SYLLABUS FOR

BACHELOR OF VOCATION (B.VOC) IN

MEDICAL LAB & MOLECULAR DIAGNOSTIC TECHNOLOGY

Centre for Vocational Studies
Islamic University of Science and Technology

Total Credits and Marks Distribution for four Semesters

Course Type	Course Title	Total Credits	Total Credits	Marks per Paper
	English Speaking Skills	4	4	100
General Education Component	Zoology	3	4	100
	Zoology (Practical)	1		50
	Biochemistry	3	4	100
	Biochemistry (Practical)	1		50
	Clinical Biochemistry-I	4	4	100
	SBC Practical-I	4	4	100
Skill Based Component	Clinical Biochemistry-II	4	4	100
	SBC Practical	4	4	100
	Field Work/ Hospital Visit	2	2	50

SEMESTER-I

General Education Component: English

Course Title: English Speaking Skills

Course Code: BML-MDTT101

Credits: 4

M.M:100

Unit 1: Communication

Recognizing and understanding communication skills: what is communication? Passive communication, aggressive communication, Passive-aggressive communication, assertive communication, verbal & non-verbal communication, barriers & gateways to communication.

Unit 2: Listening Skills

Phases of listening, types of listening , difference between hearing and listening, active listening , skills of effective listening, barriers to listening

Unit 3: Speaking Skills

Interactive nature of communication, importance of context , formal and informal , set expressions in different situations , greeting , introducing , making requests , asking for / giving permissions , agreeing / disagreeing , seeking and giving advice , conversational manners.

Unit 4: Phonetics

Introduction to phonetics. Consonants, Vowel, Syllable and Syllable division

Suggested Readings:

1. English for Effective Communication. Oxford University Press, 2013.
2. Marks, Jonathan. *English Pronunciation in Use*. New Delhi: CUP, 2007.
3. Lynch, Tony. *Study Listening*. New Delhi: CUP, 2008.
4. Kenneth, Anderson, Tony Lynch, Joan MacLean. *Study Speaking*. New Delhi: CUP, 2008.
5. Jones, Daniel. *English Pronouncing Dictionary* 17th Edition. New Delhi: CUP, 2009

General Education Component: Zoology

Course Title: Animal Diversity

Course Code: BML-MDTP102

Credits: 3

M.M:100

Unit 1: Invertebrata-I

General characters and classification up to classes of Phylum Protozoa; Locomotion

General characters and classification up to classes of Phylum Porifera

General characters and classification up to classes of Phylum Cnidaria; Coral Reefs

General characters and classification up to classes of Phylum Platyhelminthes; Life history of Taenia solium

General characters and classification up to classes of Phylum Nemathelminthes; Life history of Ascaris lumbricoides

Unit 2: Invertebrata-II

General characters and classification up to classes of Phylum Annelida

General characters and classification up to classes of Phylum Arthropoda; Metamorphosis in Insects

General characters and classification up to classes of Phylum Mollusca; Pearl Formation

General characters and classification up to classes of Phylum Echinodermata

Unit 3: Vertebrata-I

General features of Protochordates

General features of Agnatha and classification of cyclostomes up to classes

General features and Classification up to orders of fishes; Migration in Fishes

General features and Classification up to orders of Amphibia; Parental care

Unit 4: Vertebrata-II

General features and Classification up to orders of Reptilia; Poisonous and nonpoisonous snakes

General features and Classification up to orders of Aves; Flight adaptations in birds

Classification of Mammalia up to orders; Origin of mammals

General Education Component: Zoology

Course Title: Zoology Practicals

Course Code: BML-MDTP 02

Credits: 1

M.M:50

1. Study of the museum specimens belonging to various animal phyla.
2. Study of permanent slides of various animal groups available in the museum.
3. Dissection of animals to expose different systems: (Cockroach/Pheritima/Prawn/Pila-any one).
4. Key for Identification of poisonous and non-poisonous snakes
5. Study of various aspects of animal life through Charts, Models, Audio-Visual Aids, etc
6. Field visit to study local Insect/bird fauna

Suggested Readings:

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis,* III Edition, Blackwell Science
2. Dhami, P.S., and Dhami, J.K. (1979). *Invertebrate Zoology*. S. Chand and Co. New Delhi.
3. Hickman, C.P. Jr., F.M. Hickman and L.S, Roberts, *Integrated Principles of Zoology,* M College Publication. St. Louis.
4. Jordan, E.L. and P.S. Verma, *Invertebrate Zoology*, S. Chand & Co. Ltd., New Delhi
5. Jordan, E.L. and P.S. Verma, *Chordate Zoology*, S. Chand & Co. Ltd., New Delhi
6. Kotpal R. L, 2002.*Modern Textbook of Zoology-Vertebrates*, Rastogi Publications - Meerut; 2016 edition (2014).
7. Kotpal R. L, Agarval S. K. and R. P. Khetharpal 2002.*Modern Textbook of Zoology*.
8. Lal, S. S. *Practical Zoology*
9. Parker and Haswell, *Text Book of Zoology*, Vol. 1 & 2, A.Z. T.B.S. Publishers Distributors, News Delhi-110051.
10. Pough H. *Vertebrate life*, VIII Edition, Pearson International
11. Salim Ali, *The Book of Indian Birds* (Editor J. C. Daniel), Oxford University Press; 12th Rev edition (March 13, 1997)
12. Verma PS and Srivastava P.C, 1994. *Advanced Practical Zoology*, S. Chand & Co. Ltd., New Delhi
13. Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.

General Education Component: Biochemistry

Course Title: Biomolecules

Course Code: BML-MDTT103

Credits: 03

M.M:100

Unit 1: Carbohydrates

Definition and classification of carbohydrates; Monosaccharides –classification, structure of aldoses and ketoses, ring structure of sugars, conformations of sugars; mutarotation, anomers, epimers and enantiomers, biologically important sugar derivatives, reduction and oxidation of sugars and other important reactions. Oligosaccharides; disaccharides, classification, structure and function, reducing and non-reducing disaccharides. Polysaccharides – homo- and heteropolysaccharides, structural and storage polysaccharides.

Unit 2: Lipids

Lipids: Classification and function of lipids, Classification of fatty acids, Saturated & Unsaturated fatty acids, nomenclature,isomerism,essential fatty acids, their biological functions, Storage lipids - triacylglycerol and waxes. Structural lipids; phospholipids-glycerophospholipids, sphingolipids, glycolipids- glyceroglycolipids, glycoshingolipids and glycophosphatidylinositol and sterols. Lipoproteins—Composition, classification and biological functions and the medical conditions related to lipoproteins.

Unit 3: Amino acids and proteins

Amino acids: Classification, Structure stereoisomerism and naming- RS system of designating optical isomers. Classification based on the nature of "R" groups. Amino acids present in proteins and non-protein amino acids.Specialised role of amino acids. Physical and chemical properties of amino acids-titration curve. Proteins;Peptide- naming and formation of peptide bond.

Unit 4: Nucleic Acids

Basics about genetic material. Structure, naming and Properties of purine and pyrimidine bases, pentose sugar Nucleosides and nucleotides-composition and function. Biologically important nucleotides. Physical and chemical properties of nucleic acids. Denaturation of DNA.

General Education Component: Biochemistry

Course Title: Biochemistry Practicals

Course Code: BML-MDTP103

Credits: 1

M.M:50

1. Safety measures in laboratories
2. Preparation of normal and molar solutions.
3. Qualitative tests for :

   Carbohydrates.

   Amino acids

   Lipids
4. Estimation of Amino acids by ninhydrin method Estimation of Carbohydrate by anthrone method

Suggested readings:

1. Lehninger: *Principles of Biochemistry (2013)* 6thed. 6Nelson 6Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.
2. *Textbook of Biochemistry with Clinical Correlations* (2011) 7th ed., Devlin, T.M., John
3. Wiley & Sons, Inc. (New York), ISBN:978-0-470-28173-4.
4. *Biochemistry* by Mary K.Campbell & Shawn O.Farrell, 5th Edition, Cenage Learning, 2005.

Core Course: Skill Development Component

Course Title: Fundamentals of Anatomy and Physiology

Course Code: BML-MDT104

Credits: 4

M.M:100

Unit 1: Body fluids

A) Body as a whole and its constituents The cells, tissues and organization of the body Tissues-epithelial, connective, muscle, nervous Cell regeneration, membranes, glands, Organization of the body Bones of the skeleton, Axial skeleton, Appendicular skeleton, Cavities of the body,Cranial, thoracic, abdominal, pelvic.

B) Blood Composition of blood Erythrocytes-Structure and functions Leucocytes-Types, Structure and functions Platelets- Structure and functions, Hemostasis Haemoglobin, Blood groups, Coagulation Factors, Anaemia & Immunoglobulins

C) Cardiovascular System Heart-Functional anatomy; Properties of heart muscle; Heart as a pump; Cardiac output and venous return; Vascular system; Systemic arterial blood pressure

Unit 2: Respiratory System, Digestive System and Excretory system.

