

# **Punjab Technical University Kapurthala**

**Scheme and Syllabus  
of**

**Masters in Sciences Medical Laboratory Technology (Biochemistry)  
M.Sc. MLT (Biochemistry)  
Batch 2012 onwards**

**By**

**Board of Studies MLT/ MLS**

## First Semester

Contact Hours: 35 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
MMLT101	Analytical & Physical Biochemistry	4	1	-	50	100	150	5
MMLT102	Enzymes & Metabolism –I	4	-	-	50	100	150	4
MMLT103	Statistics & Clinical Biochemistry Laboratory Management	4	1	-	50	100	150	5
MMLT104	Analytical & Physical Biochemistry (Practical)	-	-	8	50	100	150	4
MMLT105	Enzymes & Metabolism –I (Practical)	-	-	8	50	100	150	4
MMLT106	Statistics & Clinical Biochemistry Laboratory Management (Practical)	-	-	5	50	100	150	3
<b>Total</b>		<b>12</b>	<b>2</b>	<b>21</b>	<b>300</b>	<b>600</b>	<b>900</b>	<b>25</b>

## Second Semester

Contact Hours: 35 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
MMLT201	Principles of Biochemistry	4	1	-	50	100	150	5
MMLT202	Enzymes & Metabolism –II	4	-	-	50	100	150	4
MMLT203	Vitamins, Hormones, General Physiology and Nutrition	4	1	-	50	100	150	5
MMLT204	Principles of Biochemistry (Practical)	-	-	8	50	100	150	4
MMLT205	Enzymes & Metabolism –II (Practical)	-	-	8	50	100	150	4
MMLT206	Vitamins, Hormones, General Physiology and Nutrition (Practical)	-	-	5	50	100	150	3
<b>Total</b>		<b>12</b>	<b>2</b>	<b>21</b>	<b>300</b>	<b>600</b>	<b>900</b>	<b>25</b>

## Third Semester

Contact Hours: 35 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
MMLT301	Organ Function Tests	4	1	-	50	100	150	5
MMLT302	Clinical Biochemistry	4	-	-	50	100	150	4
MMLT303	Molecular Biology	4	1	-	50	100	150	5
MMLT304	Organ Function Tests (Practical)	-	-	8	50	100	150	4
MMLT305	Clinical Biochemistry (Practical)	-	-	8	50	100	150	4
MMLT306	Molecular Biology (Practical)	-	-	5	50	100	150	3
<b>Total</b>		<b>12</b>	<b>2</b>	<b>21</b>	<b>300</b>	<b>600</b>	<b>900</b>	<b>25</b>

## Fourth Semester

Contact Hours: 30 Hrs.

Course Code	Course Title	Load Allocation	Marks Distribution		Total Marks	Credits
			Internal	External		
MMLT401	Dissertation	Submission with in 05 Months	150	150	300	25



## SYLLABUS

### M.Sc (MLT) BIOCHEMISTRY

(Ist Semester)

#### Paper I

#### MMLT-101

### ANALYTICAL AND PHYSICAL BIOCHEMISTRY

#### **Unit-I**

1. **Electrolytes:** - Definition, ionization of weak acids, weak bases pH, Henderson, Heisenberg equation
2. **Buffer systems:** -definition, titration curve of weak acids, buffering capacity, physiological buffers, Respiratory and metabolic acidosis and alkalosis.
3. **Law of mass action:** - Keq, activity coefficient.
4. **Osmosis:** - definition, osmotic crisis, transportation across membrane by membrane proteins.
5. **Dialysis:** - definition, purification of proteins on basis of solubility, size, charge and binding affinity.

#### **Unit-II**

6. **Definitions** - viscosity, surface tension
7. **Donnan equilibrium** - Keq, membrane hydrolysis.
8. **Biological Oxidation & Bioenergetics:** - protein folding in terms of free energy changes, Entropy, Laws of Thermodynamics useful thermodynamic function for understanding enzymes, Biomedical Importance, Redox Potential, Enzymes Involved In Oxidation , Reduction,
9. **High energy linkages:** - transport of molecules active and passive, involvement of ATP in biological systems.

