

Master of Science - Medical Lab Technology

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Programme Structure Curriculum & Scheme of Examination 2015

**AMITY UNIVERSITY, HARYANA
GURGAON**

M.Sc.-Medical Lab Technology (Total Credits-130)

Programme Structure

FIRST SEMESTER

Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits
MLT4101	Analytical & Physical Biochemistry	4	1	-	5
MLT4102	Enzymes & Metabolism-I	4	1	-	5
MLT4103	Medical Laboratory Techniques	3	1	-	4
MLT4104	Biostatistics	4	1	-	5
MLT4105	Lab Course-I	-	-	4	2
MLT4106	IT for Lab Technology	4	-	2	5
	Open Electives				5
CSS4151	Basics of Communication	1	-	-	1
BEH4151	Self Development & Interpersonal Skills	1	-	-	1
LAN4151	Foreign Business Language-I French-I German-I Spanish-I Russian-I Chinese-I Portuguese-I Korean-I Japanese-I	3	-	-	3
LAN4152					
LAN4153					
LAN4154					
LAN4155					
LAN4156					
LAN4157					
LAN4158					
	TOTAL				31

SECOND SEMESTER

Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits
MLT4201	Clinical Biochemistry-I	4	1	-	5
MLT4202	Enzymes & Metabolism-II	4	1	-	5
MLT4203	Organ Function Tests	3	1	-	4
MLT4204	General Physiology & Nutrition	3	1	-	4
MLT4205	Research Methodology	3	1	-	4
MLT4206	Lab Course-II	-	-	4	2
Open Electives					5
CSS4251	Corporate Communication	1	-	-	1

BEH4251	Behavioural Communication & Relationship Management	1	-	-	1
LAN4251 LAN4252 LAN4253 LAN4254 LAN4255 LAN4256 LAN4257 LAN4258	Foreign Business Language-II French-II German-II Spanish-II Russian-II Chinese-II Portuguese-II Korean-II Japanese-II	3	-	-	3
TOTAL					29

SUMMER PROJECT

Note: Students must submit their summer project report immediately on return from summer vacation in July / August and the same would be evaluated for 9 credit units, which would be included in the Third Semester marks.

THIRD SEMESTER

Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits
MLT4301	Clinical Immunology	4	1	-	5
MLT4302	Clinical Biochemistry-II	4	1	-	5
MLT4303	Molecular Biology	4	1	-	5
MLT4304	Lab Course-III	-	-	4	2
MLT4305	Vitamins & Hormones	4	1	-	5
MLT4306	Lab Management	5	-	-	5
MLT4335	Summer Project Evaluation	-	-	-	9
Open Electives					4
LAN4351 LAN4352 LAN4353 LAN4354 LAN4355 LAN4356 LAN4357 LAN4358	Foreign Business Language-III French-III German-III Spanish-III Russian-III Chinese-III Portuguese-III Korean-III Japanese-III	2	-	-	2
CSS4351	Interpersonal Communication	1			1
BEH4351	Leading Through Teams	1			1
TOTAL					40

FOURTH SEMESTER

Course Code	Course Title	Lectures (L) Hours Per Week	Tutorial (T) Hours Per Week	Practical (P) Hours Per Week	Total Credits
MLT4437	Dissertation	-	-	-	30
	TOTAL	-	-	-	30

Note:

Student will be sent to laboratories at Universities, National Institute and Hospitals for their project based research work during 4th Semester. At the end of 4th semester student will be evaluated on the basis of dissertation followed by presentation of their research work.

Syllabus – First Semester

ANALYTICAL & PHYSICAL BIOCHEMISTRY

Course Code: MLT4101

Credit Units: 05

Course Objective: The main objective is to prepare students with the basic concepts of biochemistry. This course will provide students with knowledge of the fundamentals of biochemistry like Biological oxidation and immunoassays.

1. Electrolytes: - Definition, ionization of weak acids, weak bases pH, Henderson-Hasselbalch 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: - 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.
6. Definitions - viscosity, surface tension
7. Donnan equilibrium in living cells, 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.
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
 - f. Enzyme Linked Immuno-Sorbant Assay (ELISA)
 - g. Chemiluminescence & Bioluminescence
 - h. Microparticle Enzyme Immuno assay (MEIA)
 - i. Fluorescence Polarization Immuno assay(FPIA)
 - j. Radio Active Energy attenuation (REA)Assays

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Methods in Molecular Biology: Amino Acid Analysis Protocols By Catherine Cooper, Nicolle Packer and Keith Williams. Publisher: Humana Press
- Medical Biochemistry [Paperback] By John Van Pilsum. Publisher: University of Minnesota Press.
- Clinical Biochemistry: Metabolic and Clinical Aspects [Paperback] By William J. Marshall and Stephen K. Bangert. Publisher: Churchill Livingstone.
- Clinical Chemistry: Techniques, Principles, Correlations (Bishop, Clinical Chemistry) [Hardcover] By Michael L Bishop, Edward P Fody and Larry E Schoeff. Publisher: Lippincott Williams and Wilkins

ENZYMES & METABOLISM-I

Course Code: MLT4102

Credit Units: 05

Course Objective: The main objective of the course is to provide students with an insight into the Enzymes used in biochemical research and their role in metabolism.

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 Carbohydrates

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

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

Lipids

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

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Methods in Molecular Biology: Amino Acid Analysis Protocols By Catherine Cooper, Nicolle Packer and Keith Williams. Publisher: Humana Press
- Medical Biochemistry [Paperback] By John Van Pilsum. Publisher: University of Minnesota Press.
- Clinical Biochemistry: Metabolic and Clinical Aspects [Paperback] By William J. Marshall and Stephen K. Bangert. Publisher: Churchill Livingstone.
- Clinical Chemistry: Techniques, Principles, Correlations (Bishop, Clinical Chemistry) [Hardcover] By Michael L Bishop, Edward P Fody and Larry E Schoeff. Publisher: Lippincott Williams and Wilkins

MEDICAL LABORATORY TECHNIQUES

Course Code: MLT4103

Credit Units: 4

Course Objective: To help students learn the common laboratory techniques used in the clinical laboratory

Module-I: Determination of glucose in body fluids, glucose tolerance test and hypoglycemia determination, analysis of ketone bodies, method of estimation of lactate, pyruvate and glycated hemoglobin in blood. Analysis of amino acids, Screening tests, quantitative tests, test for specific amino acids, determination of proteins in serum, plasma and CSF. Analytical methods for estimation of triglycerides, high density lipoproteins, low density lipoproteins, apolipoproteins