A) Respiratory System Basic features and functional anatomy, Ventilation, Functions, Lungs Volumes and capacities

B) Digestive System Elementary functional anatomy; Salivary glands; Stomach and its secretion; Liver, pancreas and their role in digestion, Bile, Small and large intestine; Movement of alimentary tract; Gastrointestinal hormones and their functions

C) Excretory system Functional anatomy of kidney; Mechanism of formation of urine; Water, electrolyte and acid-base balance; Skin and its functions

Unit 3: Nervous and Endocrine system

A) Nervous System Elementary neuroanatomy; Properties of neurons; Nerve impulse, Types of nerves; Synapse and chemical transmitters; Central nervous system-Neuroglia, membranes of; brain and spinal cord, Ventricles of brain and cerebrospinal fluid. Brain- cerebrum, cerebellum Spinal cord- structure Peripheral nervous system-Spinal nerves and cranial nerves Autonomic nervous system-Sympathetic NS, Parasympathetic NS. Functions of ANS Central visceral regulations

B) Special senses and Endocrinology Eye and Ear (in brief)- a) List of Endocrine Glands; Hormones : Their secretion and functions (in brief)

Unit 4: Reproductive and Muscular system

A) Reproductive System Female reproductive system; Anatomy- External and internal parts; Puberty, menstrual cycle, Fertilization. Male reproductive system- Elementary anatomy; Functions of male reproductive system

B) Muscular System Muscles characteristics Properties of skeletal muscles Properties of smooth muscles

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDTP104

Credits: 04

M.M:100

A) Anatomy

1. Identification and description of all anatomical structures.
2. The learning of Anatomy by demonstration only through dissected parts, slides, models, charts etc.
3. Demonstration of dissected parts (upper extremity, lower extremity, thoracic and abdominal viscera, face and brain).
4. Demonstration of skeleton - articulated and disarticulated.

B) Physiology

1. Measurement of pulse, blood pressure.
2. Elicitation of Reflexes and jerks.
3. Identification of blood cells by study of peripheral blood smear.

Suggested Readings:

1. Anatomy and physiology in health and illness - Wilson Katheen, Anne Waugh ; Churchill living stone
2. Concise medical physiology- Sujit Chaudhari; Central
3. Textbook of medical physiology- Arthur Guyton and Hall; W.B. Saunders
4. Understanding medical physiology R. L. Bijlani, Jaypee

Core Course: Skill Development Component

Course Title: General Pathology & General Microbiology

Course Code: BML-MDTT105

Credits: 4

M.M:100

Unit1: General Pathology (part I)

1. Cell Injury and Cellular Adaptations. a) Normal Cell b) Cell Injury- types of cell injury, etiology of cell injury, morphology of cell injury, cellular swelling. c) Cell death: types- autolysis, necrosis, apoptosis & gangrene. d) Cellular adaptations-atrophy, hypertrophy, hyperplasia & dysplasia. 2. Inflammation a) Acute inflammation - vascular event, cellular event, inflammatory cells. b) Chronic Inflammation - general features, granulomatous inflammation, tuberculoma.

Unit 2: General Pathology (Part II)

1. Haemodynamic Disorders: Oedema, hyperemia, congestion, haemorrage, circulatory disturbances, thrombosis, ischaemia & infarction. 2. Neoplasia: Definition, how does it differ from hyperplasia, difference between benign tumor and malignant tumor. 3. Healing Definition, different phases of healing, factors influencing wound healing.

Unit 3: General Microbiology (Part I)

1. General characters and classification of Bacteria. 2. Characteristics of Bacteria Morphology - Shape, Capsule, Flagella, Inclusion, Granule, Spore. 3. Growth and Maintenance of Microbes Bacterial division, Batch Culture, Continuous culture, bacterial growth- total count, viable count, bacterial nutrition, oxygen requirement, CO2 requirement, temperature, pH, light. 4. Sterilization and Disinfection. Physical agents- Sunlight, Temperature less than 1000C, Temperature at 1000C, steam at atmospheric pressure and steam under pressure, irradiation, filtration. Chemical Agents- Alcohol, aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.

Unit 4: General Microbiology (Part II)

1. Culture Media Definition, uses, basic requirements, classification, Agar, Peptone, Transport Media, Sugar Media, Anaerobic Media, Containers of Media, Forms of Media 2. Staining Methods Simple, Grams staining, Ziehl-Neelsen staining or AFB staining, Negative Impregnation 3. Collection and Transportation of Specimen General Principles, Containers, Rejection, Samples- Urine, Faeces, Sputum, Pus, Body fluids, Swab, Blood. 4. Disposal of Laboratory/Hospital Waste Non-infectious waste, infected sharp waste disposal, infected non-sharp waste disposal.

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDTP105

Credits: 04

M.M: 100

A) GENERAL PATHOLOGY

1. Components & setting of the Compound microscope.
2. Focusing of object.
3. Use of low & high power objectives of microscope.
4. Use of oil immersion lens.
5. Care and Maintenance of the microscope.
6. Different types microscopy Dark field microscopy Fluorescence Microscopy
7. Electronic Microscopy in brief.

B) GENERAL MICROBIOLOGY

1. Preparation of swabs/sterile tubes & bottles.
2. Preparation of smear.
3. Staining.: Gram & Ziehl -Neelsen staining.
4. Preparation of Culture media.
5. Identification and study of instruments.
6. Identification of common microbes.

Suggested Readings:

1. Textbook of Pathology - Harsh Mohan; Jaypee
2. Basic Pathology - V.Kumar, S.Robbins; Harcourt
3. Pathology - Emanuel Rubin; Lippincot
4. Pathology - Ian Cree; Chapanmann Hall
5. Text Book of Microbiology - Pelczar, Chan, Kreig
6. Bacteriology - A.J. Salle
7. Text Book of Microbiology - Vol I and Vol II - Powar and Daginawala
8. Text Book of Microbiology - Stanier
9. Human Anatomy, Physiology & Health Education by Harie R. Berasari, Gandhi & Goel
10. Textbook of Medical Physiology by Guyton and Hall 11. Human Physiology by Chaudhary

SEMESTER-II

General Education Component: English

Course Title: English Communication Skills

Course Code: BML-MDT 201

Credits: 4

M.M:100

Unit 1: Reading Skills

Reading Tactics and strategies; Reading purposes–kinds of purposes and associated comprehension; Skimming, Scanning, Intensive reading, Extensive reading

Activities: a) Active reading of passages on general topics b) Comprehension questions in multiple choice format c) Short comprehension questions based on content and development of ideas

Unit 2: Writing Skills

Guidelines for effective writing; writing styles for application, personal letter, official/ business letter, memo, notices etc.; outline and revision.

Activities: a) Formatting personal and business letters. b) Organising the details in a sequential order c) Converting a biographical note into a sequenced resume or vice-versa d) Ordering and sub-dividing the contents while making notes. e) Writing notices for circulation/ boards

Unit 3: Body Language

Body language , Kinds of body language, Paralinguistics , elements, interpretation& importance of Paralinguistics, Kinesics (body movements), kinds of body movements, occulesics (eye behavior), interpreting gestures, Open & Closed gestures, interpreting different body postures, Proxemics (nonverbal study of space & distance, Haptics (the non verbal communication study of touch).

Unit 4: Short Stories

1: Sadat Hasan Manto -------*Toba Tek Singh*

2: O' Henry ---------*The Gift of the Magi*

Suggested Readings:

1. Seely, John. *Oxford Guide to Effective Writing and Speaking.*
2. Murphy, Raymond. *English Grammar in Use* (Fourth Edition), CUP.
3. Text Book(s):Mckay, M., Davis, M. & Fanning, P.(2008). Messages: *The Communication Skills* Book(s), New Harbinger Publications
4. Perkins, P.S., & Brown, L. (2008). *The Art and Science of Communication: Tools for effective communication in the workplace,* John Wiley and Sons
5. Reference Book(s)(s): [R1] Krizan et al (2010*). Effective Business Communication,* Cengage Learning.
6. Scot, O. (2009*). Contemporary Business Communication*, Biztantra, New Delhi.
7. Chaney & Martin (2009*). Intercultural Business Communication*, Pearson Education
8. Penrose et al (2009*). Business Communication for Managers*, Cengage Learning.

General Education Component: Zoology
Course Title: Insect Vectors & Diseases
Course Code: BML-MDTT202

Credits: 03

M.M:100

Unit 1: Introduction to Insects and Insects as Vectors

General Features of Insects; Morphological features, Head – Eyes, Types of antennae; Mouth parts w.r.t. feeding habits

Classification of insects up to orders; General features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Unit 2: Concept of Vectors

Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs,Host-vector relationship, Vectorial capacity. Adaptations as vectors. Host Specificity

Unit 3: Diptera and Siphonaptera as Disease Vectors

Order Dipteran and Siphonaptera as important insect vectors – Mosquitoes, Sand fly, Houseflies, Fleas

Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes.

Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly.

Study of house fly as important mechanical vector, Myiasis, Control of house fly

Fleas as important insect vectors; Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas

Unit 4: Siphunculata and Hempitera as Disease Vectors

Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louseborne diseases – Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

General Education Component: Zoology

Course Title: Zoology Practicals

Course Code: BML-MDTP202

Credits: 1

M.M:50

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/ photographs: Aedes, Culex,Anopheles, 3. Pediculus humanus capitis, Pediculus humanus corporis, Phithirus pubis, Xenopsyllacheopis, Cimexlectularius, Phlebotomusargentipes,Muscadomestica,
4. Study of different diseases transmitted by above insect vectors

[Note: Submission of a project report on any one of the insect vectors and disease transmitted]

Suggested readings:

1. Attwal, A.S. 1991. *Agricultural Pests of India and South East Asia* by, Kalyani Publishers, New Delhi (Revised Edition)
2. Arora, D. R and Arora, B. (2001). *Medical Parasitology*. II Edition. CBS Publications and Distributors.
3. Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK
4. Gullan, P. J. & Cranston, P. S. (2005). *The Insects – an outline of Entomology*, Wiley Blackwell, UK, 3rd Ed.
5. Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, UK
6. Mathews, G. (2011). *Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases*. Wiley-Blackwell
7. Pedigo L.P. (2002). *Entomology and Pest Management.* Prentice Hall • Srivastava, P. 2005. Textbook of Applied Entomology, Vol.1& 2. Kalyani Publishers
8. Tembhare, D. B. *Modern Entomology*, Himalaya Publishing House, 2019 Edition`

General Education Component: Biochemistry

Course Title: Proteins and Enzymes

Course Code: BML-MDTT203

Credits: 03

MM: 100

Unit 1: Proteins

Proteins, Protein structure; primary structure, Peptide Bonds: Rigid and planar nature of a peptide bond. Secondary structure- helices and sheets Folding of peptide chains into regular repeating structures (helix, pleated sheets), Nature of non-covalent bonds and covalent bonds in protein folding. Tertiary and quaternary structures. Properties of proteins.

Unit 2: Myoglobin and Hemoglobin

Structure and function. Oxygen binding curves, influence of 2,3-BPG, CO_2 ,temperature and pH onoxygen binding capacity of Hb. Cooperativity between subunits and models to explain the phenomenon - concerted and sequential models.Haemoglobin disorders.

Unit 3: Enzyme catalysis

Concept of enzymes, Enzymes as catalysts. Theories of enzymes catalysis : Proximity and orientation effects, acid base catalysis, covalent catalysis. Role of metals in enzyme catalysis.

Unit 4: Enzyme Kinetics

Relationship between intial velocity and substrate concentration. Steady state kinetics. Equilibrium constant-monosubstrate reactions. Michaelis-Menten equation,lineweaver-burk plot,Eadie-Hofstee and hanes plot. Km and Vmax, Kcat and turnover number. Effect of pH, temperature,metal ions and substrate concentration on enzyme activity.

General Education Component: Biochemistry

Course Title: Biochemistry Practicals

Course Code: BML-MDTP103

Credits: 01

M.M:50

1. Protein estimation by Biuret method.
2. Glucose estimation by end point reaction
3. Estimation of Creatinine as an example of kinetic reaction
4. Estimation of amino acids-phenylalanine, tyrosine and tryptophan

Suggested readings:

1. *Lehninger: Principles of Biochemistry* (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13; 978-1-4641-0962-1 / ISBN:10-14641-0962-1.
2. *Fundamentals of Enzymology* (1999) 3rd ed., Price, N.C and Stevens, L., Oxford University Press Inc., (New York), ISBN:13: 978-0-19-806439-8.
3. *The Tools of Biochemistry* (1977; Reprint 2011) Cooper, T.G., Wiley India Pvt. Ltd. (New Delhi), ISBN: 978-81-265-3016-8.
4. *Physical Biochemistry* (2009) 2nd ed., Sheehan, D., Wiley-Blackwell (West Sussex), ISBN: 9780470856024 / ISBN: 9780470856031.

Core Course: Skill Development Component

Course Title: Basics of Biochemistry, Instruments and Reagents

Course Code: BML-MDTT204

Credits: 04

M.M:100

Unit 1: Carbohydrates metabolism and disorders

A) Chemistry of carbohydrates and their related metabolism - Introduction, definition, classification, biomedical importance & properties. Brief outline of metabolism: Glycogenesis and glycogenolysis (in brief), Glycolysis, citric acid cycle and its significance, HMP shunt and Gluconeogenesis (in brief), regulation of blood glucose level. B) Hyperglycemia and Hypoglycemia Diabetes mellitus - definition, types, features Gestation diabetes mellitus Glucose Tolerance test, glycosuria Hypoglycemia & its causes

Unit 2: Amino Acid and Lipid metabolism

A) Chemistry of Proteins and their related metabolism - Introduction-Definition Classification Biomedical importance ; Metabolism: Catabolism of amino acids, Removal of NH2 group Transformation, Deamination Decarboxylation- Ammonia formation & transport Urea cycle, Metabolic disorders in urea cycle Fate of some important amino acids- Phenylalanine, Tyrosine & Tryptophan Creatine, Creatinine - B) Chemistry of Lipids and their related metabolism Introduction-Definition Classification ;Biomedical importance; essential fatty acids Metabolism: Beta oxidation of fatty acids Fatty liver, Ketosis Cholesterol & its clinical significance Lipoproteins in the blood & their functions Atherosclerosis

Unit 3: Nucleic acids metabolism

A) Chemistry of Nucleic acid and metabolism Introduction-Definition Elementary chemistry of DNA and RNA Structure of nucleotide

DNA and RNA molecule and its structure Functions of nucleic acids Nucleotide metabolism- purines and pyrimidines B) Enzymes Introduction- definition; Classification ; Coenzymes, isoenzymes, properties Mechanism of action of enzymes; Factors affecting enzyme action Enzyme inhibition and regulation Diagnostic value of serum enzymes - Creatinine kinase, alkaline phosphatase, Acid phosphatase, LDH, SGOT, SGPT, Amylase, Lipase, Carbonic anhydrase etc

Unit 4: Instrumentation and Reagent Preparation

A) Laboratory instruments Principle and working of basic laboratory instruments -- Autoclave, Hot air oven, Incubator, pH meter, water bath, centrifuge, Refrigerator, colorimeter, Balance, Flame photometer, Microscope B) Reagent preparation Concept of molarity and normality - Molar, Normal and percent solution preparation; Dilution of the concentrated solution to desired concentration

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDTP204

Credits: 04

M.M: 100

1. Introduction Aim, basis, interpretation, safety in clinical biochemistry Laboratory

2. Laboratory organization Instruments, glassware, sample collection & specimen labeling, routine tests, anticoagulants, reagents, cleaning of glassware, isotonic solution, standardization of methods, preparation of solution & interpretation of result, normal values.

3. Identification of Carbohydrates (qualitative tests).

4. Identification of Proteins (qualitative tests).

5. To study general properties of the enzyme (Urease) & Achromatic time of salivary amylase.

6. Urine analysis - normal & abnormal constituents of urine.

7. CSF & Semen Analysis - Gross & Microscopic.

8. Glucose tolerance test & Glycosylated haemoglobin.

9. Centrifugation: Principle, types & applications.

10. Chromatography: Definition, types, RF value, description of paper chromatography & applications.

11. Uses, Care and Maintenance of various instruments of the laboratory.

Suggested Readings:

1. Text book of medical laboratory technology by Praful Godkar; Bhalani

2. Text book of biochemistry for medical students by D M Vasudevan; Jaypee

3. Fundamentals of biochemistry by J L Jain; S Chand

4. Biochemistry by D Voet, J Voet; Wiley

5. TB of biochemistry and human biology by G P Talwar; Prentice Hall

6. MOLBIO by Avinash and Kakoli Upadyay; Himalaya Publishing house

7. Clinical Biochemistry by G.Guru

8. Principal of Biochemistry by Lehninger

9. Principal of Biochemistry by M. A. Siddiqi

10. Principal of Biochemistry by David L. Nelson

11. Medical Laboratory Technology Volume II by Kanai L Mukherjee

12. Medical Laboratory Technology Volume III by Kanai L Mukherjee

Core Course: Skill Development Component

Course Title: Clinical Biochemistry & Basic Hematological Techniques

Course Code: BML-MDTT205

Credits: 04

M.M:100

Unit 1: Bioinstrumentation

1. Photometry-Definition, laws of photometry, absorbance, transmittance, absorption maxima, instruments, parts of photometer, types of photometry– colorimetry, spectrophotometry, flame photometry, fluuorometry, choice of appropriate filter, measurements of solution, calculation of formula, applications.

