written. Making statements.
5. Practice: Exercise on the use of different grammatical constructions in context. Identification of the use of above given grammatical devices from different text like newspaper, poems, stories etc.
6. Dialogues, Public speech, Telephonic conversation, Project on TV programme & newspaper.

Course outcomes: The course provides the students a basic knowledge in Communicative English so that they can fluently interact among themselves and with others in biochemical laboratories.

Environment & Community Health
PAPER II, Unit: 2
Full Mark: 50
(THEORY)
CREDIT POINT: 4
Total Number of Hours: 60

1. Basic idea about macro and micro environment, components of environment. Environmental air water, noise, radiation and food pollutions and pollutants.
2. Occupational health hazards in special reference to heat, cold, light, noise, vibration and dust. Occupational disease like silicosis, asbestosis, farmer's lung.
3. Human excreta disposal system. Health disorders due to mismanaged extra disposal standards of ventilations and types. Good lighting and its importance on health.
4. Concept of dimension of health. Concept of community & community health. Concept of disease and control of disease.
2. Determinants of health, responsibility of health. Sources of health information system.
3. Community health & nutritional indicators with their measurement. Health care of pregnant and lactating mother and infant in India.
5. Primary health care and Programs in India – mother –child health care system – village level, sub centre level primary health centre, community health centres.
6. Government and Non- Governmental agencies in community health care system.
9. National strategies for community health upgradation.
4. Communicable disease and role of environment for such transmission. Management of such communicable disease. Special reference to malaria, diarrhoea, cholera, HIV, Hepatitis, Typhoid.

5. Non-communicable diseases and role of environment for such diseases. Management of non-communicable diseases. Diabetes, CVD, Gout, Asthma.

Course outcomes: The course provides the students a basic knowledge about macro and micro environment, components of environment, environmental pollutions and pollutants as well as occupational hazards and various types of communicable and non-communicable disease and its management.

Fundamentals of Medical Laboratory and Management

PAPER III, Unit 3

Full Mark: 50

CREDIT POINT: 4

(THEORY)

Total Number of Hours: 60

1. Basic Medical terminology and basic laboratory principles.
2. Various medical or clinical laboratories and Standard laboratory Setup.
3. Medical laboratory professional - professionalism in laboratory workers, Code of conduct, communication between physician and lab technician.
4. Common Lab accidents and ways for its prevention, First aid in the clinical laboratory, Common Laboratory hazards, Biomedical Laboratory Waste and Waste disposal management.
5. Introduction to Quality control, Total quality management framework.
6. Quality laboratory processes, Quality assurance, Quality assessment, Quality control, External quality control
7. Quality planning and Quality improvement, Quality control programme, intrinsic and extrinsic and random errors.
8. Costs of conformance and non-conformance, appraisal costs, prevention costs
9. Internal quality control, basic steps, sources of error and their correction methods, CAPA - corrective action & preventive action
10. Quality control charts, Levy- Jennings and CUSUM charts
11. Current trends in laboratory accreditation, ISO certificate, and Westguard Rules
12. General and modern medical laboratory instruments with their uses.
13. Assessment of Health status and Clinical examinations of different age groups individuals and patients.

Course outcomes: The course provides the students a basic insight into the main features of the Indian health care delivery system and fundamental laboratory management and its safety rules to work properly in the laboratories.

Assignment on Health and Medical Laboratory

PAPER IV, Unit 4

Full Mark: 50

CREDIT POINT: 4

(PRACTICAL)

Total Number of Hours: 30

Submit Field base reports:

1. *Assessment of Physical health status of the healthy people and Patients.(25 marks).*
2. Assignment report on different medical laboratory setup after visiting Medical College hospital laboratories and medical diagnostic centre (25 marks).

Course outcomes: The students will be oriented to the role of a medical laboratory professional in the healthcare system, and the scope, purpose and career opportunities in the field of medical laboratory science

Human Anatomy

PAPER:V, Unit: 5

Full Mark:50

(THEORY)

CREDIT POINT: 4

Total Number of Hours: 60

1. System of the human body

1. Parts of blood vascular system,
2. Anatomy of upper and lower respiratory tract,
3. Anatomy of Gastro intestinal tract, urogenital system,
4. Endocrine system including reproductive organs,
5. Integumentary system, CNS & PNS of human body and surface anatomy.

2. Musculo- skeletal Anatomy

- A) Basic idea about the Fascia and muscles of head, neck face, trunk, upper limb and lower limb, muscles of eye
- B) General structure of all bones of skeleton and their attachment,
Classification of joints, joint of head, neck, trunk, upper limb, shoulder girdle and pelvic girdle.

