M. Sc. MEDICAL LABORATORY SCIENCE (CLINICAL BIOCHEMISTRY)

Total Contact Hours = 28 **Total Marks = 700** **Total Credits = 24**

SEMESTER 1st		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMLT1- 101		4	0	0	40	60	100	4
MMLT1- 102	Enzymes & Metabolism- I	4	0	0	40	60	100	4
MMLT1-103	Clinical Biochemistry- I	4	0	0	40	60	100	4
MMLT1-104	Physiology & Nutrition-I	4	0	0	40	60	100	4
MMLT1-105	Biostatistics	4	0	0	40	60	100	4
MMLT1-106	Clinical Biochemistry- I Lab	0	0	4	60	40	100	2
MMLT1-107	Biostatistics Lab	0	0	4	60	40	100	2
Total		**20**	**0**	**8**	**320**	**380**	**700**	**24**

« Course was dropped and was not included in December 2016 Final Exam schedule of MRSPTU

Total Contact Hours = 26 **Total Marks = 700** **Total Credits = 22**

SEMESTER 2nd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMLT1-208	Analytical Biochemistry	4	0	0	40	60	100	4
MMLT1- 209	Enzymes & Metabolism- II	4	0	0	40	60	100	4
MMLT1-210	Physiology & Nutrition-II	4	0	0	40	60	100	4
MMLT1-211	Clinical Biochemistry-II	3	0	0	40	60	100	3
MMLT1-212	Molecular Diagnostics	3	0	0	40	60	100	3
MMLT1-213	Analytical Biochemistry Laboratory	0	0	4	60	40	100	2
MMLT1-214	Clinical Biochemistry-II Laboratory	0	0	4	60	40	100	2
Total		**18**	**0**	**8**	**320**	**380**	**700**	**22**

Total Contact Hours = 32 **Total Marks = 800** **Total Credits = 24**

SEMESTER 3rd		Contact Hrs.			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MMLT1- 315	Organ Function Tests	4	0	0	40	60	100	4
MMLT1-316	Molecular Biology	4	0	0	40	60	100	4
MMLT1-317	Physical Biochemistry	4	0	0	40	60	100	4
MMLT1-318	Bio Safety and Bio Ethics	4	0	0	40	60	100	4
MMLT1-319	Organ Function Test Laboratory	0	0	4	60	40	100	2
MMLT1-320	Molecular Biology laboratory	0	0	4	60	40	100	2
MMLT1-321	Physical Biochemistry Laboratory	0	0	4	60	40	100	2
MMLT1-322	Seminar on Recent Advances in Clinical Biochemistry	0	0	4	40	60	100	2
Total		**16**	**0**	**16**	**380**	**420**	**800**	**24**

Total Contact Hrs. = 25 **Total Credits= 20**

Course		Load Allocation	Marks			Credits
Code	Name		Internal	External	Total	
MMLT1- 423	Dissertation	Submission within 5 Months	200	200	400	20

ENZYMES & METABOLISM- I

Subject Code: MMLT1- 102 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives

1. Students will learn about the role of various enzymes as well as their mechanism in metabolic processes.

UNIT-I (11 Hrs.)

Introduction to enzyme & mechanism of catalysis: Classification and characteristics, nature of active site, enzyme substrate complex, factors responsible for catalysis, allosteric enzymes, regulation of metabolic pathways, isozymes & their importance.

UNIT-II (12 Hrs.)

Enzyme Kinetics: A brief concept of bioenergetics and kinetics, Kinetics of single and bi-substrate enzyme catalyzed reactions, Michaelis Menten equation. Derivation of Michaelis Menten equation and determination of Km and Vmax values, Enzyme inhibition: reversible and irreversible inhibition.

UNIT-III (10 Hrs.)

Carbohydrate Metabolism: Digestion and absorption of carbohydrates, glycolysis, and citric acid cycle, oxidative phosphorylation, Gluconeogenesis, biosynthesis & degradation of di and polysaccharides.

UNIT-IV (12 Hrs.)

Lipid Metabolism: Digestion and absorption of lipids transport of lipoproteins, Oxidation of fatty acids, degradation and synthesis of fatty acids, triacylglycerols, phosphoglycerides, sphingolipids, and cholesterol.