2. Electrophoresis - Principle, Types & Applications.

3. Autoanalysers - Principle & Applications

Unit 2: Fluid metabolism and Organ function tests

A) Water and Mineral Metabolism- Distribution of fluids in the body, ECF & ICF, water metabolism, dehydration, mineral metabolism, macronutrients (principal mineral elements) & trace elements.

B) Vitamins- Fat & water soluble vitamins, sources, requirement, deficiency disorders & biochemical functions.

C) Liver Functions & their Assessment- Based on: Carbohydrate metabolism; Protein metabolism; Lipid metabolism. Measurements of serum enzyme levels Bile pigment metabolism, Jaundice, its types and their biochemical findings.

D) Renal Function Tests- Various Tests, GFR & Clearance

Unit 3: Cardiac Function Tests

A) Cardiac Profile - In brief Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases B) Different methods of Glucose Estimation - Principle advantage and disadvantage of different methods C) Different methods of Cholesterol Estimation - Principle, advantage and disadvantage of different methods.

Unit 4: Phlebotomy

A) Basic Hematological Techniques Preparation of blood collection – Basic steps for drawing blood by vein, capillary and artery puncture; Complications during and after blood collection Specimen rejection criteria for blood Anticoagulants- types and concentration Transport of blood sample Effect of storage on blood cell morphology Universal precautions

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDTP205

Credits: 04

M.M: 100

A) Clinical Biochemistry (By Colorimeter / Spectrophotometer)

1. Blood urea estimation
2. Serum creatinine estimation
3. Serum uric acid estimation
4. Serum total protein estimation
5. Serum albumin estimation
6. Serum globulin estimation
7. Serum glucose estimation
8. Total cholesterol estimation
9. HDL and LDL cholesterol (direct) estimation.
10. Triglyceride estimation
11. Serum Bilirubin total estimation
12. Serum Bilirubin direct estimation
13. Serum amylase estimation
14. Serum GOT (AST) estimation
15. Serum GPT (ALT) estimation
16. Alkaline phostase estimation
17. Acid phosphatase estimation
18. Serum sodium estimation
19. Serum potassium estimation
20. Serum chloride estimation
21. CK-NAC estimation

B) Hematology Practicals

1. Basic requirements for hematology laboratory.
2. Glassware's and Equipments for Hematology.
3. Anticoagulant vial preparation.

4. Determination of Blood group by ABO blood group system
5. Determination of Hemoglobin.
6. TRBC Count by Hemocytometers.
7. TLC by Hemocytometer.
8. Differential Leukocyte count.
9. Determination of Platelet Count.
10. Determination of ESR by wintrobes.
11. Complete Blood Counts.

Suggested Readings:

1. Biophysical Chemistry by Upahyay, Upadhyay, Nath; Himalaya Publishing house
2. Text book of medical laboratory technology by Praful Godkar; Bhalani
3. Essential haematology by A.V.Hoffbrand; Black well
4. De Gruchy's Clinical Haematology in medical practice by Frank Firkin, C Chester man; Black well
5. Principles of haematology Peter Haen WCB
6. Haematology by Emamanuel Besa; Harwal
7. Text Book of Microbiology by Ananthnarayan and Paniker
8. Clinical diagnosis and management by laboratory methods by Bernard Henry; W B Saunders
9. Text book of biochemistry for medical students by D M Vasudevan; Jaypee
10. TB of biochemistry and human biology by G P Talwar; Prentice Hall
11. Biophysical Chemistry by Dr. Nath, Avinash Upadyay and Kakoli Upadyay; Himalaya Publishing house 12. Clinical Biochemistry by G.Guru

SEMESTER-III

General Education Component: English

Course Title: English Speaking Skills

Course Code: BML-MDTT301

Credits: 4

M.M:100

Unit 1: Literary Terms & Concepts

Plot, Character, Protagonist, Narrator, Personification, Imagery, Symbol, Simile, Metaphor, Onomatopoeia, Alliteration, Dialogue, Monologue, Aside, Soliloquy, Epigraph, Colloquialism, Euphemism, Flashback, Hyperbole, Irony, Juxtaposition, Oxymoron, Satire, Repetition, Paradox

Unit 2: Poetry

1. Shakespeare: "All the World's a Stage"
2. Ben Johnson: "On Shakespeare"
3. John Milton: " On His Blindness"
4. PB Shelley : "Ozymandias of Egypt"

Unit 3: Short Stories

1. Oscar Wilde: *The Selfish Giant*
2. Leo Tolstoy: *How Much Land Does a Man Need*

Unit 4: Drama

1. Anton Chekhov: *The Proposal*
2. J M Synge: Riders to the Sea

Suggested Readings:

1. Albert, Edward. *A Short History of English Literature.*New Delhi: OUP, 2009
2. Abrams, M.H. *A Glossary of Literary Terms.* 7th ed. 1941. New Delhi: Harcourt India, 2001.
3. Nayar, Pramod K. *A Short History of English Literature.* New Delhi: CUP, 2009.
4. Shepherd-Barr,Kirsten E.*Modern Drama: A Very Short Introduction*.New Delhi: OUP, 2015.
5. Reid, I. *The Short Story*. London: Routledge, 1977.

General Education Component: Zoology

Course Title: Insect Vectors & Diseases

Course Code: BML-MDTT302

Credits: 03

M.M:100

Unit 1: Introduction to Biodiversity

Biodiversity: Importance and Levels of biodiversity. Biodiversity of World including India (General Account).Biodiversity hotspots. Threats to biodiversity. Ecosystem services

Unit 2: Conservation Biology

Conservation Biology: History, Scope and Ethical Principals Conservation and Management of Biodiversity (in-situ and ex-situ) Laws, Policies and Institutions for conservation: IUCN, CITES, IPBES, CBD, Ramsar Convention, National Biodiversity Act, 2002, National Biodiversity Authority (NBA) Endangered Species and Red Data Books Endangered Fauna of J&K (General account)

Unit 3: Ecology

Ecology: Definition, importance and types (Autecology and synecology), Biological communities and species interactions; Types of interactions between species Ecological Succession: Types, Causes and Process of Succession Ecosystem: Definition and Types Energy flow: Food Chain, Food Web, and Ecological Pyramids

Unit 4: Wildlife

Wildlife: Importance, and Threats Wildlife Ethics & Values Wildlife Conservation: Wildlife Protection Act of India, Protective Areas- National Parks, Sanctuary, Biosphere Reserves (general account) Conservation status and habitat of Project Tiger & Hangul Man-Animal Conflict: Causes, and Strategies for their control

General Education Component: Zoology

Course Title: Zoology Practicals

Course Code: BML-MDTP302

Credits: 01

M.M:50

1. Study of biodiversity and wildlife through audio-visual aids, charts, documentaries, etc.

2. Study and field collection and identification of different types of beaks/claws/ feathers of birds of Kashmir.

3. Study of Endangered fauna (mammals, birds, butterflies) of India & J&K.

4. Techniques to study biodiversity and preservation (wet and dry) of animals

5. Field visit to study local biodiversity (birds, Insects) and Field Report

Suggested readings:

1. Agarwal, K.C., 2001. *Environmental Biology,* Nidhi Publication Ltd. Bikaner.
2. Arjya B.Majundar, Deosmita Nandy and Swayambhu Mukherjee *2013 Environment and Wildlife Laws in India.* LexisNexis Publisher.
3. Bawa et al. 2011. *Conservation Biology, A primer for South Asia.* ATREE & Universities Press Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publishing House.
4. Dhaliwal, G. S., Sangha G. S. and Ralhan P, K. 1996. *Fundamentals of Environmental Sciences*. Kalyani Publishers, India
5. Heywood, V.H. & Watson, R.T. 1995. *Global Biodiversity Assessment*. Cambridge Univ. Press.
6. Odum, *Fundamentals of Ecology* (Saunders, 1971)
7. Raven, Berg, Johnson. *Environment* (Saunders College Publishing, 1993)
8. Ricklefs, R.E., (2000). *Ecology.* V Edition. Chiron Press
9. Sharma, P.D: *Ecology and Environment* (Rastogi Publication, 7th ed. 2000)
10. Saharia, V. B. *Wildlife in India*, Natraj Publishers.

General Education Component: Biochemistry

Course Title: Cell Biology

Course Code: BML-MDTT303

Credits: 03

MM: 100

Unit 1: Introduction to cell

Cell as fundamental unit of life. The cell theory. Basic properties of cell. Classification of cell types and their characteristics Microscopic techniques for the study of cell-light microscopy, bright and dark field microscopy, phase-contrast microscopy, fluorescence microscopy, electron microscopy. Cell fractionation.