Course outcomes: Comprehend the gross, functional and applied anatomy of various structures in the human body along with their inter-relationships.

**Human Anatomy
(Practical)
Paper-VI, Unit:6
Full mark: 50
CREDIT POINT: 4
Total Number of Hours: 30**

1. Identification of surface land marks of a human body.
2. Study on muscles of trunk, lower and upper extremities and face on a dissected human body.
3. Study on bone on human body with special reference to the origin and insertion of muscles and ligaments.
4. Study on gross anatomy of respiratory, digestive, endocrine, urinary and genital system on a dissected human body.
5. Study on the anatomy of CNS and PNS on a dissected human body.

Course outcomes:

- This subject will develop an understanding of the function of organs and organ systems in normal human body.
- Students will be able to explain the Anatomical systems of body and also understand the basis of diseases.

**Semester - II
Human Physiology
PAPER: VII, Unit: 7
Full Mark:50
(THEORY)
CREDIT POINT: 4
Total Number of Hours: 60**

- 1. Cell and tissue introduction:** Basic concept of cell structure, structure of cellular contents and transport across membranes, Different type of tissues, distribution and function.
- 2. Cardiovascular system:** Cardiac cycle, cardiac output, blood pressure, heart rate and their regulation. Coronary circulation, renal circulation, hepatic circulation, cerebral circulation. Erythropoiesis, stem cell concept in bone marrow, haemoglobin and their functions, blood coagulation, blood groups, regulation of blood PH.
- 3. Respiration:** Mechanism of inspiration, expiration, gaseous transport through blood, breathing rate regulation, hypoxia, asphyxia, dyspnoea and oxygen therapy.
- 4. Endocrine system:** Different hormones in endocrine system. Action of pituitary, thyroid, parathyroid, adrenal and gonadal hormones.
- 5. Digestive system:** Digestion of carbohydrate, protein, fat, egg, milk and absorption of different food stuffs. Absorption of water. Movement of small intestinal tract and their role.
- 6. Skin and body temperature:** Structure of the skin, function of the skin. Body temperature regulatory process in human - role of endocrine and nervous system.
- 7. Neurophysiology:** Reflex system, automatic nervous system, parts of brain and function of each part. Nerve tract and their role.

8. Muscle Physiology: Structure of skeletal muscle. Muscle contraction and relaxation. Types of muscle contraction.

9. Special senses: Structure of retina, rhodopsin and iodopsin cycle, visual tract, accommodation. Auditory tract, mechanism of audition. Structure of taste bud, taste pathway, Olfaction and its physiology.

10. Renal physiology: Structure and function of renal system. Urine formation, micturition, renal clearance test, renal buffer system.

11. Reproductive system: Male and female reproductive organs, Gametogenesis, Ovulation, Menstrual Cycle.

Course outcomes:

This subject imparts the knowledge of the structure and functions of organs and organ systems in normal human body.

Human Physiology

Paper – VIII, Unit 8

Full Mark:50

(Practical)

CREDIT POINT: 4

Total Number of Hours: 30

1. Studies on different types of microscopes (Uses and preventive maintenance).
2. Measurement of Pulse rate, Respiratory rate, Heart rate and Blood pressure (Mean pressure, Pulse Pressure) in different posture.
3. Determination of ECG, EEG, EMG, Pulse oxymeter (Before and After Exercise), Spirometry,
5. Study on Superficial and Deep reflexes.
6. Study of visual acuity (Snellen's chart) and color vision (Ishihara Chart).
7. Study of Hearing, Smell and Taste.
8. Measurement of Basal Metabolic Rate (BMR / BBE / RRE) by prediction equation and directly.
9. To demonstrate microscopic structure of Tongue, Esophagus, Stomach, Small intestine, Duodenum, jejunum, Ileum, parotid gland, large intestine, Pancreas, Liver, Lungs, Skin, Kidney, Spleen, Lymph gland, Thyroid gland, Uterus, Testis, Ovary, Spinal cord, Cerebrum, Cerebellum, with permanent slides.

Course outcomes:

This subject imparts the practical knowledge of handling various instruments for the assessment of different physiological parameters as well as to study the histological structure and function of organs and organ systems in normal human body.

