RAMA UNIVERSITY UTTAR PRADESH,

KANPUR

Faculty of Paramedical Sciences

3½ YEARS B.Sc. PROGRAMME IN

MEDICAL LABORATORY TECHNOLOGY (B.M.L.T.)

2018-19

Ordinance, Rules, Regulations

&

SYLLABUS

INTRODUCTION

Today is the era of evidence based medicine. The advancements in the medical diagnosis has elevated the clinical standards. The millions and millions of blood and other samples are tested every day to assist in making clinical diagnosis. This has increased the demand of laboratory individuals to enormous magnitude. The automation in carrying out investigations and making reports has made the job of laboratory individual simpler, quicker and precise. The bachelor of medical lab technology course plays a leading role in providing lab procedures at primary level, secondary level, territory level to very highly standardized level of care.

PROGRAMME OBJECTIVES

At the end of Medical Lab Technology training the graduate shall be able to;

1. Perform all the Medical Laboratory Techniques
2. Use discretely the essential/modern/digital laboratory services
3. Manage all types of clinical diagnostic medical lab techniques, and their recording in latest computer soft wares for digital communication.
4. Demonstrate skills in handling the modern medical lab instruments in laboratory diagnosis and techniques.
5. Develop leadership qualities to function effectively as a leader in the laboratory environment
6. Render services to the laboratory set up and to associate effectively with the pathologist, microbiologist and biochemist and the hospital management.
7. Development of skill and competency in carrying out Pathology and Biochemistry independently and their details, reporting and maintenance of records of medical lab investigations.
8. Manage the medical lab record of medico legal cases of the hospital patients for laboratory record purposes.

Programme: Bachelor of Medical Laboratory Technology (B.M.L.T.)

Duration: Three and Half Year full time course (Including 6 months internship.)

Eligibility For Admission: Intermediate Science (10+2) or equivalent from a recognized board with Physics, Chemistry & Biology and English subjects with minimum 50% of the marks.

OR

Pre degree course from a recognized University equivalent to 10+2

OR

Lateral Entry to second year for candidates who have passed diploma in Lab Technology or simillar, and registered with UP state Medical faculty.

Note:

1. The candidate must have passed individually in each of principal subjects.
2. The Candidate who have passed diploma or vocational course through correspondence shall not be eligible for the course.

Age limit for admission : Must have attained 17 years of age on 1st July.

Medium of Instructions of Course & Examinations shall be in English.

Examination: There shall be yearly Examinations at the end of each academic year according to the academic calendar of the University. This course shall be divided into three professional

examinations namely Bachelor. in Medical Laboratory Technology (B.M.L.T) Part-I at the end of first academic year, Bachelor M.L.T Part-II at the end of second academic year and Bachelor M.L.T Part-III at the end of third academic year.
All the rules will be as per guidelines of Rama University Uttar Pradesh.

The professional examinations shall be in the form of theory papers and practical examinations. The candidate shall be required to appear in every subject as specified in the course structure for each year.

Duration of Examination :

Each theory paper shall be of three hours duration.

Attendance:

Every candidate should have minimum 70% attendance of total classes held in single academic year to be eligible to appear in university examinations.

Internal Assessment :

It will be for theory and practical both. It will be done through the whole year.

Candidate must obtain at least 35% marks in theory and practical separately in internal assessment to be eligible for the annual university examination.

Internal assessment (**Theory**) will be done as follows :

a)	Mid-term and term and Pre University examinations	= 10 marks
b)	Assignments/Projects/Class test/Clinical Presentations	= 05 marks
c)	Attendance (according to %age of attendance)	= 05 marks
	Total	**= 20 marks**

Internal assessment (**Practical**) shall be done as follows :

a)	Viva voce & Practical	= 10 marks
b)	Day to day performance	= 05 marks
c)	Attendance (in Lab)	= 05 marks
	Total	**= 20 marks**

(Those subjects in which University practical examination is not held, internal assessment will be done on the basis of theory examination and projects and assignments.) Candidate must obtain at least 35% marks in the theory and practical examination separately in the internal assessment to be eligible for appearing in the professional examination. If a candidate is absent in theory and practical internal assessment examinations, he/she shall be given chance to re-test in the internal assessment evaluation as programmed by the Faculty of Paramedical Sciences with the prior permission of Registrar, Rama University before the conduction of final professional examinations.

Criteria of passing : The candidate is declared to have passed University examinations in subjects, if he/she secure 50% of the marks in the theory and 50% marks in the practical separately. For computation of 50% marks in theory and practical, the marks scored in the internal assessment (theory and practical) shall be added to the University conducted theory and practical examination respectively.

Grace marks : If a candidate fails in one subject (theory only) in the annual university examination, five grace marks shall be given to the candidate by the university before declaration of the results. Candidate failing in practical examination will be considered as failed.

Supplementary Examinations and Carry over benefits:

A candidate failing in a subject or more than one subject but securing 30% total aggregate marks will be allowed to appear in the university supplementary examination after two months in that subject/ subjects while being permitted to attend classes of the next year (carry over). Those who secure less than 30% total aggregate marks will be required to appear in all subjects. If a candidate securing internal assessment marks less than 35% in theory and practical separately then he/she has to be evaluated again for internal assessment as programmed by the Faculty of Paramedical Sciences with the prior permission of Registrar, Rama University before the conduction of final /Supplementary examinations.

(a) If the candidate fails in all subjects or fails to appear in the main examination, then his/her session will be shifted back by one year. The candidate will have to take re-admission in the previous year and pay the tuition fees for the academic year. He/she will have to appear in all subjects in the examination and internal assessment.

(b) Supplementary examinations will be held not earlier than two months and not later than six months from the date of annual university examinations.

Division : Candidate will be awarded division at the end of third (final) academic year as follows:

Percentage of marks will be calculated from aggregate of total marks obtained in all the three professional examinations.

(i) Honours – 75% marks and above in total aggregate.
(ii) Distinction – 75% and above marks in any subject.
(iii) First Division - 60% and above in the aggregate marks of all subjects.
(iv) Second Division – 50% or more but less than 60% in the aggregate of marks of all subjects.

INTERNSHIP

A candidate has to undergo internship for a period of 6 months in Medical College, a Govt. hospital/ private hospital/ Tertiary center, which fulfill the norms decided by the University. Internship is a phase of training wherein a graduate is expected to conduct actual practice of Medical Lab Technology Procedures and acquires skills under supervision so that he /she may become capable of functioning independently.

