

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB

Syllabus of M. Sc.in Medical Lab Technology

(Effective for 2022-2023 Admission Session)

SEMESTER - II

MMLT 201-- Biochemical Techniques (Theory)

Objectives:

- 1) The objective of this course is that after 50 hours of lectures, demonstrations, practicals and clinics the student will have the knowledge about different types of bio-analytical tools.
- 2) To demonstrate the different biochemical techniques for identification of biomolecules.
- 3) To describe the application of different types of bio-analytical tools.

Course Outcomes:

- 1) In this course the student will learn about principle and application of Spectroscopy.
- 2) In this course the student will learn about principle and application of Ultracentrifugation.
- 3) In this course the student will learn about principle and application of Chromatography.
- 4) In this course the student will learn about principle and application of electrophoresis.
- 5) In this course the student will learn about principle and application of flow cytometry.
- 6) In this course the student will learn the principles, techniques and applications of different essential bio-analytical tools

THEORY - MMLT 201

CO	Blooms Level (if applicable)	Unit	%age of questions
1	1,2	I	15
2	1,2	II	30
3	2,3	III	25
4	2,3	IV	15
5	2,3	V	15
			100

PRACTICAL –MMLT 291

CO	Blooms Level (if applicable)	Unit	%age of questions
1			
2			
3			
4			
5			
6	1,2	VI	100
			100

UNIT-I: SPECTROSCOPY

Concepts of spectroscopy, Visible and UV spectroscopy, Laws of photometry, Beer-Lambert's law, Principles and applications of colorimetry.

UNIT-II: ULTRACENTRIFUGATION AND RADIOACTIVITY

Ultracentrifugation - basic principles, Preparative ultracentrifugation - differential centrifugation and density gradient centrifugation, Analytical centrifugation, determination of molecular mass and purity of macromolecules

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Radioactivity: Nature of radioactivity - stable and radioactive isotopes - units and interaction of radioactivity with matter, Detection and measurement of radioactivity - GM counter, solid and liquid scintillation counter, Applications of radioisotopes in the biological sciences.

UNIT-III: CHROMATOGRAPHY

Chromatographic techniques: General principles of partition and adsorption chromatography, Thin layer chromatography, column chromatography, Ion-exchange chromatography, molecular exclusion chromatography, gas chromatography, liquid and HPLC, normal phase, reverse phase, chromatofocusing, immune affinity, capillary electrochromatography.

UNIT-IV: ELECTROPHORESIS

Principles of electrophoretic separation, Continuous, zonal and capillary electrophoresis, different types of electrophoresis including paper, cellulose, acetate/nitrate and gel, Electroporation, pulse field gel electrophoresis

UNIT-V: SCOPE OF BIOPHYSICAL CHEMISTRY

Fundamentals of Flow cytometry: Basics of technique, Principle, various applications of flow cytometer

Books recommended:

1. Hofmann A (2018) Wilson & Walker's Principles & Techniques of Biochemistry & Molecular Biology, 8th edition, Cambridge University Press.
2. S.C. Rastogi (2020) Biotechnology: Principles & Applications. Alpha Science International.

MMLT 291-- Biochemical Techniques (Practical)

1. Demonstration of principle and procedure of Column 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. Demonstration of Adsorption Chromatography
6. Separation of Amino Acids by Paper Electrophoresis
7. Separation of Lipids by Thin layer chromatography
8. Separation of Serum Proteins SDS – gel Electrophoresis
9. UV Absorption of Proteins & Amino acids
10. Demonstration of principle and use of flame photometer
11. Demonstration of principle and use of Spectrophotometer

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MMLT 202 -- Clinical Biochemistry-I (Theory)

Objectives:

- 1) The objective of this course is that after 50 hours of lectures, demonstrations, practicals and clinics the student will have the knowledge about principle and use of clinical biochemistry in diagnostic purposes.
- 2) To demonstrate the different technique of clinical biochemistry in diagnostic purposes.
- 3) To describe the applications of clinical biochemistry.

Course Outcomes:

- 1) Student will learn the scope of clinical biochemistry in diagnosis, use of clinical laboratory and interpretation of results, biochemistry of urine, blood and cerebrospinal fluid.
- 2) Student will learn the different disorder of carbohydrate metabolism.
- 3) Student will learn the different disorder of lipid metabolism.
- 4) Student will learn the different disorder of amino acids metabolism.
- 5) Student will learn the Interrelation of pharmacology and biochemistry and Generation of new pharmaceutical modalities.