Biochemistry & Biophysics

Paper – IX, Unit 9

Full Mark:50

(THEORY – 50)

CREDIT POINT: 4

Total Number of Hours: 60

- 1. Carbohydrate** – Definition, Source, Classification, Functions and Importance, Physiological importance of major type of carbohydrates.
- 2. Protein** – Definition, Source, Classification, Function and Importance of major type of proteins.
- 3. Lipids** - Definition, Source, Classification, Function of major type of lipids. Saturated and Unsaturated type of fatty acids, Essential fatty acids and their importance. Phospholipids and their importance.
- 4. Nucleic acid** – Structure and function of DNA & RNA. Nucleosides and Nucleotides, Genetic code, biologically important nucleotides.
- 5. Vitamins** – Fat-soluble and water-soluble vitamins, Daily requirements, Physiological functions and diseases of vitamin deficiency.
- 6. Bioenergetics** – Energy rich compounds. Respiratory chain and biological oxidation.
- 7. Carbohydrate metabolism** – Glycolysis, HMP shunt, TCA cycle, Glycogenesis, Glycogenolysis, Neoglucogenesis, Blood sugar level.
- 8. Lipid metabolism** – Fatty acid oxidation, Ketone bodies, Metabolism of cholesterol, Arteriosclerosis and Obesity.
- 9. Protein metabolism** – Transamination, Transmethylation, Deamination, Urea synthesis, Inborn error of metabolism.
- 10. Enzymes** – Definition, Classification, Mode of action, Factors affecting enzyme action, Chemical importance of enzyme.

Course outcomes:

This content imparts knowledge about biochemistry of carbohydrate, protein, lipids, nucleic acid, vitamins and their important role in the physiological system. This content also enhance the knowledge of metabolic effects in our body.

Biochemistry & Biophysics

Paper: X, Unit 10

Full Mark:50

(Practical)

CREDIT POINT: 4

Total Number of Hours: 30

1. Qualitative identification of Glucose, Fructose, Lactose, Maltose, Sucrose, Starch, Albumin, Peptone, Glycerol, Cholesterol, Acetone, Bile salt & pigments, Urea, HCl, Lactic acid, Uric acid in sample by biochemical tests.

2. PH determination of a solution by titration.
3. Quantification of Glucose, Lactose and Sucrose in a specific sample.
4. Preparation of different buffers used in pathological laboratory and their pH determination.

Course outcomes:

- Use basic laboratory skills and apparatus to obtain reproducible data from biochemical experiments;
- Implement experimental protocols, and adapt them to plan and carry out simple investigations;
- Analyze, interpret, and participate in reporting to their peers on the results of their laboratory experiments

Medical Entomology, Parasitology & Virology

Paper: XI, Unit 11

Full Mark:50

(Theory)

CREDIT POINT: 4

Total Number of Hours: 60

1. Basic concept of Medical Entomology and Parasitology in relation of this course.

2. Arthropods of medical importance. Arthropods borne disease and their transmission. Principle of arthropod control.

3. **Mosquito:** Role of this arthropod in disease transmission, Diseases types, Controlling measures.

4. **Houseflies:**Role of disease transmission and controlling measures. And Sandflies.

5. **Flea:** Role of disease transmission and controlling measure & itch mite.

6. **Filaria:** Causes, Symptoms and controlling measures.

7. **Taeniasis:** Causes, Symptoms and controlling measures.

8. Introduction to Virology, Classification, Structure and General properties of viruses, Bacteriophage, lytic cycle, lysogenic cycle,

9. Brief idea of Pox virus, Myxovirus, Arbovirus, Herpes virus, Enterovirus, Rabies virus, Rota virus, HIV virus, SARS - COV- 2.

Course outcomes:

The course on medical entomology, parasitology and virology will provide the students basic structure, unique characteristics, culture method and various parasitic and viral disorders.

Medical Entomology, Parasitology & Virology:

Paper: XII, Unit 12

Full Mark:50

(Practical-50)

CREDIT POINT: 4

1. Collection, Presentation & Identification of different disease-causing Arthropods (Housefly, Mosquito etc.), and Whole mount preparation of slide of different disease-causing arthropods for their detailed anatomical studies.

2. Identification of different disease-causing Helminth and Protozoan parasites.
3. Identification of different phases of life cycle of arthropods protozoa, helminth, having medical importance for causing disease.
4. Slide identification of microfilaria, *Taeniasolium*, *ascaris*, and deferent stages of malaria.
5. Examination of stool for OPV (Ova parasite Cyst)
6. Laboratory diagnosis of viral Infections-Specimens collected, Processing of specimens, Different methods of diagnosis.

Course outcomes:

This course on medical entomology, parasitology and virology will provide the students the basic practical knowledge regarding collection, presentation & identification of different disease-causing arthropods as well as handling culture method and diagnosis of various parasitic and viral disorders.

