

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB

Syllabus of M. Sc.in Medical Lab Technology

(Effective for 2022-2023 Admission Session)

SEMESTER - III

MMLT 301-- Clinical Biochemistry-II (Theory - Core)

Objectives:

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

Course Outcomes:

- 1) In this course the student will learn about estimation and application of biological materials.
- 2) In this course the student will learn about estimation and application of enzymes.
- 3) In this course the student will learn about estimation and application of hormones.
- 4) In this course the student will learn about estimation and application of vitamins & others
- 5) In this course the student will learn the principles, techniques and applications of different essential biological materials.

THEORY-MMLT 301

CO	Blooms Level (if applicable)	Unit	%age of questions
1	1,2	I	20
2	1,2	II	25
3	2,3	III	25
4	2,3	IV	30
			100

PRACTICAL –MMLT 391

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

UNIT-I:

Biological materials- Methods of estimation, normal range in blood serum, plasma and Urine of Glucose, Proteins, Urea, Uric acid, Creatinine, Cholesterol, Quality control & standardization.

UNIT-II:

Enzymes: Methods of estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of: SGOT, SGPT, Alkaline phosphatase, Acid

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phosphatase, Amylase, CPK.

Mineral estimation, principles of assay, normal range in tissues and clinical conditions leading to abnormal levels of : Na, K, Ca, Cl, P, Iodine, Nitrogen, Zn, Mg, Li.

UNIT-III:

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, β -HCG.

UNIT-IV:

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 D₃

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

Books recommended:

1. Nelson et al Lehninger (2001) Principles of Biochemistry, W.H Freeman, 8th Edition.
2. Murray RK, Granner DK, Rodwell VW & Mayer PA(2000) Harper's Biochemistry , 5th Edition, John Wiley & Sons, New York.
3. Voet D & Voet JG (2001) Biochemistry, 3rd Edition, John Wiley & Sons, New York.
4. David Baltimore & Harvey Lodish, Molecular Cell Biology, 4th Edition ,W.H Freeman & Co. Ltd.

MMLT 391-- Clinical Biochemistry-II (Practical - Core)

1. Determination of Electrolytes
2. Determination of Amylase
3. Determination of LH, FSH and Prolactin
4. Determination of Progesterone, Estrogens, Corticosteroids, Growth hormones, Testosterone, β -HCG.

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MMLT 302-- Applied Molecular Biology (Theory - Core)

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 applied molecular biology in diagnostic purposes.
- 2) To demonstrate the different technique of applied molecular biology in diagnostic purposes.
- 3) To describe the applications of applied molecular biology.

Course Outcomes:

- 1) Student will learn the different aspects of organization of genome.
- 2) Student will learn the various types of mutations and its application.
- 3) Student will learn the basic principle of genetic engineering.
- 4) Student will learn the basic tools of genetic engineering.
- 5) Student will learn the applications of recombinant DNA Technology.

THEORY-MMLT 302

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

UNIT-I : ORGANIZATION OF GENOME

Satellite DNA, Structure of Gene Regulation of Gene Expression, Gene Expression by Genetic Recombination, Regulation of Gene Expression in Yeast (Eukaryotes), Auto regulation, Hormonal Regulation Genetic Coding

UNIT-II : MUTATION

Various types of Mutation, Spontaneous Mutation, Induced Mutation, Applications of Mutation Linkage, Crossing-Over and Chromosome mapping

UNIT III: TOOLS OF GENETIC ENGINEERING

Restriction endonucleases, DNA ligase, DNA polymeraseI, reverse transcriptase, S1nuclease, Alkaline phosphatase, Plasmid, bacteriophage and cosmids as vehicles of cloning, Use of linkers, adapters, homo polymer tailing in creating recombinant DNA molecules. Cloning strategies and selection of recombinants.

Cloning Strategies: Cloning from mRNA, genomic DNA, gene libraries.