- There shall be six months of Internship after the final year examination for candidates declared to have passed the examination in all the subjects.
- During the internship candidate shall have to work full time average 7 hours per day (each working day) for 6 Calendar months.
- Each candidate is allowed maximum of 6 holidays during entire Internship Program and in case of any exigencies during which the candidate remains absent for a period more than 6 days, he/she will have to work for the extra days during which the candidate has remained absent.
- The Internship should be rotatory and cover Haematology, Histology & Cytology, Biochemistry, Microbiology, Endocrinology & Automation sections of Pathology laboratory.
- Based on the attendance and work done during posting the Director/Principal/ head of institution/department shall issue '**Certificate of Satisfactory Completion**' of internship training following which the University shall award the B.Sc. in Medical Laboratory Technology Degree or declare the candidate eligible for the same.

- **No candidate shall be awarded degree without successfully completing six months internship**.
- Institution shall have to satisfy themselves that satisfactory infrastructure facilities of Pathology Laboratory exist in the Institute / Hospital where the internship training has to be undertaken. Following parameters / guidelines have been suggested:

a. It is mandatory for the Institution to have its own well equipped and modern pathology laboratory and should be registered with state authorities.

b. Senior Pathologist should manage the pathology laboratory in the Institutes/Hospitals.

Institute's Director / Principal can at his discretion grant NOC to the students to do the Internship at the place of his choice provided the concerned Hospital/Pathology Laboratory fully satisfies the above criteria. For the purpose of granting NOC the candidate shall have to submit to the Institution the status of Pathology Laboratory services available at the place where he intends to do his Internship.

DEGREE:

On successful completion of Three and Half year programme the candidate will be awarded with **"Bachelor of Science in Medical Lab Technology"** (B.M.L.T.**)** from Rama University. The candidate will now be eligible to be registered in the U.P. State Medical faculty. After the registration he/she shall be eligible to pursue his future career as Medical Lab Technologist.

SCHEME OF EXAMINATION :

B.Sc. in Medical Laboratory Technology Part-I (First Year) University Examination

Sr. No.	Subjects	Subject Code	THEORY MARKS				PRACTICAL MARKS				Total marks
			Theory Paper	Internal Assessment	Min. Marks	Total	Practical	Internal Assessment	Min. Marks	Total	
1.	Basic Anatomy	BMLT-101	80	20	50	100	80	20	50	100	200
2.	Physiology	BMLT-102	80	20	50	100	80	20	50	100	200
3.	Biochemistry	BMLT-103	80	20	50	100	80	20	50	100	200
4.	General Pathology, Haematology, Instruments & Reagents.	BMLT-104	80	20	50	100	80	20	___	___	200
5.	General Microbiology	BMLT-105	80	20	50	100	80	20	___	___	200
								GRAND TOTAL			**1000**
6.*	Environmental Studies (EVS)	---	100	NA	50	100	NA	NA	NA	NA	100
7.*	English	---	100	NA	50	100	NA	NA	NA	NA	100

*** These subjects are only to qualify in Internal Assessment. Not included for University Examinations.**

B.Sc. in Medical Laboratory Technology Part-II (Second Year) University Examination

Sr. No.	Subjects	Subject Code	THEORY MARKS				PRACTICAL MARKS				Total marks
			Theory Paper	Internal Assessment	Min. Marks	Total	Practical	Internal Assessment	Min. Marks	Total	
1.	Pathology-I & Blood Bank Procedures	BMLT-201	80	20	50	100	80	20	50	100	200
2.	Pathology-II	BMLT-202	80	20	50	100	80	20	50	100	200
3.	General Microbiology -I (Immunology & Serology)	BMLT-203	80	20	50	100	80	20	50	100	200
4.	Microbiology -II, Parasitology	BMLT-204	80	20	50	100	80	20	50	100	200
5.	Clinical Biochemistry	BMLT-205	80	20	50	100	80	20	50	100	200
GRAND TOTAL											**1000**
6*	Computer	---	100	NA	50	100	NA	NA	NA	NA	100

*** These subjects are only to qualify in Internal Assessment. Not included for University Examinations.**

B.Sc. in Medical Laboratory Technology Part-III (Third Year) University Examination

Sr. No.	Subjects	Subject Code	THEORY MARKS				PRACTICAL MARKS				Total marks
			Theory Paper	Internal Assessment	Min. Marks	Total	Practical	Internal Assessment	Min. Marks	Total	
1.	Pathology-I Paper (Histopathology & Cytology Techniques)	BMLT-301	80	20	50	100	80	20	50	100	200
2.	Pathology-II (Coagulation studies)	BMLT-302	80	20	50	100	80	20	50	100	200
3.	Microbiology -I (Systematic Bacteriology, Mycology)	BMLT-303	80	20	50	100	80	20	50	100	200
4.	Microbiology -II (Virology, Quality Laboratory Management & Automation)	BMLT-304	80	20	50	100	80	20	50	100	200
5.	Research & Biostatistics	BMLT-305	80	20	50	100	NA	NA	NA	NA	100
GRAND TOTAL											**900**

Course Structure

FIRST YEAR

COURSE OF STUDY

B.Sc. in Medical Laboratory Technology Part-I (First Year)

Sr. No.	Subjects	Teaching Hours		
		Theory	Practical	Total
1.	Basic Anatomy	70	20	90
2.	Physiology	70	20	90
3.	Biochemistry	70	20	90
4.	General Pathology, Haematoloyg, Instruments & Reagents.	70	20	90
5.	General Microbiology	70	20	90
		350	**100**	**450**
6.*	Environmental Studies (EVS)	20	___	20
7.*	English	40	___	40

*** Not included for University Examinations.**

B.Sc. in Medical Laboratory Technology Part-II (Second Year)

Sr. No.	Subjects	Teaching Hours		
		Theory	Practical	Total
1.	Pathology-I & Blood Bank Procedures	70	30	100
2.	Pathology-II	70	30	100
3.	General Microbiology-I (Immunology & Serology)	70	30	100
4.	Microbiology-II, Parasitology	70	30	100
5.	Clinical Biochemistry	50	30	80
6.*	Computer	30	30	60

*** Not included for University Examinations.**

B.Sc. in Medical Laboratory Technology Part-III (Third Year)

Sr. No.	Subjects	Teaching Hours		
		Theory	Practical	Total
1.	Pathology-I Paper (Histopathology & Cytology Techniques)	70	30	100
2.	Pathology-II (Coagulation studies)	70	30	100
3.	Microbiology-I (Systematic Bacteriology, Mycology)	70	30	100
4.	Microbiology-II (Virology, Quality Laboratory Management & Automation)	70	30	100
5.	Research & Biostatistics	40	____	40

Note: Subsidiary subjects (i) Computer Fundamentals & Programming
(ii) Professional Communication in English
(iii) EVS (Environmental Science & Ecology)

All the subsidiary subjects examination will be conducted by the faculty of Paramedical Sciences. Their marks will not be counted in the grand total of university examinations. But EVS subjects will be included in the mark sheet of the University Exams. Passing Subsidiary subjects is mandatory as per guidelines of UGC to complete the course.