#### **Unit-III**

10. **Immunoassays : Application To Biochemistry**
  - a. Radio Immuno-Assays (RIA)
  - b. Determination of Hormones by Using Radio Immuno assays (RIA)
  - c. Nonisotopic Immuno Assays



- d. Homogeneous Enzyme Immuno Assays
- e. Heterogeneous Enzyme Immuno Assays

### **Unit-IV**

- f. Enzyme Linked Immuno-Sorbant Assay (ELISA)
- g. Chemiluminescence & Bioluminescence
- h. Micropartical Enzyme Immuno assay (MEIA)
- i. Fluorescence Polarization Immuno assay(FPIA)
- j. Radio Active Energy attenuation (REA)Assays

## **Paper II** **MMLT-102**

### **ENZYMES & METABOLISM-I**

#### **Unit-I**

##### **Nature and Classification of enzymes**

- 1. Overview of enzymes
- 2. Nomenclature
- 3. Classification of enzymes
- 4. Properties of enzymes

##### **Basic concepts and mechanism of action**

- 1. How enzymes work
- 2. Enzyme inhibition assay
- 3. Regulation of enzyme activity

##### **Kinetics**

- 4. Michaelis Menten equation
- 5. Factors affecting the reaction velocity

### **INTERMEDIARY METABOLISM OF CARBOHYDRATES, LIPIDS, & AMINO ACIDS**

#### **Unit-II**

##### **Carbohydrates**



1. Oxidative Phosphorylation
2. Glycolysis
3. Citric acid cycle

### **Unit-III**

#### **Proteins, Amino acids, and Nucleic acids**

1. Classification, properties, types, DNA & RNA
2. Urea cycle
3. Metabolic breakdown of essential amino acids and **Nucleic Acids**
4. Replication, Translation and transcription

### **Unit-IV**

#### **Lipids**

1. Classification, properties, types and common features of biological membranes and fatty acids : Key constituents
2. Fatty acid oxidation
3. Fatty acid biosynthesis

### **Paper III**

## **STATISTICS & CLINICAL BIOCHEMISTRY LABORATORY MANAGEMENT**

### **MMLT-103**

#### **Unit-I**

##### **Statistics:**

1. Meaning, Principle & Importance
2. Collection, classification & Presentation of Data-Graphs, Diagrams & Tables
3. Population & Sample & Sampling Techniques
4. Analysis of Data averages-Mean, Mode & Median
5. Variance & standard Deviation

#### **Unit-II**

6. Correlation
7. Additivity of Means & Variance



8. Regression
9. Hypothesis-Meaning, Testing of Hypothesis using t-Test, Chi-square Test & Test for ANOVA

### **Laboratory Management**

#### **Unit-III**

1. Quality Control and quality assurance in clinical biochemistry
2. Selection & Storage of Chemical Materials & Apparatus
3. Collection, preservation and transportation of clinical samples
4. Care and maintenance of General Laboratory Apparatus

#### **Unit-IV**

5. Calibration of Volumetric Apparatus
6. Storage, Handling & disposal of Infected, Radioactive & Dangerous Materials
7. Safety Measures & Emergency Treatments for Accidents

### **PRACTICAL-I**

#### **MMLT-104**

1. Preparation of Phosphate buffer and determination of pH using Indicator and pH meter
2. Titration of strong and weak acids
3. Preparation of  $2/3$  N  $H_2SO_4$
4. Preparation of 0.2 N HCl
5. Preparation of 1N  $Na_2CO_3$
6. Determination of pKa
7. Calibration of laboratory pipette
8. Standardization of Distilled water
9. Standardization of an endpoint reaction method
10. Determination of Hormones by Using Radio Immuno assays (RIA)
11. To perform Direct and Indirect ELISA
12. Demonstration of Osmosis and Dialysis