Module-II: Laboratory application of nucleic acid technologies to elucidate, diagnose, monitor disease state and to evaluate non-disease status techniques for the detection of DNA and RNA structures at the molecular level, Basic principles and techniques-nucleic acid biochemistry-Relation to laboratory evaluation of disease and establishing a molecular diagnostic laboratory facilities, equipment, personnel. Clinical testing process, quality assurance, clinical validation and accreditation

Module-III: Molecular genetics of hematopoietic neoplasm-lineage probes in the evaluation of hematopoietic neoplasma- Molecular analysis of chromosomal aberrations in leukemias and lymphomas, Molecular diagnosis of genetic diseases. Choice of techniques, choice of applications, special concept unique to molecular genetic disorders, specific disease examples. Application of molecular methods in clinical microbiology

Module-IV: DNA analysis; historical aspects advantage of DNA over traditional serology; impact of DNA specimen collection, DNA degradation and environmental damage, quality assurance, standard, databank, legal challenge

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Methods in Molecular Biology: Amino Acid Analysis Protocols By Catherine Cooper, Nicolle Packer and Keith Williams. Publisher: Humana Press
- Medical Biochemistry [Paperback] By John Van Pilsum. Publisher: University of Minnesota Press.
- Clinical Biochemistry: Metabolic and Clinical Aspects [Paperback] By William J. Marshall and Stephen K. Bangert. Publisher: Churchill Livingstone.
- Clinical Chemistry: Techniques, Principles, Correlations (Bishop, Clinical Chemistry) [Hardcover] By Michael L Bishop, Edward P Fody and Larry E Schoeff. Publisher: Lippincott Williams and Wilkins
- Nucleic Acid Amplification Technologies: Application to Disease Diagnosis [Hardcover] By H Olsvik (Editor), S Morse (Editor), O Lee (Editor). Publisher: Eaton Publishing, USA.
- Chromosomal Alterations: Methods, Results and Importance in Human Health [Hardcover] By Gunter Obe and Vijayalaxmi. Publisher: Springer
- Handbook of Hematologic Pathology (Diagnostic Pathology) [Hardcover] By Harold R. Schumacher, Sanford A. Stass and William A. Rock. Publisher: Marcel Dekker Inc.

- Molecular Diagnosis of Genetic Diseases (Methods in Molecular Medicine) (Methods in Molecular Biology) (v. 1) [Hardcover] By Rob Elles. Publisher: Humana Press.
- Color Atlas and Textbook of Diagnostic Microbiology [Hardcover] By Elmer W Koneman, Stephen D Allen, William M Janda, Paul C Schreckenberger and Washington C Winn. Publisher: Lippincott
- Molecular Diagnostics: Promises and Possibilities [Hardcover] By Mousumi Debnath, Godavarthi B.K.S. Prasad and Prakash S. Bisen. Publisher: Springer

BIOSTATISTICS

Course Code: MLT4104

Credit Units: 05

Course Objective

To introduce the basic statistical methods used in public health research. As part of this introduction, students will learn to make practical use of statistical computer packages.

Course Contents

Module I: Introduction

Classification of data, Source of data, data organization Method of scaling - nominal, ordinal, ratio and interval scale, building composite scales, measuring reliability and validity of scales.

Module II: Properties of measurement & Probability distributions

- Measurement of central tendency, measurement of dispersion.
- Concepts of probability, Probability distributions, Variance and Standard Deviation of random variables; Binomial Probability Distribution, Poisson Probability Distribution and Normal Probability Distribution.

Module III: Sampling

Sampling methods, Sampling Errors; Sampling distribution.

Module IV: Testing Hypothesis

Null and Alternative hypothesis, One-Tailed and Two-Tailed tests of hypothesis, Type I and Type II error, Hypothesis Testing to compare two populations, Interpretation of computer output of ANOVA, Chi – Square Test, F-test, Test of significance

Module V: Forecasting Techniques

Correlation-Karl Person, Spearman's Rank methods, Regression Analysis, least squares method, coefficient of determination, Time Series Analysis, Numerical application of trend analysis.

Module VI: Statistical methods and application:

SPSS processing, Transformation and manipulation of SPSS file, Statistical procedures-descriptive, univariate, bivariate and multivariate statistics.

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- B.K. Mahajan. *Methods in Biostatistics*, Jaypee Brothers
- P.S.S. Sundar Rao. *An Introduction to Biostatistics: A manual for students in Health Sciences*, J.Richard Prentice Hall, 1996.
- Daniel, Wayne.W. *Bio-Statistics: A foundation for Analysis in the Health Sciences*, John Wiley and Sons Pub, 1991.
- K. Vishwas Rao. *Bio-Statistics: A Manual of statistical methods for use in the Health, Nutrition and Anthropology*, Jaypee Brothers Medical Pub, 1996.
- Verma B.L., Shukla G.D. *Bio-Statistics perspective in Health care research and practice*, C.B.S. Pub, 1993.
- Krishnaiah, P.K. Rao, C.R. (ed), *Handbook of Statistics*, Elsevier Science Pub, 1988.

LAB COURSE-I

Course Code: MLT4105

Credit Units: 02

Course Objective: To help students learn reagent preparations and analysis.

Module-I: Preparation of Buffers and various biochemical reagents, Calculations of Normality and molarity of the reagents, pH estimations, Weighing of reagents, Preparation of distilled water, Autoclaving, cleaning and sterilization of reagents.

Module-II: Preparation of glucose standard curve, Estimation of glucose in biological fluids using various biochemical methods, Estimation of other carbohydrates,

Module-III: Thin layer chromatography (TLC) and paper chromatography (PC).

Module-IV: Rf Value calculation of various amino acids using TLC & PC, Biochemical assay for protein estimations (Branford and Lowry method),

Module-V: Estimation of Sodium, Potassium, Calcium, chloride, bicarbonate, phosphorus and magnesium in biological fluids.

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Experimental Biochemistry- R.W. Switzer & L.F. Garritty (W.H.Freeman & Co.)
- Modern Experimental Biochemistry - R. Boyer (Pearson Education)
- Practical Biochemistry - K. Wilson & J. Walker (Cambridge Univ. Press)
- Laboratory Manual in Biochemistry - J. Jayaraman (Narosa Publishing House)
- Practical Biochemistry - D.T. Plummer (TATA McGraw-Hill)
- Practical Biochemistry - R.C.Gupta & S. Bhargava
- Experimental Physiology and Biochemistry - P.V.Chadha
- Experimental Biochemistry – A Student Companion - B.S. Rao & V. Deshpande,
- I.K. Interational Pvt. Ltd. (N. Delhi, Mumbai, Bangalore) 2005.

