

**Guru Kashi University**



**Session: 2022-23**

**Bachelor of Science in Medical Laboratory  
Technology**

**Department of Paramedical Sciences**

**Program Learning Outcomes (POs: After completion of the program, the student will be able to:**

- Demonstrate conceptual knowledge in hematology, coagulation, clinical chemistry, immunology, immunohematology, pathogenic microbiology and phlebotomy.  
Demonstrate professional conduct and interpersonal communication skills with patients, laboratory personnel, other health care professionals, and the public.
- Competently perform laboratory procedures in all areas of the clinical laboratory (i.e. Hematology, Coagulation, Urinalysis, Phlebotomy, Serology, Microbiology, Chemistry, and Immunohematology).  
Apply systematized problem solving techniques to identify and correct procedural errors, identify instrument malfunctions and seek proper supervisory assistance, and verify the accuracy of laboratory results obtained.
- Perform within the guidelines of the code of ethics of the Indian Society for Clinical Laboratory Science, the Indian Society of Clinical Pathologists, and the restrictions established by state and local regulatory authorities.  
Scope for the graduates is in the designations like R&D contractual lab assistant, junior technical executive etc. in hospital and research organizations.
- Students will learn about bio molecules, their source, classification, function and physiological importance of carbohydrate, protein and lipid etc.  
They can able to know about principle of sero-diagnostic tests like precipitation flocculation, agglutination, neutralization and coagulation etc.
- They can able to know about principle of sero-diagnostic tests like precipitation flocculation, agglutination, neutralization and coagulation etc.

### Programme Structure

<b>Semester- I</b>							
<b>S. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Type of course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	BML101	General Anatomy	Core Course	4	0	0	4
2	BML102	General Physiology	Core Course	4	0	0	4
3	BML103	Basic Haematology	Core Course	4	0	0	4
4	BML104	General Anatomy (Practical)	Technical Skills	0	0	4	2
5	BML105	General Physiology (Practical)	Technical Skills	0	0	4	2
6	BML106	Basic Haematology (Practical)	Technical Skills	0	0	4	2
7	BML107	Medical Ethics and Legal Aspects	Technical Skills	4	0	0	4
8	BML108	Basic in Computer and Information Science	Technical Skills	4	0	0	4
<b>TOTAL</b>				<b>20</b>	<b>0</b>	<b>12</b>	<b>26</b>

<b>Semester-II</b>							
<b>S. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Type of course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	BML201	Analytical Clinical Biochemistry	Core Course	4	0	0	4
2	BML202	General Clinical Microbiology	Core Course	4	0	0	4
<b>Disciplinary Elective (Any one of the following)</b>							
3	BML205	Remedial Biology	Disciplinary Elective	3	0	0	3
4	BML206	Remedial Mathematics					
5	BML207	Community Survey	Research Based Skill	3	0	0	3
6	BML208	Analytical Clinical Biochemistry (Practical)	Technical Skills	0	0	6	3
7	BML209	General Clinical Microbiology (Practical)	Technical Skills	0	0	6	3
<b>Open Elective (For other Departments)</b>							
8	Open Elective			3	0	0	3
<b>TOTAL</b>				<b>17</b>	<b>0</b>	<b>12</b>	<b>23</b>
<b>Open Elective (For other Departments)</b>							
9	BML203	Introduction To Quality and Patient Safety	Open Elective	3	0	0	3
10	BML204	Environmental Science					

**Semester-III**

BMLT (Batch 2022-2023)

<b>S. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Type of course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	BML301	Basics Haematological Diseases	Core Course	4	0	0	4
2	BML302	Systematic Bacteriology	Core Course	4	0	0	4
3	BML303	Applied Clinical Biochemistry	Core Course	4	0	0	4
<b>Disciplinary Elective (Any one of the following)</b>							
4	BML304	Immunology	Disciplinary Elective	3	0	0	3
5	BML305	Cytopathology					
<b>Disciplinary Elective (Any one of the following)</b>							
6	BML306	Blood Banking	Disciplinary Elective	3	0	0	3
7	BML307	Medical Laboratory Management					
8	BML308	Basic Hematological Diseases (Practical)	Technical skills	0	0	6	3
9	BML309	Systematic Bacteriology (Practical)	Technical skills	0	0	6	3
10	BML310	Applied Clinical Biochemistry (Practical)	Technical skills	0	0	6	3
11	BML311	Research Methodology, Biostatistics and IPR	Research Based Skill	3	0	0	3
<b>TOTAL</b>				<b>21</b>	<b>0</b>	<b>18</b>	<b>30</b>

<b>Semester-IV</b>							
<b>S. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Type of course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	BML401	Applied Clinical Biochemistry-I	Core course	4	0	0	4
2	BML402	Histo technology	Core course	4	0	0	4
<b>Disciplinary Elective (Any one of the following)</b>							
3	BML405	Cyto pathology	Disciplinary Elective	3	0	0	3
4	BML406	Virology					
<b>Value Added Course (For other disciplines also)</b>							
5	BML407	Nutrition	VAC	2	0	0	2
6	BML408	Applied Clinical Biochemistry-I (Practical)	Technical skills	0	0	6	3
7	BML409	Histo technology (Practical)	Technical skills	0	0	6	3
<b>Open Elective (for other Departments)</b>							
8			Open Elective	3	0	0	3
<b>TOTAL</b>				<b>16</b>	<b>0</b>	<b>12</b>	<b>22</b>
<b>Open Elective (for other Departments)</b>							
10	BML403	Mycology	Open Elective	3	0	0	3
11	BML404	Medical Parasitology and Entomology					

<b>Semester-V</b>							
<b>S. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Type of course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	BML501	Applied Bacteriology	Core Course	4	0	0	4
2	BML502	Clinical Histopathology	Core Course	4	0	0	4
<b>Disciplinary Elective (Any one of the following)</b>							
3	BML503	Molecular Biology and Genetics	Disciplinary Elective	3	0	0	3
4	BML504	Metabolism					
<b>Disciplinary Elective (Any one of the following)</b>							
5	BML505	Applied Clinical Biochemistry-III	Disciplinary Elective	3	0	0	3
6	BML506	Human Values and Professional Ethics					
7	BML507	Fundamentals of Nursing	Ability Enhancement	2	0	0	2
8	BML508	Applied Clinical Biochemistry-III (Practical)	Technical skills	0	0	6	3
9	BML509	Applied Bacteriology (Practical)	Technical skills	0	0	6	3
10	BML510	Clinical Histopathology (Practical)	Technical skills	0	0	6	3
<b>TOTAL</b>				<b>16</b>	<b>0</b>	<b>18</b>	<b>25</b>

**Semester-VI**

<b>S. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	BML601	Training/Internship Report	0	0	0	20
<b>Total</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>20</b>

**Evaluation Criteria for Theory Courses**

- A. Continuous Assessment: [25 Marks]
- i. Surprise Test (Two best out of three) - (10 Marks)
  - ii. Term paper (10 Marks)
  - iii. Assignment(s) (10 Marks)
  - iv. Attendance (5 marks)
- B. Mid Semester Test-1: [30 Marks]
- C. MST-2: [20Marks]
- D. End-Term Exam: [20 Marks]

Evaluation Criteria for other courses has been given separately with the Respective courses



**Semester -1st****Course Title: GENERAL ANATOMY****Course Code: BML101**

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 After studying student will get to learn about the various muscles, organs, bones, joints, tendons, ligaments, blood vessels and cells.
- 2 After studying anatomy of cell organelles, blood component, function, skeletal system, circulatory system, lymphatic system and its structure help in employability
- 3 They will study about the different properties of nerve fibres, anatomy of neuralgia, synapse, CNS, CSF, brain, cranial nerves, demonstration of reflexes.
- 4 Gain knowledge about Hormones, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas, help in employability
- 5 Know about organization of the human body at the cellular level

**Course Contents****UNIT-I****14 Hours**

Introduction to Anatomical terms of the human body - Basic anatomical terminology, anatomical position, anatomical planes, levels of organization in the body, organ systems, skeleton, cavities of the body, Organization of the human body at the cellular level - Structure of the cell comprising of cell membrane, cytoplasm, cell organelles, nucleus, cell extensions etc., Organization of the human body at the tissue level - Epithelial, Connective, Muscular& Nervous tissue.

**UNIT-II****16 Hours**

Blood - Composition of blood, Features of red blood cells, white blood cells, platelets, Lymphatic system - Features of lymph vessels, lymphatic tissue & organs,

lymphatics, spleen, tonsil, thymus, Nervous system - Central nervous system, brain, cerebellum, spinal cord, cranial nerves, autonomic nervous system, Muscular system - Skeletal muscle, cardiac muscle, smooth muscle, muscles of the body, Skeletal system - Features of bones, axial skeleton, and appendicular skeleton, Musculoskeletal system - Joints of upper & lower limb.

### **UNIT-III**

**16 Hours**

Respiratory system - Nose & paranasal sinuses, pharynx, larynx, trachea, lungs, Cardiovascular system - Heart & blood vessels, Digestive system - Oral cavity, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, liver, gallbladder, pancreas, Urinary system - Kidneys, glomerular apparatus, Ureter, urinary bladder, urethra.

### **UNIT-IV**

**14 Hours**

Reproductive system in females - External & internal genital organs, breast, Reproductive system in males - Penis, scrotum, testes, prostate gland, Endocrine system - Hormones, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas, Special senses - Olfactory system, taste apparatus, external middle & internal ear, eye, Skin - Features of skin, hair, sebaceous glands, sweat glands, nails.

### **Transaction Modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Chaurasia, B. D. (2010). *BD Chaurasia's Human Anatomy*. CBS Publishers & Distributors Pvt. Ltd.

Mescher, A. L. (2013). *Junqueira's basic histology: text and atlas* (Vol. 12). 13th ed. New York: McGraw-Hill

Halim, A. (2008). *Human Anatomy: Volume I: Upper Limb And Thorax*. IK International Pvt Ltd.

Hallam, J. (2009). Grey's Anatomy: Scalpels, sex and stereotypes. *Medical Humanities*, 35(1), 60-61.

**Semester -1st****Course Title: GENERAL PHYSIOLOGY****Course Code: BML102**

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 After studying student will understand the function of each structures related to human body.
- 2 They will learn about the anatomy of cell organelles, blood component, function, skeletal system, circulatory system, lymphatic system and its structure
- 3 Properties of nerve fibres, function of neuralgia, synapse, CNS, CSF, brain, cranial nerves, demonstration of reflexes.
- 4 Provide knowledge about functioning of Hormones, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas, help in employability
- 5 Provide knowledge about functioning of composition of body

**Course Contents****UNIT-I****14 Hours**

Introduction to physiology of the human body –Composition of body, Homeostasis, Introduction to chemistry of life, Organization of the human body at the cellular level – Function of lipids, carbohydrates, proteins & cell organelles, Organization of the human body at the tissue level – Function of Epithelial, Connective, Muscular & Nervous tissues, Blood – Haemopoiesis, haemostasis, coagulation of blood, blood transfusion, Lymphatic system – Function of lymph vessels, lymphatic tissue & organs, lymphatics, spleen, tonsil, thymus, Resistance & immunity – Innate immunity, acquired immunity, humoral & cell mediated immunity.

**UNIT-II****16 Hours**

Respiratory system – Physiology of respiration, pulmonary function tests, gas exchange in lungs, transport of gases between lungs & tissues, regulation of respiration, Cardiovascular system - Heart & blood vessels: Systemic circulation, pulmonary circulation, ECG, cardiac output, blood pressure.