UNIT-IV: BASIC TECHNIQUES

Isolation Handling and quantification of Nucleic acids, agarose gel electrophoresis,

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Preparation of labelled DNA probes, Southern blotting. Northern blotting. DNA sequencing
DNA finger printing, Polymerase chain reaction, site directed mutagenesis, Transformation,
Transfection.

UNIT-V: APPLICATION OF RECOMBINANT DNA TECHNOLOGY

In Medicine: Molecular diagnostics, vaccines, drugs, gene therapy.

In Forensic Science: Minisatellite DNA, inheritance of repetitive DNA, inheritance of RFLP.

Books recommended:

1. Primrose SB, Twyman RM and Old RW (2001) Principles of Gene manipulation, 6th Edition, Blackwell Scientific Publication, Oxford, UK.
2. WastsonJD, ToozeJand KurtzDT(1991) RecombinantDNA A Short Course, 2nd Edition, W.H. Freeman and Company, New York.
3. Brown TA (2001) Gene Cloning and DNA Analysis, An Introduction, 4th Edition, Blackwell Scientific Publication, Oxford, UK.
4. Christopher Howe (1995) Gene Cloning and Manipulation, Cambridge University Press, New York.
5. Dale JW, Schantz MU (2002) From Genes to Genomes: Concepts and Applications of DNA Technology, John Wiley & Sons, New York.
6. Micklos DHA, Freyer GA, Crotty DA and Freyer G (2002) DNA Science: A First Course in DNA Technology, 2nd Edition, Cold Spring Harbor Lab Press, New York.

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MMLT 303—Statistics and Clinical Biochemistry Laboratory Management (Theory -Elective)

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 statistics and clinical biochemistry laboratory management
- 2) To demonstrate the different statistical methods used in clinical data interpretation.
- 3) To describe the general aspect of clinical biochemistry laboratory management.

Course Outcomes:

- 1) Student will learn the different statistical methods in clinical biochemistry.
- 2) Student will learn the different statistical hypothesis in clinical biochemistry.
- 3) Student will learn the principle of quality control and quality assurance in clinical biochemistry.
- 4) Student will learn the principle of calibration, storage, safety measures and protocol development for accreditation of clinical biochemistry lab
- 5) In this course the student will learn the principles, techniques and applications of different statistical methods, principle of calibration, storage, safety measures and protocol development for accreditation of clinical biochemistry lab.

THEORY-MMLT 303

CO	Blooms Level (if applicable)	Unit	%age of questions
1	1,2	I	25
2	1,2	II	20
3	2,3	III	30
4	2,3	IV	30
			100

PRACTICAL –MMLT 393

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

Unit I

Importance of statistical methods in clinical biochemistry

Collection, classification & Presentation of Data-Graphs, Diagrams & Tables

Population & Sample & Sampling Techniques

Analysis of Data averages-Mean, Mode & Median

Variance & standard Deviation

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Unit II

Correlation

Additivity of Means & Variance

Regression

Hypothesis-Meaning, Testing of Hypothesis using t-Test, Chi-square Test & Test for ANOVA

Laboratory Management

Unit III

Quality Control and quality assurance in clinical biochemistry

Selection & Storage of Chemical Materials & Apparatus

Collection, preservation and transportation of clinical samples

Care and maintenance of General Laboratory Apparatus

Unit IV

Calibration of Volumetric Apparatus

Storage, Handling & disposal of Infected, Radioactive & Dangerous Materials

Safety Measures & Emergency Treatments for Accidents

Protocol development for accreditation of clinical biochemistry lab

Books Recommended

1. Debajyoti Das, Arati Das (2005) Statistics in Biology & Psychology, Academic Publishers.
2. Pranab Kumar Banerjee (2007) Introduction to Biostatistics (A Textbook of Biometry), S Chand.