DETAILED SYLLABUS

B.Sc. in Medical Laboratory Technology (B.Sc.-MLT) First Year

ANATOMY (GENERAL)
Subject Code : BMLT-101

Introduction of anatomy – gross human anatomy & their relations :

1. **General Anatomy**

a) Cell - structure & function

Ultra structure and functions of cell- Plasma membrane- Nucleus – Mitochondria- Centrosome- Ribosome-Endoplasmic reticulum- Golgi body & lysosome. Nucleus – Ultra structure & functions.

b) Chromosomes:

Structure & chemical composition, types of chromosome. Chromosome aberration. Cell Division: Amitosis- Mitosis- Meiosis- Significance of mitosis & meiosis- Cell cycle. Tissues:- Structure, position and functions of epithelial, connective, muscular & nervous tissue.

c) Tissue
- Epithelium
- Connective
- Sclerous
- Muscular
- Nervous

d) Lymphatic System

2. **Systemic**

Basic Features of :

a) Cardiovascular system
b) Respiratory system
c) Digestive system
d) Excretory system
e) Genital (Male & Female) system
f) Nervous system

Osteology:

- The skeleton – axial & appendicular (over view), Cavities of body- (cranial, thoracic, abdominal, pelvic). Structure of bone, Type & function of bone, Blood & nerve supply of the bone. Planes of the body. Anatomical terminology.
- Joints – classification, fibrous joints, cartilaginous joints, synovial joints(structure & types). Types of movement at sinovial joints.
- Anatomy of muscular system – Skeletal muscle structure. Important skeletal muscle (muscles of facial expression, mastication. Muscle that move the head). Over view of Trunk muscles, upper limb muscles, lower limb muscles.
- Anatomy of nervous system – spinal cord anatomy (external & internal anatomy). Connection & distribution of spinal nerves-overview(Branches, plexuses. Intercostal nerves). Overview of brain organization & blood supply. Brief anatomical idea on – brain stem, cerebellum, diencephalon, cerebrum. Cranial nerves

<u>Embryology – general</u>

Gametogenesis(spermatogenesis & oogenesis) –Structure of testis,ovary &sperm –Phases of embryonic development – formation of three germ layers- derivatives of germ layers – Embryonic or Foetal membrane (chorion, amnion, allantois, yolk sac) &placenta & its functions.

PHYSIOLOGY
Subject Code : BMLT-102

GENERAL PHYSIOLOGY

1. **Cell :** Structure & function

2. **Blood : <u>Blood Vascular system:</u>**

Composition and functions of blood. Plasma proteins – normal values, origin and functions. Brief idea on Bone marrow. Formed elements of blood – origin, formation, functions and fate. Hemoglobin – functions, compounds and derivatives. Abnormal hemoglobin-overview. Thalassemia-brief idea. Different types of anemia and their causes-overview. Erythrocyte sedimentation rate (ESR) and its significance. Hematocrit. PCV, MCV, MCH, MCHC. Blood volume – normal values, regulation. Blood coagulation – factors, process, anticoagulants, Prothrombin time. Clotting time. Bleeding time. Blood groups – ABO systems and Rh factors. Blood transfusion. Ultra structure & functions of blood vessels (artery & vein). Structure type and function of capillaries. Differences between artery & vein. Anaemia & Immunoglobulins

3. **Cardiovascular system**

Heart rate, cardiac cycle, cardiac output, hypertension, radial pulse. Structure & function of Heart & blood vessels (artery, vein and capillary) (Anatomical position, chambers of heart.) Blood circulation through heart. Special junctional tissue of heart.(Myogenic and neurogenic heart-conducting system of heart. E.C.G. Cardiac cycle. Heart Sound , Blood vessels – type, Structure & function, Systemic & pulmonary circulation. Blood – composition, Function, blood group, Blood clotting. Cardiac cycle and cardiac output. Blood Pressure-regulation & controlling factors.

4. **Respiratory System**
   a) Ventilation
   b) Functions
   c) Lungs Volumes and capacities

5. **Gastrointestinal System**
   Process of digestion in various parts

6. **Endocrinology**
   a) List of Endocrine Glands
   b) Hormones : Their secretion and functions (in brief)

7. **Excretion system**

<u>Renal System</u>:

Function of kidney, Anatomy & Histology of Nephron & collecting duet. – Urine formation(Filtration, reabsorbtion and secretion)- Counter – current system of urine concentration, Anomalies in urine concentration.

8. **Central Nervous System**
    a) Parts
    b) Sliding Filament Theory
    c) Neuro Muscular Junction
    d) Wallerian Degeneration
    e) Motor Nervous system
        - Upper motor neuron system
        - Lower motor neuron system
    f) Sensory nervous system
    g) Sympathetic Nervous system
    h) Parasympathetic nervous system

9. **Skin** - Function & Structure

10. **Muscular System**

    Classification of muscles & their functions:

    Microscopic and electron microscopic structure of skeletal, smooth and cardiac muscles. Difference between skeletal, smooth and cardiac muscles. The sarcotubular system. Red and white striated muscle fibers. Single unit and multi unit smooth muscle. Motor point. Properties of muscle: excitability and contractility, all or none law, summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue, refractory period, tonicity, conductivity, extensibility and elasticity. Electromyography. Muscle contraction – E C Coupling, Muscle fatigue, Rigor mortis, Sliding filament theory, Slow & fast muscle fibers, Isotonic & Isometric contraction.

11. **Special Senses -** Eye & ear (in brief)

PHYSIOLOGY (General)
(Practical)

1. Hemoglobin estimation
2. Determination of blood pressure
3. Determination of BT, CT, ESR
4. Blood film making & identification of different blood corpuscle.
5. ECG wave identification
6. Measurement of TC of RBC & WBC & DC of WBC.
7. Determination of Blood Group (ABO; Rh).

BIOCHEMISTRY-I
Subject Code : BMLT-103

THEORY

I. Clinical Laboratory

- Responsibility of health care personnel
- Laboratory hazards- Physical, Chemical and Biological Laboratory safety measures- Safety regulations and first aid in laboratory.