Digestive system – Process of digestion, function of oral cavity, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, liver, gallbladder, pancreas, Urinary system – Function of kidneys, glomerular apparatus, Ureter, urinary bladder, urethra, physiology of urine formation, Glomerular filtration, tubular reabsorption, water balance, micturition.

### **UNIT-III**

**16 Hours**

Reproductive system– female: Physiology of female reproductive system, Reproductive system – male: Physiology of male reproductive system, Endocrine system - Mechanism of action of hormones, function of pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas, Special senses - Physiology of olfaction, taste, hearing, balance & vision, Skin – Function of skin, hair, sebaceous glands, sweat glands, nails, temperature regulation

### **UNIT-IV**

**14 Hours**

Nervous system – Properties of nerve fibers, function of neuroglia, synapse, CNS, CSF, brain, cranial nerves, demonstration of reflexes, Muscular system – Properties of skeletal muscle, cardiac muscle, smooth muscle, muscles of the body, Skeletal system – Functions of bones, axial skeleton, and appendicular skeleton, Musculoskeletal system – Movement in the joints of upper & lower limb.

### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Ashalatha, P. R., &Deepa, G. (2012). *Textbook of Anatomy & Physiology for Nurses*. JP Medical Ltd.

Chatterjee, C. C. (2020). *Human Physiology*. (13 th edition). CBS Publisher and Distributor Pvt. Ltd. Colorimetry

Heilbrunn, L. V. (1952). *General physiology*. Saunders, Philadelphia.

Hall, J. E. 1. (2016). Guyton and Hall textbook of *medical physiology* (13th edition.). Philadelphia, PA: Elsevier.

### Semester -1st

**Course Title: BASIC HAEMATOLOGY**

**Course Code: BML103**

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 The students will be able to understand about the various abnormalities related to blood and blood component
- 2 Students will able to perform different test such as TLC, DLC, ESR, Reticulocyte count, platelet count and preparation of blood films
- 3 This will help the student in employability and entrepreneurship
- 4 Provide knowledge of Internal and external quality control including reference preparation,
- 5 Handle Routine quality assurance protocol in haematology laboratory

### Course Contents

#### UNIT-I

**14 Hours**

Introduction to Hematology, Definition, Importance, Important equipment used, Laboratory organization and safety measures in Hematology Laboratory, Introduction to blood, its composition, function and normal cellular components.

#### UNIT-II

**16 Hours**

Anticoagulants Types, mode of action and preference of anticoagulants for different hematological studies, Collection and preservation of blood sample for various hematological investigations.

#### UNIT-III

**16 Hours**

Formation of cellular components of blood (Haemopoiesis) Erythropoiesis, Leucopoiesis, Thrombopoiesis, Hemoglobin: definition, types, structure, synthesis and degradation, Morphology of normal blood cells, Normal Hemostasis & physiological properties of coagulation factors, Radioactivity Definition, half-life, physical decay and units, Urine analysis

#### **UNIT-IV**

**14 Hours**

Quality assurance in Hematology, Internal and external quality control including reference, preparation, Routine quality assurance protocol, Statistical

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

#### **Suggested Readings**

Bain, Imelda, B. and John V. D. (2001). *Practical Haematology*. London: Churchill Livingstone

Christopher, A. L. (1990) *Clinical Haematology*.

John, B. H. (2001). *Clinical Diagnosis & Management by Laboratory methods*.

McDonald, G.A. (1989). *Atlas of haematology*

Godkar, P. B., & Godkar, D. P. (2003). *Textbook of medical laboratory technology. Bhalani*.

Stephen, M. (2001). *Clinical Haematology (Pathophysiological basis for clinical practice) (3rd edition)*.

### **Semester -1st**

**Course Title: GENERAL ANATOMY (PRACTICAL)**

**Course Code: BML104**

L	T	P	Cr.
0	0	4	2

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Students will be able to learn the practical knowledge of digestive system, liver structure and function
- 2 The study of electrolytes and various body fluids.
- 3 Students will be able to become instructor in anatomy laboratory.
- 4 It helps the student to understand the function of various systems of the body
- 5 Understand structure and functioning of urinary system, genital system.

### **Course Contents**

#### **List of Practical's / Experiments:**

1. Demonstration of-Basic anatomical terminology, anatomical position, anatomical planes, levels of organization in the body, organ systems, skeleton, cavities of the body.
2. Lymphatic system - Features of lymph vessels, lymphatic tissue & organs, lymphatics, spleen, tonsil, thymus.
3. Nervous system - Central nervous system, brain, cerebellum, spinal cord, cranial nerves, autonomic nervous system.
4. Muscular system - Skeletal muscle, cardiac muscle, smooth muscle, muscles of the body.
5. Skeletal system - Features of bones, axial skeleton, appendicular skeleton.
6. Musculoskeletal system - Joints of upper & lower limb.
7. Respiratory system - Nose & paranasal sinuses, pharynx, larynx, trachea, lungs.
8. Cardiovascular system - Heart & blood vessels.
9. Digestive system - Oral cavity, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, liver, gallbladder, pancreas.
10. Urinary system - Kidneys, juxtaglomerular apparatus, Ureter, urinary bladder, urethra.
11. Introduction to genetics - Features of chromosomes, DNA.
12. Reproductive system in females - External & internal genital organs, breast.
13. Reproductive system in males - Penis, scrotum, testes, prostate gland.

14. Endocrine system - Hormones, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Semester -1st**

**Course Title: GENERAL PHYSIOLOGY (PRACTICAL)**

**Course Code: BML105**

L	T	P	Cr.
0	0	4	2

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 After studying student will understand the function of each structures related to human body.
- 2 After studying anatomy of cell organelles, skeletal system, student will be able to identify site for sample collection.
- 3 Properties of nerve fibres, function of neuralgia, synapse, CNS, CSF, brain, cranial nerves, demonstration of reflexes.
- 4 Provide knowledge about functioning of Hormones, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas, help in employability
- 5 Understand Blood component, function, and morphology of blood cells.

**Course Contents**

**List of Practical's / Experiments:**

Demonstration of-Basic physiological terminology, anatomical position, anatomical planes, levels of organization in the body, organ systems, skeleton, cavities of the body.

Lymphatic system - Features of lymph vessels, lymphatic tissue & organs, lymphatics, spleen, tonsil, thymus.



Nervous system - Central nervous system, brain, cerebellum, spinal cord, cranial nerves, autonomic nervous system.

Muscular system - Skeletal muscle, cardiac muscle, smooth muscle, muscles of the body.

Skeletal system - Features of bones, axial skeleton, appendicular skeleton.

Musculoskeletal system - Joints of upper & lower limb.

Respiratory system - Nose & paranasal sinuses, pharynx, larynx, trachea, lungs.

Cardiovascular system - Heart & blood vessels.

Digestive system - Oral cavity, pharynx, salivary glands, esophagus, stomach, small intestine, large intestine, liver, gallbladder, pancreas.

Urinary system - Kidneys, juxtaglomerular apparatus, Ureter, urinary bladder, urethra.

Introduction to genetics - Features of chromosomes, DNA.

Reproductive system in females - External & internal genital organs, breast.

Reproductive system in males - Penis, scrotum, testes, prostate gland.

Endocrine system - Hormones, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, endocrine pancreas.

### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Semester -1st**

**Course Title: BASIC HAEMATOLOGY (PRACTICAL)**

**Course Code: BML106**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr.</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

### **List of Practical's / Experiments:**

Demonstration of-

Preparation of various anticoagulants:

EDTA

Sodium Citrate,

Oxalate with Fluoride

Collection of blood sample for various Lab Investigations

Familiarization and working of routine Hematology Lab. Instruments

Microscopes  
 Haemocytometers  
 Colorimeter  
 Spectrophotometer  
 Glass pipettes & Auto pipettes  
 Glassware  
 Sahli's Apparatus  
 Identification of Normal blood cells  
 Urine Analysis:  
 Routine biochemistry of Urine for:  
 pH  
 Specific Gravity  
 Glucose  
 Ketones  
 Bilirubin  
 Albumin  
 Microscopic Examination of Urine

### Semester -1st

**Course Title: MEDICAL ETHICS AND LEGAL ASPECTS**

**Course Code:** BML107

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Interaction with the patients and health care professionals in working area.
- 2 Handle Legal Responsibilities, Patient safety and quality
- 3 Management of Biomedical waste generated from hospital or
- 4 Maintain Medical records and reports preparation
- 5 Employs a body systems-oriented, word-analysis approach to learning medical terminology.

### Course Contents

**UNIT-I**

**20 Hours**

Role of medical laboratory Technician, Definition and Interaction with the patients and health care professionals, Ethical, Moral, and Legal Responsibilities, Patient safety and quality, restraint policies and role of health professionals. Biomedical waste Management, medical records and reports.

**UNIT-II****20 Hours**

Medical terminology- The course employs a body systems-oriented, word-analysis approach to learning medical terminology.

**UNIT-III****20 Hours**

The goal of the class is to prepare students for the terminology they might encounter in their subsequent coursework, in their clinical rotations and ultimately in their roles as health care professionals.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested readings**

Pozgar, G. D. (2012). *Legal aspects of health care administration*. Sudbury, Mass: Jones & Bartlett Learning

Morrison, E. E., & Furlong, E. (2014). *Health care ethics: Critical issues for the 21st century*. Burlington, MA: Jones & Bartlett Learning.

Kliegman, R., Stanton, B., St. Geme, J. W., Schor, N. F., & Behrman, R. E. (2016). *Nelson textbook of pediatrics* (Edition 20.). Philadelphia, PA: Elsevier.

**Semester -1st****Course Title: BASIC IN COMPUTER& INFORMATION SCIENCE****Course Code: BML108**

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Use Computer resources for learning and made education more flexible and easy to access.
- 2 Students can gain knowledge and information from available online resources.

- 3 Video tutorials also contribute in the resources that are needed by the students.
- 4 Computers have supplied infinite resources for learning and made education more flexible and easy to access.
- 5 Creating and manipulating presentation, views, formatting and enhancing text, and slide with graphs.

## **Course Contents**

### **UNIT-I**

**16 Hours**

Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages, Input output devices: Input devices(keyboard, point and draw devices, data scanning, devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice response systems).

### **UNIT-II**

**14 Hours**

Processor and memory: The Central Processing Unit (CPU), main memory, Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices, Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.), Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge.

### **UNIT-III**

**18 Hours**

Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs, Introduction to power-

point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.

#### **UNIT-IV**

**12 Hours**

Introduction of Operating System: introduction, operating system concepts, types of , operating system, Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet, Application of Computers in clinical settings.

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

#### **Suggested Readings**

Rajaraman, V., & Radhakrishnan, T. (2006). *Digital Logic and Computer Organization*. PHI Learning Pvt. Ltd..

Mehdi, M. M. (2015). Information Technology for Management by. *FIIB Business Review*, 4(1), 46-47.

Ram, B. (2000). *Computer fundamentals: architecture and organization*. New Age International.

Basandara, S. K. (2017). *Computers Today*, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.

Sadagopan, S. (1998). *Internet for everyone* by Alexis Leon and Matthews Leon, Vikas Publishing House, 1997, Rs. 128.00.

Saxena, S. (2009). *A first course in computers: Based on Windows Xp & Office*. Vikas Publishing House Pvt Ltd.