Unit 2: Bio-Membranes

Composition of biological membranes. Structural organization of cell membrane-Fluid Mosaic model. Membrane permeability. Membrane dynamics. Membrane fluidity and factors affecting membrane fluidity. Functions of cell membrane. Membrane transport-passive and active transport.

Unit 3: Cell Organelles

Ribosomes-Structure, composition, types and role in protein synthesis. Endoplasmic reticulum: Structure, composition and functions. Golgi complex-structure and functions. Structure and function of lysosomes. Cytoskeleton-Composition and functions of microtubules, microfilaments and intermediate filaments. Mitochondria- Structure, composition and its functions. Nucleus-structure and function. Extra cellular matrix.

Unit 4: Cell Cycle and cancer.

Eukaryotic cell cycle-G, S and M phase. Cell Division-Mitosis and Meiosis. Regulation of cell cycle. Cell death. Basic aspects of intercellular communication-autocrine, endocrine and Paracrine signaling. Cancer-properties of cancer cells. Proto oncogenes. Tumor suppressor genes.

General Education Component: Biochemistry

Course Title: Biochemistry Practicals

Course Code: BML-MDTP303

Credits: 01

M.M:50

1. Study the structure of any prokaryotic and eukaryotic cell.
2. Light microscopy: principles, parts & function, Operation.
3. Visualization of any plant and animal cell by methylene blue
4. Micrographs of different cell components (dry lab).
5. Study of slides showing different stages of mitosis and meiosis.

Suggested readings:

1. Karp, G. 2010. *Cell and Molecular Biology: Concepts and Experiments.* 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. *Cell and Molecular Biology*. 8th edition.Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. *The Cell: A Molecular Approach.* 5th edition. ASMPress & Sunderland, Washington, D.C.; Sinauer Associates, MA.

Core Course: Skill Development Component

Course Title: Systemic bacteriology, mycology, virology and hematological disorders

Course Code: BML-MDTT304

Credits: 04

M.M:100

Unit 1: Systemic Bacteriology

Morphology, cultural characteristics, biochemical reaction, \pathogenesis/disease caused and lab diagnosis of - Staphylococcus, Streptococcus, Pneumococcus, Neisseira gonorrhoea, Neisseira meningitis, Cornybacterium diptheriae, Mycobaterium, Clostridium, E.coli, Klebsiella, Salmonella, Proteus, Pseudomonas, Vibrio and Spirochaetes

Unit 2: Mycology

Morphology and Structure of fungi Classification of fungi, Nutrition and cultivation of fungus, Cutaneous and Sub cutaneous and Systemic Mycosis (in brief), Lab diagnosis of fungal Infections, Opportunistic fungal infections

Unit 3: Virology

General characters of viruses, Lab diagnosis of viral infections, Bacteriophages. Retro viruses - HIV, Hepatitis virus, Pox virus. Picrona virus - Polio Orthomyxo virus –Influenza, Arbo virus – Chikungunya, Dengue Herpes and Adeno virus

Unit 4: Haematological Disorders

Classification of Anemia : Morphological & etiological. b. Iron Deficiency Anemia : Distribution of body Iron, Iron Absorption, causes of iron deficiency, lab findings. c. Megaloblastic Anemia : Causes, Lab findings. d. Haemolytic Anemia : Definition, causes, classification & lab findings. e. Bone Marrow: Cell composition of normal adult Bone marrow, Aspiration, Indication, Preparation & Staining, Special Stain for Bone Marrow -Periodic Acid Schiff, Sudan Black, Myeloperoxidase. f. Leukaemia: Classification, Blood Picture, Differentiation of Blast Cells.

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDT304

Credits: 04

M.M: 100

Systemic bacteriology:

1. Culture Techniques
2. Culture methods & identification of common bacteria on media.
3. Antibiotic sensitivity testing.
4. To perform biochemical test - a) IMVic test b) Catalase test c) Coagulase test d) Oxidase test e) Gelatin liquefaction test f) Urease test
5) Identification of organism from urine, pus and blood samples.

Mycology and Virology

1. Culture Media used for fungus.
2. Fungal culture
3. Methods of lab diagnosis of virus.

Hematology

1. Determination of ESR by Westergeren's method.
2. Determination of PCV by Wintrobes.
3. Erythrocyte Indices- MCV, MCH, MCHC.
4. Reticulocyte Count.
5. Absolute Eosinophil Count.
6. Morphology of Red Blood Cells.
7. Determination of bleeding time
8. Determination of blood clotting time

Suggested Readings:

1. Text book of medical laboratory technology by Praful Godkar; Bhalani
2. Essential haematology by A.V.Hoffbrand; Black well
3. Text Book of Microbiology by Ananthnarayan and Paniker
4. Medical microbiology by Davis and Dulbacco

Core Course: Skill Development Component

Course Title: Immunology, Serology and Parasitology

Course Code: BML-MDTT305

Credits: 04

M.M:100

Unit 1: Immunology

Immunity and Immune Response Immunity- Definition and classification - General Principles of Innate and Acquired Immunity. Immune Response - Humoral immunity and cell mediated immunity. B) Antigen and Antibodies Antigen - Definition, classes, properties. Antibodies/Immunoglobulins - Definition, Properties, Sub types of Immunoglobulins C) Vaccination - Schedule and Vaccines D) Structure and Functions of Immune System - Parts of Immune system, T/B cells, other cells and their functions E) Hyper sensitivity Reactions - General Principles of different types of hypersensitive reactions i.e., type I, II, III, IV and V. F) Auto immune disorders G) Skin Tuberculin test

Unit 2: Serology

A) General Terminologies of serology. B) General features of Antigen- antibody reactions C) Types of Antigen/antibody Reactions - Precipitation, Agglutination, Complement fixation test, Neutralization, Opsonisation, Immune adherence, Immuno-fluorescence, Immuno-electron microscopic test. D) Principles, Types & Applications of Immunodiffusion Techniques, Radioimmunoassay & ELISA

Unit 3: Parasitology

Definition - parastism, HOST, Vectors etc. 2. Classification of Parasites. 3. Phylum Protozoa- general Pathogenic and non-pathogenic protozoa. 4. Phylum Nemathelminths/Round words (Nematoda). 5. Phylum Platyhelminths - class-Cestoda, class-Trematoda. 6. Lab diagnosis of parasitic infections. 7. Protozoa: i. Intestinal Amoebae a. E. histolytica: Life cycle, Morphology, Disease & Lab Diagnosis ii. Flagellates of intestine/genitalia a. Giardia lamblia: Life cycle, Morphology, Disease & Lab Diagnosis

b. Trichomonas vaginalis : Life cycle, Morphology, Disease & Lab Diagnosis iii. Malarial Parasite - a. Plasmodium vivax : Life cycle, Morphology, disease & lab diagnosis b. Differences between P. vivax, P. malaria, P. falcipaum & P.ovale.

Unit 4: Nematodes

A) Intestinal Nematodes : a. Ascaris : Life cycle, Morphology, disease & lab diagnosis b. Brief discussion about Enterobius vermicularis (Thread worm) and Ancylostoma duodenale (Hook worm) Tissue Nematodes : W. bancrofti - Life cycle, Morphology, Disease & Lab Diagnosis B) Phylum Platyhelminths a. Cestodes - T. solium, T. saginata & E. granulosus. (In brief) b. Trematodes - S. haematobium & F. hepatica (in brief)

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDTT305

Credits:04
M.M: 100

Immunological Techniques

1. WIDAL Test
2. VDRL Test,
3. RA Test
4. CRP Test
5. Pregnancy Test
6. Immunodiffusion
7. Qualitative test for ABO grouping with antisera
8. Qualitative test for Determination of D(Rho) antigen on human red blood cells.
9. To perform direct coomb's test
10. Determination of antistrptolysin O(ASO)
11. To perform C-reactive protein test (CRP)
12. Tuberculine test
13. HIV Test
14. ELISA test

Parasitology

1. Microscopic examination of stool specimen
2. Gross examination and physical examination of stool.
3. Detection of malarial parasite
4. Detection of trypanosomes (the causal agent of sleeping sickness)
5. Laboratory diagnosis of kala azar
6. Quantitative determination of serum (or plasma) igG class antibodies to toxoplasma gondii by ELISA
7. Determination of IgM class antibodies to toxoplasma gondii by ELISA
8. Identification of different ova & cysts in stool samples.