II. Laboratory apparatus : Different types use, care and maintenance (Where appropriate, diagrams to be drawn in practical record)

- Glass ware in laboratory – Significance of boro silicate glass. Plastic ware in laboratory. Cleaning of glass ware and plastic ware.
- Pipettes – Glass and Automated
- Burettes, Beakers, Petri dishes, Porcelain dish
- Flasks – different types (volumetric, round bottomed, Erlenmeyer, conical etc.,)
- Funnels – different types (Conical, Buchner etc.,)
- Bottles – Reagents, Wash bottles
- Measuring cylinders, reagent dispensers.
- Tubes – Test tube, Centrifuge tube, Folin-Wu tube
- Curettes and its use in measurements, curettes for visible and UV range
- Racks – Bottle, Test tube, Pipette and draining racks
- Tripod stand, Wire gauze, Bunsen burner, Desiccators, Stop watch, timers

III. Instruments: Use, care and maintenance (Where appropriate, pictures/diagrams and schematic diagrams to be drawn in practical record)

- Water bath, Oven & Incubators, Distillation apparatus - water distillation plant and water deionizers, Reflux condenser, Cyclomixers, Magnetic stirrer, Shakers
- Refrigerators, Deep freezers, Cold box
- Centrifuges*: Principle, Svedberg unit, centrifugal force, centrifugal field, rpm, Conversion of G to rpm and vice versa) Components, working.

  Different types of centrifuges
- Laboratory balances*: Physical and analytical. Mono & double pan, Electronic balances. Weighing different types of chemicals, liquids, hygroscopic compounds etc. Precautionary measures while handling (Diagram)
- Photometry – Colorimeter*- Principle, limitations of Beer-Lambert's law, components, working.
- pH meter*- Principle, components-pH measuring electrodes, Working, Precautions taken while handling. (Diagram of pH meter)

  (*Diagram mandatory)

IV. Units of measurement

- Metric system. Common laboratory measurements, Prefixes in metric system
- International system of units- SI units- definition, classification, Conversion of conventional and SI Units.

V. Introduction of general Bio-molecules:

- Chemistry of carbohydrates: Classification (structures for monosaccharide*), Functions of carbohydrates
- Chemistry of amino acids*: Classification based on structure and nutritional requirement, Occurrence. Functions of amino acids.
- Chemistry of lipids: Classification: Classification of lipids and fatty acids. Functions of lipids.
- Chemistry of nucleotides*: Purine and Pyrimidine bases. Composition of nucleosides and nucleotides. Occurrence of bases.

***Structure mandatory**

VI. Fundamental Chemistry

- Valence, molecular weight & Equipment weight of elements and compounds. Normality. Molarity, Molality.

VII. Solutions: Definition, use, classification where appropriate, preparation and storage

- Stock and working solutions.
- Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, H_2SO_4, H_3pO_4, CH_3COOH etc)
- Preparation of percent solutions – w/w, v/v w/v (solids, liquids and acids), Conversion of a percent solution into a molar solution
- Saturated and supersaturated solutions
- Standard solutions. Technique for preparation of standard solutions and Storage. E.g: glucose, albumin etc.
- Dilution- Diluting Normal, Molar and percent solutions. Preparing working standard from stock standard.
- Part dilutions: Specimen dilutions. Serial dilutions. Reagent dilution. Dilution factors

VIII. Acids, Bases, Salts and Indicators: Basic concepts. Determination of pH-Henderson Hasselbach's equation. Buffer solution. pH determination of buffers. Blood pH. Fluid buffers.

IX. Biomedical waste management

PRACTICAL

1- Introduction
Aim, basis, interpretation, safety in clinical biochemistry Laboratory

2- Laboratory organisation
Instruments, glassware, sample collection & specimen labeling, routine tests, anticoagulants, reagents, cleaning of glassware, isotonic solution, standardization of methods, preparation of solution & interpretation of result, normal values.

3- Identification of Carbohydrates (qualitative tests).

3- Identification of Proteins (qualitative tests).

4- To study general properties of the enzyme (Urease) & Achromatic time of Salivary amylase.

5- Urine analysis – normal & abnormal constituents of urine.

6- CSF & Semen Analysis - Gross & Microscopic.

7- Glucose tolerance test & Glycosylated haemoglobin.

8- Centrifugation : Principle, types & applications.

9- Chromatography : Definition, types, RF value, description of paper chromatography & applications.

10- Uses, Care and Maintenance of various instruments of the laboratory.

GENERAL PATHOLOGY, HEMATOLOGY, CLINICAL PATHOLOGY INSTRUMENTS & REGENTS

Subject Code : BMLT-104

THEORY

GENERAL PATHOLOGY:

1. Cell Injury and Cellular Adaptations.

a) Normal Cell

b) Cell Injury- types of cell injury, etiology of cell injury, morphology of cell injury, cellular swelling.

c) Cell death : types- autolysis, necrosis, apoptosis & gangrene.

d) Cellular adaptations-atrophy, hypertrophy, hyperplasia & dysplasia.

2. Inflammation

a) Acute inflammation - vascular event, cellular event, inflammatory cells.
b) Chronic Inflammation - general features, granulomatous inflammation, tuberculoma.

3. Hemodynamic Disorders :

Oedema, hyperemia, congestion, haemorrage, circulatory disturbances, thrombosis, ischaemia & infarction.

4. Neoplasia :

Definition, how does it differ from hyperplasia, difference between benign tumor and malignant tumor.

5. Healing

Definition, different phases of healing, factors influencing wound healing.

HISTOPATHOLOGY:

- Mounting techniques
- Section cutting
- Tissue processing
- H & E staining

HEMATOLOGY:

THEORY

1. Hematological Disorders:

a. Classification of Anemia	:	Morphological & etiological.
b. Iron Deficiency Anemia	:	Distribution of body Iron, Iron Absorption, causes of iron deficiency, lab findings.
c. Megaloblastic Anemia	:	Causes, Lab findings.
d. Hemolytic Anemia	:	Definition, causes, classification & lab findings.
e. Bone Marrow	:	Cell composition of normal adult Bone marrow, Aspiration, Indication, Preparation & Staining
f. Leukemia	:	Classification, Blood Picture, Differentiation of Blast Cells.

2. Basic Hematological Techniques:

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

MICROBIOLOGY, INSTRUMENTS & REGENTS

Subject Code : BMLT-105

THEORY

MICROBIOLOGY

1. **General characters and classification of Bacteria.**

2. **Introduction to Characteristics of Bacteria**
   Morphology - Shape, Capsule, Flagella, Inclusion, Granule, Spore.

3. **Growth and Maintenance of Microbes**
   Bacterial division, Batch Culture, Continuous culture, bacterial growth- total count, viable count, bacterial nutrition, oxygen requirement, CO_2 requirement, temperature, pH, light.