MMLT 393-- Statistics and clinical biochemistry Laboratory management (Practical - Elective)

- Demonstration of use of statistical methods in quality control of routine biochemistry parameters.
- Sampling techniques
- Sample storage
- Transportation of samples
- Safety and sample handling
- Third party quality control
- First aid and emergency facilities in the laboratory
- Standardization of 0.1 ml volumetric pipette.

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- Preparation of protein free filtrates of blood.
- Separation of serum from clotted blood.
- Standardization of a photometer/UV-spectrometer.
- Calibration of instruments used in clinical biochemistry

MMLT 304-- Automation in the Clinical Biochemistry Laboratory (Theory - Elective)

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 automation technique in clinical biochemistry laboratory for diagnostic purposes.
- 2) To demonstrate the different automation techniques used in clinical biochemistry laboratory for diagnostic purposes
- 3) To describe the applications automation techniques of clinical biochemistry laboratory.

Course Outcomes:

- 1) Student will learn the various types of Auto analyzers, reagents & kits and ELISA method.
- 2) Student will learn the different instruments and their application in clinical biochemistry lab.
- 3) Student will learn the validation method, source of error and quality control technique in clinical biochemistry lab.
- 4) Student will learn the different tumor markers and Hb-electrophoretic technique used in clinical biochemistry lab.
- 5) In this course the student will learn the principles, techniques and applications of different assay methods in auto analyzer, clinical instruments, validation and quality control techniques used in clinical biochemistry lab.

THEORY-MMLT 304

CO	Blooms Level (if applicable)	Unit	%age of questions
1	1,2	I	25
2	1,2	II	30
3	1,2	III	25
4	2,3	IV	20
			100

PRACTICAL –MMLT 392

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

UNIT I

- a. Various types of Auto analyzers: Semi-automated, Fully automated analyzers

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- b. Reagents and Kits for Auto analyzers
- c. ELISA reader and ELISA washer

UNIT II

- d. Colorimeter and UV-Spectrophotometer
- e. Flow cytometer: use in cancer marker detection
- f. Vacutainer
- g. Cold chain refrigeration
- h. Use of Laboratory centrifuges in clinical biochemistry lab
- i. Chemiluminiscence
- j. PCR/RT-PCR

UNIT III

- k. Validation of the Machine
- l. Sources of Error
- m. Quality Assurance and Quality Control

UNIT IV

- n. Tumor markers : CEA, AFP (α - β proteins),
- o. Serum Urine and Hb-electrophoresis

Books recommended:

1. Kory M. Ward, Craig A. Lehmann, Alan M. Leiken (1994) Clinical Laboratory Instrumentation and Automation - Principles, Applications, and Selection, Saunders Publisher
2. George E. Sims (1972) Automation of a Biochemical Laboratory, Butterworths Publisher

MMLT 392-- Automation in the Clinical Biochemistry Laboratory (Practical - Elective)

- Various types of Auto analyzers: Semi-automated, Fully automated analyzers
- Reagents and Kits for Auto analyzers
- ELISA reader and ELISA washer
- Colorimeter and UV-Spectrophotometer
- Flow cytometer: use in cancer marker detection
- Vacutainer
- Cold chain refrigeration
- Use of Laboratory centrifuges in clinical biochemistry lab
- Chemiluminiscence
- PCR/RT-PCR
- Validation of the Machine

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- Sources of Error

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MMLT 305 - List of MOOCS Courses (Second & third semester for MMLT)

- Development Research Methods (NPTEL)-Mandatory Course
- Nanotechnology and Nanosensors Part I (Coursera)
- Nanotechnology and Nanosensors Part 2 (Coursera)
- Classical Papers in Molecular genetics (Coursera)
- Design and conduct of Clinical Trials (Coursera)
- Clinical Epidemiology (Coursera)
- Biomedical nanotechnology (NPTEL)
- Cell culture technologies (NPTEL)
- Drug Delivery : Principle & Engineering (NPTEL)
- Experimental Biotechnology (NPTEL)
- Functional Genomics (NPTEL)

MMLT 381-- Seminar/journal club (Practical – Elective)