Suggested Readings:

1. Text book of medical laboratory technology by Praful Godkar; Bhalani
2. Essential haematology by A.V.Hoffbrand; Black well

3. Text Book of Microbiology by Ananthnarayan and Paniker
4. Medical microbiology by Davis and Dulbacco
5. Parasitilogy by C.C. Chatterjee
6. Medical Microbiology by David Greenwood, Richard C. B. Slack and John f. Peutherer
7. Immunology by Kuby 8. Immunology and Serology by Joshi

SEMESTER-IV

General Education Component: English

Course Title: English Communication Skills

Course Code: BML-MDTT401

Credits: 04

M.M:100

Unit 1: Poetry

1. Wordsworth: *"Tintern Abbey*"
2. W B Yeats: "*Easter 1916*"
3. John Keats: *"Ode on a Grecian Urn"*
4. PB Shelley: "*Ode to the West Wind*"

Unit 2: Essays (by George Orwell)

1. *Politics & the English Language*
2. *Shooting an Elephant*

Unit 3: Drama

1. Serafin&JoaquinAlvarez Quintero: *Sunny Morning: a Comedy of Madrid*
2. George Bernard Shaw*: How He Lied to Her Husband*

Unit 4: Fiction

Mary Shelley*: Frankenstein*

Suggested Readings

1. Abrams, Meyer H, The Mirror and the Lamp. New York: OUP, 1953.
2. Butler, M. 'Appendix A, Mary Shelley introduction to 1831 edition'. In MaryShelley: *Frankenstein*. Oxford: Oxford University Press.1994
3. Keskinen, Kenneth. "'Shooting an Elephant'- An Essay to Teach." The English Journal, vol. 55, no. 6, 1966, pp.669-675. *JSTOR.*
4. Seymour, M. *Mary Shelley*. London: Faber & Faber, 2011.

General Education Component: Zoology

Course Title: Comparative Anatomy and Developmental Biology of Vertebrates
Course Code: BML-MDTT402

Credits: 03

M.M:100

Unit 1: Comparative anatomy-I

- Integumentary System: Derivatives of integument w.r.t. glands and digital tips
- Skeletal System: Evolution of visceral arches
- Digestive System: Brief account of alimentary canal and digestive glands
- Respiratory System: Brief account of Gills, lungs, air sacs and swim bladder

Unit 2: Comparative Anatomy II

- Circulatory System: Evolution of heart and aortic arches
- Urinogenital System: Succession of kidney, Evolution of urinogenital ducts
- Nervous System: Comparative account of brain
- Sense Organs: Types of receptors

Unit 3: Embryonic development

- Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals,
- Fertilization: external and internal
- Vitellogenesis
- Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula);
- Fate of germ layers;
- Placenta: Structure, Types & Significance (with respect to humans)

Unit 4: Control of Development

- Fundamental processes in development (brief idea) – Gene activation, determination, Induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death.
- Role of Hormones & Environment in the Development
- Teratogenesis, Amniocentesis and Ageing (General account)

General Education Component: Zoology

Course Title: Zoology Practicals

Course Code: BML-MDTP402

Credits: 01

M.M:50

1. Comparative Analysis of following:
2. Scales in Fishes,
3. Feathers in Birds,
4. Horns
5. Disarticulated skeleton of fowl and rabbit.
6. Mammalian skulls: Herbivorous and carnivorous animal.
7. Frog - Study of developmental stages - whole mounts and sections through permanentslides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external andinternal gill stages.
8. Study of the different types of placenta- histological sections through permanent slides orphotomicrographs.
9. Study of various invertebrate and vertebrate egg specimens (insects, fishes, frog and birds).

Suggested Readings:

1. Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV
   a. Edition. McGraw-Hill Higher Education.

2. Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition.The McGraw-Hill Companies.

3. Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons.

4. Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.

5. Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc.,Publishers, Sunderland, Massachusetts, USA.

6. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson ComputerPress.

7. Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.\

8. Kingsley, J. S. *Outlines of Comparative Anatomy of Vertebrates*, Central Book Depot, Allahabad

9. Young, Z. G, *Life of Mammals*, Oxford University Press, London

10. Young, Z. G. *Life of Vertebrates,* Oxford University Press, London

General Education Component: Biochemistry

Course Title: Clinical Diagnostics and Medical Diagnostics

Course Code: BML-MDTT403

Credits: 03

MM: 100

Unit I. Genetic Disorders, Diagnosis and Treatment

Disorders of carbohydrate metabolism: Diabetes mellitus, Diabetes Insipid us, glycohemoglobins, hypo-glycemias, galactosemia and ketone bodies. Various types of glucose tolerance tests. Glycogen storage diseases. Disorders 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 animoacidurias. b) Disorders of nucleic acid metabolism- Disorders in purine/ pyrimidine metabolism

Unit II: **Disorders Prevalent in the Society & Treatments**

Malnutrition of important vitamins and amino acids. Significance of Mid-day meal program in combating malnutrition. Gastroenteritis, Celiac disease, Gastroesophageal reflux disease. Malaria; Cholera. Tuberculosis. Lower respiratory tract infection (LRI), diarrheal diseases, and neonatal syndromes (preterm birth complications, neonatal encephalopathy, neonatal sepsis, and other neonatal disorders) in children. Nutritional deficiencies in children. Management of life style diseases including Hypertension, Coronary Heart Disease, Stroke, Diabetes, Obesity. Chronic obstructive pulmonary disease (COPD/asthma).

UNIT III: Environmental and Mental Health Diseases Disorders (15 Lectures)

Environmental Pollution, Air Pollution, Tobacco Smoking, Chemical and Drug Injury, Alcohol, Lead and Carbon monoxide poisoning, Drug abuse; Allergens; Injury by physical agents, Thermal and Electricalinjury, injury by radiation.; Nutritional disease- Obesity, starvation, Protein Energy and Malnutrition, Disorders of vitamins, Trace elements and Diet. Characteristics of mentally healthy person; Warning signals of poor mental health; Types and causes of mental illness. Depression: causes & and its treatments. Substance abuse (Drugs, Cigarette, Alcohol)-de-addiction and rehabilitation.

UNIT IV: Diagnostic Tools and Applications in Diagnosis (15Lectures)

Common Diagnostic Tools-Principle and importance in disease diagnosis with examples: Stethoscopes, Sphygmomanometers, Ophthalmoscopes, Otoscopes, Electrocardiographs, Thermometer

Advanced Diagnostic Tools-Principles and importance in disease diagnosis with examples X-ray, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET) scan, Ct/CAT scan/ ECG, EEG and Blood gas apparatus. Pre-natal diagnostic techniques. Mass Spectrometry/ LCMS-MS

Imaging Techniques: Angiocardiography, angiography-cerebral angiography ; Brain scanning-echoencephalography, magnetoencephalography and pneumoencephalography; cholecystography, echocardiography, endoscopic retrograde cholangiopancreatoscopy; lung ventilation/perfusion scan, magnetic resonance imaging-cardiac magnetic resonance imaging, functional magnetic resonance imaging and magnetic resonance spectroscopy; mammography, myelography, prenatal testing, tomography-computed tomography, positron emission tomography and single photon emission computed tomography, ultrasound, and Urography

General Education Component: Biochemistry

Course Title: Biochemistry Practicals

Course Code: BML-MDTP403

Credits: 1

M.M:50

Suggested Readings:

- Marshall, W.J., Lapsley, M., Day, A. and Ayling, R., 2014. *Clinical Biochemistry E-Book: Metabolic and Clinical Aspects*. Elsevier Health Sciences.
- Mütze, Ulrike. "Jean-Marie Saudubray, Matthias R. Baumgartner, John Walter (Eds.). Inborn metabolic diseases: diagnosis and treatment." (2017): 165-165.
- Nyhan, William L., and Georg F. Hoffmann. *Atlas of inherited metabolic diseases*. CRC Press, 2020
- Blau, N., Duran, M., Gibson, K.M. and Dionisi-Vici, C. eds., 2014. *Physician's guide to the diagnosis, treatment, and follow-up of inherited metabolic diseases* (pp. 247-264). Heidelberg:: Springer.
- Suetens, P., 2017. *Fundamentals of medical imaging*. Cambridge university press.

Core Course: Skill Development Component

Course Title: Endocrinology, Tumor and Cancer Markers

Course Code: BML-MDTT404

Credits: 4

M.M:100

Unit 1: Endocrinology-I

Introduction Difference between hormones and enzymes. Classification of hormones. Regulation and general mechanism of action of hormones. Pituitary gland and hypothalamus Hormones of the Anterior Pituitary- Growth hormone, Prolactin, Gonadotropin, Follicle Stimulating hormone, Leuteinizing Hormone, Thyroid stimulating hormone (TSH), Adrenocorticotropic hormone (ACTH). Hormones of neurohypophysis- Oxytocin, Antidiuretic hormone (ADH)

Unit 2: Endocrinology-II

Hormones of the Thyroid gland- chemistry and normal physiology, Thyroid disorders-goiter, myxodema, autoimmune thyroiditis, tumors of the thyroid gland, hyperthyroidism, Graves disease, Calcitonin, Parathyroid Hormone (PTH) Adrenocortical hormones-synthesis and secretion, Aldosterone and its function, Addisons disease, Glucocorticoids and functions, Mineralocorticoids and functions, Cortisol and functions, Cushing's syndrome, Conn's syndrome. Adrenal medulla-metabolism of catecholamines Hormones of the gonads - Testosterone, Estrogens, Progesterone, their synthesis and functions. Human Chorionic Gonadotropin (HCG), hormone, menstrual cycle, Menopause Hormone of pancreas - Insulin- its metabolic effects on carbohydrates, fats and protein, control of insulin secretion, Glucagon- functions, metabolic effects, blood glucose regulation, Diabetes Mellitus, Somatostatin. Hormone of kidney - Renin

Unit 3: TUMOR & CANCER MARKERS -I:

1. Introduction. 2. The Carcinogens-definition. 3. Oncogene-definition- Mechanism of action of Oncogenes (outline). 4. Characteristics of growing tumor cells-general and morphological changes, biochemical changes. 5. Tumor Markers- Introduction and definition 6. Clinical applications of tumor markers. 7. Enzymes as tumor markers, Alkaline Phosphatase (ALP), Creatine kinase (CK), Lactate dehydrogenase (LDH), Prostatic acid phosphatase (PAP), Prostate specific antigens (PSA).