Recommended Books

1. T. Palmer and P.L. Bonner, 'Enzymes: Biochemistry, Biotechnology and Clinical Chemistry', 2nd Edn, Woodhead Publishing
2. J.M. Berg, J.L. Tymoczko, G.J. Gatto and L. Stryer, 'Biochemistry', 8th Edn., W.H. Freeman & Co., New York.
3. D.L. Nelson and M.M. Cox, 'Lehninger Principles of Biochemistry', 6th Edn., Macmillan Worth Publishers, New Delhi.
4. Voet D., Voet JG and Pratt CW, 'Fundamentals of Biochemistry', 5th Edn. John Wiley & Sons. New York.

CLINICAL BIOCHEMISTRY- I

Subject Code: MMLT-103 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I

Course Objectives

1. Students will learn the clinical aspects of the biochemistry.

UNIT-I (12 Hrs.)

Disorders of carbohydrates & lipids metabolism - Diabetes mellitus, glycohemoglobins, hypo-glycemias, galactosemia and ketone bodies, various types of glucose tolerance tests, glycogen storage diseases, Plasma lipoproteins, cholesterol, triglycerides & phospholipids in

health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies, Abetalipoproteinemia.

UNIT-II (11 Hrs.)

Hormonal Disturbance: Protein hormones (anterior pituitary hormones, posterior pituitary hormones), steroid hormones, adrenocorticosteroids, and reproductive endocrinology. Disturbances in thyroid function.

UNIT-III (10 Hrs.)

Electrolytes, Acid-Base Balance & Digestive Diseases: Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes, maldigestion, malabsorption, creatorrhoea, diarrhea and steatorrhoea.

UNIT-IV (12 Hrs.)

Biochemical Aspects of Hematology, Liver & Kidney: Disorders of erythrocyte metabolism, hemoglobinopathies, thalessemias thrombosis and anemias. Laboratory tests to measure coagulation and thrombolysis, jaundice, fatty liver, normal and abnormal functions of liver and kidney, inulin and urea clearance.

Recommended Books

1. M.N. Chatterjea and Rana Shinde, 'Textbook of Medical Biochemistry', Jaypee Brothers.
2. John W. Baynes and Marek Dominiczak, 'Medical Biochemistry', Mosby.
3. G. Beckett, S. Walker, P. Rae, P. Ashby, 'Clinical Biochemistry', Blackwell Publishing.

PHYSIOLOGY & NUTRITION- I

Subject Code: MMLT1- 104 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives

1. Students will learn the physiological and nutritional aspects of the human body.

UNIT-I (12 Hrs.)

Cellular Physiology & Biochemical aspects of Tissues - Body fluid compartments, membrane potential, inter and intra cellular communication, homeostasis, electrolytes contents, functions of sodium, potassium, chloride and their absorption & transportation, hydrogen ion balance, structure, chemical composition and functions of mussels, nerves and sensory tissues.

UNIT-II (11 Hrs.)

Respiration: Functional anatomy of air- passages and lung, respiratory muscles, mechanics of respiration- intrapleural and airway pressures, lung volumes and capacities dead space, alveolar ventilation transport of gasses- O_2 dissociation and CO_2 dissociation curves, Gas exchange- diffusion and gases across alveolo- capillary membrane, ventilation- perfusion ratio, control of breathing.

UNIT-III (11 Hrs.)

Gastro- Intestinal System: Mastication and swallowing, salivary secretion and its regulation, gastric secretion and motility, function and regulation of bile secretion, intestinal secretion and motility- regulation (including defection).

UNIT-IV (11 Hrs.)

Human Nutrition & Dietetics: Energy value of foods- direct and indirect colorimetry- respiratory quotient- energy needs of the body- basal metabolism calculation of total caloric

requirements, recommended dietary allowances (RDA) protein efficiency ratio, nutritional and food requirements to meet the needs of infants, adolescents, adults.

Recommended Books

1. E.P. Widmaier, H. Raff, K.T. Strang, Vander, Sherman, 'Luciano's Human Physiology: The Mechanisms of Body Function', McGraw Hill.
2. L.K. Mahan, Krause, 'Food, Nutrition and Diet Therapy', Saunders Publishers.
3. C.W. Suitor, M.F. Crowely, 'Nutrition Principles and Applications in Health Promotion', Lippincoot Williams and Wilkins.
4. G.A. Spiller, 'CRC Handbook of Dietary Fiber in Human Nutrition', CRC Press.
5. G.H. Bell, J.N. Davidson and H. Scarborough, 'Textbook of Physiology and Biochemistry', Livingstone Ltd.

BIOSTATISTICS

Subject Code: MMLT1-105 **L T P C** **Duration: 36 Hrs.**
3 0 0 3

Course Objectives

1. Students will understand the various aspects of biostat and its importance in the medical sciences.

UNIT-I (10 Hrs.)