4. **Sterilization and Disinfection.**
   Physical agents- Sunlight, Temperature less than 100^0C, Temperature at 100^0C, steam at atmospheric pressure and steam under pressure, irradiation, filtration.
   Chemical Agents- Alcohol, aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.

5. **Culture Media**
   Definition, uses, basic requirements, classification, Agar, Peptone, Transport Media, Sugar Media, Anaerobic Media, Containers of Media, Forms of Media

6. **Staining Methods**
   Simple, Grams staining, Ziehl-Neelsen staining or AFB staining, Negative Impregnation

7. **Collection and Transportation of Specimen**
   General Principles, Containers, Rejection, Samples- Urine, Faeces, Sputum, Pus, Body fluids, Swab, Blood.

8. **Disposal of Laboratory/Hospital Waste**
   Non-infectious waste, Infected sharp waste disposal, infected non-sharp waste disposal.

PRACTICAL

GENERAL MICROBIOLOGY

1. Preparation of swabs/sterile tubes & bottles.
2. Preparation of smear.
3. Staining.: Gram & Ziehl -Neelsen staining.
4. Identification of Culture media.
5. Identification of instruments.
6. Identification of common microbes.

PROFESSIONAL COMMUNICATION IN ENGLISH

- Grammar-structure of sentences etc.
- Essay- Descriptive-Comparative-Argumentative etc.
- Reading Comprehension from recommended text etc. biodata, Resume-curriculum vitae etc.
- Report writing-structure, types of reports etc.
- Communication-public speaking skills, features of effective speech etc.
- Group discussions-principle-practice etc.

Reference books: a. Communication (Mark McCormack)

b. How to write reports (John Metchell)

c. Business Correspondence and Report R.C. Sharma & K.Mohan)
(Tata Mc Graw , New Delhi 1984)

EVS (ENVIRONMENTAL SCIENCE & ECOLOGY)

General

Introduction, components of the environment, environment degradation.

Ecology

Elements of Ecology; Ecological balance and consequences of change, principles of environmental impact assessment.

Air Pollution and Control

Atmospheric composition, energy balance, climate, weather, dispersion, sources and effects of pollutants, primary and secondary pollutants, green house effect, depletion of ozone layer, standards and control measures.

Water Pollution and Control

Hydrosphere, natural water, pollutants: their origin and effects, river/lake/ground water pollution, standards and control.

Land Pollution

Lithosphere, pollution (municipal, industrial, commercial, agricultural, hazardous solid wastes); their origin and effects, collection and disposal of solid waste, recovery and conversion methods.

Noise Pollution

Sources, effects, standards and control.

SYLLABUS

B.Sc. in Medical Laboratory Technology (B.Sc.-MLT) Second Year

PATHOLOGY-I & BLOOD BANK PROCEDURES
Subject Code : BMLT-201

THEORY

1. Blood Grouping:
- Introduction
- Human Blood Group system
- ABO Subgroups
- Red Cell Antigen
- Natural Antibodies
- Rh System
- Rh Antigens & Rh Antibodies
- Hemolytic Disease of Newborn & Prevention
- Principal of Blood grouping, antigen-antibodyreaction.
- Agglutination, Haemagglutination, Condition required for antigen antibody reaction.
- Blood grouping techniques, Cell grouping, Serum grouping.
- Methods for ABO grouping. Slide & Tube Method, Cell grouping, Serum grouping, Rh grouping by slide & tube method.
- Difficulties in ABO grouping.
- Rouleaux formation, how it interfere with Blood grouping.
- Auto agglutinins.
- Antiserum used in ABO test procedures, Anti –A, Anti-B Anti- AB Antiserum.
- Inheritance of the Blood groups.
- Control, A&B Cells preparation, Auto control.
- Medical applications of Blood groups.

2. Blood Transfusion:
- Principal & Practice of blood Transfusion.
- Blood Transfusion service at District level.
- Guide lines for the use of Blood, Appropriate use of Blood, Quality Assurance.
- Antilogous Blood Transfusion practices.
- Objectives of Quality Assurance in Blood Transfusion services, Standard operating procedures for usage, donation & storage of blood, screening of donor, compatibility testing, safety, procurement of supplies.

3. Blood Donation:
- Introduction
- Blood donor requirements
- Criteria for selection & rejection
- Medical history & personal details
- Self-exclusion.
- Health checks before donating blood.
- Screening for TTI.

4. **Blood Collection**
   - Blood collection packs.
   - Anticoagulants.
   - Taking & giving sets in Blood transfusion.
   - Techniques of collecting blood from a doctor.
   - Instructions given to the donor after blood donation.
   - Adverse donor reaction.

5. **Testing Donor Blood**
   - Screening donor's blood for infectious agents - HIV, HCV, HBV, Trepanoma palladium, Plasmodium, HTLV.
   - Bacterially contaminated Blood.

6. **Blood Donor Records**
   - Blood donation record book.
   - Recording results.
   - Blood donor card.

7. **Storage & Transport**
   - Storage of blood.
   - Changes in blood after storage.
   - Gas refrigerator.
   - Lay out of a blood bank refrigerator
   - Transportation.

8. **Maintenance of Blood Bank Records**
   - Blood bank temperature sheet.
   - Blood bank stock sheet.
   - Blood transfusion request form.

9. **Compatibility Testing**
   - Purpose
   - Single tube compatibility techniques using AHG reagent.
   - Emergency compatibility testing.
   - Difficulties in cross matching.
   - Labeling & Issuing cross- matched blood.

10. **Blood Components & Prepration**
    - Collection of blood components for fractional transfusion.
    - Platelets packed Red Cell, Platelet rich Plasma, Platelets concentrate.
    - Preparation of concentrated (packed) Red cells.
    - Techniques of preparation.

11. **Blood Transfusion Reactions**
    - Investigation of a Transfusion reaction.
    - Hemolytic transfusion reaction.
    - Actions to take when transfusion reaction occurs.