Semester-III
IMMUNO-HAEMATOLOGY,
Paper: XIII, Unit 13
Full Mark:50
(Theory)
CREDIT POINT: 4
Total Number of Hours: 60

1. Basic requirements of haematology laboratory, cleaning of laboratory glassware in Haematology, Sterilization process.
2. Genetics in blood banking, Blood collection & preservation including cryopreservation, Coombs tests-significance.
3. Haemoglobin, its synthesis and types, normal and abnormal haemoglobins, extravascular and intravascular haemolysis.
4. Haemolytic anaemia, pathogenesis and laboratory investigations, principle and procedure of special test, G-6-PD
5. Haemolytic disease of new born, Haemostasis, Idea about Thalassaemia and sickle cell anaemia. Blood donor selection, screening, Transfusion transmitted diseases & their lab diagnosis.
6. HLA- theory importance in transplantation, disease associations & basic techniques used in tissue typing.
7. Automation in Haematology Laboratory.

Course outcomes:

The haematology course aims to help the students understand and recognize the pathologies behind benign and malignant disorders of erythrocytes, leucocytes, thrombocytes and the bone marrow. This course was specially designed with the future doctor in mind and its main goals are:

- To provide in depth knowledge about the pathology and pathophysiology of haematological disorders.

- To help the students, read and evaluate laboratory values from routine blood examination and be able to differentiate between pathologies.
- To enhance the student's ability to produce a differential diagnosis based on clinical examination and laboratory values.
- To provide a basic understanding of the treatment protocols which are in place for haematology.

IMMUNO-HAEMATOLOGY

PAPER: XIV, Unit 14

(Practical)

Full mark: 50

CREDIT POINT: 4

Total Number of Hours: 30

1. Specimens, Blood collection & preservation using different anticoagulants & preservative solutions.
2. Experiments on TC & DC, PCV, MCV, MCH, MCHC and ESR. (Wintrob method)
3. Determination of haemoglobin-by-haemoglobin meter and by colorimetric method.
4. Determination of Bleeding time and clotting time, PT
5. Screening test for sickle cell anemia and slide identification of Thalassemia.

Course outcomes:

This course has been designed to understand the blood component, function of blood, blood collection and its laboratory diagnosis protocols and various type of laboratory test.

Clinical Immunology

Paper-XV, Unit 15

Full Mark:50

(Theory)

CREDIT POINT: 4

Total Number of Hours: 60

1. Basic concept of Immune system. Types of immunity, cellular, humoral, active, passive, natural, and acquired immunity. Primary immune organs.
2. Antibody formation and antigen-antibody reaction, type of reactions
3. Basic concept of immunization. Primary and secondary response of immunization. Vaccination and Booster dose.
4. Immunoglobins—type, structure and their specific importance.
5. Immunodeficiency diseases.
6. Immunosuppression - role of organ transplantation.

7. Auto immune disease: Hasimoto's disease, myasthenia gravis, RA and Lupus erythematosus, Erthroblastosis foetalis.
8. Antibiotics, Definition, types and properties, mode of action, use.

Course outcomes:

This course has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.

Clinical Immunology
Paper-XVI, Unit 16
Full Mark:50
(Practical)
CREDIT POINT: 4
Total Number of Hours: 30

1. Determination of 'ABO' blood grouping and 'Rh' typing.
2. Antibody measurement by ELISA, Flow Cytometry, Radial immuno-diffusion (RID) technique.
3. Antigen-Antibody reaction testing by precipitin ring. Ouchterlony test.
4. Qualitative and Quantitative assay of Immunoglobins in plasma. (IgG, IgM)

Course outcomes:

The course aims to develop skills of performing basic clinical immunological tests important in clinical investigations, to develop familiarity with immunological techniques, and to introduce students about ELISA, Flow Cytometry, Radial immuno-diffusion (RID) technique.

SEROLOGY
PAPER-XVII, Unit 17
Full Mark:50
(Theory)
CREDIT POINT: 4
Total Number of Hours: 60

1. Collection and preparation of specimen material for Culture-Urine, Blood, CSF, Throat Swab, Faeces, Body fluids separation of Sera, Preservation & Transport for serological test.
2. Principle of Sero-diagnostic tests, precipitation, Flocculation, Agglutination, neutralization and coagulation.
3. Serological test for syphilis (STS) and VDRL, CRP, RPR test.
4. WIDAL test for *Salmonella Typhi*.
5. Sero-diagnosis test for AIDS, Rubella, Toxoplasmosis, Leishmaniasis, Trypanosomiasis. TORCH panel test.

6. Immunological test for pregnancy (Direct and Indirect)
7. Intradermal hypersensitivity test – Montoux Test.
8. ASO (Antistreptolysin O) test.

Course outcomes:

This course has been formulated to impart basic aspects of, various serological techniques, reactions, and their utility in laboratory diagnosis of human diseases.