**PRACTICAL-II****MMLT-105**

1. **Determination of Serum Amylase**
2. **Determination of Serum Lipase**
3. **Variation of Serum Alkaline Phosphatase activity with Enzyme concentration**
4. **Effect of Temperature on Activity of  $\alpha$ - amylase**
5. **Determination of Serum Lactate Dehydrogenase (LDH)**
6. **Estimation of Serum Acid Phosphatase**
7. **Estimation of Glutamate Dehydrogenase**
8. **Lipid Composition of Wheat Grain**

**PRACTICAL-III****MMLT-106**

1. **Colorimetric estimation of inorganic phosphate in serum**
2. **First aid and emergency facilities in the laboratory**
3. **Standardization of 0.1 ml volumetric pipette.**
4. **Preparation of protein free filtrates of blood.**
5. **Separation of serum from clotted blood.**
6. **Determination of unknown concentration of a coloured solution by phosphate method.**
7. **Standardization of a photometer/spectrometer.**
8. **Calibration of instruments used in clinical biochemistry**



**M.SC.(MLT) BIOCHEMISTRY**  
**(2<sup>nd</sup> SEMESTER)**

**Paper I**

**MMLT-201**

**Principles of Biochemistry**

**Unit-I**

**Principles & Application of Chromatography**

- Chromatography Definition
- Types of Chromatography
  1. Adsorption Chromatography
  2. Partition Chromatography
  3. Ion-exchange Chromatography
  4. Gel Filtration
  5. Affinity Chromatography
  6. Paper Chromatography & its Applications
  7. Thin Layer Chromatography & its Applications
  8. Column Chromatography & its Applications
  9. High Performance liquid Chromatography (HPLC) & its Applications
    - Diagnostic Application of DNA Probes
    - Clinical Significance
    - Application of DNA (RNA) Probes
    - Separation & Identification of Amino Acids by Circular Paper Chromatography

**Unit-II**

**Electrophoresis:- Definition, General Methodology**

- Factors affecting migration of charged particles
- Proteins separation by gel Electrophoresis
- Isoelectric Focusing
- Two Dimensional Electrophoresis
- Protein purification and Evaluation – total protein, total activity , specific activity , yield , purification level
- Densitometry
- Blot Techniques- Southern & Northern Techniques
- Ultracentrifugation , valuable for separating Biomolecules and Determining their masses





- Fractionation of Serum Proteins by Agarose Gel Electrophoresis
  - Fractionation of Lipoproteins by Agarose gel Electrophoresis
  - Western Blotting Techniques for Detection of proteins Separated by gel Electrophoresis

## **Unit-III**

### **Spectrophotometry:-**

- Protein Mass Determination by Mass Spectrometry
- Protein Purification
- Protein analysis
- Protein Sequence
- Immunological techniques For Protein Investigation
- Antibodies to Specific Proteins
- Enzyme Linked Immuno sorbent assay
- NMR spectroscopy & X- ray Crystallography for three Dimensional Protein structure

## **Unit-IV**

### **Fluorimetry**

- Principles
- Factors Affecting Fluorescence
- Fluorescent Markers – Visualization of Proteins in the Cell
- Components of Fluorimeter
- Advantage of Fluorimeter

### **Reflectance Photometry**

- Introduction & Applications
- Flame Photometry
- Immunochemical Techniques

## **Paper II**

## **ENZYMES AND METABOLISM – II**

### **MMLT-202**



## Unit-I

### 1. Interrelationship

- Metabolic interrelationship between adipose tissue, liver & extra hepatic tissues
- Clinical Importance
- Key Junction Glucose – 6 – Phosphate, Pyruvate & Acetyl-Co-A
- Unique metabolic profile of various organs

### 2. Electron Transport & Oxidative Phosphorylation

- Components of Electron Transport Chain
- Respiratory Chain
- Energy Coupling hypothesis
- Proton- Gradient generation
- Mechanism of ATP synthesis
- Uncoupling of Oxidative Phosphorylation

## Unit-II

### 3. Metabolism of Purines & Pyrimidines

#### (a) Purine Biosynthesis

- Formation of PRPP
- Biosynthesis of Inosine-mono Phosphate
- Purine Nucleotide inter conversion
- Regulation of Purine biosynthesis