Sinha P.K. and Sinha, P. (2007) *Computer Fundamentals*, BPB Publications.

Bangia, R. (2008). *Computer Fundamentals and Information Technology*. Firewall Media.

#### **Semester -2nd**

**Course Title: ANALYTICAL CLINICAL BIOCHEMISTRY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr.</b>
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**Course Code:** BML201

4	0	0	4
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**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Understand the theory of spectrophotometer and colorimetry, Lambert`s law and Beer`s law.
- 2 Describe general principles of flame photometry, limitations of flame photometry.
- 3 Understand principle, types, and details for qualitative and quantitative analysis by chromatography.
- 4 Understand principle, instrumentation, applications, and types of electrophoresis.
- 5 Understand experimental techniques, application of TLC, limitations, High performance thin layer chromatography

### **Course Contents**

#### **UNIT-I**

**14 Hours**

Colorimetry and Spectrophotometry, Introduction, Theory of spectrophotometry and colorimetry, Lambert`s law and Beer`s law, Applications of colorimetry and spectrophotometry

#### **UNIT-II**

**16 Hours**

Photometry Introduction, General principles of flame photometry, Limitations of flame photometry, Instrumentation, Applications of flame photometry, Atomic absorption spectroscopy – Principle & applications

#### **UNIT-III**

**20 Hours**

Chromatography: Introduction, Types of chromatography, Paper Chromatography: Introduction, principle, types, details for qualitative and quantitative analysis, application, Thin layer chromatography: Introduction, experimental techniques, application of TLC, limitations, High performance thin layer chromatography, Column chromatography: Introduction, principle column efficiency, application of column chromatography, Gas chromatography: Introduction principle, instrumentation, application, Ion exchange chromatography: Introduction,

Definition and principle, cation and anion exchangers, application, Gel Chromatography: Introduction Principle and method, application and advantages

#### **UNIT-IV**

**10 Hours**

Electrophoresis: Introduction, Principle, Instrumentation, Applications, Types of electrophoresis, Paper electrophoresis, Gel electrophoresis

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

#### **Suggested readings**

Champe, P. C., Harvey, R. A., & Ferrier, D. R. (2005). Biochemistry. Lippincott Williams & Wilkins.

Ferrier, D. R. (2014). Biochemistry. Lippincott Williams & Wilkins.

Varley, H. (1954). Practical clinical biochemistry. Practical clinical biochemistry.

Lucock, M. (2000). Folic acid: nutritional biochemistry, molecular biology, and role in disease processes. Molecular genetics and metabolism, 71(1-2), 121-138.

Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger principles of biochemistry. Macmillan.

Vasudevan, D. M., Sreekumari, S., & Vaidyanathan, K. (2013). Textbook of biochemistry for medical students. JP Medical Ltd.

#### **Semester-2nd**

**Course Title: GENERAL CLINICAL MICROBIOLOGY**

**Course Code: BML202**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr.</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 This subject will give the detailed information about the host, parasite, their life cycle and relationship of various diseases.
- 2 It also provides the information to the collection and transportation of laboratory samples related to parasitological analysis

- 3 This knowledge makes the student capable to Care & handling of laboratory animals.
- 4 Knowledge of Classification of microbes with special reference to prokaryotes & eukaryotes, Morphological classification of bacteria, Bacterial anatomy
- 5 Care and handling of glassware, Cleaning of glassware

### **Course Contents**

#### **UNIT-I**

**13 Hours**

Definition, History, Host - Microbe relationship, Safety measures in Clinical Microbiology, Glassware used in Clinical Microbiology Laboratory, Care and handling of glassware, Cleaning of glassware, Equipment used in clinical Microbiology Laboratory, Care and maintenance including calibration.

#### **UNIT-II**

**17 Hours**

Microscopy & Sterilization Microscopy, Introduction and history, Types, principle and operation mechanism of following microscopes, Light microscope, DGI, Fluorescent, Phase contrast, Electron microscope: Transmission/ Scanning, Definition, Types and principles of sterilization methods, Heat (dry heat, moist heat with special Reference to autoclave), Radiation, Filtration, Efficiency testing to various sterilizers.

#### **UNIT-III**

**20 Hours**

Antiseptics and disinfectants, Definition, Types and properties, Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants, Biomedical waste management in a Medical Microbiology laboratory, Types of the waste generated – Segregation – Treatment – Disposal, General characteristics & classification of Microbes: (Bacteria & fungi), Classification of microbes with special reference to prokaryotes & eukaryotes, Morphological classification of bacteria, Bacterial anatomy (Bacterial cell structures), Growth and Nutrition of Microbes, General nutritional & other requirements of the bacteria, Classification of bacteria on the basis of their nutritional requirements, Physical conditions required for growth, Normal growth cycle of bacteria (growth curve), Types of microbial cultures: Synchronous, Static, continuous culture.



**UNIT-IV****10 Hours**

Culture media Introduction, Classification of culture media (Example & Uses) solid media, liquid media, semisolid, Media, routine/synthetic/defined media, basal media, enriched, enrichment, Selective differential media, sugar fermentation media, transport media, preservation media and anaerobic culture media, Quality control in culture media, Automation in culture media preparation Aerobic & anaerobic culture methods: Concepts, Methods Used for aerobic cultures, Methods used for anaerobic cultures

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Collee, J. C., Dugmid, J. P., Fraser, A. G., &Marmion, B. P. (1996). Practical medical microbiology, Mackie and Mc Cartney.

Gupte, S. (2007). *Review of medical microbiology* (No. Ed. 2).Jaypee Brothers Medical Publishers (P) Ltd.

Mukherjee, K. L. (2013). *Medical Laboratory Technology Volume 3* (Vol. 3).Tata McGraw-Hill Education.

Cheesbrough, M. (2018). District Laboratory Practice in Tropical Countries. *IJMS*, 1(1).

Willey, J. M., Sherwood, L., &Woolverton, C. J. (2011). *Prescott's microbiology* (Vol. 7). New York: McGraw-Hill.

**Semester -2nd**

**Course Title: INTRODUCTION TO QUALITY AND PATIENT SAFETY**

**Course Code:** BML203

L	T	P	Cr.
3	0	0	3

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 They will get the knowledge about the health care discipline that emerged with the evolving complexity in health care systems and the resulting rise of patient harm in health care facilities.

- 2 Students will get to know the ways to prevent and reduce risks, errors and harm that occur to patients during provision of health care.
- 3 This subject is continuous improvement based on learning from errors and adverse events.
- 4 Important role in Quality improvement approaches, standards and norms,
- 5 Use quality improvement tools, introduction to NABH guidelines.

### **Course Contents**

#### **UNIT-I**

**14 Hours**

Quality assurance and Management Introduction, Quality improvement approaches, standards and norms, quality improvement tools, introduction to NABH guidelines. Basic of Emergency care and Life support skills Basic life support (BLS) following cardiac arrest, recognition of sudden cardiac arrest and activation of emergency response system, early cardiopulmonary resuscitation (CPR) and rapid defibrillation with an automated external defibrillator (AED)

#### **UNIT-II**

**09 Hours**

Basic emergency care First aid, choking, rescue breathing methods, ventilation including use of bag valve masters (BVMs) Biomedical Waste Management Definition, waste minimization.

#### **UNIT-III**

**10 Hours**

BMW-segregation, collection, transportation, treatment and disposal (Including color coding), Liquid BMW, Radioactive waste, metals/chemicals/drug waste, BMW management and methods of disinfection, use of Personal protective equipment (PPE), Infection Prevention and Control, Sterilization, Disinfection, Effective hand hygiene, use of PPE,

#### **UNIT-IV**

**12 Hours**

Prevention and control of common health care associated infections, Guidelines (NABH) and JCI for hospital infection control. Disaster preparedness and management Fundamentals of emergency management

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Vincent, C. (2011). *Patient safety*. John Wiley & Sons.

Hall, L. M. (Ed.). (2005). *Quality work environments for nurse and patient safety*. Jones & Bartlett Learning.

Sandars, J., & Cook, G. (Eds.). (2009). *ABC of patient safety* (Vol. 72). John Wiley & Sons.

Carayon, P. (2006). *Handbook of human factors and ergonomics in health care and patient safety*. CRC press.

**Semester -2nd**

**Course Title: ENVIRONMENTAL SCIENCE**

**Course Code: BML204**

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Understand Natural Resources and associated problems, use and over exploitation
- 2 Understand causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution
- 3 Understand concept of ecosystem, structure, interrelationship of producers, consumers and decomposers,
- 4 Learn about sustainable development, urban problems related to energy, Water conservation, rain water harvesting,.
- 5 Learn about Issues involved in enforcement of environmental legislation  
Public awareness.

**Course Contents****UNIT-I****14 Hours**

Introduction: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness. Natural Resources - Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

**UNIT-II****09 Hours**

Ecosystems: Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hotspots of biodiversity

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards, Solid waste management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies, Disaster management: Floods, earthquake, cyclone and landslides.

### **UNIT-III**

**10 Hours**

Social blemishes and the Environment: From Unsustainable to Sustainable development, urban problems related to energy, Water conservation, rain water harvesting, water shed management Resettlement and rehabilitation of people; its pros and concerns. Case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland reclamation, Consumerism and waste products. Environment Protection Act, Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.

### **UNIT-IV**

**12 Hours**

Human Population and the Environment, Population growth, variation among nations. Population explosion–Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies. Understanding the Hospital Environment Understanding the environment in the following clinical laboratories: Microbiology, Biochemistry, Histopathology, Hematology Clinical laboratory hazards to the environment from the following and means to prevent: Infectious material, Toxic Chemicals, Radioactive Material, Other miscellaneous wastes

### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Vincent, C. (2011). *Patient safety*. John Wiley & Sons.

Hall, L. M. (Ed.). (2005). *Quality work environments for nurse and patient safety*. Jones & Bartlett Learning.

Sandars, J., & Cook, G. (Eds.). (2009). *ABC of patient safety* (Vol. 72). John Wiley & Sons.

Carayon, P. (2006). *Handbook of human factors and ergonomics in health care and patient safety*. CRC press.

## Semester -2nd

**Course Title: REMEDIAL BIOLOGY**

**Course Code:** BML205

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Know the classification and salient features of five kingdoms of life
- 2 To understand the basic components of anatomy & physiology of plant
- 3 By knowing understand the basic components of anatomy
- 4 The physiology animal with special reference to human

## Course Contents

### UNIT-I

**14 Hours**

**Living world:** Definition and characters of living organisms, Diversity in the living world, Binomial nomenclature, **Cell** - The unit of life: Structure and functions of cell and cell organelles. Cell division, **Tissues:** Definition, types of tissues, location and functions. **Body fluids and circulation:** Composition of blood, blood groups, coagulation of blood Composition and functions of lymph, Human circulatory system, Structure of human heart and blood vessels, Cardiac cycle, cardiac output and ECG.

### UNIT-II

**09 Hours**

**Digestion and Absorption:** Human alimentary canal and digestive glands, Morphology of Flowering plants, Role of digestive enzymes, Digestion, absorption and assimilation of digested food, **Breathing and respiration:** Human respiratory

system, Mechanism of breathing and its regulation, Exchange of gases, transport of gases and regulation of respiration, Respiratory volumes.