Unit 4: Cancer Markers-II

1. Hormones as tumor markers (introduction of each type in brief). 2. Oncofetal antigens. 3. Alpha feto protein (AFP) 4. Carcino embryonic antigen (CEA) 5. Squamous cell carcinoma (SCC) antigen. 6. Carbohydrate markers (brief introduction of each type) CA 15-3, CA 125 7. Blood group antigen (brief introduction of each type) CA 19-9, CA 50, CA 72-4, CA 242 8. Bladder cancer markers (introduction in brief) - Bladder tumor antigen (BTA) 9. Fibrin- Fibrinogen degradation product (FDP). 10. Nuclear matrix protein (NMP22). 11. Biomarkers still in research (introduction in brief)- 12. Telomeres, TRAP assay, hyaluronic acid and Hyaluronidase

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDTP404

Credits: 04

M.M: 100

1. Blood grouping and Cross Matching
2. Estimation of T3
3. Estimation of T4
4. Estimation of TSH
5. Estimation of FSH
6. Estimation of LH
7. Estimation of hCG
8. Estimation of Cortisol
9. Estimation of Progesterone
10. Estimation of Testosterone
11. Estimation of Alpha feto proteins (AFP)
12. Estimation of Carcino embryonic antigen (CEA)
13. Estimation of CA- 125
14. Estimation of Prostate specific antigen (PSA) Other ELISA test
15. Test for HIV
16. Test for Hepatitis B (HBsAg)
17. Test for Hepatitis (HCV)
18. Malaria antigen 19) Tuberculosis-lgG/IgM

Suggested Readings:

1. Manual of Endocrinology and Metabolism by Norman Levin
2. Endocrinology by Headley Ongenomics Handbook edited by William J. Rochelle and Richard A. Shimkets, Humana Presss Cancer Systems Biology edited by Edwin Wang, CRC press

Core Course: Skill Development Component

Course Title: Clinical pathology and Blood banking

Course Code: BML-MDTT05

Credits: 04

M.M:100

Unit 1: Body Fluid Examination-I

A) Urine Analysis Formation and Composition of urine; Collection and preservation of urine; Physical and chemical examination of urine; Microscopic examination of urine; Clinical significance of urine analysis B) CSF analysis Formation and composition of CSF; Collection and preservation of CSF; Physical and chemical examination of CSF; Microscopic examination of CSF; Clinical significance of CSF analysis.

Unit 2: Body Fluid Examination-II

A) Semen Analysis Composition of semen; Collection and preservation of semen; Physical and chemical examination of semen; Microscopic examination of semen; Clinical significance of semen analysis B). Sputum Analysis Composition of sputum; Collection and preservation of sputum; Physical and chemical examination of sputum; Microscopic examination of sputum; Clinical significance of sputum analysis C) Cavity Fluids Transudates and exudates; Synovial fluid analysis; Peritoneal fluid analysis; Pericardial fluid analysis

Unit 3: Blood Examination

A) Blood Components Collection of blood components for fractional transfusion. Platelets packed Red Cell, Platelet rich Plasma, Platelets concentrate. Preparation of concentrated (packed) Red cells. Techniques of preparation. Hemoglobinopathies B). Compatibility Testing Purpose Single tube compatibility techniques using AHG reagent. Emergency compatibility testing. Difficulties in cross matching. Labelling and issuing cross- matched blood.

Unit 4: Blood Transfusion reactions

A) Blood Transfusion Reactions Investigation of a Transfusion reaction. Hemolytic transfusion reaction. Actions to take when transfusion reaction occurs B) Blood Components Collection of blood components for fractional transfusion. Platelets packed Red Cell, Platelet rich Plasma, Platelets concentrate. Preparation of concentrated (packed) Red cells. Techniques of preparation. C) Blood Donor and Blood Bank Records Blood donation record book. Recording results. Blood donor card. Blood bank temperature sheet. Blood bank stock sheet. Blood transfusion request form. Maintenance of records, government regulations (FDA) D) Storage and Transport Storage of blood. Changes in blood after storage. Gas refrigerator. Lay out of a blood bank refrigerator Transportation.

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDTP405

Credits: 04

M.M: 100

1. Blood grouping & Cross Matching
2. Routine examination of peritoneal (ascitic) fluid
3. Routine examination of pleural fluid
4. Routine examination of synovial fluid
5. Routine examination of CSF
6. Chemical examination of CSF
7. Urine analysis
8. Staining of Sputum
9. Microscopic Semen analysis
10. Gross examination and physical examination of stool.

Suggested Readings:

1. Medical Laboratory Sciences, Theory and Practical by A. Kolhatkar Medical Laboratory Technology – Volume I by Kanai Mukherjee
2. Medical Laboratory Technology – Volume II by Kanai Mukherjee Medical Laboratory Technology – Volume III by Kanai Mukherjee

SEMESTER-V

General Education Component: English

Course Title: English Communication Skills

Course Code: BML-MDTT501

Credits: 04

M.M:100

LITERATURE -3

Unit 1: Poetry

Nissim Ezekiel

1. *Night of the Scorpion*
2. *Poet Lover and Birdwatcher*

A.K. Ramanujan

1. *Of Mothers, among other things*
2. *Ecology*

Kamla Das

1. *My Grandmother's House*
2. *A Hot Noon in Malabar*

Eunice de Souza

1. *Mother*
2. *Marriages are Made*

Unit 2: Short Story

1. *MunshiPremchand:Lottery*
2. Saadat Hasan Manto: *The Dog of Tithwal*

Unit 3: Novel

R K Narayan*: The Guide*

Unit 4: Play

1. Rupert Brooke: *Lithuania*
2. Edward Albee: *The Zoo Story*

Suggested Readings

1. A.L. McLeod (ed.). R.K, Narayan: Critical Perspectives. New Delhi: 1994.
2. Chirantan, Kulshrestha (ed). *Contemporary Indian English Verse*: *An Evaluation*. Delhi: Arnold Heinemann, 1980.
3. E. deSouza. *Talking Poems: Conversations with Poets*. New Delhi: 1999.
4. Parthasarthy, R. (ed). *Ten Twentieth Indian poets*. Delhi: OUP, 2004.
5. Reid, I. *The Short Story*. London: Routledge, 1977.

General Education Component: Zoology

Course Title: Molecular Biology

Course Code: BML-MDTT502

Credits: 03

MM: 100

Unit 1: DNA Replication and Repair

Structural organization of DNA. Semi-conservative nature of replication-Experimental evidence. DNA replication in prokaryotes-DNA polymerase, replication fork, origin of replication, enzymes and proteins involved in replication. Replication in eukaryotes. Comparison of replication in prokaryotes and eukaryotes. DNA repair-an overview.

Unit 2: Transcription-Biosynthesis of RNA.

Transcription in prokaryotes-initiation, elongation and termination. Role of enzymes and factors in transcription-RNA polymerase, sigma factor. Role of promoters. Transcription in eukaryotes. Inhibitors of transcription. RNA processing-brief idea. Reverse transcription.

Unit 3: Translation-From RNA to proteins

Genetic code-basic features and significance. Wobble hypothesis .Ribosome structure-A,P and E site. Mechanism of translation in prokaryotes-initiation, elongation and termination. Regulation of translation .translation in eukaryotes-brief overview. Translation inhibitors-Role of antibiotics. Post translational modifications.

Unit 4: Regulation of gene expression

Control of gene expression in prokaryotes. Operon concept-Lac operon, Trp operon. Negative and positive regulation. Role of activators and repressors in regulation of gene expression.

Regulation of gene expression in eukaryotes- a brief overview. Heterochromatin, Euchromatin, chromatin remodeling.

General Education Component: Zoology

Course Title: Zoology Practicals

Course Code: BML-MDTP502

Credits: 01

M.M:50

Practicals:

1. Extraction of whole nucleic acid from blood
2. Spectrophotometric analysis of purified DNA
3. Agarose gel electrophoresis of genomic DNA
4. Effect of inhibitors on protein synthesis-Role of antibiotics.