SEROLOGY
PAPER-XVIII, Unit 18
Full Mark:50
(PRACTICAL)
CREDIT POINT: 4

1. Collection and preparation of specimen material for Sero Diagnosis and Preservation & Transport for serological specimen.
2. Diagnosis of viral infections-isolation& serological test advanced serological techniques-ELISA, Immuno-electrophoresis, Immunodiffusion, Serological diagnosis for viruses
3. VDRL test, WIDAL test, RPR, ASO test.
4. CRP test, RA test, AIDS test, STS test.
5. Immunological test for Pregnancy (direct and indirect)
6. Montoux test.

Course outcomes:

This course has been formulated to impart practical knowledge of various serological techniques, reactions, and serological diagnosis for viruses as well as their utility in laboratory diagnosis of human diseases.

Semester-IV
Clinical Pathology and Onchopathology
PAPER-XIX, Unit 19
Full Mark:50
(THEORY)
CREDIT POINT: 4
Total Number of Hours: 60

1. Collection of urine and stool specimen, types of urine and stool specimen and preservation of urine and stool. Routine examination of urine – physical and Microscopic examination. Routine test for stool and occult blood test.
2. Chemical test of urine for glucose, protein, Ketone bodies, bilirubin, urobilinogen & blood.
3. Laboratory investigation, Serous fluid and Gastric juice.

4. Collection and processing of CSF and its laboratory investigation.
5. Hallmarks of Cancer, Incidence and Etiology of Cancer, Cancer and metabolism, Crisper cas9
6. The Carcinogens-definition, Oncogene-definition Mechanism of action of Oncogenes (outline), Characteristics of growing tumor cells-general and morphological changes, biochemical changes,
7. Tumor Markers: Introduction and definition, Clinical applications of tumor markers, Enzymes as tumor markers, Alkaline Phosphatase (ALP), Creatine kinase (CK), Lactate dehydrogenase (LDH), Prostatic acid phosphatase (PAP), Prostate specific antigens (PSA), Hormones as tumor markers (introduction of each type in brief), Oncofetalantigen Alpha feto protein (AFP), Carcino embryonic antigen (CEA), Squamous cell carcinoma (SCC) antigen, Carbohydrate markers (brief introduction of each type) CA 15-3, CA 125, Bladder cancer markers (introduction in brief) - Bladder tumor antigen (BTA) , Fibrin- Fibrinogen degradation product (FDP)m Nuclear matrix protein (NMP22). Biomarkers still in research (introduction in brief)- Telomeres, TRAP assay, hyaluronic acid and Hyaluronidase.

Course outcomes:

The course on clinical pathology and oncopathology will provide the students basic knowledge about collection, chemical test and laboratory investigations of CSF, urine for glucose, protein, Ketone bodies, bilirubin, urobilinogen & blood. It also provide detail knowledge about various tumor markers.

Clinical Pathology and Oncopathology

Paper – XX, Unit 20

Full Mark:50

(PRACTICAL)

CREDIT POINT: 4

Total Number of Hours: 30

1. Physical and Microscopic examination of Urine.
2. Bio-chemical estimation of glucose in urine.
3. Bio-chemical estimation of protein and ketone bodies in urine, bile salt, bile pigment, urobilinogen and blood in urine.
4. Laboratory testing of CSF, Serous fluid, Gastric juice, and Synovial fluid.
5. Collection and processing of CSF and its laboratory investigation.
6. Routine test and microscopical test for stool and occult blood test.

Course outcomes:

- Clinical pathology is a place to conduct all the science experiments to obtain a specific result. It helps to diagnose the diseases using different tools in the laboratory. Moreover, they can also test it through blood samples or any fluid samples from the body.
- This paper aims to understand the principle, procedure & demonstration of various cancerous tissue constituents and advance tools.

Clinical Bio-chemistry
Paper: XXI, Unit 21
Full Mark: 50
(Theory)
CREDIT POINT: 4
Total Number of Hours: 60

1. Specimens processing for biochemical analysis – preparation of serum specimen, protein free filtrate and urine.
2. Principles of Immuno Chemistry – RIA & ELISA.
3. Determination of glucose, urea, creatinine, uric acid, bilirubin, Triglyceride, cholesterol and Phospholipids, LDL, VLDL, HDL, Troponin T test in blood.
4. Liver function tests. (Total protein, Albumin, Globulin ratio, ALP, ALT, AST, conjugated and unconjugated bilirubin)
5. Gastric function tests: Free acidity, Total acidity, total acidity, gastric pH, gastric enzyme analysis.