PRACTICAL

- Blood grouping & Cross Matching, collection procedures, storage and components separation

PATHOLOGY-II – HISTOPATHOLOGY & HEMATOLOGY
Subject Code : BMLT-202

THEORY

- Automated Tissue Procedure, Micro tomes, Frozen section, Special stains like pas, mucicarmine, maintaining techniques, application of computer in pathology, museum techniques.
- Reticulocyte count, red cell indices, sickling test, osmotic fragility test, G6 PD Deficiency, Test for autoimmune Hemolytic anemia
- Hemostasis and coagulation
- Schilling Test
- FNAC
- LE Cell Phenomena

PRACTICAL

(i) Paraffin Section Cutting
(ii) HE stain
(iii) WBC Count, Platelets count, RBC Count
(iv) ESR
(v) BT, CT
(vi) PT, APTT
(vii) VII. Blood smear preparation

MICROBIOLOGY-I

Subject Code : BMLT-203

THEORY

IMMUNOLOGY & SEROLOGY

1. Immunity - Definition and classification
   - General Principles of Innate & Acquired Immunity.
2. Immune Response- Humoral immunity & cell mediated immunity.
3. Antigen - Definition, classes, properties.
4. Antibodies/Immunoglobulins - Definition, Properties, Sub types of Immunoglublines
5. Antigen/Ab Reaction/Serological Refractions –
6. Features of antigen/antibody Reaction-
   - Precipitation
   - Agglutination
   - Complement fixation test
   - Neutralization
   - Opsonization
   - Immune adherence
   - Immuno fluorescence
   - Immuno electron microscopic test
7. Structure and functions of Immune System
   - Parts of Immune system
   - T/B cells, other cells & their functions
8. Hyper sensitivity Reactions
   - General Principles of different types of hypersensitive reactions i.e., type 1, 2, 3, 4.
   - Auto immune disorders
9. ELISA
10. Vaccination - Schedule & Vaccines
11. Biomedical Waste & Management and Law Governing it.

MICROBIOLOGY-II (IMMUNOLOGY, SEROLOGY & PARASITOLOGY)

Subject Code : BMLT-204

THEORY

PARASITOLOGY

1. Definition - parastism, HOST, Vectors etc.
2. Classification of Parasites .
3. Phylum Protozoa- general Pathogenic and non pathogenic protozoa.
4. Phylum Nemathelminths/Round words (Nematoda) .
5. Phylum Platyhelminths - class-Cestoda, class-Trematoda.
6. Lab diagnosis of parasitic infections.

Protozoa :

i. Intestinal Amoebae
   a. E. Histolytica : Life cycle, Morphology, Disease & Lab Diagnosis
   b. B. coli : Life cycle, Morphology, Disease & Lab Diagnosis

ii. Flagellates of intestine/genitalia
   a. Giardia lamblia : Life cycle, Morphology, Disease & Lab Diagnosis
   b. Trichomonas vaginalis : Life cycle, Morphology, Disease & Lab Diagnosis
   c. Giardia
   d. Toxoplasma
   e. Malaria
   f. Leishmania

Helminthology:

(a) Cestodes - Taenia
- Echinococcus
- D. Latum
- H. nana

(b) Trematodes - Schistosoma, Fasciola

(c) Nematodes - Ascaris, Hool worm, Strongyloides, Trichuris, Trichinella, Dracunculus, wuchereria bancrofti

PRACTICAL

IMMUNOLOGY & SEROLOGY

- WIDAL Test
- VDRL Test,
- RA Test
- CRP Test
- Pregnancy Test & HIV Test

PARASITOLOGY

- Stool examination.
- Identification of different ova & cysts in stool samples.

CLINICAL BIOCHEMISTRY

Subject Code : BMLT-205

THEORY

Biochemistry II

I. Basic Laboratory Practices

Preparation of solutions and reagents

- Basic requirement – type / grade of chemicals, solvents, types of water and other requirement,
- Various types of solutions and reagent – Normal Molar , percent, buffer solutions and substrates, indicators, standards.

Measurements in Clinical Laboratory

- Quantitative estimations-Selecting a method, linearity of a method , endpoint and rate reaction method .Checking accuracy and precision
- Calibration: Preparation of calibration curve , importance of a calibration curve straight line calibration and non-liner calibration graph ; Technique of preparing a calibration curve using stock standard solution .Graphic representation of calibration.
-

II. Chemistry of Carbohydrates

- Structural properties- Stereoisomerism, optical activity, cyclic structures, mutarotation, epimers.
- Monosaccharides of biological importance. Important chemical reactions –formation of furfural derivatives, enediols, osazones, sugar acids, sugar alcohols. Deoxy sugar Biomedical importance of amino sugar, glycosides.
- Disaccharides: Properties of maltose, lactose, sucrose. Invert sugars. Biomedical importance of Lactose and Sucrose.
- Polysaccharides: Properties of starch and glycogen. Biomedical importance of inulin. Mucopolysaccharides- Composition, tissues distribution and functions.

III. Chemistry of amino acids and proteins

- Properties of amino acids-Isomerism, amphoteric nature and isoelectric pH. Peptide bond formation. Colour reactions of amino acids. Use of amino acids analysis in diagnosis of diseases. Peptide and functions
- Proteins – Function. Classification- Based on composition and solubility, functional and nutritional. Protein Structure – primary(insulin), secondary , tertiary and quaternary.
- Precipitation reactions of proteins – salting out, iso-electric precipitation, precipitation by organic solvents, heavy metal ions, alkaloidal reagents. Denaturation of proteins. Heat coagulation. Preparation of protein free filtrates for quantitative estimations.

IV. Enzymes

- Classification, properties, specificity, mechanism of enzyme action , factors affecting enzyme activity, enzyme inhibition. Coenzymes. Analytical and therapeutic role of enzymes. Immobilized enzymes.

V. Chemistry of Nucleic acids

- Structure of DNA. Waston – Crick model, different forms of DNA.
- Structure of RNA. Types of RNA. Structure of tRNA.
- Functions of DNA and RNA.

VI. Water soluble vitamins:

- Thaimine , riboflavin, niacin, pyridoxine, vitamin B12,Folic acid and Vitamin C
- Chemistry, Sources, RDA, functions, deficiency and or toxicity. Antivitamins.

VII. Metabolism of Carbohydrates

- Digestion and absorption of carbohydrates. Disorders.
- Metabolic pathways, energetic, inhibitors and regulation, disorders- Glycolysis, TCA cycle, Glycogen metabolism.
- Diabetes mellitus-Diagnosis and management.
- Principles and procedure for the determination of plasma glucose levels- reductometric and enzymatic method.
- Urinary glucose.

VIII. Metabolism of amino acids and nucleic acids

a. Non protein nitrogenous compounds:

- Formation of ammonia – transamination and deamination, Urea cycle and disorders, Blood urea/Blood urea nitrogen- clinical importance.
- Biosynthesis of creatine. Formation of creatinine, clinical importance of creatinine.
- Degradation of purine nucleotides, formation of uric acid, disorders- Gout, Lesch Nyhan syndrome.