#### (b) Pyrimidine Biosynthesis

- Assembling of Pyrimidine Nucleus
- Regulation of Pyrimidine Biosynthesis

#### (c) Salvage Pathway for Purine & Pyrimidine Biosynthesis

#### (d) Related Disorders

### 4. Glycogen Storage Diseases & Galactosuria:

#### a) Introduction

#### b) Different types of Diseases:

- Pompe's Disease
- Cori's Disease
- McArdle's Disease
- Andersen's Disease
- Hers' Disease
- Taruis Disease

#### c) Galactosuria



## Unit-III

### 5. Intrinsic Disorders of Red Cells, Haemoglobin and Porphyrins Sphingolipidases:

- a) Disorders of Red Cells:
  - Hemolytic Anemia
  - Sickle Cell Anemia
  - Thalassaemia
- b) Disorders of Hemoglobin
  - Haemoglobinuria
  - Other Haemoglobinuriopathies
- c) Disorders of Porphyrins
  1. Introduction
  2. Porphyria : Definition and types
  3. Ala Dehydratase Deficient Porphyria
  4. Acute Intermittent Porphyria

### 6. Aminoaciduria:

- a) Definition
- b) Types of Aminoaciduria
  - Overflow Aminoaciduria
  - Renal Aminoaciduria

## Unit-IV

### 7. Gout & Genetic Defects in Urate Metabolism:

- a) Introduction
- b) Types of Gout
  - Primary
  - Secondary
- c) Treatment
- d) X-Linked Disorder

### 8. Errors in Lipid Metabolism



**Paper III****VITAMINS, HORMONES, GENERAL PHYSIOLOGY AND NUTRITION****MMLT-203****Unit-I**

- 1. Chemistry and functions of Vitamins and Hormones.**
- 2. Digestion and Absorption of food.**
  - Digestion of Carbohydrates
  - Digestion of Proteins
  - Digestion of Lipids
  - Digestion of Nucleic acids
  - Absorption of Monosaccharide
  - Absorption of amino acid, dipeptides and tripeptides
  - Absorption of Lipids
  - Absorption of Electrolytes
  - Absorption of Vitamins
  - Absorption of Water

**Unit-II**

- 3. Respiration**
  - Lung volume and capacities
  - Internal and external respiration
  - Transport of oxygen and carbon dioxide
- 4. Muscle contraction**
  - Sliding filament contractions
  - The contraction cycle
  - Excitation-contraction coupling
- 5. MINERALS AND THEIR ROLE IN NUTRITION**
  - Common mineral salts – Source, function and importance
  - Trace mineral salts - Source, function and importance

**Unit-III**

**6. NUTRITION IN HEALTH AND DISEASE**

- Balanced diet-Regulations of food intake and energy storage.
- Disorder of nutrition-Malnutrition, malabsorption, obesity, starvation, deficiency diseases

**7. DETOXIFICATION**

- Pathways of metabolism.
- Drug Biotransformation

**8. ANTIBIOTICS**

- Introduction- Nomenclature & General characteristics
- Classification & Mechanism of Action
- Antibacterial antibiotics-Penicillin, Tetracycline, Cephalosporin & Sulphonamides
- Antifungal antibiotics-Griseofulvin & Nystatin
- Antiviral antibiotics & Interferons

**Unit-IV****9. NITROGEN FIXATION**

- Mechanism of nitrogen fixation.
- Symbiotic nitrogen fixation.
- Non-symbiotic nitrogen fixation.
- Genetic Basis of Nitrogen Fixation
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**10. FERMENTATION**

- Types of fermentation.
- Pathway of fermentation.
- Anaerobic fermentation.
- Enzymes as fermentation products.