INFORMATION TECHNOLOGY FOR LAB TECHNOLOGY

Course Code: MLT4106

Credit Units: 05

Course Objective: This course will expose students to developments in computer technology and understand the working of a computer system. It will introduce end-user computing and build skills in using IT and understanding various technologies like internet, telecom, DBMS concepts, e-commerce etc. The course will expose the students to the latest trends in computer.

Course Contents:

Module I: Modern Computer Systems

Evolution of Computer Systems, Input, output and storage technologies, Computer Assisted Control and Automation , (e.g. Delhi Metro , Digitally Controlled Car engines etc.) , Computer Controlled Biometric/RFID based Access Control , Contemporary hardware and software platforms(Open Source, Web Software etc.), Storage of Data Resources

Module II: Data Resource Management

Introduction to DBMS, Benefits of DBMS over traditional file system, Types of DBMS, Application of DBMS using MS-ACCESS / ORACLE as a tool for understanding of DBMS concepts. SQL Query handling , Forms, Concept of Data Warehouses and Data Marts, Introduction to Data Centers. Storage Technologies and Architecture (DAT, NAS, SAN etc.) . Live examples of storage strategies of companies like Google, Amazon Wal-Mart dealing with storage crisis

Module III: Telecommunications and Computer Networks

Networked Enterprise :- Components, Types of networks, Advantages of Network Environment, Business Uses of Internet, Intranet and Extranet, Web 2.0/3.0 , Distributed/Cloud/Grid Computing, GSM & CDMA, GPRS ,3G & 4G technologies, VOIP and IPTV.

Module IV: Electronic Commerce Systems

Introduction to e-Commerce and M-Commerce, Advantages and Disadvantages of each. Concept of B2B, B2C, C2C , with examples. Concept of Internet Banking and Online Shopping, Electronic Payment Systems. Project Discussion :- Development of e-commerce store (Web Site Development, Internet Publicity , Payment Gateway, Packaging & Delivery , After Sales Support) .

Module V: E-governance

Concept of e-governance , World Perspective , Indian Perspective , Technologies for e-governance , e-governance as an effective tool to manage the country's citizens and resources, Advantages and Disadvantage of E-governance, E-governance perspective in India. Discussion on MCA21 Project ,Bhoomi etc. .

Module VI: Security Management

The Information Security, System Vulnerability and Abuse, Security Threats (Malicious Software , Hacking etc.) and counter measure. Definition of Cyber Crime and Types. Antivirus, Firewalls, Anti-Spyware , Security Audit, Discussion on Overview of IT-ACT 2000.

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Norton P (2010), Introduction to Computers, Tata McGraw-Hill
- Potter T (2010), Introduction to Computers, John Wiley & Sons
- Morley D & Parker CS (2009), Understanding Computers – Today and Tomorrow, Thompson Press
- Jawadekar, WS (2009); Management Information System; Tata Mc Graw Hill
- Mclead R & Schell G (2009), Management Information Systems; Pearson Prentice Hall
- O'Brein, JA (2009); Introduction to Information Systems; Tata Mc Graw Hill

Syllabus - Second Semester

CLINICAL BIOCHEMISTRY-I

Course Code: MLT4201

Credit Units: 05

Course Objective: The objective of the course is to provide students with a knowledge of the various diseases arising due to disorders in the biochemical processes of cells, involving the hepatobiliary, myocardial and endocrinal systems and the classification and role of antibiotics.

Course Contents:

Module-I : Errors in metabolism:

Introduction, Metabolic disorders of carbohydrates, galactosemia, glycogen storage disease, deficiency of glucose-6-phosphate dehydrogenase, Hypoglycemia, Diabetes mellitus. Metabolic disorder of lipid: Tay-Sachs disease, Nieman Pick disease. Metabolic disorder of amino acid: phenylketonuria, alkaptonuria, Maple syrup urine disease. Metabolic disorder of nucleotides: gout, Lesch-Nyhan Syndrome.

Module-II: Function of liver in health and disease:

Jaundice, Hepatitis; liver function test. Evaluation of organ function test: Assessment and clinical manifestation of renal, hepatic, pancreatic, gastric & intestinal function, enzyme of pancreatic origin and biliary tract, test of myocardial infarction. Enzymes as clinical diagnostic tools. Endocrinal disturbance: protein hormones and hormones of hypothalamus, pituitary, thyroid and steroid hormones. Disorders of blood coagulation, different types of anaemia.

Module-III: Antibiotics:

Classification. Primary mode of action of penicillin, streptomycin, chloramphenicol, tetracycline, actinomycin D, mitomycin C, polyenes, mechanism of antibiotics resistance, multiple drug resistance.

Module-IV: Cancer:

Oncogenes, different types of malignancy, Hodgkin's and non-Hodgkin's lymphoma, leukemia, anti cancer drugs, chemotherapy

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Notes on clinical chemistry- Whitby-Smith-Beekett-Walker. Balackwell Sci, Inc.
- Principle of internal Medicine- Harison T. R. McGrow Hill, NY.
- Antibiotics" Vol. I & II -Gotleib & Shaw.
- Lehninger Principles of Biochemistry, Fourth Edition by David L. Nelson (Author), Michael M. Cox (Author)
- Biochemistry, Fourth Edition by Donald Voet, Judith G. Voet.
- Plant biochemistry, Second Edition by Goodwin, Mercer.

ENZYMES & METABOLISM-II

Course Code: MLT4202

Credit Units: 05

Course Objective: The main objective is to prepare students with the basic concepts of biochemistry. This course will provide students with knowledge of the fundamentals of biochemistry like metabolic pathways, carbohydrates, lipids, proteins and enzymes.

Course Contents:

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.
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, Tarui's Disease, c) Galactosuria.
5. Intrinsic Disorders of Red Cells, Haemoglobin and Porphyrins Sphingolipidases: a) Disorders of Red Cells: Hemolytic Anemia, Sickle Cell Anemia, Thalassemia, b) Disorders of Hemoglobin Haemoglobinuria, Other Haemoglobinopathies, c) Disorders of Porphyrins (1. Introduction 2. Porphyria Definition and types 3. Δ -ALA Dehydratase Deficient Porphyria 4. Acute Intermittent Porphyria
6. Types of Aminoaciduria Overflow Aminoaciduria, Renal Aminoaciduria, Gout & Genetic Defects in Urate Metabolism: a) Introduction b) Types of Gout Primary, Secondary, c) Treatment d) X-Linked Disorder, Errors in Lipid Metabolism

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Textbook of Medical Biochemistry By MN Chatterjea and Rana Shinde, Jaypee Brothers.
- Lehninger Principles of Biochemistry 5th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.
- Davidson's Principles and Practice of Medicine: A Textbook for Students and Doctors (Hardcover) 15th Ed By LSP Davidson, J MacLeod and CRW Edwards. Publisher: Churchill Livingstone.
- Medical Biochemistry (Paperback) By John W. Baynes and Marek Dominiczak. Publisher: Mosby.