Introduction to Statistics: Biological data types, accuracy and significant figures, frequency distribution and it graphical representations, sampling, measures of central tendency, AM, GM, HM, QM, median, quartiles and quantiles, mode. Measures of dispersion and variability, range, quartile deviation, mean deviation, variance, standard deviation, coefficient of variation, Shannon-Wienner diversity index.

UNIT-II (12 Hrs.)

Probability and Distributions: Permutations, combinations, probability, addition and multiplication of probabilities, binomial distribution, Poisson distribution, normal distribution, symmetry and kurtosis of normal distribution curve, proportions of normal distribution.

UNIT-III (11 Hrs.)

Hypothesis Testing: Introduction to statistical hypothesis testing, significance level and critical value, type I and type II errors, power of statistical test, one- and two tailed tests, confidence interval, parametric and non-parametric tests. One sample, two sample and paired sample t-tests, Mann Whitney test and Wilcoxon paired sample test, variance ratio test.

UNIT-IV (12 Hrs.)

Multiple Sample Hypothesis: Single factor and two factor ANOVA, multiple comparison tests, Tukey test, SNK, Chi-square test, simple linear regression, coefficient of correlation, coefficient of determination and rank correlation, contingency tables, relative risk ratio and odds ratio.

Recommended Books

1. J.H. Zar, 'Biostatistical Analysis', Pearson Education.
2. K.V. Rao, 'Biostatistics – A Manual of Statistical Methods for Use in Health, Nutrition and Anthropology', Jaypee Brothers.

CLINICAL BIOCHEMISTRY- I LAB.

Subject Code: MMLT1-106 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

1. Determination of serum and urine creatinine, serum bilirubin, serum chloride
2. Estimation of blood urea by Nesslerization method
3. Estimation of Serum Cholesterol
4. Determination of Serum Uric Acid by Henry Caraway's method
5. Estimation of Serum amylase
6. Glucose Tolerance Test
7. Colorimetric determination of Calcium in food

Recommended Books

1. G.P. Talwar, 'Text book of Biochemistry & Human Biology'.
2. Linten, 'Nutrional Biochemistry & Metabolism'.
3. M.E. Skills and V.R. Yong, 'Modern Nutrition in Health & Diseases'.
4. W.J. Marshall and S.K. Angert, 'Clinical Biochemistry – Metabolic and Clinical Aspects'.
5. T. Devli, 'Biochemistry with Clinical Correlation'.

BIOSTATISTICS LAB.

Subject Code: MMLT1-107 **L T P C** **Duration: 24 Hrs.**
0 0 2 1

1. Calculation of AM, GM, HM, QM of given raw data. Also plot frequency polygon and bar graph of the raw as well as classified data
2. Determine median, mode, range, quartile deviation, mean deviation, standard deviation and coefficient of variation for the give set of data
3. Determining Shannon-Wienner diversity index
4. Determine binomial and Poisson probability distributions
5. To plot normal density function
6. Hypothesis test problems based on normal distribution, two sample test and paired t-test
7. ANOVA based problems and extension into Tukey test problem
8. Problems based on Mann Whitney test and Wilcoxon paired sample test
9. Problem based on test of goodness by chi square test
10. Correlation, regression and rank correlation based problems
11. Problems based on contingency tables
12. Odds ratio and relative risk ratio

Recommended Books

1. J.H. Zar, 'Biostatistical Analysis', Pearson Education.
2. K.V. Rao, 'Biostatistics – A Manual of Statistical Methods for Use in Health, Nutrition and Anthropology', Jaypee Brothers.

ANALYTICAL BIOCHEMISTRY

Subject Code: MMLT1-208 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

Electrochemical Analysis: The concepts of pH, dissociation and ionization of acids and bases, pKa, buffers and buffering mechanism, Henderson Hasselbalch equation, dissociation of amino acids and determination of pKa; Principle and Applications of Biosensors.

UNIT-II (12 Hrs.)

Chromatography & Electrophoresis: Principles, Instrumentations and applications of High-performance liquid chromatography, Adsorption chromatography, Ion-exchange chromatography, Gas chromatography; Electrophoresis of proteins- SDS- PAGE, 2D- PAGE, native gels and nucleic acids.

UNIT-III (11 Hrs.)

Spectroscopy & Radioactivity: Principle, Instrumentations and applications of Ultraviolet and visible light spectroscopy, Fluorescence spectroscopy, Luminometry, Atomic spectroscopy. 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; Autoradiography. Applications of radioisotopes in the biological sciences.