**MMLT-204****Principles of Biochemistry****Practical**

1. Separation of Leaf Pigments by Adsorption Chromatography



2. Separation of Amino Acids by Ion – exchange Chromatography
3. Separation of Proteins by Two – dimensional Paper Chromatography
4. Separation of Proteins by Ion- Exchange Chromatography
5. Separation of Amino Acids by Paper Electrophoresis
6. Identification of Sugars in fruit juices by using Thin layer Chromatography
7. Separation of Lipids by Thin layer chromatography
8. Demonstration of principle and procedure of Column chromatography
9. Separation of Serum Proteins SDS –gel Electrophoresis
10. UV Absorption of Proteins & Amino acids
11. Colorimetric Estimation of Inorganic Phosphate
12. Demonstration of principle and use of flame photometer
13. Demonstration of principle and use of Spectrophotometer

## **Practical**

### **ENZYMES AND METABOLISM – II**

#### **MMLT-205**

1. To determine total serum iron
2. To determine total protein bound iron
3. To determine total serum folic acid
4. To determine G-6-PD
5. To perform Hb Electrophoresis
6. To determine serum uric acid
7. To determine RA factor
8. To determine serum lipid profile
  - a. To determine serum total cholesterol
  - b. To determine serum HDL
  - c. To determine serum LDL
  - d. To determine serum VLDL

## **Practical**

### **VITAMINS, HORMONES, GENERAL PHYSIOLOGY AND NUTRITION**

#### **MMLT-206**

1. Determination of bicarbonate



2. Estimation of total and differential proteins
3. Estimation of Electrolytes
4. Estimation of hormones:
  - a. T3
  - b. T4
  - c. TSH
  - d. LH
  - e. FSH
  - f. Prolactin
  - g. Testosterone – total and free
  - h. Catecholamines
5. To determine Vitamin D3
6. To determine Vitamin B12
7. To determine serum Calcium



**ORGAN FUNCTION TESTS**  
**MMLT-301**  
**UNIT-I**

**A) Cardiac Function:**

1. Definitions of Acute coronary syndrome, angina, coronary artery disease ischemia, myocardial infarction, plague, atherosclerosis, factors promoting atherosclerosis
2. Diagrammatic representation of blood flow through heart and lungs
3. Events leading to an acute myocardial infarction, hypercoagulable state
4. Cardiac markers, symbolism and embolism

**B) Uro-genital system function (Male):**

1. Macroscopic and microscopic anatomy of renal system
2. Define-Nephron, glomerular filtration rate, plasma renal flow, hemodialysis, hemostasis, erythropoietin
3. Functions of renal system
4. End stage renal disease, acute renal failure, acute nephrotic syndrome, pyelonephritis and urinary tract obstruction, urine analysis & its applications in renal diseases, tumors of the urogenital system, prostate related diseases.

**C) Uro-genital system function (Female):**

1. Female genital system including breast. Diseases of urinary tract (kidney, ureter, bladder), diseases of cervix, cervical carcinoma, vulva, vagina, ureter, uterus, fallopian tubes, ovaries including tumors of these organs (benign breast diseases, inflammatory diseases, carcinoma breast etc).

**UNIT II**

**D) Liver Function:**

1. Macroscopic and microscopic anatomy of hepatic system
2. Define hepatic lobule, portal triad, jaundice, viral and chronic hepatitis, cirrhosis, cholestasis, cholecystitis, liver cancer and secondary tumors, gall bladder tumors
3. Major functions of liver
4. Enzymes synthesized by liver, their functions and clinical significance.
5. Three specific patterns of liver cell injury, its causes and symptoms

**E) Gastric, pancreatic and intestinal function:**





1. Define-Ulcer, cystic fibrosis, steatorrhoea, acid peptic diseases.
2. Three phases of digestion.
3. Structure and function of stomach, intestinal tract and pancreas
4. Function and clinical significance of intrinsic factor
5. Hormones and enzymes synthesized in the GI tract, their functions and clinical significance
6. Zollinger-Elison syndrome, gastritis, pancreatitis, pancreatic tumor, lactose intolerance and Diabetes Mellitus, stomach, intestine, rectal, benign and malignant tumors, reflux oesophagitis, hiatus hernia, barret, oesophageal cancer.