ORGAN FUNCTION TEST

Course Code: MLT4203

Credit Units: 04

Course Objective: The main objective is to prepare students with the basic concepts of biochemical tests. This course will provide students with knowledge of the fundamentals of biochemistry tests that deals with specific organs such as liver function test and kidney function test.

Module-I

A) Cardiac Function:

1. Definitions of Acute coronary syndrome, angina, coronary artery disease ischemia, myocardial infarction, plaque, 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).

Module-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, steatorrhea, 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-Ellison syndrome, gastritis, pancreatitis, pancreatic tumor, lactose intolerance and Diabetes Mellitus, stomach, intestine, rectal, benign and malignant tumors, reflux oesophagitis, hiatus hernia, Barrett, oesophageal cancer.

Module-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.

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-Addison's disease, Conn's disease, Cushing's syndrome, congenital 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 17

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Textbook of Medical Biochemistry By MN Chatterjee and Rana Shinde, Jaypee Brothers.
- Lehninger Principles of Biochemistry 5th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.
- Davidson's Principles and Practice of Medicine: A Textbook for Students and Doctors (Hardcover) 15th Ed By LSP Davidson, J MacLeod and CRW Edwards. Publisher: Churchill Livingstone.
- Medical Biochemistry (Paperback) By John W. Baynes and Marek Dominiczak. Publisher: Mosby.
- Clinical Biochemistry: An Illustrated Colour Text (Paperback) 3rd Ed By Allan Gaw, Michael Murphy, Robert Cowan, Denis O'Reilly, Michael Stewart and James Shepherd. Publisher: Churchill Livingstone.

GENERAL PHYSIOLOGY AND NUTRITION

Course Code: MLT4204

Credit Units: 04

Course Objective:

- This will cover the fundamental concepts of cell biology and cell physiology at the post graduate level. The main objective is to prepare students with a clear concept of basic cellular and physiological processes to help them understand the upcoming topics clearly.
- To help the students to correctly identify the organelles and the structure and function of a typical mammalian cell and to explain the term homeostasis and how it applies to physiology of the body.
- To provide and explain the function of the cell in relation to homeostasis of the body.

Course Content:

Module-I: Composition and function of blood

- BLOOD: Components, haematocrit, ESR, blood volume measurements.
- RBC, WBC & platelet counts, names of developmental stages of RBC, functions and fate of RBC. Functions of WBC and platelets.
- Basis of blood coagulation.
- Blood groups – ABO & Rh

Module-II: Muscular System and Nutrition

- Structure in brief, mechanism of muscle contraction, isotonic and isometric contractions
- energy sources of muscle contractions, motor unit. Vitamins, water soluble and fat soluble and minerals micro and macro nutrients.

Module-III: Cardiovascular System

- Anatomy of heart, cardiac cycle, heart sounds
- Definitions of cardiac output, stroke volume,
- Principles of measurements of cardiac output
- ECG – methods of recording and ECG waves.
- Normal values of blood pressure, heart rate and their regulation in brief.

Module-IV: Digestive System

- Functional anatomy of G.I.T, functions of G.I secretions, principles of secretion and movements of GIT.
- Liver- Functions of Liver
- Salivary Glands-Structure and function
- Bile secretion- composition, function regulation of bile secretion

Module-V: Respiratory System

- Principles of respiration, respiratory muscles
- lung volumes and capacities
- Collection and composition of inspired alveolar and expired airs.
- Transport of oxygen and carbon dioxide.
- Brief account of respiratory regulation
- Definition of hypoxia, Cyanosis, asphyxia
- Methods of artificial respiration

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References

- Review of Medical Physiology by William. F. Ganong. McGraw-Hill Medical; 22 edition (2005)
- Human Physiology and Mechanisms of Disease by Guyton. Saunders Publications; 6th edition (1996)
- Human physiology by C.C. Chatterjee. 11th edition (1985)
- Human Nutrition and Dietetics by Davidson and Passmore. Churchill Livingstone; 8th edition (1986)
- Principles of Nutrition by M.S.Swaminathan
- Modern Nutrition and Health Diseases by M.E. Skilis and V.R. Young

RESEARCH METHODOLOGY

Course Code: MLT4205

Credit Units: 04

Course Objective: The course aims to promote progress in the crucial biochemical research aspects of the development of biological processes associated with everything from raw materials preparation to product recovery, relevant to industries as diverse as medical / healthcare. Its applications are used in the medical diagnostic, pharmaceutical, biotechnology, and medical treatment field.

Module-I

Importance and need for research. Ethics and scientific research. Formulation of hypothesis. Types and characteristic designing a research work. Scientific writing - Characteristics - Logical format for writing thesis and papers. Essential features of abstract, introduction, review of literature, materials and methods, and discussion. Effective illustration - tables and figures. Reference styles - Harvard and Vancouver systems.

Module-II: BIOSTATISTICS

Collection and classification of data - diagrammatic and graphic representation of data-measurement of central tendency - standard deviation - normal distribution - test of significance based on large samples - small samples - Student t test - correlation and regression - Chi square test for independence of attributes - ANOVA.