UNIT-V (11 Hrs.)

Immunoassays: Radio Immuno- Assay (RIA), Homogeneous Enzyme Immuno Assays, Heterogeneous Immuno Assays, ELISA (indirect, direct, competitive), Chemiluminescence, Elispot assay, Western Blotting.

Recommended Books

1. Katoch, Rajan, 'Analytical Techniques in Biochemistry and Molecular Biology', Springer, **2011.**
2. Martin Holtzhauer, 'Basic Methods for the Biochemical Lab', Springer, **2007.**
3. Keith Wilson and John Walker, 'Principles and Techniques of Biochemistry and Molecular Biology', Cambridge University Press, **2010.**
4. S.B. Primrose, R.M. Twyman, and R.W. Old, 'Principles of Gene Manipulations', Blackwell Science, **2012.**
5. Walker and Gastra, 'Techniques in Molecular Biology', Croom Helm, **1983.**
6. Cornish Bowden, 'Basic Mathematics for Biochemists', Oxford University Press, **1998.**

ENZYMES & METABOLISM- II

Subject Code: MMLT1-209 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Integration of Metabolism: Recurring motifs in biochemistry, regulation of major metabolic pathways, metabolic fates of glucose-6-phospohate, pyruvate and acetyl CoA, Metabolic profiles of brain, muscle, adipose tissue, liver and kidney, Hormonal regulation of metabolism, metabolic adaptations.

UNIT-II (10 Hrs.)

Metabolism of Nitrogen Compounds: Digestion and absorption of proteins, Nitrogen fixation and its mechanism, Assimilation of ammonia, Nitrogen cycle.

UNIT-III (12 Hrs.)

Anabolism & Catabolism of Amino Acids: Biosynthesis of essential and non-essential amino acids, Regulation of amino acid biosynthesis, Metabolism of amino acids precursors; General reactions of amino acids metabolism i.e. transamination deamination decarboxylation, Urea cycle, Catabolism of individual amino acids.

UNIT- IV (11 Hrs.)

Biosynthesis & Degradation of Nucleotides: Biosynthesis of purine and pyrimidine nucleotides, biosynthesis of deoxyribouncleotides and nucleotide coenzymes, Regulation of nucleotide biosynthesis. Degradation of purines and pyrimidines, Salvage pathways.

Recommended Books

1. D.L. Nelson and M.M. Cox, 'Lehninger Principles of Biochemistry', Macmillan Worth Publishers, New Delhi, **2013.**
2. J.M. Berg, J.L. Tymoczko and L. Stryer, 'Biochemistry', W.H. Freeman & Co., New York.
3. R.K. Murray, D.A. Bender, K.M. Botham, P.J. Kennelly, V.W. Rodwell and P.A. Weil 'Harper's Biochemistry', McGraw Hill Medical Canada.
4. D. Voet, J.G. Voet and C.W. Pratt, 'Fundamentals of Biochemistry', John Wiley & Sons. New York.

PHYSIOLOGY & NUTRITION- II

Subject Code: MMLT1-210 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Carbohydrates & Lipids: Classification, sources and functions of carbohydrates and fats, their absorption, utilization and storage, digestion, absorption, hormonal regulation of blood glucose; dietary fiber, disadvantages of dietary fibers; role of saturated fat, cholesterol, lipoprotein and triglycerides and EFA in the diet.

UNIT-II (11 Hrs.)

Proteins & Nucleic Acids: Classification, sources, functions, digestion, absorption, utilization and storage, protein quality evaluation, nutritional classification of amino acids and their balance and imbalance, toxicity; Structure of nucleoside, nucleotide. De novo and salvage pathways of nucleotide synthesis.

UNIT-III (10 Hrs.)

Hormones: Mode of action, functions of hormones of the endocrine glands- Pituitary, adrenal, thyroid, gonadal hormones, pineal body and parathyroid, hypo and hyper functions of the glands.

UNIT-IV (12 Hrs.)

Vitamins & Minerals: Chemistry, functions, physiological action, digestion and absorption of vitamins, interaction of fat and water soluble vitamins with other nutrients, hypo and hypervitaminosis; major trace minerals, their bound forms and functions.

Recommended Books

1. E.P. Widmaier, H. Raff, K.T. Strang, Vander, Sherman, 'Luciano's Human Physiology: The Mechanisms of Body Function', McGraw Hill.