### UNIT-III

**10 Hours**

**Excretory products and their elimination:** Modes of excretion, Human excretory system- structure and function, Urine formation, Rennin angiotensin system, Neural control and coordination, Definition and classification of nervous system, Structure of a neuron, Generation and conduction of nerve impulse, Structure of brain and spinal cord, Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata,

### UNIT-IV

**12 Hours**

**Chemical coordination and regulation:** Endocrine glands and their secretions, Functions of hormones secreted by endocrine glands, **Human reproduction:** Parts of female reproductive system, Parts of male reproductive system, Spermatogenesis and Oogenesis, Menstrual cycle, Respiration, glycolysis, fermentation (anaerobic),

### Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

### Suggested Readings

Text book of Biology by S. B.Gokhale

A Text book of Biology by Dr. Thulajappa and Dr.Seetaram.

A Text book of Biology by B.V. SreenivasaNaidu

A Text book of Biology by Naidu andMurthy

Botany for Degree students ByA.C.Dutta.

Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.

A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

### Semester -2nd

**Course Title: REMEDIAL METHAMATICS**

**Course Code:** BML206

L	T	P	Cr.
3	0	0	3

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Know the theory and their application in Paramedical Sciences.

- 2 Solve the different types of problems by applying theory.
- 3 Appreciate the important application of mathematics in Paramedical Sciences.
- 4 Learn about Issues involved in enforcement of environmental legislation Public awareness.
- 5 Learn about sustainable development, urban problems related to energy, Water conservation of Public awareness.

### Course Contents

#### UNIT-I

**14 Hours**

**Partial fraction:** Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics. and clinical analysis, **Logarithms:** Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems., **Function:** Real Valued function.

#### UNIT-II

**09 Hours**

**Matrices and Determinant:** Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving clinical analysis and biochemical equations.

#### UNIT-III

**10 Hours**

**Differentiation** : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of  $x^n$  w.r.t  $x$ , where  $n$  is any rational number, Derivative of  $e^x$ , Derivative of  $\log_e x$ , Derivative of  $a^x$ , Derivative of trigonometric functions from first principles(**without Proof**), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point.

**UNIT-IV****12 Hours**

**Application of Differential Equations:** Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving** biochemical equations, **Laplace Transform:** Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and biochemical equations.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Differential Calculus by Shanthinarayan

Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.

Integral Calculus by Shanthinarayan

Higher Engineering Mathematics by Dr.B.S.Grewal

**Semester -2nd**

**Course Title: Community Survey**

**Course Code: BML207**

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Identify groups which require special attention (elderly, adolescents, gender the poor and other marginalized groups) including those facing occupational hazards
- 2 Manage Health Information System and respond appropriately to the information gathered
- 3 Establish Surveillance System and respond to public health threats efficiently and effectively
- 4 Use effectively the tools of epidemiology for understanding disease causation and determinants of diseases



- 5 Learn about sustainable development, urban problems related to energy, Water conservation of Public awareness.

### **Course Contents**

#### **UNIT-I**

**14 Hours**

History of Health Services in India. Bhore Committee's and other Committee Reports on Health Services, Health care and Health Professional Education in India. Collection and Dispatch of Samples to laboratory. Examination and interpretation of simple laboratory tests on blood, stool and urine. Peripheral blood examination of Thick and Thin Smears and Reporting. Interpretation of commonly used serological tests such as Widal/HIV/Hepatitis B/VDRL/Viral Antibody Titers.

#### **UNIT-II**

**09 Hours**

Nutrients. Daily Requirements. Balanced Diet. Primordial Prevention of lifestyle related disease, Classification of Foods. Daily Requirements of Nutrients.

Water borne disease - Epidemiology and Control- Investigation of outbreak of waterborne disease and report including water testing. Water Quality Standards.

Community Geriatrics - implications of demographic changes In Indian Population - Health Problems of the aged - Preventive Health Services for the aged

#### **UNIT-III**

**10 Hours**

Disposal of Waste and Sanitation - Sources and Classification of wastes - Disposal of Solid Wastes - Excreta Disposal - Sewage Treatment - Healthcare and Hospital Waste Management,  
Environmental Pollution - Sources of Environmental Pollution - Monitoring of Environmental Pollution - Prevention and Management of Environmental Pollution. Principles of Occupational Health - Occupational environment, - Occupational Hazards - Absentism - Problems of Industrialisation - Health Protection of Workers - Prevention of Occupational Diseases

#### **UNIT-IV**

**12 Hours**

Infectious and Non Infectious Disease Epidemiology –

Respiratory Diseases such as Small Pox. Chicken Pox. Measles. Mumps. Rubella. Diphtheria, Pertussis, Influenza, Tuberculosis, ARI.

Intestinal Infections such as Poliomyelitis. Hepatitis. Food Poisoning. Cholera. Enteric Fevers. Amoebiasis, Worm Infestations etc –

Arthropod Borne Infections such as Malaria, Filariasis, Dengue and others - Zoonotic Diseases such as Brucellosis. Rickettsial Diseases, Parasitic –

Surface Infections including AIDS, STDs, Leprosy, Tetanus, Trachoma among others –

Non-Infectious Diseases of Public Health Importance - Cardiovascular diseases. diabetes. blindness. accidents, cancers.

### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Abramson, J. H. (1974). *Survey methods in community medicine*. Churchill Livingstone, 23 Ravelston Terrace, Edinburgh EH4 3TL..

Park, K. (2014). *Doctors and medicine in early Renaissance Florence* (Vol. 38). Princeton University Press.

Park, J. E. (1970). Textbook of preventive and social medicine.(A treatise on community health.). *Textbook of preventive and social medicine.(A treatise on community health.)*.

### **Semester -2nd**

**Course Title: ANALYTICAL CLINICAL BIOCHEMISTRY  
(PRACTICAL)**

**Course Code:** BML208

L	T	P	Cr.
0	0	4	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

#### **List of Practical's / Experiments:**

Demonstration of-

To demonstrate the principle, working & maintenance of spectrophotometer.

To demonstrate the principle, working & maintenance of colorimeter.

To demonstrate the principle, working & maintenance of flame photometer.

To demonstrate the principle, procedure of paper chromatography.

To demonstrate the principle & procedure of Gas chromatography.

To demonstrate the principle & demonstration of TLC.

To demonstrate the principle & procedure of column chromatography.

To demonstrate the principle & procedure of Electrophoresis

### **Suggested readings**

Champe, P. C., Harvey, R. A., & Ferrier, D. R. (2005). Biochemistry. Lippincott Williams & Wilkins.

Ferrier, D. R. (2014). Biochemistry. Lippincott Williams & Wilkins.

Varley, H. (1954). Practical clinical biochemistry. Practical clinical biochemistry.

Lucock, M. (2000). Folic acid: nutritional biochemistry, molecular biology, and role in disease processes. Molecular genetics and metabolism, 71(1-2), 121-138.

Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger principles of biochemistry. Macmillan.

Vasudevan, D. M., Sreekumari, S., & Vaidyanathan, K. (2013). Textbook of biochemistry for medical students. JP Medical Ltd.

### **Semester -2nd**

**Course Title: GENERAL CLINICAL MICROBIOLOGY  
(PRACTICAL)**

**Course Code:** BML209

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr.</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>3</b>

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

#### **List of Practical's / Experiments:**

Demonstration of-

To demonstrate safe code of practice for a Microbiology laboratory

To prepare cleaning agents & to study the technique for cleaning & sterilization of glassware.

To demonstrate the working & handling of Compound microscope.

To demonstrate the method of sterilization by autoclave including its efficacy testing.

To demonstrate the method of sterilization by hot air oven including its efficacy testing.

To demonstrate the method of sterilization of media/solution by filtration.

Demonstration of Antiseptics, Spirit, Cetrimide&Povidone-Iodine.

To demonstrate the use of disinfectants.

Demonstrate the precaution while using disinfectants.

To prepare working dilution of commonly used disinfectants.

In-use test

Rideal-walker phenol co-efficient test.

Kelsey-Sykes test

To demonstrate the different morphological types of bacteria

Preparation of one culture media from each type

To demonstrate aerobic culture

To demonstrate anaerobic culture

Visit to animal house & demonstrate about care of laboratory animals

### **Suggested Readings**

Collee, J. C., Dugmid, J. P., Fraser, A. G., & Marmion, B. P. (1996). Practical medical microbiology, Mackie and Mc Cartney.

Gupte, S. (2007). *Review of medical microbiology* (No. Ed. 2). Jaypee Brothers Medical Publishers (P) Ltd.

Mukherjee, K. L. (2013). *Medical Laboratory Technology Volume 3* (Vol. 3). Tata McGraw-Hill Education.

Cheesbrough, M. (2018). District Laboratory Practice in Tropical Countries. *IJMS*, 1(1).

Willey, J. M., Sherwood, L., & Woolverton, C. J. (2011). *Prescott's microbiology* (Vol. 7). New York: McGraw-Hill.

### **Semester -III**

**Course Title: BASIC HAEMATOLOGICAL DISEASES**

**Course Code:** BML301

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Understand about the disorders of the blood and blood-forming organs
- 2 Learn about the blood cell cancers, hematologic diseases include rare genetic disorders, anaemia.
- 3 Anticipate and recognize problems, identify causes of these problems, quantify potential impacts, analyze.
- 4 Identify Causes of bleeding disorders
- 5 Differentiate Micro-cytic hypochromic anemia, Macro-cytic anemia.

### **Course Contents**

#### **UNIT-I**

**16 Hours**

Anemia-Introduction, Classification, Microcytic hypochromic anemia, Macrocytic anemia, Normocytic normochromic anemia Quantitative disorders of Leukocytes Cause and significance  
Granulocytic and Monocytic Disorders, Lymphocytic Disorders.

#### **UNIT-II**

**14 Hours**

Anemia-Introduction, Classification, Microcytic hypochromic anemia, Macrocytic anemia, Normocytic normochromic anemia Quantitative disorders of Leukocytes Cause and significance  
Granulocytic and Monocytic Disorders, Lymphocytic Disorders.

#### **UNIT-III**

**18 Hours**

Bleeding disorders: Introduction Causes of bleeding disorders Vascular defect, Platelet defect, Factor deficiency, Inhibitors, Hyper fibrinolysis, Types of bleeding disorders, Inherited bleeding disorders, Acquired bleeding disorders.

#### **UNIT-IV**

**12 Hours**

Thrombosis Introduction, Causes of thrombosis Monitoring of Anticoagulants Oral anticoagulants by INR, Heparin.

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

#### **Suggested Readings**

Godkar, P. B. and Godkar, P. (2014). *Textbook Of Medical Laboratory Technology*. Bhalani Publishing House

- L Mukherjee, K., Swarajit. G. (2010). *Medical Laboratory Technology (Volume I)*.  
 Soor, R. (2003) *Haematology for Students & Practitioners*. Jaypee Brothers.  
 Talib, V.H. (1985). *Hand book of Medical Laboratory Technology*(First edition).  
 Emmanuel, C. B. *Haematology* (International edition) Harwal Publisher.  
 Bain, Imelda, B. and John V. D. (2001). *Practical Haematology*. London: Churchill Livingstone  
 Christopher, A. L. (1990) *Clinical Haematology*.  
 John, B. H. (2001). *Clinical Diagnosis & Management by Laboratory methods*.  
 McDonald, G.A. (1989). *Atlas of haematology*.