Course outcomes:

The course aims to develop skills of performing basic biochemical tests and its importance in clinical investigations, to develop familiarity with biochemical laboratory techniques, and to introduce students to various practical aspects of enzymology and their correlation in disease conditions.

Clinical Bio-Chemistry
Paper – XXII, Unit 22
Full Mark: 50
(Practical)
CREDIT POINT: 4

1. Preparations of plasma, serum, and protein free filtrate from blood for biochemical analysis.
2. Determination of Blood glucose, total protein in serum, blood urea, blood creatinine, serum uric acid, serum TG, blood cholesterol and blood Phospholipids and Ketone bodies.
3. Estimation of Hepatitis – A, B, C, E.
4. Experiment on Glucose tolerance test.
5. LFT, LP, Renal Profile
6. Determination of G-6-PD
7. Sodium and Potassium estimation in Serum

Course outcomes: The course aims to develop practical skills and knowledge of performing basic biochemical tests important in clinical investigations, to develop familiarity with biochemical laboratory techniques, and to introduce students to various practical aspects of enzymology and their correlation in disease conditions.

**Cytotechnology & Histotechnology,
Paper-XXIII, Unit 23
Full Mark:50
(Theory)
CREDIT POINT: 4
Total Number of Hours: 60**

1. Equipment's used in Cytotechnology and Histotechnology.
2. Specimen preparation in Cytotechnology and Histotechnology –fixation, dehydration, clearing, embedding, section cutting, mounting staining.
3. Stain preparation. Haematoxylin, eosin, trichrome stain, PAS stain.
4. Techniques followed in routine Haematoxylin – Eosin staining, Trichrome staining, PAS staining, Geimsa staining.
5. Idea about frozen section techniques and automation of biotechnology laboratory.

Course outcomes:

Students will learn about various diseases associated with various system of human body and histo-techniques, handling and processing of tissue specimens as well as staining procedures.

**Cytotechnology & Histotechnology:
Paper-XXIV, Unit 24
Full Mark:50
(Practical)
CREDIT POINT: 4
Total Number of Hours: 30**

1. Tissue collection and fixation, Idea about Grossing
2. Dehydration of collected tissue sample in the graded alcohol.
3. Stain preparation – Haematoxylin, eosin, PAS, Trichrome, iron,haematoxylin.
4. Staining techniques using above stains.
5. Preparation of specimen for cytological evaluation by papaniculas, staining, crystal violet Staining.
6. Characterization of benign and malignant cells.

Course Outcomes:

The following practical are done in the Cytotechnology and Histotechnology portion –

1. Tissue collection and fixation.
2. Dehydration of collected tissue sample in the graded alcohol.
3. Stain preparation – Haematoxylin, eosin, PAS, Trichrome, iron hematoxylin staining.

Preparation of specimen for cytological evaluation by papaniculas staing, crystal violet staining

Semester - V
Clinical Endocrinology, Toxicology and Andrology:
Paper –XXV, Unit 25
(Theory)
Full Mark:50
CREDIT POINT: 4
Total Number of Hours: 60

1. Information on pituitary-gonadal axis, pituitary –thyroid axis, pituitary – Adrenocortical axis, feedback system. Information on pancreatic hormones.
2. Hormonal disorders in Diabetes mellitus and insipidus, hypertension, goiter, obesity and infertility.
3. Techniques followed in hormone assay – ELISA / RIA cross reaction, inter assay, intra assay variation.
4. Spermatogenesis and its hormonal control, semen physiology, sperm count, sperm motility, sperm morphology, fructose estimation of semen. Sperm viability test.
5. Primary idea on Assisted Reproductive Technology (ART). Acid phosphatase in semen.
6. Introduction of Toxicology, Alcohol poisoning, Lead poisoning, Zinc poisoning, Mercury poisoning drugs abuse, screening procedure for drug screening, Spot tests, hair and urine test, Immunoassay for drugs.

Course Outcomes:

The course aims to develop theoretical knowledge of clinical endocrinology, toxicology and andrology and to develop familiarity with biochemical laboratory techniques.

Clinical Endocrinology, Toxicology and Andrology:
Paper –XXVI, Unit 26
(Practical)
Full Mark:50
CREDIT POINT: 4
Total Number of Hours: 30

1. Demonstration of male and female infertility test.
2. Hormone assay by ELISA reader – Estrogen, Testosterone, T3 and T4, LH, FSH, PRL, Insulin, Glucagon, Glucocorticoids, GH.
3. Sperm count, sperm motility, sperm morphology, fructose assay in semen, Acid Phosphatase in semen. Sperm viability test.