2. L.K. Mahan, 'Krause's Food, Nutrition and Diet Therapy', Saunders Publishers.
3. C.W. Suitor, M.F. Crowely, 'Nutrition Principles and Application in Health Promotion', Lippincoot Williams and Wilkins.
4. G.A. Spiller, 'CRC handbook of Dietary Fiber in Human Nutrition', CRC Press.
5. G.H. Bell, J.N. Davidson and H. Scarborough, 'Textbook of Physiology and Biochemistry', Livingstone Ltd.
6. A.B.S. Mahapatra, 'Essentials of Medical Physiology', Current Books International Publishers.
7. Z. Kroner, 'Vitamins and Minerals: Facts versus Fictions', Greenwood Pub Group Inc.

CLINICAL BIOCHEMISTRY- II

Subject Code: MMLT1-211 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

UNIT-I (12 Hrs.)

Principles and Methods for Biological Materials Estimation: Blood serum, plasma, glucose in urine, estimation of uric acid, urea, creatinine, cholesterol; quantification of enzymes: alkaline phosphate, acid phosphate, amylase, creatine phosphokinase, Serum glutamic oxaloacetic transaminase, serum glutamic-pyruvic transaminase; estimation of Na, K, Ca, Cl, O_2, CO_2, P, Zn, Mg.

UNIT-II (11 Hrs.)

Hormones & Vitamins Estimation Methods and Their Principles: Androgen, pregnonediol, estrogens, corticosteroids, catecholamine, thyroid, prolactin, growth hormones: FSH, LH, testosterone; vitamins estimations: Vitamin A, thiamin, niacin, pyridoxine, ascorbic acid, vitamin D_3.

UNIT-III (12 Hrs.)

Immunological Techniques: RIA, ELISA, immunofixation, immunochemistry, turbidimetry and immunohistochemistry; Tumor markers.

UNIT-IV (10 Hrs.)

Automation in the Medical Laboratory: Various types of auto analyzers, reagents and kits, validation of machine, source of errors, quality assurance and quality control.

Recommended Books

1. Gowenlock Alen H., 'Varley's Practical Clinical Biochemistry', CRC Publishers, **1988.**
2. Ranjna Chawla, 'Practical Clinical Biochemistry Methods and Interpretation, Jaypee Brothers Medical Publishers, **2014.**
3. David T. Plummer, 'An Introduction to Practical Biochemistry', Tata-McGraw Hill, **1987.**

MOLECUALR DIAGNOSTICS

Subject Code: MMLT1-212 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

UNIT-I (12 Hrs.)

Introduction to Molecular Diagnostics: Reverse transcriptase PCR, Quantitative real time PCR, the basic concept and threshold cycle, fluorescent dyes used in real time PCR, Taqman™,

specimen collection and transportation, nucleic acids extraction, PCR optimization and inhibitors, handling contamination, applications of real time PCR as diagnostic tool.

UNIT-II (11 Hrs.)

Signal Amplification Methods: Concept of molecular diagnostic techniques – identification, characterization and quantization of specific nucleic acids sequences, branched DNA amplification and its application in quantization of HCV and HIV, hybrid capture assay and its application in detection of HPV, invader technology.

UNIT-III (11 Hrs.)

Chip Based Diagnostics: DNA sequence analysis, gene expression profiling, biomarker detection, their role in detection of diseases or their susceptibility, applications of chips, on-chip blood cells separation, on-chip extraction of cell contents such as DNA and proteins, on-chip approach for genetic analysis using miniaturized PCR, SNP detection by probe ligation and amplification (MLPA), next generation sequencing in molecular diagnostics.

UNIT-IV (11 Hrs.)

Molecular Diagnostics of Infectious Diseases: Molecular diagnostics of infectious diseases such as, Leishmania, detection of large DNA viruses. Molecular diagnostics of non-infectious diseases such as cystic fibrosis, X-linked mental retardation disorder, Huntington disease, molecular markers for early detection of cancer.

Recommended Books

1. R.M. Nakamra, F.L. Kiechle, W.W. Grody and C. Strom, 'Molecular Diagnostics – Techniques and Applications for the Clinical Laboratory', Academic Press.
2. L. Buckingham, 'Molecular Diagnostics – Fundamentals, Methods and Clinical Applications', F.A. Davis Company.

ANALYTICAL BIOCHEMISTRY LAB.

Subject Code: MMLT1-213 **L T P C**
0 0 4 2

1. Preparation of Phosphate buffer and determination of pH.
2. Titration of strong and weak acids.
3. Demonstration of Osmosis and Dialysis.
4. Estimation of protein by UV Spectrophotometer by $E_{280}/_{E260}$ method.
5. Seperation of proteins by SDS gel electrophoresis.
6. Starch preparation and characterization.
7. Alpha and Beta amylolysis.