THEORY- MMLT 202

CO	Blooms Level (if applicable)	Unit	% age of questions
1	1,2	I	20
2	1,2	II	15
3	1,2	III	15
4	2,3	IV	25
5	2,3	V	25
			100

PRACTICAL –MMLT 292

CO	Blooms Level (if applicable)	Unit	% age of questions
1			
2			
3			
4			
5	1,2	VI	100
			100

UNIT-I

Introduction: Definition and scope of clinical biochemistry in diagnosis, use of clinical laboratory and interpretation of results.

Body Fluids: Biochemistry of urine, blood and cerebrospinal fluid, normal and abnormal constituents and clinical entities in body fluids

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UNIT-II

Disorders of Metabolism: Disorders of carbohydrate metabolism: diabetes mellitus, ketoacidosis, hypoglycemia, glycogen storage diseases, galactosemia, lactose intolerance, and lactic acidosis.

UNIT-III

Disorders of lipids: lipid malabsorption and steatorrhea, sphingolipidosis, clinical interrelationships of lipids, lipoproteins and apolipoproteins.

UNIT-IV

Disorders of amino acid metabolism: inborn errors of amino acid metabolism-alkaptonuria, phenylketouria, albinism, gout, hyperglycemia, phenylalaninemia, homocystineuria, tyrosinemia, aminoacidurias, disorders of nucleic acid metabolism (Purine and Pyrimidine metabolism),

UNIT-V

Interrelation of pharmacology and biochemistry, drug detoxification, host-drug interactions, molecular mechanism of action of drugs, medicinal chemistry: phytochemicals of therapeutic value.

Generation of new pharmaceutical modalities: recombinant vaccines, recombinant enzymes, monoclonal antibodies, hormones, cytokines, blood clotting factors, pharmacogenomics, introduction to gene therapy, bio-nanotechnology

Books recommended:

1. Abeles RH, Frey PA and Jeneks WP (1992) Biochemistry, Jones and Bartlett Publishers, Boston.
2. Berg JM, Tymoczko, JL and Stryer L (2002) Biochemistry, 5th Edition, WH Freeman & Co., New York.
3. Cohn EE, Stumph PK, Bruening GandDoi RH(1987) Outlines of Biochemistry, 5th Edition, John Wiley & Sons, New York.
4. Murray RK, Granner DK, Rodwell VW and Mayes PA (2000) Harper's Biochemistry, 25thEidtion, Applaton and Lange Publications, California, USA.
5. Nelson DL and Cox MM (2001) Lehninger Principles of Biochemistry, 3rd Edition, MacMillon Worth Publishers, New Delhi.
6. Rawn JD (1990) Biochemistry, 2nd Edition, Harpers and Row Publications, NewYork.
7. Voet D and Voet JG (2001) Biochemistry, 3rd Edition, John Wiley & Sons, NewYork.
8. Zubey G (1998) Biochemistry, 4th Edition, WMC Brown Publishers, USA.

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9. Parveen Bansal, S.N. Das (2014) Biotechnology in Medicine and Herbal Drug Development, 1st edition, Gulab publishers.

MMLT 292-- Clinical Biochemistry-I (Practical)

1. Estimation and standardization of
 - a) Glucose
 - b) Urea
 - c) Cholesterol
 - d) Triglycerides
 - e) Phospholipids
 - f) Total Lipids
 - g) Uric Acid
 - h) Creatinine
 - i) Ketone Bodies
 - j) Glycosylated Haemoglobin
 - k) Bilirubin
 - l) Myoglobin
2. Estimation of porphyrins and porphobilinogen in urine.
3. Urine quantitative and qualitative analysis: Random and 24 hours

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MMLT 203-- Molecular Metabolism- II (Theory)

Objectives:

- 1) The objective of this course is that after 50 hours of lectures, demonstrations, practicals and clinics the student will have the knowledge about principle and significance of amino acid, nucleic acid metabolism and intrinsic disorders of red cells
- 2) To demonstrate the different technique of organ function test.
- 3) To describe the general aspect of molecular metabolism.

Course Outcomes:

- 1) Student will learn the general reactions and regulations of amino acid metabolism.
- 2) Student will learn the general reactions and regulations of nucleic acid metabolism.
- 3) Student will learn the principle of intrinsic disorders of red cells.