Principles and procedures for the determination of Blood urea nitrogen, creatinine & uric acid-colorimetric and enzymatic methods.

b. Catabolism of Branched chain, Phenylalanine/Tyrosine catabolism:

- Pathway Disorders- Phenylketonuria, Alkaptonnuria, Maple Syrup Urine Disease

IX. Overview of Body Fluids

- Ascitic fluids, CSF, peritoneal, pleural, pericardial and synovial fluids. Quantitative analysis of constituents in different types of fluids.

X. Specimen collection: Technique, use of anticoagulants and preservatives where appropriate. Storage, time of collection, instructions to patients for timed sample collection.

Disposal

- Blood –venous and capillary puncture.
- Urine-random, timed & 24 hrs.

X. Normal constituents of urine: Physical characteristics. Chemical examination of urinary constituents.

XI. Renal function tests.

- Glomerular and tubular function. Handling of different solutes by tubules. Reabsorption of water.
- Abnormal constituents of urine –Physical characteristics. Chemical examination of urinary constituents.
- Clearance tests. Definition. Procedure for creatinine clearance test, reference values and significance.
- Tests of tubular function: Concentration and dilution tests. Measurement of specific gravity and osmolality.
- Urinary acidification: Ammonium chloride loading test.

XII. Techniques

- **Spectrophotometry:** Principle, components, operation, care and maintenance, relation between concentration and optical density, standardization of spectrophotometer.

- **Chromatography:** Principle. Partition chromatography- instrumentation and application in identification of amino acids.

- **Others-Principle and application**

  Osmometry, Reflectance photometry, Turbidimetry, Nephelometry.

- **Glucometers:** Principle, instrumentation and application.

ASSIGMENT TOPIC:

- Oral Glucose tolerance test.
- Glycated HbA1c
- Microalbuminuria

PRACTICAL SYLLABUS

I. PRACTICAL APPROACH TO BASIC LABURATORY PRACTICES

a. Pipetting techniques

- Use of glass pipettes-graduated and volumetric pipets; Specimen and Reagent using fixed and variable pipettes

b. Operation of instruments

- Analytical Balance: Weighing chemicals, deliquescent, hygroscopic compounds and acids.
- pH meter : Checking pH of urine and buffers by electrometry.
- Centrifuges: concept of balancing, time and speed specifications.
- Urinometer, Esbach's albuminometer.

c. Techniques of preparation of solutions and reagents

- Normal ,Molar, percent (Na_2CO_3, NACI, NaOH, KCl, HCl, H_2SO_4, CH_3COOH, Sodium tungstate) Buffers (Phosphate buffer, citrate buffer), Indicators.
- Standard solutions - Creatinine, Total Protein etc.

d. Dilution technique

- Dilution of stock standards and reagents to working.
- Dilution of acids
- Part dilution of body fluids

e. Determination of pH : using indicators, pH paper, universal indicator solutions

II. QUALITATIVE

a. color reactions- known test solutions

- Carbohydrates: Glucose, Fructose, Xylose, Sucrose, Starch.
- Amino acids in protein solution
- NPN-Urea, Creatinine and Uric acid.
- Titrable acidity and ammonia in urine.

b. Precipitation reactions

- Albumin
- Preparation of protein free filtrates for quantitative estimations- glucose, urea, creatinine uric acid estimation.

c. Spot tests for

- Phenylketonuria, alkaptonuria, MSUD

d. Urine analysis

- Normal and Abnormal urine

III. QUANTITATIVE

a. Operation of colorimeter / Spectrophotometer.

- Colorimetric experiment to select a complementary filter.
- Concept of use of blank, reagent blank.
- Standardization of a colorimeter/spectrophotometer using coloured solution.
- Graphing of Beer's law-drawing calibration curve.
- Determination of unknown concentration of colored solution from calibration curve. Concept of one point calculation or calibration (T/S X concentration of standard)

b. Quantitative estimation by manual methods-Preparation of calibration curve & estimation of unknown analyte concentration

- Blood Glucose by reductometric method (Not to use O-toluidine method as it is a potent carcinogen)
- Blood urea by Diacetyl Monoxime method.
- Serum and urine creatinine by Jaffe's reaction. Determination of Creatinine clearance rate.
- Serum uric acid by Caraway's method.
- CSF and urine protein by sulphosalicylic acid method

COMPUTER FUNDAMENTALS AND PROGRAMMING

Basic computer Architecture:

Fundamentals of Computers, Block diagram of PC, peripheral devices of PC and their functions

Number System & Data Representation:

Decimal Number System, Binary number system, Decimal to Binary conversion, Binary operations. Octal number system & the conversion. Octal to Decimal. Binary to Octal & Vice Versa.

Boolean Algebra:

Definition, Difference between Boolean with Arithmetic & ordinary algebra. Two valued Boolean Algebra. Basic theorems of Boolean Algebra. Precedence of voperators. Boolean function & truth tables. The AND, OR, NOT gate. DeMorgans theorem. The NOR, NAND gate. The XOR & X-NOR gate. Conversion of Boolean expression into logic diagram. Using AND, OR, AND, NOT gates.

Logic Circuits:

Combinational logic circuit, Adder , Subtractor, Decoder, Encoder.

Operating System:

Introduction & classification of software, working principle of MS DOS (Some basic internal & external commands). Creating a file. Windows & its components. Accessories, program manager, main, desktop icons.

MS- Office:

Introduction of word processing-invoking MS-word – create, edit, save document, cut & paste perform operations on blocks of text, header & footer, Mail Merge, printer setup. Introduction of EXCEL. Concept of worksheet, making Charts & graphs, perform calculations & re calculations.

C-Language:

Overview of C, algorithm & flow chart, datatypes. Variables & constants, operators, expressuions & assignment statements, control statements, arrays in C (One dimentional).

Introduction to Internet:

Basic concepts of Internet.

SYLLABUS

B.Sc. in Medical Laboratory Technology (B.Sc.-MLT) Third Year

PATHOLOGY-I (HISTOPATHOLOGY & CYTOLOGY TECHNIQUES)
Subject Code : BMLT- 301

THEORY

1. Introduction to Histopathology, expfoliative Cytology.

2. Basic steps for Tissue Processing- Fixing, Embedding, Microtomy, Staining, Mounting, methods of decalcifications.

3. Laboratory requirements for Histopathology & Cytology - Chemicals & Reagents.

4. Equipments - Microscope, Microtome -Types, Uses, Parts, different types of microtome knives, care & maintenance. Automated tissue processor - components, working & precautions during use, Tissue floating bath.