### UNIT-III

#### **F) Thyroid and salivary gland functions :**

1. Anatomy of Benign and malignant tumors
2. Define-Follicle, colloid, thyroglobulin, reverse T3, goiter, Thyrotropin releasing hormone, tumors of thyroid.
3. Structure and function of thyroid gland
4. Synthesis, regulation and metabolism of thyroid hormones.
5. Effects of increased and decreased concentrations of thyroid hormones on TSH levels
6. Laboratory tests to assess thyroid gland function.
7. Hashimoto's disease, graves disease, secondary hyperthyroidism and thyroid antibodies

### UNIT-IV

#### **G) Adrenocortical function**

1. Structure and function of adrenal cortex
2. Synthesis of adrenocortical hormones from cholesterol
3. Hormones synthesized by each specific zone of the adrenal cortex and their function
4. Adrenal disorders-Addisons's disease, Conn's disease, Cushing's syndrome, congenial adrenal hyperplasia
5. Laboratory tests to assess adrenocortical function.

#### **(H) Lung function**



Anatomy of the lung lobule air way obstruction diseases, constricting diseases, interstitial diseases, Bronchial asthma, chronic bronchitis emphysema, Pneumonia, TB, tumors of lung and pleura, plural cavity.

**(I) Central Nervous System**

Anatomy of brain, spinal cord, Meningitis, CSF, brain tumors

**CLINICAL BIOCHEMISTRY  
MMLT-302**

**UNIT-I**

- a) Biological materials- Methods of estimation, normal range in blood serum, plasma and Urine of Glucose, Proteins, Urea, Uric acid, Creatinine, Cholesterol, Quality control & standardization.
- b) Enzymes-Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of : SGOT, SGPT, Alkaline phosphatase, Acid phosphatase, Amylase, CPK.
- c) Mineral-Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of : Na, K, Ca, Cl, O<sub>2</sub>, CO<sub>2</sub>, P, Iodine, Nitrogen, Zn, Mg, Li.

**UNIT-II**

- d) Hormones-Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of: Androgens, Pregnenolone, estrogens, corticosteroids, catecholamine, thyroid, prolactin, growth hormones. FSH,LH, testosterone,  $\beta$ -HCG.
- e) Vitamins-Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of: Vitamin A, thiamine, Niacin, Pyridoxine, Ascorbic acid, Vitamin D<sub>3</sub>

**UNIT-III**

- f) Others- Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of Barbiturates, Urobilinogen, Opiates, organophosphorus.



- g) Immunological techniques-Equipment, reagents and principles of measurement, Significant molecules that can be detected, sensitivity, sources of error of RIA and ELISA ,immunofixation, immunochemistry, turbimetry, and immunohistochemistry.

#### **UNIT-IV**

- h) Automation in the Medical Laboratory
- a. Various types of Autoanalyzers
  - b. Reagents and Kits for Autoanalyzers
  - c. Validation of the Machine
  - d. Sources of Error
  - e. Quality Assurance and Quality Control
- i) Tumor markers : CEA, AFP ( $\alpha$ - $\beta$  proteins), Serum Urine and Hb electrophoresis



**MOLECULAR BIOLOGY**  
**MMLT-303**  
**Unit-I**

**Organization of Genome**

1. Structure of Chromosome
2. Lamp brush Chromosome
3. Chromatin Structure
4. Satellite DNA

**Unit-II**

**Structure of Gene**

**Regulation of Gene Expression**

1. Gene Expression by Genetic Recombination
2. Regulation of Gene Expression in Yeast (Eukaryotes)
3. Auto regulation
4. Hormonal Regulation

**Genetic Coding**

**Introduction of Mutation**

1. Various types of Mutation
2. Spontaneous Mutation
3. Induced Mutation
4. Applications of Mutation

**Unit-III**

**Linkage, Crossing-Over and Chromosome mapping**

**Genetic Engineering & the Future**

1. Gene Cloning
2. Construction of Gene Libraries
3. Types of Cloning Vectors
  - a. Plasmids
  - b. Bacteriophage
  - c. Cosmids