Course Outcomes:

The course aims to develop practical skills and techniques for performing basic biochemical tests important in clinical investigations and to develop familiarity with biochemical laboratory techniques related to clinical endocrinology, toxicology and andrology.

Clinical Microbiology
Paper: XXVII, Unit 27
Full Mark:50,
CREDIT POINT: 4
(Theory)
Total Number of Hours: 60

1. Specimen collection and handing in microbiological laboratory; safety regulation of the laboratory, basic laboratory procedures of diagnostic laboratory.
2. Microscopic examination techniques, culture media and quality control in microbiology.
3. Diagnostic bacteriology – Grouping, characteristics of common pathogen bacteria.
4. Laboratory diagnosis of mycotic infections.
5. Virology of following diseases: Influenza, measles, Rabies, Kalazar, Swine-flu.
6. Antiseptics & Disinfectants: Definition, types and properties, mode of action, use, qualities of good disinfectants.
7. Chemical disinfectants: phenol and its compounds, alcohol, halogen, heavy metals and quaternary ammonium compounds, aldehyde, gaseous compound. use and abuse of disinfectants. precautions while using the disinfectants.

Course outcomes:

This course has been formulated to impart basic knowledge on clinical microbiology and handling various microbiological techniques and their utility in laboratory diagnosis of human infections.

Clinical Microbiology:
Paper –XXVIII, Unit 28
Full Mark:50
CREDIT POINT: 4
(PRACTICAL)
Total Number of Hours: 30

1. Sterilization techniques and cleaning of glassware.
2. Preparation of culture media, biochemical test for bacterial differentiation.
3. Examination of skin scapper fungi and Acid-fast bacilli and examination of sputum for Acid fast bacilli.
4. Biochemical test for bacterial differentiation.
5. Gram staining: (gram positive and gram negative)
6. RNA & DNA analysis by Gel and PCR Technique.
7. Demonstration of Hot air oven and sterilization of glass wares.
8. Preparation of Antibiotics and perform antibiotic sensitivity test.

9. To perform gram staining, staining of bacterial spores

10. Basic techniques of collections of specimens for direct examination of pathogenic fungi KOH Lactophenol cotton blue method cultivation of fungi basic techniques of collection & transport of specimens for serological tests.

Course outcomes:

This course gives a general insight into the history, basics of microbiology and imparts practical knowledge and handling techniques about equipment used in microbiology and to perform staining of bacterial spores.

Blood Transfusion and Blood Bank:

Paper- XXIX, Unit 29

(Theory)

Full Mark:50

CREDIT POINT: 4

Total Number of Hours: 60

1. Principles of blood grouping, Blood transfusion in total or in fractionated part. Blood group antigen: their importance in blood transfusion.
2. Condition of blood transfusion, basic principles followed for such case.
3. Disorders of mismatched blood transfusion, Transmission of diseases in relation to blood transfusion (HIV, Hepatitis, Jaundice, Malaria, Syphilis).
4. Introduction of blood collection and basic concept for storage of blood and it's transportation. Donor's selection.
5. Preparation of reagents for blood Banking.
6. Fractionation of blood storage.
7. QC
8. Blood Components, Preparation, Indications, Storage, difficulties and autologous transfusions.

Course outcomes:

This course gives a general knowledge about blood transfusion and blood bank. It also highlights the concept and importance of blood collection and for storage of blood and it's transportation.

Blood Transfusion and Blood Bank

Paper- XXX, Unit 30

Full Mark:50

(Practical)

CREDIT POINT: 4

Total Number of Hours: 30

1. Reagent Preparation of Blood Bank.
2. Determination of Blood groups.(forward grouping and reverse grouping)
3. Determination of cross matching by blood group testing techniques, Coomb's test.(direct and indirect)
4. Fraction collection from Blood and it's storage.

5. Pre & Post transfusion reaction screening:
6. Apheresis
7. Investigation of transfusion reactions Investigation of haemolytic disease of new born HBsAg& HIV antibody testing in blood bank,
8. Auditing in blood banks how to store blood.
9. Test Compatibility testing cross matches.

Course outcomes:

This course gives a general practical knowledge about blood transfusion and blood banking. It also highlights the practical techniques of blood collection, blood grouping, cross matching by blood group testing techniques and blood storage.

Semester- VI
Research Methodology and Medical Statistics:
Paper: XXXI,Unit 31
(Theory)
Full Mark:50
CREDIT POINT: 4
Total Number of Hours: 60

1. Concepts of Research and it's types.
2. Concepts of hypothesis.
3. Basic idea about Project formation.
4. Data collection.
5. Experimental design.
6. Mean, median, mode, Percentile, Variance, SEM, SD.
7. 't' test, Chi-Square test and One way ANOVA, correlation of coefficient.