5. Staining Methods -
   a. Hematoxylin & Eosin stain, Hematoxylin - Types, methods of preparation, staining, Eosin - Method of preparation.
   b. Reticulin stain
   c. PAP staining- components & methods.
   d. Giemsa

6. Museum Techniques
   a. The mounting of pathological specimens - Introduction., Preparation of specimen, Fixation of specimen- Kaiserling solution-1 & Kaiserling solution-2
   b. Precaution taken for the Fixation of Specimens.
   c. Storage of Specimens.
   d. Mounting of Museum Specimens.
   e. Routine Mounting of Specimens.
   f. Filling and Scaling.

7. Immunohisto Chemistry

PRACTICAL

1. Parts of microtome
2. Tissue processing
3. H&E staining
4. PAP staining.
5. Giemsa

PATHOLOGY-II (COAGULATION STUDIES)
Subject Code : BMLT- 302

THEORY

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

2. Coagulation -
   a. Basic Physiology, coagulation factors.
   b. Mechanism of blood coagulation.
   c. Extrinsic Pathway.
   d. Intrinsic Pathway.
   e. Regulators of blood coagulation.

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

4. Quality Assurance for routine Heamostasis Laboratory-
   a. Introduction.
   b. Sample collection technique (Phelbotony)
   c. Sample preparation, Anticoagulant used, Importance of use of Sodium

5. Role in Diseases, Bleeding disorders-
   a. Platelet disorder - Thrombocytopenias - causes including aplastic anemia.
   b. D I C
   c. IT P
   d. Hemophilia

PRACTICAL

1. Precautions to prevent hemolysis
2. Storage of blood specimens
3. Bleeding time & clotting time estimation
4. Prothrombin time estimation
5. aPTT (activated partial thromboplastin time) estimation.
6. Clot retraction time.

MICROBIOLOGY-I (SYSTEMIC BACTERIOLOGY, MYCOLOGY)
Subject Code : BMLT- 303

THEORY

SYSTEMIC BACTERIOLOGY:

Study of -

Staphylococcus, Streptococcus, Pneumococcus, Neisseira gonorrhoea, Neisseira meningitis, Cornybacterium diptheriae, Mycobaterium, Clostridium, E.coli, Klebsiella, Salmonella, Proteus, Pseudomonas, Vibrio & Spirochaetes with reference to their :

- Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & lab diagnosis.

Mycobacteria

Mycoplasma

Chalmyadiae

Ricketssiaceae

MYCOLOGY:

- Morphology and Structure of fungi
- Classification of fungi
- Nutrition and cultivation of fungus
- Cutaneous & Sub cutaneous and Systemic Mycosis (in brief)
- Lab diagnosis of fungal Infections
- Opportunistic fungal infections

MICROBIOLOGY-II (VIROLOGY, QUALITY LABORATORY MANAGEMENT & AUTOMATION)

Subject Code : BMLT- 304

THEORY

VIROLOGY:

- General characters of viruses
- Classification of viruses
- Cultivation of viruses
- Pox viruses,
- Herpes viruses
- Adeno viruses
- Picorna viruses
- Orthomyxo viruses
- Paramyxo viruses
- Arbo viruses
- Rhabdo viruses
- Hepatitis viruses
- Oncogenic viruses
- HIV
- Parvo viruses
- Viral Haemorrhagic fever
- Rota viruses
- Corona viruses
- Lab diagnosis of viral infections
- Bacteriophages.

Laboratory Management & Automation

PRACTICAL

SYSTEMIC BACTERIOLOGY:

1. Culture Techniques
2. Composition of culture media
3. Preparation of media
4. Identification of media & their uses
5. Culture methods & identification of common bacteria on media.
6. Antibiotic sensitivity testing.

MYCOLOGY & VIROLOGY:

1. Culture Media used for fungus.
2. Fungal culture
3. Methods of lab diagnosis & virus.

BIOSTATISTICS

Subject Code : BMLT- 305

1. **Introduction:**
   Definition, Scope, Application and uses of Biostatistics, Types of Statistics – Medical Statistics, Health Statistics, Vital Statistics, Biostatistics. Scales of measurement – Nominal, Ordinal, Interval & Ratio Scale.

2. **Data & Its Presentation:**
   Types of Variables - Simple, Composite, Dependent, Independent, Latent & Random Variables.
   Types of Data – Discrete, Continuous, Qualitative, Quantitative, Grouped, Ungrouped, Primary & Secondary.
   Charts and diagrams for qualitative & quantitative data:
   Qualitative Data Diagram: Simple, Multiple, Component, Pie or Sector diagram, Pictogram.
   Quantitative Data Diagram: Histogram, Frequency Curve, Frequency Polygon, Cumulative Frequency Curve (Ogive), Scatter Diagram,

3. **Measure of location – Average and Percentiles:**
   Measure of Central Tendency – Mean, Median, Mode, Geometric Mean
   Measures of Location - Quartiles, Deciles, Percentiles.

4. **Variability & its measures:**
   Types of Variability- Biological, Real, Experimental Variability.
   Measures of Dispersion – Range, Mean Deviation, Standard Deviation, Variation, Coefficient of Variation.
   Normal Distribution – Normal Curve
   Divergence from normal curve – Skewness & Kurtosis.

5. **Probability :**
   Definition, Uses of Probability, Addition theorem & Multiplication theorem.

6. **Sample size and sampling technique:**
   Some common terminology used in statistics - Parameter, Statistics, Population, Sample, Sampling Unit, Sampling frame, Sample size determination for quantitative and qualitative data.
   Types of Sampling – Probability Sampling & Non Probability Sampling.
   Probability Sampling : Simple random sampling, Stratified sampling, Systematic sampling, Cluster sampling.
   Non-Probability Sampling : Purposive sampling, Judgment sampling, Multistage sampling, Convenience sampling.

7. **Sampling variability and Null hypothesis:**
   Standard error, Standard error of mean, Standard error of proportion, Confidence limits, Confidence Interval, Level of significance, p-value, Type-I & Type-II error. One tailed and two tailed test, Degree of freedom.

8. **Difference between proportion:**
   X^2-test, Z-test for proportion.

9. **Difference between means:**
   Paired t-test, Independent t-test.

10. **Correlation & Regression:**
    Relation between two variables Regression.

Applications: Collection, presentation and analysis of hospital statistical data with examples. Collection, presentation and analysis of Lab Investigation data with few examples.

INTERNSHIP

Duration of the Internship is Six months. After passing third academic year candidate is eligible for Six months internship. Internship can be pursued from Rama University, Faculty of Paramedical Sciences or elsewhere from any Institute, Medical College, Hospital recognized by State Medical Faculty. After completion of internship, the name of candidate completing full course will be sent to U.P. State Medical Faculty for registration, and will be awarded degree by Rama University.