Recommended Books

1. Wilson and J. Walker, 'Practical Biochemistry: Principles and Techniques'.
2. David Plummer, 'Practical Biochemistry'.
3. S.K. Sawhney and R. Singh, 'Introductory Practical Biochemistry'.

CLINICAL BIOCHEMISTRY- II LABORATORY

Subject Code: MMLT1- 214 **L T P C**
0 0 4 2

1. Estimation of phospholipids, free fatty acids in serum.

2. Estimation, of cholesterol and triacyglycerol plasma.
3. Estimation of LDH, phosphatases, CPK in serum.
4. Thyroid function tests like T3 T4 assays.
5. Analysis of Gastric juice.
6. Chromatographic separation of sugars, amino acids, lipids and proteins.

Recommended Books

1. Herold Varley et al, 'Practical Clinical Biochemistry', Vol. I and II, Arnold - Heinemann.
2. M.D. John Bernard Henry, 'Todd Sanford Davidson's Clinical Diagnosis and Management by laboratory methods', W.B. Saunders Company.
3. Colowich and N.O. Kaplan, 'Methods in Enzymology', Academic Press.
4. W.J. Marshall and S.K. Angert, 'Clinical Biochemistry – Metabolic and Clinical Aspects'.

ORGAN FUNCTION TESTS

Subject Code: MMLT1-315 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

Cardiac Function: Definitions of Acute coronary syndrome, angina, coronary artery disease ischemia, myocardial infarction, plague, atherosclerosis, factors promoting atherosclerosis; Events leading to an acute myocardial infarction, hypercoagulable state; Cardiac markers, symbolism and embolism.

UNIT-II (11 Hrs.)

Uro-genital System Functions of Male & Female: Anatomy and functions of each part of renal system; End stage renal disease: acute renal failure, acute nephrotic syndrome, phyelonephritis and urinary tract obstruction, tumors of the urogenital system, prostate related diseases; Female genital system including breast; Diseases of cervix, cervical carcinoma, vulva, vagina, ureter, uterus, fallopian tubes, ovaries and breast cancer.

UNIT-III (12 Hrs.)

Liver & Intestinal Function: Anatomy and functions of hepatic system; diseases of the liver system: jaundice, viral and chronic hepatitis, cirrhosis, cholestasis, cholecystitis, liver cancer and secondary tumors, gall bladder tumors. Gastro-Intestinal tract anatomy, their different parts function and clinical significance; GI complications: Zollinger-Elison syndrome, gastritis, pancreatitis, pancreatic tumor, lactose intolerance and Diabetes Mellitus, benign and malignant tumors, reflux oesophagititis, hiatus hernia, barret, oesophgeal cancer.

UNIT-IV (11 Hrs.)

Thyroid & Lung Function: Structure and function of thyroid gland; Laboratory tests to assess thyroid gland functions; Thyroid related complications: Hashimoto's disease, Graves disease. Anatomy of the lungs; Lungs Problems: lobule air way obstruction diseases, constricting diseases, bronchial asthma, chronic bronchitis emphyscma, Pneumonia, TB, tumors of lung and pleura, plural cavity.

Recommended Books

1. M.N. Chatterjea, R. Chawla, 'Clinical Chemistry (Organ Function Tests, Laboratory Investigations and Inborn Metabolic Diseases)', Jaypee Brothers Medical Publishers.
2. Allan Gaw, Michael J. Murphy, Rajeev Srivastava, Robert A. Cowan, Denis St. J. O'Reilly, 'Clinical Biochemistry: An Illustrated Colour Text', Churchill Livingstone/Elsevier.

MOLECULAR BIOLOGY

Subject Code: MMLT1- 316 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Genetic Material and DNA Replication: Structure and properties of nucleic acids, DNA as genetic material, nucleosomes, chromosomal structure and organization, Semiconservative mode of DNA replication, linear and circular replicons, origin of replication in bacteria and yeast, DNA replication in bacteria, eukaryotes and phages, prokaryotic and eukaryotic DNA polymerases and their properties, semi-discontinuous mode of DNA synthesis, Okazaki fragments, other proteins in DNA replication such as helicase, sliding clamps, clamp loader, primase.

UNIT-II (11 Hrs.)

Repair and Recombination: DNA damage, structural distortions and mutations, pyrimidine dimers, DNA repair, photoreactivation, mismatch repair system, excision repair (BER and NER), recombination repair, error prone repair, SOS system. Genetic recombination, synapsis and homologous recombination, site-specific recombination, mechanism involving breakage and reunion of DNA strands, Holliday structure.