Module-III: BIOINFORMATICS Introduction to bioinformatics, scope of bioinformatics, role of computers in biology The internet. The World Wide Web. Useful search engines - Boolean searching, search engine algorithms. Finding scientific articles - PubMed. Running computer software, computer operating systems, soft downloading and installation

Module-IV: DATABASES Data base concepts - database, database system, database management systems - hierarchical, relational and network, database security. Biological databases - types, sequence and structure. Genome and organism specific databases. Data submission and data retrieval. Searching sequence databases - sequence similarity searches, amino acid substitution matrices. Database search - FASTA and BLAST, CLUSTAL

Module-V: BIOETHICS AND PATENTING Declaration of Bologna. Ethics in animal experimentation. CPCSEA guidelines - Animal care and technical personnel environment, animal husbandry, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia. Composition of (Human) institutional Ethical Committee (IEC) - General ethical issues. Specific principles for chemical evaluation of drugs, herbal remedies and human genetics research, Ethics in food and drug safety. Environmental release of microorganisms and genetically engineered organisms Ethical issues in human gene therapy and human cloning. Patenting - definition of patent. Product and process patents. Patenting multicellular organisms. Patenting and fundamental research

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References

- R.A. Day. How to write a scientific paper. Cambridge University Press.
- Cooray P.G. Guide to scientific and technical writing.
- Carter V. Good and Douglas E seats Methods of Research.
- Alley, Michael. The craft of scientific writing. Englewood Cliffs. N.N. Prentice 1987.
- M.C. Sharma, Desk Top Publishing on PC, BPB Publications, 1997.
- Lesk, A.M. Introduction to Bioinformatics Oxford 2002.
- Bergeron BP 2002 Bioinformatics Computing 1st Edition, Printice Hall
- Krane et al Fundamental concepts of bioinformatics Benjamin Cummings.
- Sundar Rao, Jesudian Richard - An Introduction to Biostatistics.
- S.P. Gupta - Fundamentals of statistics, Sultan Chand.
- Ethics and the use of alternatives to animals in research and education, ShiraneePereira, CPCSEA.
- CPCSEA guidelines for laboratory animal facility (CPCSEA) - No.13 Seaward road, Valmiki Nagar, Chennai-41.
- Ethical guidelines for biomedical research on human subjects. ICMR, New Delhi,2000.
- Dickson. Molecular and cell biology of human gene therapeutics. Series Chapman and Hall 1995.

LAB COURSE-II

Course Code: MLT4206

Credit Units: 02

Course Objective: The main objective of the course is to provide students with an insight into the basic instrumentation techniques used in medical laboratories and biochemical research.

Module-I

Handling of spectrophotometer, water baths, pipettes, Preparation and handling of reagents for enzyme assay, Enzyme assay and calculation of optimum pH, Temperature, time of incubation for alkaline phosphatase, AST and ALT, Polyacrylamide gel electrophoresis (PAGE) and SDS- PAGE),

Module-II

Qualitative and quantitative determination of RNA and DNA, Standard curve preparation of DNA & RNA, Isolation of DNA, Agarose gel electrophoresis, Polymerase chain reaction. Blood urea, serum creatinine, uric acid, total protein and Albumin.

Module-III

Collection of urine and blood, Types of preservative, physical examination; Volume, colour, odour, appearance, specific gravity and pH.

Module-IV

Reducing sugar-Benedict test, protein: -Heat and acetic acid test, and sulfosalicylic acid method, Ketone bodies-Roth's test, Bile pigment (Fouchet method), bile salt (Hay's test), Urobilinogen-Ehrlich aldehyde test and Bence Jones protein test, Renal clearance test-urea, creatinine, Test for mucin.

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References

- Biophysical techniques, Upadaya and Upadhyaya
- Medical Laboratory Techniques by Praful B. Godkar

Syllabus – Third Semester

CLINICAL IMMUNOLOGY

Course Code: MLT4301

Credit Units: 05

Course Objective: The objective of this course is to familiarize students about the structural features of the components of the immune system as well as their functions. An overview of clinical immunology will help students understand the utmost importance of this particular branch of science.

Course Contents:

Module-I: Introduction to Immune System:

Memory, specificity, diversity, innate and acquired immunity, self vs non-self discrimination. Structure and functions of primary and secondary lymphoid organs. Cells Involved in Immune Responses: Phagocytic cells and their killing mechanisms; T and B lymphocytes; Differentiation of stem cells and idiotypic variations. Nature of Antigen and Antibody: Antigen vs Immunogen, Haptens; Structure and functions of immunoglobulins; Isotypic, allotypic and idiotypic variations.

Module-II: Generation of Diversity in Immune System:

Clonal selection theory - concept of antigen specific receptor. Organization and expression of immunoglobulin genes: generation of antibody diversity. T cell receptor diversity. Humoral and Cell Mediated Immune Responses: Kinetics of primary and secondary immune response. Complement activation and its biological consequences. Antigen processing and presentation. Cytokines and costimulatory molecules: Role in immune responses. T and B cell interactions. Major Histocompatibility Complex (MHC) Genes and Products: Role of MHC antigens in immune responses. MHC antigens in transplantation.

Module-III: Development, Regulation and Evolution of the Immune System:

Measurement of Antigen-Antibody Interaction. Production of polyclonal and monoclonal antibodies: Principles, techniques and applications. Agglutination and precipitation techniques. Radio immunoassay, ELISA, immunofluorescence assays: Fluorescence activated cell sorter (FACS) technique. Tolerance vs Activation of Immune System: Immunotolerance, Immunosuppression, Hypersensitivity (Types I, II, III and IV).

Module-IV: Immune Responses in Diseases:

Immune responses to infectious diseases: viral, bacterial and protozoal. Cancer and immune system. Immunodeficiency disorders. Autoimmunity. Immunization: Active immunization (immunoprophylaxis), Passive immunization (Immunotherapy) and role of vaccines in the prevention of diseases.

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References

- Fundamental Immunology (Hardcover) By William E. Paul. Publisher: Lippincott Williams and Wilkins.
- Immunology: International Edition (Paperback) By Janis Kuby, Thomas J. Kindt, Barbara A. Osborne and Richard A. Goldsby. WH Freeman and Co. Ltd.

- Immunology (Paperback) By Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne and Janis Kuby. WH Freeman and Co. Ltd.
- Immunology (Paperback) By Ivan M. Roitt, Jonathan Brostoff and David Male. Publisher: Mosby.
- Introduction to Medical Immunology By Gabriel Virella, Marcel Dekker Inc.
- Roitt's Essential Immunology By Ivan M. Roitt and Peter J. Delves, Blackwell Publishing.
- Understanding Immunology (Cell and Molecular Biology in Action) (Paperback) By Peter Wood. Publisher: Prentice hall.
- Basic Immunology: The Functions of the Immune System (Paperback) By Abul K. Abbas and Andrew H. Lichtman. Publisher: Saunders.
- A Handbook of Practical Immunology, By G. P. Talwar, Pub: Vikas Publishing House.
- Fundamental Immunology (Hardcover) By Robert M. Coleman and M.F. Lombard. Publisher: Brown (William C.) Co , U.S.
- Atlas of Immunology (Hardcover) By J.M. Cruse (Author), Robert E. Lewis. CRC Press Inc. 12. Immunology By Edwards S Golub. Sinauer Associate, Sunderland. - See more at: <http://www.sgtuniversity.ac.in/faculty-of-allied-health-sciences/pages/paper-8-clinical-immunology#sthash.ToVJNacj.dpuf>

CLINICAL BIOCHEMISTRY-II

Course Code: MLT4302

Credit Units: 05

Course Objective: The objective of the course is to provide students with an insight in advanced medical biochemistry techniques. The students will be provided with an in-depth knowledge about disorders of clinical biochemistry, and endocrinology.