### Semester -3rd

**Course Title: SYSTEMATIC BACTERIOLOGY**

**Course Code: BML302**

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 To learn techniques for Inoculation of bacteria on culture media
- 2 Bacterial identification : To demonstrate reagent preparation and procedure for
- 3 To prepare the reagent and demonstrate biochemical tests with positive and negative control bacteria
- 4 Understand Principle, procedures and interpretation of the biochemical tests for identification of different bacteria
- 5 Understand Significance of staining in bacteriology, Principle, Reagent preparation

### Course Contents

#### UNIT-I

**15 Hours**

Bacterial culture: Instruments used to seed culture media, Culture procedures – seeding a plate. Staining techniques in bacteriology, Significance of staining in bacteriology, Principle, Reagent preparation, Procedures and interpretation of the following-Simple staining, Negative staining, Gram stain, Albert's stain, Neisser's stain, Ziehl –Neelsen staining, Capsule staining Flagella staining, Spore staining, Fontana stain for spirochetes.

#### UNIT-II

**15 Hours**

Principle, procedures and interpretation of the following biochemical tests for identification of different bacteria. Catalase, Coagulase, Indole, Methyl Red, Voges Proskauer, Urease, Citrate, Oxidase, TSIA, Nitrate reduction, Carbohydrate fermentation, Huger and Leifson, Bile solubility, H<sub>2</sub>S productions, Demonstration of motility, Decarboxylases, CAMP, Hippurate hydrolysis, Nagler's reaction, Cholera-red reaction

### **UNIT-III**

**16 Hours**

Definition, Classification, Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria, Staphylococcus, Streptococcus Pneumococcus, Neisseria gonorrhoea and Neisseria meningitidis, Haemophilis, Corynebacterium Enterobacteriaceae: Escherichia coli, Klebsiella, Citrobacter, Enterobacter, Proteus, Salmonella, Shigella, Yersinia enterocolitica and Yersinia pestis, Vibrio, Aeromonas and Plesiomonas, Clostridia of wound infection

### **UNIT-IV**

**14 Hours**

Definition, Classification, Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria, Mycobacterium tuberculosis complex, Atypical Mycobacteria and M. leprae, Spirochetes – Treponema, Borrelia and leptospira Bordetella and brucella, Mycoplasma and Ureaplasma, Rickettsia, Chlamydia, Actinomyces, Pseudomonas and Burkholderia, Brief introduction about non sporing anaerobic cocci and bacilli

### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Collee, J. G., Mackie, T. J., and McCartney, J. E. (1996). *Mackie & McCartney practical medical microbiology*. New York: Churchill Livingstone

Ananthanarayan, R. and Paniker, C., 1980. *Textbook of microbiology*. 1st ed. Orient Longman.

Murray, P. R., Rosenthal, K. S., & Pfaller, M. A. (2013). *Medical microbiology*.

Cheesbrough, M. (1984). *Medical Laboratory manual for tropical countries*. Doddington publisher.

Muralidhar, V. (2006). *Hospital Acquired Infections*. Viva Books private limited.

**Semester -3rd****Course Title: APPLIED CLINICAL BIOCHEMISTRY-I****Course Code: BML303**

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Understand hazards & safety measures in clinical Biochemistry laboratory
- 2 Understand quality control and quality assurance in a clinical biochemistry laboratory
- 3 Learning principles, procedures for estimation & assessment of Sodium, Potassium and Chloride, Iodine
- 4 Learn about maintain quality of reagent and accuracy in the procedure of biochemical parameter analysis.
- 5 Learning principles, procedures for estimation & assessment of Glucose Proteins, Urea, Uric acid

**Course Contents****UNIT-I****16 Hours**

Hazards & safety measures in clinical Biochemistry laboratory, Quality control and quality assurance in a clinical biochemistry laboratory Laboratory organization, management and maintenance of records.

**UNIT-II****14 Hours**

Principles of assay procedures, Normal range in blood, Serum, Plasma and Urine and reference values for: Glucose, Proteins, Urea, Uric acid, Creatinine, Bilirubin, and Lipids.

**UNIT-III****16 Hours**

Principles, procedures for estimation & assessment of the following including errors involved and their corrections- Sodium, Potassium and Chloride, Iodine, Calcium, Phosphorous and Phosphates

**UNIT-IV****14 Hours**

Instruments for detection of Radioactivity, Applications of Radioisotopes in clinical biochemistry.



## Enzyme linked Immune Sorbent Assay

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Godkar, P. B. and Godkar, P. (2014). *Textbook of Medical Laboratory Technology*. Bhalani Publishing House

Mukherjee, K., Swarajit. G. (2010). *Medical Laboratory Technology (Volume I)*.

Varley, H., Gowenlock, A. H., McMurray, J. R., and McLauchlan, D. M. (1988). *Varley's practical clinical biochemistry*. London: Heinemann Medical Books.

Siddiqi, M.A. (2006). *Principal of Biochemistry*.

Chatwal, G.R. and Anand, S.K. (1979). *Text book of Medical Biochemistry*, Himlayan publishing house.

Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry (7th ed.)*. W.H. Freeman

Voet, D., and Voet, J. G. (1995). *Biochemistry*. New York: J. Wiley & Sons.

Berg, J. M., Tymoczko, J. L., Stryer, L., & Stryer, L. (2002). *Biochemistry*. New York: W.H. Freeman

**Semester -3rd**

**Course Title: IMMUNOLOGY**

**Course Code: BML304**

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 To study the various concepts about Complement fixation its components, Complement activation pathways, Basic concepts about their mechanisms
- 2 Understand the types of antigens and determinants of antigenicity.
- 3 To study various principle, procedure and applications of Complement fixation test, Immuno- fluorescence, ELISA,
- 4 To study the basic concepts of Humoral and Cellular immune responses.
- 5 To study Basic concepts about its components, Complement activation pathways, Basic concepts about their mechanisms

## Course Contents

### UNIT-I

**12 Hours**

History and introduction to immunology Immunity, Innate, Acquired immunity, Complement system: Definition, Basic concepts about its components, Complement activation pathways, and Basic concepts about their mechanisms Definition, types of antigens and determinants of antigenicity.

### UNIT-II

**11 Hours**

Definition, types, structure and properties of immunoglobulin Antigen-Antibody reactions Definition, Classification, General features and mechanisms, Applications of various antigen antibody reactions Principle, procedure and applications of under mentioned in Medical Microbiology: Complement fixation test, Immunofluorescence, ELISA, SDS-PAGE, Western blotting

### UNIT-III

**11 Hours**

Immune response: Introduction Basic concepts of Humoral and Cellular immune responses Hypersensitivity: Definition, Types of hypersensitivity reactions Basic concepts of autoimmunity and brief knowledge about autoimmune diseases.

### UNIT-IV **11 Hours**

Widal, VDRL, ASO, CRP, and Brucella tube agglutination, Rose-Waaler, Automation in diagnostics serology Vaccines: Definition, Types, Vaccination schedule, Brief knowledge about Extended programme of immunization (EPI) in India.

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

#### **Suggested Readings**

Collee, J. G., Mackie, T. J., and McCartney, J. E. (1996). *Mackie & McCartney practical medical microbiology*. New York: Churchill Livingstone.

Ananthanarayan, R. and Paniker, C., 1980. *Textbook of microbiology*. 1st ed. Orient Longman.

Ananthanarayan, R.; Panicker, J.K. (2005) [1978]. *Textbook of Microbiology* (7 ed.)

L Mukherjee, K., Swarajit. G. (2010). *Medical Laboratory Technology* (Volume I).

Willey, J., Sherwood, L. and Woolverton, C. (2013).

*Prescott's Microbiology*: 9th revised edition. London: MCGRAW HILL.

**Course Title: CYTOPATHOLOGY****Course Code: BML305**

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Learn about the cryostat sectioning, its applications in diagnostic Cytopathology
- 2 Understand about the Automation in cytology, and use of automatic slide strainers.
- 3 Learn about the fluid cytology urine, CSF , body fluids (pleural, pericardial, ascetic)
- 4 To study the classification of indications & utility of the technique with special emphasis on role in FNAC
- 5 To study Principles and preparation, Cytocentrifuge, molecular cytology, Cell Block and Immune- cytochemistry

### **Course Contents**

**UNIT-I****12 Hours**

Cryostat sectioning, its applications in diagnostic Cytopathology, Enzyme Cytochemistry: Diagnostic applications, Demonstration of Phosphates, Dehydrogenises, Oxidase & Peroxides

**UNIT-II****11 Hours**

Vital staining for Sex Chromatin: Aspiration cytology: Principle Indications & utility of the technique with special emphasis on role of cytotechnologist in FNAC clinics

**UNIT-III****11 Hours**

Exfoliative cytology (Papanicolaou technique for the staining of cervical smears), Cervical cytology

Fluid Cytology, Urine, CSF, Body Fluids (Pleural, Pericardial, Ascetic).

**UNIT-IV****11 Hours**

Automation in cytology, Liquid based cytology: Principles and preparation, Cytocentrifuge, molecular cytology, Cell Block and Immune-cytochemistry

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

- Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.
- Bancroft, J. D., & Gamble, M. (Eds.). (2008). *Theory and practice of histological techniques*. Elsevier health sciences.
- Culling, C. F. A., Allison, R. T., & Barr, W. T. (2014). *Cellular pathology technique*. Elsevier.
- Mohan, H. (2015). *Textbook of pathology*. Jaypee Brothers Medical Publishers.
- Mohan, H. (2012). *Pathology practical book*. JP Medical Ltd.
- Culling, C. F. A. (2013). *Handbook of histopathological and histochemical techniques: including museum techniques*. Butterworth-Heinemann.

### Semester -3rd

**Course Title: BLOOD BANKING**

**Course Code: BML306**

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Do the Compatibility test in blood transfusion.
- 2 To learn about the collection of blood for cross matching from a blood bag.
- 3 Prepare various fractions of blood for transfusion and therapeutic purposes
- 4 Understand bacterial cell and eukaryotic cell; parallelism between genes and chromosomes.
- 5 Collect blood for cross matching from a blood bag

### Course Contents

#### UNIT-I

**11 Hours**

Introduction to Blood Banking History and discovery of various blood group systems ABO blood group system Rh and other major blood group system Sources of error in blood grouping and their elimination.

#### UNIT-II

**12 Hours**

ABO grouping: Forward and reverse grouping. Causes of discrimination between forward and reverse grouping Rh grouping, Compatibility test in blood

transfusion, Collection of blood for cross matching from a blood bag, Major cross matching, Minor cross matching, Use of enzymes in blood bank specially Papain

### **UNIT-III**

**10 Hours**

Brief introduction of blood substitute/artificial blood, Hemapheresis: pertaining to Leucocytes, platelets and plasma, Quality control in blood bank, Complications and hazards of blood transfusion, Laboratory investigations of transfusion reactions and mismatched blood transfusion, Precautions while procurement and storage of grouping antisera.

### **UNIT-IV**

**12 Hours**

Various anticoagulants used to collect blood for transfusion purposes, Selection of donor and procedure for collection of blood from a healthy donor, Preparation of various fractions of blood for transfusion and therapeutic purposes such as: Packed red cells, washed red cells and FROZEN Red cells, Platelet Rich Plasma (PRP), Platelet concentrate and frozen platelets, Fresh plasma (FP), Fresh Frozen Plasma (FFP) and cryoprecipitate

### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Lewis, S. M., Bain, B. J., Bates, I., & Dacie, J. V. (2001). *Dacie and Lewis practical haematology*. London: Churchill Livingstone

Lawicki, S., Covin, R. and Powers, A., 2017. The Kidd (JK) Blood Group System. *Transfusion Medicine Reviews*, 31(3), pp.165-172.