UNIT-III (11 Hrs.)

Transcription: Transcription initiation, structure and properties of bacterial RNA polymerase, sigma factor, promoter structure and its recognition by RNA polymerase, transcription elongation and termination, rho dependent and rho-independent termination, operons, regulation of lac and trp operons, *cis*-elements and *trans*-factors. Structure and function of eukaryotic RNA polymerases and their respective promoters, transcription factors, TBP, regulatory elements, enhancers and insulators.

UNIT-IV (10 Hrs.)

Protein Expression: Post translational modifications, 5' capping, 3' polyadenylation and splicing of mRNA. mRNA, tRNA and rRNA, and their role in protein synthesis, structure of tRNAs, aminoacyl-tRNA, ribosome. Initiation, elongation and termination of protein synthesis, bacterial initiation factors, initiator tRNA, Shine-Dalgarno sequence. Initiation of translation in eukaryotes, eukaryotic initiation factors, elongation factors. Genetic code, degeneracy of codons, wobble hypothesis, initiation codon and termination codons.

Recommended Books

1. Lewin B, 'Genes IX', Pearson Prentice Hall.
2. Malacinski, GM, 'Freifelder's Essentials of Molecular Biology', Narosa Publishing House.

PHYSICAL BIOCHEMISTRY

Subject Code: MMLT1-317 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Thermodynamic and Hydrodynamic Aspects: Structure, conformation, folding, and assembly of biological molecules, macromolecules and membranes. Forces affecting the structure and conformation of biological macromolecules, and their interactions. Thermodynamics and Hydrodynamics properties of bio-molecules: Thermodynamic laws as applicable to bio-

molecules: phase transition, helix- coil transition folding in proteins and nucleic acids. Hydrodynamic properties: Concept of ideal and non ideal solutions. Concept of Viscosity. Sedimentation, and Membrane transport.

UNIT-II (10 Hrs.)

Bio-Chemical Kinetics: Mechanisms of chemical and biochemical reactions. Concept of transition state theory and diffusion limited process. Chemical and Biochemical Kinetics: Differential and integrated rate laws. Enzyme kinetics and Kinetic methods in biomedical diagnostics.

UNIT-III (12 Hrs.)

Methods for Separation of Macromolecules: Basic principle of Sedimentation and centrifugation, determination of sedimentation rate and molecular mass, Analytical centrifugation and ultracentrifugation. Chromatographic techniques: General Principles of chromatography, Chromatographic techniques applicable to bio-molecules: Ion-exchange chromatography, Affinity chromatography, Molecular exclusion chromatography, High-performance liquid Chromatography Electrophoretic techniques: General Principles of electrophoresis, Agarose and Poly-acrylimide Gel electrophoresis of proteins, and nucleic acids. SDS-PAGE, 2-D gel electrophoresis, Iso-electric focusing of proteins, capillary electrophoresis, Microchip electrophoresis.

UNIT-IV (11 Hrs.)

Methods for Characterization of Macromolecules: Spectroscopic techniques: visible and UV spectroscopy. Fluorescence spectroscopy; principles and applications in the analysis of proteins and nucleic acids. Fluorescence resonance energy transfer (FRET); NMR, X-Ray diffraction, mass spectrometry and their applications in the characterization of macromolecules.

Recommended Books

1. David Sheehan, 'Physical Biochemistry: Principles and Applications'.
2. Peter Atkins, Julio de Paula, *'Physical Chemistry*,' Either complete book or *Volume 2:*
3. Quantum Chemistry, Spectroscopy and Statistical Thermodynamics, W.H. Freeman & Co., New York.
4. David Eisenberg, Donald Crothers, 'Physical Chemistry with Applications to the Life Sciences', Benjamin/Cummings Publishing Co.
5. Kensal E. van Holde, W. Curtis Johnson, P. Shing Ho, 'Principles of Physical Biochemistry', Pearson Prentice Hall.

BIOSAFETY & BIOETHICS

Subject Code: MMLT1-318 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Biosafety: Biosafety guidelines, regulations & operation; Biosafety decision making structure in India – Institutional Biosafety Committee (IBSC), District level committee (DCL), State Biotechnology Coordination Committee (SBLC), Review committee and genetic engineering approval committee (GEAC); Biosafety Levels; Biosafety Levels of Specific Microorganisms; Biosafety containment levels - Personal Protective Equipment and clothing; Biological waste disposal.

UNIT-II (11 Hrs.)