THEORY - MMLT 203

CO	Blooms Level (if applicable)	Unit	% age of questions
1	1,2	I	35
2	1,2	II	35
3	2,3	III	30
			100

PRACTICAL – MMLT 293

CO	Blooms Level (if applicable)	Unit	% age of questions
1			
2			
3			
4	1,2	IV	100
			100

UNIT-I: METABOLISM OF AMINO ACIDS

General reactions of amino acids metabolism i.e. transamination, deamination, decarboxylation, Catabolism of individual amino acids, Urea cycle, biosynthesis of essential and non-essential amino acids, Regulation of amino acid biosynthesis, Metabolism of amino acids precursors.

Aminoaciduria: a) Definition b) Types of Aminoaciduria: Overflow Aminoaciduria,

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Renal Aminoaciduria

UNIT-II: METABOLISM OF PORPHYRINS AND NUCLEOTIDES

Metabolism of Porphyrins: Biomedical importance, Heme biosynthesis, catabolism of heme bilirubin, Hyper bilirubinoemia, Degradation of purines and pyrimidines, Salvage pathways, Biosynthesis of purine and pyrimidine nucleotides, Biosynthesis of deoxyribo nucleotides, Biosynthesis of nucleotide coenzymes, Regulation of nucleotide biosynthesis.

Unit-III: 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 Haemo-globinuriopathies, c) Disorders of Porphyrins 1. Introduction 2. Porphyria : Definition and types 3.ALA Dehydratase Deficient Porphyria 4.Acute Intermittent Porphyria

Books Recommended

1. Abeles RH, Frey PA and Jeneks WP (1992) Biochemistry, Jones and Bartlett Publishers, Boston.
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5. Nelson DL and Cox MM (2001) Lehninger Principles of Biochemistry, 3rd Edition, Mac Millon Worth Publishers, New Delhi.
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MMLT 293-- General Physiology and Organ Function Test (Practical)

- Thyroid Function Test
- Renal function Test
- Liver Function test
- Gastric and pancreatic Function Test
- Arterial Blood gas Analyser: working and its uses
- Stone analysis
- Tumor markers
- Estimation of Heavy metals- Copper, Zinc, Cadmium, Iron, Aluminum, Mercury, Arsenic, Lead etc.
- Biological fluids: cerebrospinal fluid analysis
- Body fluid analysis: biochemical analysis of peritoneal fluid, pleural fluid, synovial fluid, ascetic fluid, semen, amniotic fluid
- Cardiac function Test (enzyme based)

**MMLT 204 - General Physiology and Organ Function Test
(Theory)**

Objectives:

- 1) The objective of this course is that after 50 hours of lectures, demonstrations, practicals and clinics the student will have the knowledge about different physiological functions of body
- 2) To describe the general aspect of organ function tests.

Course Outcomes:

- 1) Student will learn the principle and mechanism of digestion and absorption of food.
- 2) Student will learn the mechanism of respiration.
- 3) Student will learn the principle and mechanism of blood clotting.
- 4) Student will learn the role of minerals in nutrition.
- 5) Student will learn the principle of nutrition in health and disease
- 6) Student will learn the principle of different organ function test.

THEORY - MMLT 204

CO	Blooms Level	Unit	% age of questions
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	(if applicable)		
1	1,2	I	15
2	1,2	II	15
3	2,3	III	20
4	2,3	IV	20
5	2,3	V	15
6	2,3	VI	15
			100

Unit-I: Digestion and Absorption of food

Digestion and absorption of carbohydrates, Proteins, Lipids, Nucleic acids, Absorption of Electrolytes, Absorption of Vitamins, Absorption of Water

UNIT-II: Respiration

Lung volume and capacities, Internal and external respiration, Transport of oxygen and carbon dioxide, Muscle contraction Sliding filament contractions, The contraction cycle, Excitation- contraction coupling

UNIT-III : Blood Clotting

Chemistry of blood coagulation and coagulation disorders

UNIT-IV: Minerals and Their Role in Nutrition

Minerals and trace elements - Source, function and importance

UNIT-V: Nutrition in Health and Disease

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

UNIT-VI: Organ Function Test

Thyroid function test, Renal Function test, Liver Function Test and Gastric Function Tests, Cardiac Function test (Enzyme based)

Books Recommended:

1. Berg JM, Tymoczko, JL and Stryer L (2002) Biochemistry, 5th Edition, WH Freeman & Co., New York.
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