Lazarus, H. and Schmaier, A., 2012. *Concise guide to hematology*. Chichester, West Sussex, UK: Wiley-Blackwell, pp.77-81.

Overfield, J., Dawson, M. and Hamer, D., 2008. *Transfusion science*. Bloxham, Oxfordshire: Scion.

### **Semester -3rd**

**Course Title: MEDICAL LABORATORY MANAGEMENT**

**Course Code: BML307**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr.</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 The student become compatibility in ethical principles.
- 2 To learn about the duty to the society.
- 3 The student come to know preparevarious awareness / Safety in a clinical laboratory
- 4 The student come to know quality management system.
- 5 The student acquire the knowledge of regulations and accreditation.

**Course Contents**

**UNIT-I**

**11 Hours**

Ethical Principles and standards for a clinical laboratory professional: Duty to the patient, Duty to colleagues and other professionals, Duty to the society, Good Laboratory Practice (GLP)

**UNIT-II**

**12 Hours**

Awareness / Safety in a clinical laboratory: General safety precautions, HIV : pre- and Post-exposure guidelines, Hepatitis B & C : pre- and Post-exposure guidelines, Drug Resistant Tuberculosis, Patient management for clinical samples collection, collection of sample, transportation and preservation.

**UNIT-III**

**10 Hours**

Sample accountability: Purpose of accountability, Methods of accountability, Sample analysis, Introduction, Factors affecting sample analysis, Reporting results, Basic format of a test report, Reported reference range, Clinical Alerts, Abnormal results, Turnaround time, Results from referral laboratories, Release of examination results, Alteration in reports, Quality Management system, Introduction

**UNIT-IV**

**12 Hours**

Regulations and Accreditation, Introduction to Basics of GLP and Accreditation, Aims of GLP and Accreditation, Advantages of Accreditation, Brief knowledge about Nation and International Agencies for clinical laboratory accreditation.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

- Lewis, S. M., Bain, B. J., Bates, I., & Dacie, J. V. (2001). *Dacie and Lewis practical haematology*. London: Churchill Livingstone
- Lawicki, S., Covin, R. and Powers, A., 2017. The Kidd (JK) Blood Group System. *Transfusion Medicine Reviews*, 31(3), pp.165-172.
- Lazarus, H. and Schmaier, A., 2012. *Concise guide to hematology*. Chichester, West Sussex, UK: Wiley-Blackwell, pp.77-81.
- Overfield, J., Dawson, M. and Hamer, D., 2008. *Transfusion science*. Bloxham, Oxfordshire: Scion.
- Sangeeta Sharma et.al., Medical Laboratory Management, Viva Books Pvt Ltd. 4737/23, Ansar Road, Daryaganj, New Delhi
- Lynne Shore Garcia, Clinical Laboratory Management, ISBN Number 978-1-55581-279

### Semester -3rd

**Course Title: BASIC HEMATOLOGICAL DISEASES  
(PRACTICAL)**

**Course Code: BML308**

L	T	P	Cr.
0	0	6	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

#### **List of Practical's / Experiments:**

Demonstration of-

Haemoglobin estimation methods (Sahli's, Oxyhaemoglobin, and cyanmethaemoglobin)

Differential leukocyte count (DLC)

Recognition and staining of various types of blood cells (normal and abnormal)

Preparation of thick and thin blood smear for malaria parasite (Leishman/Giemsa/JSB)

RBC counting

WBC counting

Platelet counting

Routine Examination of urine

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

#### **Suggested Readings**

- Lewis, S. M., Bain, B. J., Bates, I., & Dacie, J. V. (2001). *Dacie and Lewis practical haematology*. London: Churchill Livingstone
- Lawicki, S., Covin, R. and Powers, A., 2017. The Kidd (JK) Blood Group System. *Transfusion Medicine Reviews*, 31(3), pp.165-172.
- Lazarus, H. and Schmaier, A., 2012. *Concise guide to hematology*. Chichester, West Sussex, UK: Wiley-Blackwell, pp.77-81.
- Overfield, J., Dawson, M. and Hamer, D., 2008. *Transfusion science*. Bloxham, Oxfordshire: Scion.

### Semester -3rd

**Course Title: SYSTEMATIC BACTERIOLOGY (PRACTICAL)**

**Course Code:** BML309

L	T	P	Cr.
0	0	6	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

#### **List of Practical's / Experiments:**

Demonstration of-

Bacterial identification: To demonstrate reagent preparation, procedure and interpretation for

Gram stain, Albert stain, Neisser's staining, Z-N staining, Capsule staining, Demonstration of flagella by staining methods, Spore staining

To demonstrate spirochetes by Fontana staining procedure

To prepare the reagent and demonstrate following biochemical tests with positive and negative control bacteria: Catalase, Coagulase, Indole, Methyl Red (MR), VogesProskauer (VP), Urease

Citrate, Oxidase, TSIA, Nitrate reduction, Carbohydrate fermentation, Huger and Leifson, Bile solubility, H<sub>2</sub>S production, Demonstration and motility, Decarboxylases, CAMP, Hippurate hydrolysis

Nagler's reaction

To demonstrate various characteristics (morphological, cultural and biochemical) of bacteria commonly isolated from clinical samples i.e. Staphylococcus, Streptococcus, Corynebacterium, Escherichia coli, Klebsiella, Citrobacter, Enterobacter, Proteus, Salmonella, Shigella, Vibrio cholera

Mycobacterium tuberculosis, Pseudomonas

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question



**Suggested Readings**

- Lewis, S. M., Bain, B. J., Bates, I., & Dacie, J. V. (2001). *Dacie and Lewis practical haematology*. London: Churchill Livingstone
- Lawicki, S., Covin, R. and Powers, A., 2017. The Kidd (JK) Blood Group System. *Transfusion Medicine Reviews*, 31(3), pp.165-172.
- Lazarus, H. and Schmaier, A., 2012. *Concise guide to hematology*. Chichester, West Sussex, UK: Wiley-Blackwell, pp.77-81.
- Overfield, J., Dawson, M. and Hamer, D., 2008. *Transfusion science*. Bloxham, Oxfordshire: Scion.

**Semester -3rd**

**Course Title: APPLIED CLINICAL BIOCHEMISTRY-I  
(PRACTICAL)**

**Course Code:** BML310

L	T	P	Cr.
0	0	6	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

**List of Practical's / Experiments:** Demonstration of-

- Estimation of Glucose in Urine and in Blood.
- Estimation of Protein in Urine and Blood.
- Estimation of Urea in blood.
- Estimation of uric acid in blood.
- Estimation of serum Bilirubin
- Estimation of Total Cholesterol in blood.
- Estimation of HDL Cholesterol.
- Estimation of LDL Cholesterol.
- Estimation of TG
- Estimation of Creatinine in Blood
- Estimation of serum calcium, Inorganic phosphate
- Estimation of electrolytes Sodium, Potassium & Chloride.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

- Godkar, P. B. and Godkar, P. (2014). *Textbook of Medical Laboratory Technology*. Bhalani Publishing House
- Mukherjee, K., Swarajit. G. (2010). *Medical Laboratory Technology (Volume I)*.

- Varley, H., Gowenlock, A. H., McMurray, J. R., and McLauchlan, D. M. (1988). *Varley's practical clinical biochemistry*. London: Heinemann Medical Books.
- Siddiqi, M.A. (2006). *Principal of Biochemistry*.
- Chatwal, G.R. and Anand, S.K. (1979). Text book of Medical Biochemistry, Himlayan publishing house.
- Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry* (7th ed.). W.H. Freeman
- Voet, D., and Voet, J. G. (1995). *Biochemistry*. New York: J. Wiley & Sons.
- Berg, J. M., Tymoczko, J. L., Stryer, L., & Stryer, L. (2002). *Biochemistry*. New York: W.H. Freeman

### Semester -3rd

**Course Title: RESEARCH METHODOLOGY, BIostatISTICS AND IPR**

**Course Code:** BML311

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Research methods, identifying research problem, Ethical issues in research, Research design.
- 2 Overview types of Data, Research tools and Data collection methods, Sampling methods.
- 3 Understanding of data representation in biostatistics, How to get relevant data, Relation between data & variables.
- 4 Summarizing data on the pretext of underlined study, Understanding of statistical analysis
- 5 Understand How & where to get relevant data, Relation between data & variables

### Course Contents

#### UNIT-I

**14 Hours**

Research Methodology: Introduction to research methods, identifying research problem, Ethical issues in research, Research design.

#### UNIT-II

**16 Hours**

Basic Concepts of Biostatistics Types of Data, Research tools and Data collection methods, sampling methods, develops a research proposal. Biostatistics: Need of

biostatistics, what is biostatistics: beyond definition, Understanding of data  
biostatistics, how& where to get relevant data, Relation between data & variables

**UNIT-III****20 Hours**

Type of variables: defining data set Collection of relevant data: sampling methods  
Construction of study: population, sample, normality and its beyond (not design of  
study, perhaps) Summarizing data on the pretext of underlined study,  
Understanding of statistical analysis (not methods)

**UNIT-IV****10 Hours**

**IPR:** Patent, Trade, Copy Right, Entrepreneurship

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Armitage, P., Berry, G., & Matthews, J. N. S. (2008). *Statistical methods in medical research*. John Wiley & Sons.

Mahajan, B. K. (1997). *Methods in Biostatistics for medical students and research workers*.

Pagano, M., &Gauvreau, K. (2000). *Principles of biostatistics*. Australia: Duxbury.

**Semester – 4th**

**Course Title: APPLIED CLINICAL BIOCHEMISTRY-II**

**Course Code:** BML401

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Understand hazards & safety measures in clinical Biochemistry laboratory.
- 2 Apply quality control and quality assurance.
- 3 Performprinciples, procedures for estimation & assessment of Sodium, Potassium and Chloride, Iodine
- 4 Maintain quality of reagent and accuracy in the procedure of biochemical parameter analysis.

- 5 Learn the principles, procedures for estimation & assessment of Glucose Proteins, Urea, Uric acid

### Course Contents

#### UNIT-I

**16 Hours**

Hazards & safety measures in clinical Biochemistry laboratory, Quality control and quality assurance in a clinical biochemistry laboratory, Laboratory organization, management and maintenance of records

#### UNIT-II

**14 Hours**

Principles of assay procedures, Normal range in blood, Serum, Plasma and Urine and reference, values for Glucose Proteins, Urea Uric, acid, Creatinine, Bilirubin, Lipids.

#### UNIT-III

**16 Hours**

Principles, procedures for estimation & assessment of the following including errors involved and their corrections-Sodium, Potassium and Chloride, Iodine Calcium, Phosphorous and Phosphates

#### UNIT-IV

**14 Hours**

Instruments for detection of Radioactivity, Applications of Radioisotopes in clinical biochemistry.

Enzyme linked immune sorbent assay

#### Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

#### Suggested Readings

Godkar, P. B. and Godkar, P. (2014). *Textbook of Medical Laboratory Technology*. Bhalani Publishing House

L Mukherjee, K., Swarajit. G. (2010). *Medical Laboratory Technology (Volume I)*.

Varley, H., Gowenlock, A. H., McMurray, J. R., and McLauchlan, D. M. (1988). *Varley's practical clinical biochemistry*. London: Heinemann Medical Books.

Siddiqi, M.A. (2006). *Principal of Biochemistry*.

Chatwal, G.R. and Anand, S.K. (1979). *Text book of Medical Biochemistry*, Himlayan publishing house.

Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry (7th ed.)*. W.H. Freeman

Voet, D., and Voet, J. G. (1995). *Biochemistry*. New York: J. Wiley & Sons.

Berg, J. M., Tymoczko, J. L., Stryer, L., & Stryer, L. (2002). *Biochemistry*. New York: W.H. Freeman

### Semester – 4th

**Course Title: HISTOTECHNOLOGY**

**Course Code: BML402**

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

#### Course Contents

- 1 Learn basic concepts of Histotechnology .
- 2 Understand various equipments used in Laboratory
- 3 Knowledge of various types of fixatives used in Histotechnology
- 4 Perform different types of staining
- 5 Recall use of section cutting and Microtome

#### Course Contents

##### UNIT 1

**14 Hours**

Introduction to histotechnology, Care and maintenance of laboratory equipment used, Safety measures in a histopathology laboratory, Basic concepts about routine methods of examination of tissues. Collection and transportation of specimens for histological examination.

##### UNIT-II

**16 Hours**

Various types of fixatives used in histopathology laboratory (Simple fixatives, Compound fixatives and Special fixatives), Decalcification and Technique of decalcification, various types of decalcifying fluids (Organic & Inorganic Acid, chelating agents), Use of Ion-exchange resins and decalcification and treatment of hard tissues.

##### UNIT-III

**16 Hours**

Processing of various tissues for histological examination, Automatic tissue processing. Components & principles of various types of automatic tissue processors, Section Cutting, Microtome, Knives, Sharpening of Microtome Knives,

Honing, Stropping, various types of micro tome and their applications , Freezing Micro tome and various types of Stains, Dyes and their uses.

#### UNIT-IV

**14 Hours**

Theory of Staining. Types of Dyes and Stains, Use of Controls in Staining Procedures. Preparation of Stains, General Staining Procedures for manual and Automatic Staining

#### Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

#### Suggested Readings

Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.

Bancroft, J. D., & Gamble, M. (Eds.). (2008). *Theory and practice of histological techniques*. Elsevier health sciences.

Culling, C. F. A., Allison, R. T., & Barr, W. T. (2014). *Cellular pathology technique*. Elsevier.

Mohan, H. (2015). *Textbook of pathology*. Jaypee Brothers Medical Publishers.

Mohan, H. (2012). *Pathology practical book*. JP Medical Ltd.

Culling, C. F. A. (2013). *Handbook of histopathological and histochemical techniques: including museum techniques*. Butterworth-Heinemann.

### Semester – 4th

**Course Title: MYCOLOGY**

**Course Code:** BML403

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Learn taxonomy of various medically important fungi
- 2 Understand classification of fungi
- 3 Perform anti-fungal susceptible tests
- 4 Prepare culture media used fungal testing

## 5 Processing of clinical samples for diagnosis of fungal infections

**Course Contents****UNIT 1****12 Hours**

Introduction to Medical Mycology, Basic concepts about superficial and deep Mycoses, Taxonomy and classification and general characteristics of various medically important fungi, Normal fungal flora.

**UNIT 2****10 Hours**

Morphological, cultural characteristics of common fungal laboratory contaminants, Culture media used in mycology, Direct microscopy in Medical mycology laboratory.

**UNIT 3****11 Hours**

Processing of clinical samples for diagnosis of fungal infections i.e. Skin, nail, hair, pus, sputum, CSF and other body fluids, Techniques used for isolation and identification of medically important fungi

Methods for identification of yeasts and moulds.

**UNIT 4****12 Hours**

Dimorphism in fungi, Antifungal susceptibility tests, Preservation of fungal cultures, Routine myco-serological tests and skin tests.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Collee, J. G., Mackie, T. J., and McCartney, J. E. (1996). *Mackie & McCartney practical medical microbiology*. New York: Churchill Livingstone

Murray, P. R., Rosenthal, K. S., & Pfaller, M. A. (2013). *Medical microbiology*.

Chander, J. (2017). *Textbook of medical mycology*. JP Medical Ltd.

**Semester – 4th****Course Title: MEDICAL PARASITOLOGY AND ENTOMOLOGY****Course Code:** BML404

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Understand geographical distribution, Habitat, Morphology, life cycle, Mode of action and laboratory diagnosis of various parasites.
- 2 Ability to apply basic diagnostic principles in Parasitology.
- 3 List general characteristics of Cestodes, Trematodes and Nematodes
- 4 Examination of Stool, blood samples for parasites for intestinal protozoan infections.
- 5 Understand general characteristics of protozoa.

### **Course Contents**

#### **UNIT 1**

**12 Hours**

Introduction to Medical Parasitology ,General characteristics of protozoa, Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Entamoeba sp., Giardia, Trichomonas sp., Plasmodium and Toxoplasma sp., Helminthology.

#### **UNIT 2**

**11 Hours**

**Helminthes parasites:** General characteristics of Cestodes, Trematodes and Nematodes, Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of: Taeniasolium and saginata, Hymenolepis nana, Schistosoma haematobium and mansoni, Fasciola hepatica, Ancylostomaduodenale,

#### **UNIT 3**

**11 Hours**

General rules for microscopic examination and collection of stool samples of intestinal protozoa infections, Concentration techniques i.e. Flotation and sedimentation techniques, Egg counting techniques, Examination of blood for parasites

#### **UNIT 4**

**11 Hours**

Preparation of thin and thick blood film, Leishman staining, Examination of thick and thin smear, Field's stain, JSB stain, Examination of blood film for Malaria parasite and Microfilaria, Collection, Transport, processing and preservation of samples for routine parasitological investigations.



**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Leventhal, R. (1997). *Medical Parasitology*, A self Instruction Text.

Hegazi M. (1994). *Applied Human Parasitology*. 1st ed, Egypt

Chaterjee, K. D. (2011). *A text book by parasitology*.

Ichhpujani, R.L. and Bhatia, R (2003). *Medical parasitology*

**Semester – 4th**

**Course Title: CYTOPATHOLOGY**

**Course Code: BML405**

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Learn about the cryostat sectioning, its applications in diagnostic Cytopathology
- 2 Understand the working of the Automation in cytology.
- 3 Diagnosethe fluid cytology urine, CSF , body fluids (pleural, pericardial, ascetic)
- 4 Narrate indications & utility of the technique with special emphasis on role in FNAC
- 5 Follow Principles and preparation, Cytocentrifuge, molecular cytology, Cell Block and Immune- cytochemistry

**Course Contents****UNIT 1****12 Hours**

Cryostat sectioning, its applications in diagnostic Cytopathology, Enzyme Cytochemistry, Diagnostic applications Demonstration of Phosphates, Dehydrogenises, Oxidase & Peroxides

**UNIT 2****11 Hours**

Vital staining for Sex Chromatin, Aspiration cytology: Principle Indications & utility of the technique with special emphasis on role of cytotechnologist in FNAC clinics

**UNIT 3****11 Hours**

Exfoliative cytology (Papanicolaou technique for the staining of cervical smears),  
Cervical cytology  
Fluid Cytology, Urine, CSF, Body Fluids (Pleural, Pericardial, Ascetic)

**UNIT 4****11 Hours**

Automation in cytology, Liquid based cytology: Principles and preparation,  
Cytocentrifuge, molecular cytology, Cell Block and Immune-cytochemistry

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

- Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.
- Bancroft, J. D., & Gamble, M. (Eds.). (2008). *Theory and practice of histological techniques*. Elsevier health sciences.
- Culling, C. F. A., Allison, R. T., & Barr, W. T. (2014). *Cellular pathology technique*. Elsevier.
- Mohan, H. (2015). *Textbook of pathology*. Jaypee Brothers Medical Publishers.
- Mohan, H. (2012). *Pathology practical book*. JP Medical Ltd.
- Culling, C. F. A. (2013). *Handbook of histopathological and histochemical techniques: including museum techniques*. Butterworth-Heinemann.

**Semester – 4th****Course Title: VIROLOGY****Course Code:** BML406

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Learn medically important viruses
- 2 Collect, transport and storage of sample for viral diagnosis.
- 3 Processing of samples for viral culture (Egg inoculation and tissue culture).
- 4 Rapid diagnosis of viral infections with special reference to HIV, HBV and HCV

### **Course Contents**

#### **UNIT 1**

**12 Hours**

Virology: Introduction to medical virology, Introduction to medically important viruses

#### **UNIT 2**

**11 Hours**

Structure and Classification of viruses, Multiplication of viruses, Collection, transportation and storage of sample for viral diagnosis

#### **UNIT 3**

**11 Hours**

Staining techniques used in Virology, Processing of samples for viral culture (Egg inoculation and tissue culture)

#### **UNIT 4**

**11 Hours**

Rapid diagnosis of viral infections with special reference to HIV, HBV and HCV, EIA, Immuno fluorescence, PCR

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

#### **Suggested Readings**

Collee, J. G., Mackie, T. J., and McCartney, J. E. (1996). *Mackie & McCartney practical medical microbiology*. New York: Churchill Livingstone

Ananthanarayan, R. and Paniker, C., 1980. *Textbook of microbiology*. 1st ed. Orient Longman.

Murray, P. R., Rosenthal, K. S., & Pfaller, M. A. (2013). *Medical microbiology*.

**Semester – 4th****Course Title: NUTRITION****Course Code: BML407**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr.</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**Total Hours 30**

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Understand meaning of Nutrition and daily food requirement
- 2 Learn role of carbohydrates , Proteins and Fats
- 3 Narrate role of BMI and weight management of steps
- 4 Knowledge diet plan and exercise schedule for weight gain and loss

**Course Contents****UNIT – I****07 Hours**

Meaning and Definition of Nutrition, Factor to consider for developing nutrition plan, General Nutrients of the diet, daily food requirement in different activities, appropriate diet before, during and after activity.

**UNIT – II****08 Hours**

Nutrients: Ingestion to energy metabolism, Carbohydrates, Protein, Fat – Meaning, classification and its function, Role of carbohydrates, Fat and protein during exercise, Vitamins, Minerals, Water – Meaning, classification and its function, Role of hydration during exercise, water balance, Nutrition – daily caloric requirement and expenditure.

**UNIT – III****08 Hours**

Nutrition and Weight Management, Meaning of weight management Concept of weight management in modern era Factor affecting weight management and values of weight management, Concept of BMI (Body mass index), Obesity and its hazard, Myth of Spot reduction, dieting versus exercise for weight control, Common Myths about Weight Loss, Obesity – Definition, meaning and types of obesity, Health Risks Associated with Obesity, Obesity - Causes and Solutions for Overcoming Obesity.

**UNIT – IV****07 Hours**

Steps of planning of Weight Management, Nutrition – Daily calorie intake and expenditure, Determination of desirable body weight, Balanced diet for Indian School Children, Maintaining a Healthy Lifestyle, Weight management program for sporty child, Role of diet and exercise in weight management, Design diet plan and exercise schedule for weight gain and loss.

### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Bessesen, D. H. (2008). *Update on obesity*. *J ClinEndocrinolMetab*.93(6), 2027-2034.

Butryn, M.L., Phelan, S., & Hill, J. O. (2007). *Consistent self-monitoring of weight: a key component of successful weight loss maintenance*.

Chu, S.Y. & Kim, L. J. (2007). *Maternal obesity and risk of stillbirth: a metaanalysis*. *AmJObstetGynecol*, 197(3), 223-228.

DeMaria, E. J. (2007). *Bariatric surgery for morbid obesity*. *N Engl J Med*, 356(21), 2176-2183.