Module-I: Disorders of carbohydrate metabolism:

Diabetes mellitus, glycohemoglobins, hypo-glycemias, galactosemia and ketone bodies. Various types of glucose tolerance tests. Glycogen storage diseases. Physiology of lipids/lipoproteins. Lipidosis. Clinical inter-relationships of lipids (sphingolipidosis and multiple sclerosis), lipoproteins and apolipoproteins. Diagnostic tests for HDL-cholesterol, LDL-cholesterol and triglyceride disorders. Inborn errors of metabolism: a) Disorders of amino acid metabolism- Phenylalanemia, homocystinuria, tyrosinemia, MSUD, phenylketonuria, alkaptonuria, albinism and aminoacidurias. b) Disorders of nucleic acid metabolism- Disorders in purine/ pyrimidine metabolism.

Module-II: Electrolytes, blood gases, respiration and acid-base balance. Disorders of acid-base balance and their respiratory and renal mechanisms. Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Clinical importance of bilirubin. Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase. Enzyme tests in determination of myocardial infarction. Enzymes of pancreatic origin and biliary tract.

Module-III: Hormonal disturbances: Protein hormones (anterior pituitary hormones, posterior pituitary hormones), steroid hormones, adrenocorticosteroids, and reproductive endocrinology. Disturbances in thyroid function. Disorders of mineral metabolism: Hypercalcaemia, hypocalcaemia, normocalcaemia, hyperphosphataemia and hypophosphataemia.

Module-IV: Biochemical aspects of hematology: Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemias thrombosis and anemias. Laboratory tests to measure coagulation and thrombolysis. Detoxification in the body: enzymes of detoxification, polymorphism in drug metabolizing enzymes. Mechanism of drug action and channels of its excretion, Disorders of vitamins and trace elements.

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Textbook of Medical Biochemistry By MN Chatterjea and Rana Shinde, Jaypee Brothers.
- Lehninger Principles of Biochemistry 5th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.
- Davidson's Principles and Practice of Medicine: A Textbook for Students and Doctors (Hardcover) 15th Ed By LSP Davidson, J MacLeod and CRW Edwards. Publisher: Churchill Livingstone.
- Medical Biochemistry (Paperback) By John W. Baynes and Marek Dominiczak. Publisher: Mosby.

- Clinical Biochemistry: An Illustrated Colour Text (Paperback) 3rd Ed By Allan Gaw, Michael Murphy, Robert Cowan, Denis O'Reilly, Michael Stewart and James Shepherd. Publisher: Churchill Livingstone.
- Review of Medical Physiology (Lange Basic Science) (Paperback) By William F. Ganong. Publisher: McGraw-Hill Medical
- Harper's Biochemistry (Lange Medical Books) (Paperback) By Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell. Publisher: Appelton and Lange.
- Clinical Biochemistry By Richard Luxton. Scion Publishing Ltd.

MOLECULAR BIOLOGY

Course Code: MLT4303

Credit Units: 05

Course Objective: To provide students with an overview of the principles of animal genetics including Mendelian and modern concepts of heredity. Developments in molecular genetics will be addressed through the biochemistry and physiology of the gene and the nature of gene action in prokaryotic and eukaryotic cells. This course will also provide students with knowledge of the diseases arising out of genetic disorders

Module-I: Secondary and tertiary Structure of DNA and RNA, Locked nucleic acids, role of locked nucleic acid in therapeutics, siRNA, Micro RNA, Role of micro RNA in gene regulation, Isolation of nucleic acids, Qualitative and quantitative estimation of nucleic acids, Recombinant DNA Technology, Applications of recombinant DNA, Polymerase chain reaction, application of PCR in Diagnostics of pathogens identification, Site directed mutagenesis, RAPD, RFLP & DNA finger printing, DNA Foot Printing, Mobility shift assay, Promoter & Reporter assay, Yeast Two hybrid systems, antisense-RNA technology, chromosomal walking, gene therapy and recombinant vaccines.

Module-II: Nucleic Acid analysis, Extraction, purification and analysis of mRNA from eukaryotic cells, methods for synthesis of double strand cDNA, Expression profiling, Transcriptome analysis, RT PCR and Real Time PCR, Rapid DNA sequencing techniques like Sanger's dideoxynucleotide, partial ribonucleotide substitution, Maxam and Gilbert's method, pyrosequencing and single molecule sequencing, Genome, Genome sequencing, DNA Sequence Characterization (Open reading frames, promoters, coding frames)

Module-III: Molecular diagnostics, Viral load monitoring, window period, Role of molecular diagnostics in present diagnostic area, Benefits of molecular diagnostics over serological diagnostics tests, Ethical issues related to molecular diagnostics, role of Molecular diagnostics in Blood banking, Basic techniques used in molecular diagnostics, future of molecular diagnostics,

Module-IV: Molecular diagnostic of various viral diseases: HIV type -1, HIV type -II, HPV, Various hepatitis strains, Influenza (H1N1) , sample preparation, various steps required for viral infection analysis and Viral load monitoring, Molecular diagnostics of bacterial infections; Mycobacterium tuberculosis, Shwenella typhus, Pathogenic E Coli, sample preparation and pathogen detection. Prenatal diagnostics of various genetic disorders

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Basic Biotechnology (Paperback) By Colin Ratledge and Bjorn Kristiansen. Cambridge University Press.
- Introduction to Biotechnology (Paperback) By William J. Thieman and Michael A. Palladino. Benjamin Cummings; US Ed edition.
- Recombinant DNA Principles and Methodologies By James Joseph Greene, CRC Press.
- Molecular Biotechnology: Principles and Applications of Recombinant DNA (Paper-back) By Bernard J Glick and Jack J Pasternak. Publisher: American Society for Microbiology.