Course outcomes:

This course gives a basic knowledge regarding concept and importance of research, hypothesis, data collection, experimental design, statistics and project formulation.

Research Methodology and Medical Statistics:
Paper: XXXII,Unit 32
(Practical)
Full Mark:50
CREDIT POINT: 4 Total Number of Hours: 30

1. Assignment for project formulation. (At list one)
2. Problem solving on mean, median, SEM, SD.

3. Problem solving on 't' test: match group, single group study, population mean study.
4. Problem solving on Chi-square test for association.

Course outcomes:

This course gives a knowledge regarding concept and importance of research, data collection, experimental design and statistical analysis and project formulation.

**Computer Application, Biomedical Informatics and
Health care system**

Paper: XXXIII, Unit 33

(Theory)

Full Mark:50

CREDIT POINT: 4

(Total Number of Hours: 60)

1. Study on various components of a personal computer, hardware and software.
2. Computer Applications in pathological laboratory to recording and data presentation.
3. Basic knowledge and utility in multimedia in laboratories.
4. Application of the digital computer in patient maintaining, Basic knowledge on MS office, Floppy recording, Storage of data in pathological laboratory.
5. Interactive patient's education and counselling

Course outcomes:

This course gives a knowledge regarding concept of computer application and biomedical Informatics on health care system.

Computer Application AND Biomedical Informatics

Paper: XXXIV, Unit 34

(Practical)

Full Mark:50

CREDIT POINT: 4

Total Number of Hours: 30

1. Operation of personal computer.
2. Data storage, reporting, data presentation in computer.
3. Application of MS-office, MS-excel in pathological laboratories.

Course outcomes:

This course gives a practical knowledge regarding computer application and biomedical Informatics on health care system.

Project Preparation**Paper: XXXV****Full Mark: 50 Marks****CREDIT POINT: 4****Total Number of Hours: 60**

(An independent research project work undertaken by student under the guidance of a teacher, can either be a survey or Laboratory oriented research. The research should be submitted at the end of session in the form of a dissertation. The project work can be undertaken at University, departments, affiliated research institutions, quality control laboratories, food industries or other institutions with prior approval)

Project Presentation**Paper: XXXVI****Full Mark: 50 Marks****CREDIT POINT: 4****Total Number of Hours: 60**

(The student should appear before examiners board and the dissertation shall be evaluated by means of presentation and viva – voce).

Internship: 6 Months Report submission & evaluation: 200 Marks**Course outcomes:**

This internship programme in various hospitals and health care units will be a part of their outreach extension programme that will help them to learn various instrumental techniques through hands on training. It will increase their potential and handling skills of various instruments. They can easily interact with patients during their internship programme that will enhance their communication as well as performance skill for testing various physiological and biochemical parameters. In future this will help them to work properly in biomedical laboratories.

Recommended Books:

1. Guide of patters and usages in English, A S Hornby
2. English Vocabulary in use, Michael Mc Carth and Felicity O ‘ Dell
3. Better pronunciation, O Conner.
4. Hand Book of Practical Communication skills, Chrissie Wright.
5. History of Science, Samarendra Nath Sen.
6. Science and Society in Ancient India, D P Chattopadhyay.
7. Environment and Health, Goutam Pal.
8. Preventive and Social Medicine, Park and Park.
9. Fundamentals of Human Anatomy, Dr. N Chakraborty and Dr. D Chakraborty.
10. Anatomy, Gray
11. Clinical Anatomy for Medical students, Snell
12. Human Anatomy, Dutta
13. Essentials of Anatomy, Singh.
14. Concise Medical Physiology, Choudhury.
15. Text book of Medical Physiology, Guyton.
16. Review of Medical Physiology, Ganong.
17. Biochemistry, D Das.
18. Biochemistry for students, Malthotra.
19. Review of Biochemistry, Harper.
20. Biophysics, D.Das. 21. Biophysics, R.N.Roy.
22. TB of Medical Parasitology, Panikar.
23. Medical Parasitology, Bhatia.
24. Text book of Pathology, N. C. Deb & T. K. Roy.
25. Practical Pathology, P. Chakraborty.
26. Medical Laboratory Technology, K. L. Mukherjee.
27. Basic Pathology, Kumar. 28. Practical Pathology, Parulekar.
28. Introduction Medical Laboratory Technology, Baker.
29. Modern Blood Banking & Blood Transfusion Practical, Harmening.
30. Text Book of Modern Immunology, Dasgupta.
31. Essential Immunology, Roitt.
32. Hand Book of Ultrasound, Garkal.