**Unit-IV****Applications of Molecular Biology in health and disease****1. Oncogene and tumor suppressor gene**

MMLT-304

ORGAN FUNCTION TESTS

Practicals

1. Cardiac Function:
  - a. Lipid Profile
2. Renal function
  - a. Urea
  - b. Creatinine
  - c. Uric acid
3. Liver Function:
  - a. Total proteins
  - b. Bilirubin
  - c. SGOT
  - d. SGPT
  - e. Alkaline phosphatase
  - f. Bile pigments
4. Gastric, pancreatic and intestinal function:
  - a. Serum amylase
  - b. Serum lipase
  - c. Serum insulin level
5. Thyroid and salivary gland functions :
  - a. T3, T4, TSH and PTH
6. Adrenocortical function
  - a. Estimation of ACTH



**MMLT-305**  
**CLINICAL BIOCHEMISTRY**  
**(Practical)**

1. Determination of Electrolytes
2. Determination of Amylase
3. Determination of LH, FSH and Prolactin
4. Determination of
  - a. Progesterone,
  - b. Estrogens,
  - c. Corticosteroids,
  - d. Prolactin,
  - e. Growth hormones.
  - f. FSH,
  - g. LH,
  - h. Testosterone,
  - i.  $\beta$ -HCG.
5. Immunological techniques i.e. ELISA

**MMLT-306**  
**MOLECULAR BIOLOGY**  
**Practical**

1. DNA/RNA – diagrammatic representation
2. Chromosomal studies - demonstration from models/charts
3. Detection of DNA/RNA in a clinical sample
4. Polymerase Chain reaction
5. Karyotyping
6. Detection of mutations
7. Gene cloning
8. Introduction of cloning in vectors



## **Ordinance for evaluation of M.Sc MLT Biochemistry Dissertation**

### **Aim of Dissertation:**

The students shall learn to find out cross reference from a library or from internet, study and understand those, develop a hypothesis for their study, prepare a study protocol/plan and to design an experiment as per funds and facilities available. They will also learn how to write a dissertation/thesis and finally a research paper to be published in a scientific journal.

### **Rational of evaluation rules:**

The students shall get guidance of institute as well as external experts at every level of their work and will be fully prepared for examination and shall face examination protocol with full confidence as their work has been evaluated by experts at every level.

### **Ethical and Research Evaluation Committee of dissertation**

The institute/College shall constitute a committee under the title “**Ethical and Research Evaluation Committee**” consisting minimum seven members as follows:

- |   |                   |
|---|-------------------|
| 1. An external expert of the related discipline         | : Chairperson     |
| 2. One Legal expert                                     | : Member          |
| 3. One Industry expert                                  | : Member          |
| 4. Two faculty members from the institute               | : Members         |
| 5. One faculty of the related discipline from institute | : Member          |
| 6. Dean/Registrar or their representative               | : Member convener |

### **Procedure for evaluation:**

The student shall prepare his research proposal/protocol under the guidance of his/her guide and final proposal shall be presented to the “**Ethical and Research Evaluation Committee**” in its meeting. The committee shall evaluate the proposal:

1. Whether the work is acceptable from ethical angle?
2. Whether the work is feasibility in the institute keeping in view the budget and facilities?
3. Whether the design of study protocol is acceptable?
4. Whether the work is worth M.Sc MLT Biochemistry Dissertation?
5. Anything else related to the acceptability of study protocol.

After clearance from “**Ethical and Research Evaluation Committee**” the protocol shall be submitted to the university and the student shall start his/her work. The guide shall evaluate the



work progress of student and will record his performance every month till the work is complete. If the guide feels any change or amendments in protocol during the study, that has to be evaluated and approved by **“Ethical and Research Evaluation Committee”**. Any amendment in study protocol without the approval from this committee shall not be accepted. After completion of work and before printing, the work along with results shall be presented as a power point presentation, to **“Ethical and Research Evaluation Committee”** of the institute which shall evaluate the study performed by student for:

1. Whether the work performed by student is as per protocol approved by **“Ethical and Research Evaluation Committee”** before starting the work and the amendments evaluated and approved by the committee during the work.

After getting information regarding assigned external examiner from PTU, one copy of dissertation shall be submitted to external examiner and comments of examiner be invited. The comments of examiner be evaluated by the guide and if necessary then may be by the **“Ethical and Research Evaluation Committee”** and approved amendments be made in dissertation before inviting the examiner for final examination.