Laboratory and Environmental Biosafety: Health aspects; toxicology, allergenicity, antibiotic resistance; Impact on environment: gene flow in natural and artificial ecologies; Sources of gene escape, tolerance of target organisms; Radiation safety and non- radio isotopic procedure; the laws of Radioactive Decay; Physical, biological and effective half lives, Radionuclide hazards; Contamination monitoring.

UNIT-III (10 Hrs.)

Medical Emergencies: Death of patient, Loss of radioactive sources; Internal exposure – contamination control; External exposure – shielding, distance, time; Safe handling of radioactive sources. Activity in body fluids – urine, blood, breast milk.

UNIT-IV (12 Hrs.)

Bioethics: Ethical decision making process; Bioethics guidelines; International bioethics survery (1993), International bioethics committee of UNESCO and International association of Bioethics, European bioethics Convention, EuropaBio's' Core Ethical Value (A document Drafted of European Association of Bioindustries, the EuropaBio), Convection of Human rights & Biomedicine (1996); Ethical issue in cloning, transgenic organisms & Gene therapy.

Recommended Books

1. Biosafety in the Laboratory: Prudent Practices for Handling and Disposal of Infectious Materials by National Research Council (U. S.)
2. O. Diane, Fleming and Debra Long Hunt, 'Biological Safety: Principles and Practices (Biological Safety: Principles & Practices)'.
3. Sree Krishan, V. 'Bioethics and Biosafety in Biotechnology', New Age International (P) Ltd. Publ. Mumbai **2007**
4. Robert J. Slater, 'Radioisotopes in Biology', Practical Approach Series

ORGAN FUNCTION TETS LAB.

Subject Code: MMLT1- 319 **L T P C**
0 0 4 2

1. Cardiac Function: Lipid profile.
2. Renal Function: urea, creatinine, uric acid.
3. Liver Function: Total protein, Bilirubin, SGOT, SGPT,
4. Intestinal Function: Serum Insulin level.
5. Thyroid Function: T3, T4, TSH.
6. Identification of Pathological Physical and Chemical Urine Constituents & Microscopic examination of Urine.
7. Quantitative Determination of Urine Creatinine- Measurement of Creatinine Clearance.

Recommended Books

1. M.N. Chatterjea, R. Chawla, 'Clinical Chemistry (Organ Function Tests, Laboratory Investigations and Inborn Metabolic Diseases)', Jaypee Brothers Medical Publishers.
2. Allan Gaw, Michael J. Murphy, Rajeev Srivastava, Robert A. Cowan, Denis St. J. O'Reilly, 'Clinical Biochemistry: An Illustrated Colour Text', Churchill Livingstone/Elsevier, **2013.**

MOLECULAR BIOLOGY LAB.

Subject Code: MMLT1- 320 **L T P C**
0 0 4 2

1. Detection of DNA/RNA in a clinical sample.
2. Polymerase Chain reaction.
3. Karyotyping.
4. Detection of mutations.
5. Gene cloning.
6. Introduction of cloning in vectors.

Recommended Books

1. J. Fritsch and E.F. Maniatis, 'Molecular Cloning, A Laboratory Manual', Cold Spring Harbor Laboratory, **1999.**
2. G.M. Malacinski, 'Freifelder's Essentials of Molecular Biology', Narosa Publishing House.

PHYSICAL BIOCHEMISTRY LAB.

Subject Code: MMLT1-321 **L T P C**
0 0 4 2

1. Isolation of proteins/enzymes
2. Isolation of nucleic acids
3. Determination of activity of enzyme (Amylase /phosphatase).
4. Study denaturation of proteins/enzymes: determination of thermo-stability of enzymes.
5. Study denaturation of Nucleic acids: determination of melting temperature (Tm) of DNA.
6. Separation of proteins using PAGE.
7. Determination of molecular mass of proteins using SDS- PAGE.
8. Determination of sedimentation rate of macromolecules using centrifugation technique.
9. Determination of proteins/nucleic acid by UV spectrophotometric method.
10. Separation and detection of nucleic acids using agarose gel electrophoresis.

Recommended Books

1. D.T. Plummer, 'An introduction to practical biochemistry', Tata McGraw Hill Publishers Co. Ltd., New Delhi. **2004**
2. Fritsch, J. and Maniatis,E.F., Molecular Cloning, 'A laboratory Manual, Cold Spring Harbor Laboratory', **1999.**
3. G.M. Malacinski, 'Freifelder's Essentials of Molecular Biology', 4th Edn., Narosa Publishing House.