- Laboratory Techniques in Biochemistry and Molecular Biology; DNA sequencing (Vol 10). By J Hindley. Elsevier Biomedical.
- Methods of DNA and RNA sequencing. By Sherman M. Weissman. Pub: Praeger
- RNA isolation and analysis By P. Jones, J Qiu and D. Rickwood. Bios Scientific Publishers. 9.
- Biotechnology: Expanding Horizons By B. D. Singh, Kalyani Publishers.
- Textbook of Biotechnology By PK Gupta, Rastogi Publications.
- Biotechnology By U. Satyanarayana.
- Molecular diagnostics: for the clinical laboratorian By William B. Coleman and Gregory J. Tsongalis. Publisher: Humana Press
- Fundamentals of molecular diagnostics By David E. Bruns, Edward R. Ashwood and Carl A. Burtis

LAB COURSE-III

Course Code: MLT4304

Credit Units: 02

Course Objective: To provide students hands-on training in the major instrumentation techniques common to biochemistry.

- Calibration of laboratory pipette , Standarization of Distilled water , Standardization of an endpoint reaction method
- Determination of Hormones by Using Radio Immuno assays (RIA)
- To perform Direct and Indirect ELISA
- Thyroid hormones, (T3, T4, TSH), FSH, LH and Prolectin.
- Determination of Serum Amylase, Determination of Serum Lipase
- Variation of Serum Alkaline Phosphatase activity with Enzyme concentration
- Effect of Temperature on Activity of α - amylase
- Determination of Serum Lactate Dehydrogenase (LDH), Bilirubin.
- Estimation of Serum Acid Phosphatase
- Estimation of Glutamate Dehydrogenase, Lipid Composition of Wheat Grain
- DNA/Protein Gel Electrophoresis.
- PCR applications in assigning genotypes to RFLP / VNTR sequences; screening samples for identified mutations.
- Blood Pressure, Pulse rate, Clotting time, Bleeding time, Haemoglobin estimation, Erythrocyte Sedimentation Rate, Packed cell volume. Prothrombin time, Differential count,
- GGT,CPKMB, Troponin.
- Tumor markers; CEA, CA 15.3, AFP.
- Therapeutic drug monitoring:
- Cyclosporin
- Digoxin
- Tacrilomus

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References:

- Textbook of Medical Biochemistry By MN Chatterjea and Rana Shinde, Jaypee Brothers.
- Lehninger Principles of Biochemistry 5th Ed By David L. Nelson and Michael M. Cox, WH Freeman and Company.
- Davidson's Principles and Practice of Medicine: A Textbook for Students and Doctors (Hardcover) 15th Ed By LSP Davidson, J MacLeod and CRW Edwards. Publisher: Churchill Livingstone.
- Medical Biochemistry (Paperback) By John W. Baynes and Marek Dominiczak. Publisher: Mosby.

VITAMINS AND HORMONES

Course Code: MLT4305

Credit Units: 05

Course Objective: The objective of the course is to provide students with a detailed in-sight into the transport and signaling pathways in the cells as well as to make them understand the processes of developmental biology, vitamins and their importance.

- Vitamins: Classification of vitamins.
- Chemistry, properties, biological importance and deficiency manifestations of fat soluble vitamins.
- Chemistry, properties, biological importance, deficiency manifestations and coenzyme functions of water soluble vitamins.
- Hormones: Classification of hormones, mechanism of hormone action, regulation of hormone secretion.
- Chemistry, metabolism, biological functions and disorders of-
 - Hypothalamus & Pituitary hormones
 - Thyroid hormones
 - Parathyroid hormones
 - Pancreatic hormones
 - Adrenal hormones
 - Gonadal hormones
 - Ovarian hormones

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References

- Methods in Molecular Biology: Amino Acid Analysis Protocols By Catherine Cooper, Nicolle Packer and Keith Williams. Publisher: Humana Press
- Medical Biochemistry [Paperback] By John Van Pilsum. Publisher: University of Minnesota Press.
- Clinical Biochemistry: Metabolic and Clinical Aspects [Paperback] By William J. Marshall and Stephen K. Bangert. Publisher: Churchill Livingstone.
- Clinical Chemistry: Techniques, Principles, Correlations (Bishop, Clinical Chemistry) [Hardcover] By Michael L Bishop, Edward P Fody and Larry E Schoeff. Publisher: Lippincott Williams and Wilkins

LABORATORY MANAGEMENT

Course Code: MLT4306

Credit Units: 05

Course Objective: The main objective of the course is to provide students with an insight into laboratory maintenance and management.

Module-I: Laboratory: Role of laboratory in human health and diseases; Human diseases and methods of diagnosis; Laboratory at different level (National/State/District); Duties and responsibilities of laboratory personnel; Laboratory services are a backbone of health care delivery system; Types of laboratory, Laboratory management; prevention of transmission of pathogens; Role of technician.

Module-II: Laboratory Glassware, Chemicals and Equipment: General Principles of Care, storage and Cleaning of general and volumetric Glassware ; Making Simple Glassware in the Laboratory; Care of equipment and apparatus; Laboratory chemicals – Proper use, care, storage and labelling; Different grade of chemicals, preparation of solution and reagent; Buffer: preparation of buffer; Specimen handling : Appropriate container; Method of collection; Method of transportation; Method of preservation and disposal of laboratory waste.

Module-III: Laboratory Instruments: Basic knowledge about the working principles, uses and care of laboratory Instruments : Balance, pH Meter, Centrifuge, Cyclo -mixer, Magnetic stirrers, Spectrophotometer, Microscopes (Optical and Electron), Distillation plant, Flame photometer, Laminar flow, Autoclave.

Module-IV: Laboratory automation: Continuous and Discrete analyzers; Green Laboratory: Disposal of laboratory waste; Disinfection of laboratory; Sterilization of some laboratory apparatus

Module-V: Lab Management: Ethics of the pathological clinics; Personality development and patient relationship; reports writing; Accountancy in clinical pathology Hospital Management; Operation ethics; Social ethics; Proper handling of instruments.

Module-VI: Laboratory Planning: General principles; Laboratory goals; Operational data; Market potential; Selection of area; Competition; Laboratory trends, Space requirements, Designing of laboratory sections; Staff and their duties, Work schedule and workload assessment.

Module-VII: Laboratory Safety: General principles of safety programmes; First aid and safety measures for Mechanical, Electrical, Chemical, Radioactive and Biological hazards; Universal safety precautions.