Suggested readings:

1. Molecular and cell biology by Lodish et al
2. Molecular biology by Robert Weaver
3.Molecular biology of the gene-Watson,JD baker,T.A.bell,S.P.Gann et al., Cold spring Harbor laboratory press,Cold spring Harbor(New York)
4. Lehninger:principles of biochemistry.Nelson,D.L, and Cox,M.M.,W.H.Freeman & company(New York)

General Education Component: Biochemistry

Course Title: Pharmacology

Course Code: BML-MDTT503

Credits: 03

MM: 100

Unit 1: General Pharmacology:

Classification of Drugs. Nomenclature of drugs, Routes of drug administration. Pharmacokinetics (Brief Introduction) Absorption of drugs, Distribution, Biotransformation and Elimination of drugs) Zero Order elimination, First order elimination. Dissolution Testing, Disintegration Testing, Pharmacodynamics (Brief Introduction), Factors affecting drug action and absorption. Bioavailability of drugs, Volume of Distribution. Drug abuse and Drugs of abuse.

Unit 2: Experimental Pharmacology

Ethical aspects of Experimental Pharmacology. Different types of Experimental animals used. Definition and Principal of Bioassay. Chromatography, High Performance Liquid Chromatography. Flame photometry, Principal and applications of flame photometer.

Unit 3: Clinical Pharmacology:

Introduction to drug development. Clinical Trials (conduction in different phases), Ethical aspects of Clinical trials, Therapeutic Drug Monitoring, Drug act and Drug Control (various schedules)

Unit 4: Systemic Pharmacology

Introduction to various systems. Antibiotics, Antiseptics, Life Saving drugs

General Education Component: Biochemistry

Course Title: Biochemistry Practicals

Course Code: BML-MDTP503

Credits: 01

M.M:50

Practicals:

1. Introduction to Equipments:
2. Kymograph, flame photometer
3. Estimation of Drugs by High Pressure Liquid Chromatography (HPLC)
4. LD50, ED50, Pyrogen Testing.

Suggested readings:

1. Molecular and cell biology by Lodish et al
2. Molecular biology by Robert Weaver
3.Molecular biology of the gene-Watson,JD baker,T.A.bell,S.P.Gann et al., Cold spring Harbor laboratory press,Cold spring Harbor(New York)
4. Lehninger:principles of biochemistry.Nelson,D.L, and Cox,M.M.,W.H.Freeman & company(New York)

Core Course: Skill Based Component

Course Title: Histopathology, cytology techniques and coagulation studies

Course Code: BML-MDTT504

Credits: 04

M.M:100

Unit 1: Principles of Histopathology

A) Basics of Histopathology- Introduction to Histopathology, exfoliative Cytology. Basic steps for Tissue Processing- Fixing, Embedding, Microtomy, Staining, Mounting, methods of decalcifications. B) Laboratory requirements for Histopathology and Cytology Chemicals and Reagents Equipments - Microscope, Microtome -Types, Uses, Parts, different types of microtome knives, care and maintenance. Automated tissue processor - components, working and precautions during use, Tissue floating bath.

Unit 2: Methods of Cytological Staining

Staining Methods - Hematoxylin and Eosin stain, Hematoxylin - Types, methods of preparation, staining, Eosin - Method of preparation. Reticulin stain; PAP staining- components and methods.

Unit 3: Coagulation Studies

A) Hemostasis–Definition, Basic concept and principle, Basic steps involved in Hemostasis. B) Coagulation – a. Basic Physiology, coagulation factors. Mechanism of blood coagulation- Extrinsic Pathway, Intrinsic Pathway. Regulators of blood coagulation. Testing of blood coagulation - a. Bleeding Time, Duke's method Clotting Time- Capillary tube method and Lee white's method. PT, aPTT, TT Clot retraction time Determination of fibrinogen.

Unit 4: Quality Control in a Haematology Laboratory

Quality Assurance for routine Haemostasis Laboratory. Introduction. Sample collection technique (Phlebotomy) Sample preparation, Anticoagulant used, Importance of use of Sodium Citrate. Role in Diseases, Bleeding disorders- Platelet disorder - Thrombocytopenia’s - causes including aplastic anaemia, D I C IT P, Haemophilia

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDTP504

Credits: 04

M.M:100

Coagulation Studies

1. Precautions to prevent hemolysis
2. Storage of blood specimens
3. Bleeding time & clotting time estimation
4. Prothrombin time estimation
5. aPTT (activated partial thromboplastin time) estimation.
6. Clot retraction time.

Histopathology

Parts of microtome
Section Cutting of the tissue and staining
Tissue processing
Hand E staining
PAP staining.

Suggested Readings:

1. Text Book of Histology by Gartner
2. Wheater's Histology by Allen Steven
3. Histology for pathologist by Stacey e. Mills
4. Text book of medical laboratory technology by Praful Godkar; Bhalani

Core Course: Skill Based Component

Course Title: Molecular biology and Molecular diagnostic techniques

Course Code: BML-MDTT505

Credits: 4

M.M:100

Unit 1: rDNA Technology

Introduction and Application of rDNA technology Steps involved in rDNA technology, isolation of DNA from different sources, concept of restriction modification, restriction endonucleases; Introduction of vector and host. Introduction to generation of genomic and cDNA libraries. Improvement of plant, animals and microbes. Gene therapy, pharmaceutical products and molecular diagnostics, Molecular pharming. Metagenomics, Metabolic engineering.

Unit 2: Polymerase Chain Reaction

A) Gene amplification through PCR and Types - Polymerase Chain Reaction: Principle, methodology, primer designing, types of polymerase and factors affecting PCR, advantages, limitations and application PCR. Variants of PCR: Reverse Transcriptase PCR, Real Time PCR, Inverse PCR, anchored PCR, nested PCR, hot start PCR, multiplex PCR, touchdown PCR, ARMS (amplification refractive mutation system) PCR) DNA fingerprinting methods Methodology and application of DNAfingerprinting methods (RFLP with probe introduction, RAPD, AFLP, SSR, SCAR, DGGE).

Unit 3: Forensic Science -I

Definition, scope and need of Forensic Science, Tools and Techniques of Forensic Science General Methods of Investigation -- Narco analysis: History, Importance as an investigative tool, methods as use of drugs, Hypnosis etc. Limitations and legal aspects . Brain fingerprinting: Concepts, History, Significance, method, future perspective of the technique, limitations.

Unit 4: Forensic Science -II

Criminal Profiling: Introduction, Importance, Profile of the victim and culprit, investigative strategy, crime scene characteristics, limitations. DNA Profiling -- Introduction, History of DNA Typing DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR. Mitochondrial DNA, Allele frequency determination, match probability- database, quality control, certification and accreditation. Forensic Significance of DNA profiling: Applications in disputed paternity cases, child swapping, missing person's identity Status of development of DNA profiling in India and abroad. New and future technologies: DNA chips Limitations of DNA profiling. Biologic evidence – Importance, nature, location, collection, evaluation and tests for identification of Hair and Fibres, saliva, sweat, urine, blood, fecal matter, vaginal secretions and tests for their identification Blood grouping from stains of blood, semen,saliva and other body fluids by Absorption inhibition, Absorption-elution and mixed agglutination techniques, determination of secretor/non-secretor status. Emerging Forensic Techniques

PCR, Terminal Restriction Fragment Length Polymorphism (TRFLP), Amplified Fragment Length Polymorphism (AFLP), Single Stranded Conformation Polymorphism Analysis (SSCP), Thermal and Denaturating Gradient Gel Electrophoresis (TGGE, DGGE)

Core Course: Skill Development Component

Course Title: Practicals

Course Code: BML-MDTP505

Credits: 04

M.M: 100

1. PCR
2. Isolation of Genomic and plasmid DNA
3. Restriction Digestion
4. Western Blotting
5. Gradient Gel Electrophoresis
6. Single strand conformation polymorphism
7. FISH

Suggested Readings:

1. Gene VIII (2004) and Gene IX (2008). B. Lewin Oxford
2. Molecular biology of The Cell Alberts et al. Garland science
3. Cell and molecular Biology, Concepts and experiments Gerald Karp Wiley
4. Lehninger Principles of Biochemistry Nelson LD and Cox WH Freeman
5. Molecular Biology of the Cell Lodish et al., WH Freeman
6. Principle of gene manipulation Old and Primerose Blackwell
7. Gene cloning T.A. Brown Nelson Thornes
8 Recombinant DNA Watson et. al. WH Freeman
9. Methods of Forensic Science Curry, A. S. Interscience, New York
10. Forensic Biology Chowdhari, S. B P R & D, Govt of India
11. Forensic Science Hand book Richard saferstein Prentice Hall