Examination Scheme:

Components	CT	HA	S/V/Q	ATTD	EE
Weightage(%)	15	5	5	5	70

References

- Biophysical techniques, Upadaya and Upadabya
- Medical Laboratory Techniques by Praful B.Godkar

SUMMER INTERNSHIP EVALUATION

Course Code: MLT4335

Credit Units: 09

Objectives:

The basic objective of a summer internship is to provide first hand practical exposure of the corporate functioning and to acquaint students with the culture of corporate. The summer training will also provide an opportunity to the students to apply their theoretical understanding while working on the concerned project in the industry. Thus, this summer internship programme is an attempt to bridge the gap between theory and practice. This will also enhance the students' intellectual ability and attributes related to data handling, decision making, report writing, oral presentation and imbibing an interdisciplinary approach.

General Guidelines:

Every student will be required to undergo a practical training in a corporate organization approved by the Institute for eight weeks, normally in the Summer Vacation, after the end of the fourth semester examinations. The candidates shall be required to undergo training in the various areas of the organization concerned. The organization may assign a specific project to the candidate, which will be completed by him/her during the period of training. The work done by the candidate during the training period shall be submitted in the form of a report as per the guidelines provided by the Department.

Chapter Scheme for the SIP Report:

Chapter I: Introduction	- 20 marks
Chapter II: Conceptual Framework/National/International Scenario	- 5 marks
Chapter III: Presentation, Analysis and Findings	- 35 marks
Chapter IV: Conclusion and Recommendations	- 15 marks

The report has to be written in font Times New Roman, 12 points, 1.5 line spacing on both sides of the paper, Spiral Bound. The report should comprise of a maximum of 70 pages and has to be submitted in two copies.

THE COMPONENTS OF A SIP REPORT

The outcome of Summer Internship is the Project Report. A project report should have the following components:

- 1) Cover Page: This should contain the title of the project proposal, to whom it is submitted, for which degree, the name of the author, name of the supervisor, year of submission of the project work, name of the University.
- 2) Acknowledgement: Various organizations and individuals who might have provided assistance /co-operation during the process of carrying out the study.
- 3) Table of Content: Page-wise listing of the main contents in the report, i.e., different Chapters and its main Sections along with their page numbers.
- 4) Body of the Report: The body of the report should have these four logical divisions
 - a. *Introduction*: This will cover the background, rationale/ need / justification, brief review of literature, objectives, methodology (the area of the study, sample, type of study, tools for data collection, and method of analysis), Limitations of the Study, and Chapter Planning.
 - b. *Conceptual Framework / National and International Scenario*: (relating to the topic of the Project).
 - c. *Presentation of Data, Analysis and Findings*: (using the tools and techniques mentioned in the methodology).
 - d. *Conclusion and Recommendations*: In this section, the concluding observations based on the main findings and suggestions are to be provided.

5) Bibliography or References: This section will include the list of books and articles which have been used in the project work, and in writing a project report.

6) Annexure: Questionnaires (if any), relevant reports, etc.

Evaluation Scheme:

SIP Report	Power Point Presentation & Viva
75 marks	25 marks

Syllabus – Fourth Semester

DISSERTATION

Course Code: MLT4437

Credit Units: 30

GUIDELINES FOR PROJECT FILE AND PROJECT REPORT

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critically analyzed by the faculty guide and corrected by the student at each stage.

PROJECT FILE

The Project File may be a very useful tool for undertaking an assignment along-with a normal semester, an exploratory study, sponsored projects, a project undertaken during summer period or any other period as per curriculae where the researcher is working with a company/organization. The project/ assignment may also be a part of the bigger research agenda being pursued by a faculty/ institution/ department. The Project File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation. This file may be considered in continuous assessment.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated objectives;
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen and may be useful to document for future reference.

PROJECT REPORT

The Project Report is the final research report that the student prepares on the project assigned to him. In case of sponsored project the lay out of the project could be as prescribed by the sponsoring organization. However, in other cases the following components should be included in the project report:

- **Title or Cover Page**
The title page should contain Project Title; Student's Name; Programme; Year and Semester and Name of the Faculty Guide.
- **Acknowledgement(s)**
Acknowledgment to any advisory or financial assistance received in the course of work may be given. It is incomplete without student's signature.
- **Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project. It should not exceed more than 1000 words.

➤ **Table of Contents**

Titles and subtitles are to correspond exactly with those in the text.

➤ **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

➤ **Materials and Methods**

This section should aim at experimental designs, materials used (wherever applicable). Methodology should be mentioned in details including modifications undertaken, if any. It includes organization site(s), sample, instruments used with its validation, procedures followed and precautions.

➤ **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing this section, emphasis should be laid on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note that in writing the various sections, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary, do not write in "point" form.

While presenting the results, write at length about the various statistical tools used in the data interpretation. The result interpretation should be simple but full of data and statistical analysis. This data interpretation should be in congruence with the written objectives and the inferences should be drawn on data and not on impression. Avoid writing straight forward conclusion rather, it should lead to generalization of data on the chosen sample.

Results and its discussion should be supporting/contradicting with the previous research work in the given area. Usually one should not use more than two researches in either case of supporting or contradicting the present case of research.

➤ **Conclusion(s) & Recommendations**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

Check that your work answers the following questions:

- Did the research project meet its aims (check back to introduction for stated aims)?
- What are the main findings of the research?
- Are there any recommendations?
- Do you have any conclusion on the research process itself?

➤ **Implications for Future Research**

This should bring out further prospects for the study either thrown open by the present work or with the purpose of making it more comprehensive.

➤ **Appendices**

The Appendices contain material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➤ **References**

References should include papers, books etc. referred to in the body of the report. These should be written in the alphabetical order of the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

Examples:

For research article:

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117.

For book:

Kowalski,M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), **7**: 63-67

The Layout Guidelines for the Project File & Project Report:

- A4 size Paper
- Font: Arial (10 points) or Times New Roman (12 points)
- Line spacing: 1.5
- Top and bottom margins: 1 inch/ 2.5 cm; left and right margins: 1.25 inches/ 3 cm

ASSESSMENT OF THE PROJECT FILE AND THE PROJECT REPORT

Essentially, the assessment will be based on the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project. Project execution is concerned with assessing how much work has been put in.

The Project should fulfill the following **assessment objectives**:

- Range of Research Methods used to obtain information
- Execution of Research
- Data Analysis (Analyze Quantitative/ Qualitative information)
- Quality Control
- Conclusions

Assessment Scheme:

Continuous Evaluation:

40% (Based on punctuality, regularity of work, adherence to plan and methodology, refinements/mid-course corrections etc. as reflected in the Project File.)

Final Evaluation:

60% (Based on the Documentation in the file, Final report layout, analysis and results, achievement of objectives, presentation/ viva)

It is recommended that the Final evaluation should be carried out by a panel of evaluators.