Dixon, J.B., O'Brien, P.E., Playfair, J. (n.d.). *Adjustable gastric banding and conventional therapy for type 2 diabetes: a randomized controlled trial*. *JAMA*. 299(3), 316-323.

## **Semester -4th**

**Course Title: APPLIED CLINICAL BIOCHEMISTRY -II  
(PRACTICAL)**

**Course Code:** BML408

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr.</b>
<b>0</b>	<b>0</b>	<b>6</b>	<b>3</b>

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

**List of Practical's / Experiments:** Demonstration of-

Estimation of Glucose in Urine and in Blood.

Estimation of Protein in Urine and Blood.

Estimation of Urea in blood.

Estimation of uric acid in blood.

Estimation of serum Bilirubin

Estimation of Total Cholesterol in blood.

Estimation of HDL Cholesterol.

Estimation of LDL Cholesterol.

Estimation of TG

Estimation of Creatinine in Blood

Estimation of serum calcium, Inorganic phosphate

Estimation of electrolytes Sodium, Potassium & Chloride.

### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Godkar, P. B. and Godkar, P. (2014). *Textbook of Medical Laboratory Technology*. Bhalani Publishing House

Mukherjee, K., Swarajit. G. (2010). *Medical Laboratory Technology (Volume I)*.

Varley, H., Gowenlock, A. H., McMurray, J. R., and McLauchlan, D. M. (1988). *Varley's practical clinical biochemistry*. London: Heinemann Medical Books.

Siddiqi, M.A. (2006). *Principal of Biochemistry*.

Chatwal, G.R. and Anand, S.K. (1979). *Text book of Medical Biochemistry*, Himlayan publishing house.

Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry (7th ed.)*. W.H. Freeman

Voet, D., and Voet, J. G. (1995). *Biochemistry*. New York: J. Wiley & Sons.

Berg, J. M., Tymoczko, J. L., Stryer, L., & Stryer, L. (2002). *Biochemistry*. New York: W.H. Freeman

### **Semester – 4th**

**Course Title: HISTOTECHNOLOGY (PRACTICAL)**

**Course Code: BML409**

L	T	P	Cr.
0	0	4	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

**List of Practical's / Experiments:** Demonstration of-

Use of antiseptics, disinfectants and insecticides in a tissue processing laboratory

Reception and labeling of histological specimens.

Preparation of various fixatives.

To perform embedding and casting of block

To process a bone for decalcification.

To demonstrate various part and types of microtome.

To perform section cutting

### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.

Bancroft, J. D., & Gamble, M. (Eds.). (2008). *Theory and practice of histological techniques*. Elsevier health sciences.

Culling, C. F. A., Allison, R. T., & Barr, W. T. (2014). *Cellular pathology technique*. Elsevier.

Mohan, H. (2015). *Textbook of pathology*. Jaypee Brothers Medical Publishers.

Mohan, H. (2012). *Pathology practical book*. JP Medical Ltd.

Culling, C. F. A. (2013). *Handbook of histopathological and histochemical techniques: including museum techniques*. Butterworth-Heinemann.

## **Semester-5th**

**Course Title: APPLIED BACTERIOLOGY**

**Course Code: BML501**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr.</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Identify the disease producing organisms that includes bacteria, fungi, parasite and virus.
- 2 Explain the concepts and principles of immunity, hypersensitivity, Autoimmunity, and immunization.
- 3 Collection, transportation and processing of body fluids for laboratory diagnosis
- 4 Perform bacteriological examination of water, milk, food and air.

## **Course Contents**

### **UNIT 1**

**16 Hours**

Laboratory strategy in the diagnosis of various infective syndromes: Samples of choice, collection, transportation and processing of samples for laboratory diagnosis of the following complications: Septicemia and bacteremia, Upper and lower Respiratory tract infections, Wound, skin, and deep sepsis, Urinary, Genital and

Gastrointestinal tract infections, Meningitis, Enteric fever, Tuberculosis (Pulmonary and Extra-pulmonary)

### **UNIT 1I**

**14 Hours**

Antibiotic susceptibility testing in bacteriology, Definition of antibiotics, Culture medium used for Antibiotic susceptibility testing, Preparation and standardization of inoculums, Control bacterial strains, Choice of antibiotics, MIC and MBC: Concepts and methods for determination, Various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method, Basics of Nucleic acid techniques in diagnostic microbiology with special reference to Polymerase chain reaction (PCR), Automation in bacterial culture detection and antimicrobial susceptibility testing: Principles and importance.

### **UNIT III**

**16 Hours**

Bacteriological examination of water, milk, food and air, examination of water, Collection and transportation of water sample, Presumptive coli form count and Eijkman test, Membrane filtration tests, Interpretation of results, Examination of Milk and milk products, Basic Concepts regarding gradation of milk, Various tests for Bacteriological examination of milk, Examination of food articles  
Basic Concepts regarding classification of food like frozen food, canned food, raw food, cooked food etc., Various tests for Bacteriological examination with special reference to food poisoning bacteria Examination of Air, Significance of air bacteriology in healthcare facilities, Settle plate method Types of air sampling instruments, Collection processing and reporting of an air sample.

### **UNIT IV**

**14 Hours**

Sterility testing of I/V fluids, Collection, transportation and processing of I/v fluids for bacterial contamination, Recording the result and interpretation, Nosocomial Infection: Introduction, sources and types of nosocomial infections, Surveillance of hospital environment for microbial load, Role of microbiology laboratory in control of nosocomial infections, Epidemiological markers: Introduction Types, Serotyping, Phage typing and, Bacteriocin typing, Preservation methods for microbes, Basic concepts of preservation of microbes, Why do we need to preserve bacteria, Principle and procedures of various short term and long term preservation methods with special reference to lyophilization.

### **Transactional modes**



Video based teaching, Collaborative teaching, Case based teaching, Question

### **Suggested Readings**

Collee, J. G., Mackie, T. J., and McCartney, J. E. (1996). *Mackie & McCartney practical medical microbiology*. New York: Churchill Livingstone.

Ananthanarayan, R. and Paniker, C., 1980. *Textbook of microbiology*. 1st ed. Orient Longman.

Ananthanarayan, R.; Panicker, J.K. (2005) [1978]. *Textbook of Microbiology* (7 ed.)

L Mukherjee, K., Swarajit. G. (2010). *Medical Laboratory Technology* (Volume I).

Willey, J., Sherwood, L. and Woolverton, C. (2013). *Prescott's Microbiology*: 9th Revised edition. London: MCGRAW HILL.

Control of Hospital infection-A practical Handbook by GajAyliffe, A.P. Fraise, A.M. Geddes, K. Mitchel

### **Semester-5th**

**Course Title: CLINICAL HISTOPATHOLOGY**

**Course Code:** BML502

L	T	P	Cr.
4	0	0	4

**Total Hours 60**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Demonstrate and identify minerals and pigments, removal of Pigments/artifacts in tissue sections.
- 2 Perform diagnostic applications and the demonstration of Phosphatases, Dehydrogenises, Oxidase&Peroxides
- 3 Processing of eye ball, bone marrow, and muscle biopsy.
- 4 Demonstrate Carbohydrates, lipids, fat & fat like substances in tissue section.

### **Course Contents**

#### **UNIT 1**

**16 Hours**

Cryostat sectioning, its applications in diagnostic histopathology. Special Staining Procedures for detection of Connective tissue elements, trichrome staining, muscle fibers, elastic, reticulin fibers, collagen fibers etc., Metachromatic staining such as Toluidine blue on frozen sections. Principles of metal impregnation techniques, Demonstration and identification of minerals and pigments, removal of Pigments/artifacts in tissue sections.

**UNIT II****15 Hours**

Demonstration of Proteins & nucleic acids, Demonstration of Carbohydrates, lipids, fat & fat like substances, Demonstration of bacteria and fungi in tissue section, Tissue requiring special treatment i.e. eye ball, bone marrow, and muscle biopsy, under calcified or uncalcified bones, whole brain, and whole lungs including other large organs.

**UNIT III****16 Hours**

Enzyme histo-chemistry: Diagnostic applications and the demonstration of Phosphatases, Dehydrogenases, Oxidase&Peroxides, Vital staining, Neuro-pathological techniques, Museum techniques.

**UNIT IV****15 Hours**

Electron Microscope: Working principle and its components Processing, embedding and ultra-microtomy Micrometry and Morphometry

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.

Bancroft, J. D., & Gamble, M. (Eds.). (2008). *Theory and practice of histological techniques*. Elsevier health sciences.

Culling, C. F. A., Allison, R. T., & Barr, W. T. (2014). *Cellular pathology technique*. Elsevier.

Mohan, H. (2015). *Textbook of pathology*. Jaypee Brothers Medical Publishers.

Mohan, H. (2012). *Pathology practical book*. JP Medical Ltd.

Culling, C. F. A. (2013). *Handbook of histopathological and histochemical techniques: including museum techniques*. Butterworth-Heinemann.

**Semester-5th****Course Title: MOLECULAR BIOLOGY AND GENETICS****Course Code: BML503**

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Learn molecular structure of DNA & RNA and use DNA & RNA templates for diagnostic application.
- 2 Clarify DNA repair mechanisms, light dependent repair, methyl-directed mismatch repair, nucleotide excision repair, post-replication repair, SOS repair.
- 3 Perform Cloning strategies for preparation of genomic DNA library and cDNA library, and applications of genetic engineering.
- 4 Identify transcription and translation processes.

**Course Contents**

**UNIT-1**

**12 Hours**

Molecular basis of heredity: central dogma, structure of DNA & RNA, denaturation and renaturation of DNA, genetic code, Wobble hypothesis, DNA replication: components, mechanism, unidirectional and bidirectional-replication, rolling circle mechanism of replication, Genetic variability: mutations- types of mutations, (spontaneous, induced, forward, backward, suppressor, point and frame shift), chemical mutagens- base analogues, nitrous acid, acridines, alkylating and hydroxylating agents, biochemical basis of mutations & genetic mechanism of drug resistance.

**UNIT-II**

**11 Hours**

DNA damage and repair: types of DNA damages (alkylation, deamination, pyrimidine dimers), repair mechanisms (light dependent repair, methyl-directed mismatch repair, nucleotide excision repair, post-replication repair, SOS repair), Genetic recombination in bacteria: types of plasmids- F-plasmid, R-plasmid, col-plasmid, Ti-plasmid, transformation, conjugation, transduction

**UNIT-III**

**11 Hours**

Transcription: prokaryotic transcription, transcription cycle (initiation, elongation and termination), bacterial promoters and regulating factors, rho dependent and rho

independent terminations, eukaryotic transcription- RNA polymerases, transcription factors, processing of mRNA in eukaryotes

Translation: initiation of translation, elongation and termination of translation (both prokaryotic and eukaryotic), Regulation of gene expression: operon concept, lac operon- positive control and negative control, trp operon- repressible regulation and attenuator regulation, Transposable elements: transposable elements- IS elements, composite transposons and Tn3 transposons, mechanisms of transposition (conservative and replicative), retrotransposons and retroposons.

#### **UNIT-IV**

**11 Hours**

Genetic engineering: enzymes used in genetic engineering- restriction endonucleases, nuclease, polymerase, terminal deoxynucleotidyl transferase, reverse transcriptase and ligases, vectors- cloning vectors, expression vectors and shuttle vectors, cloning strategies, preparation of genomic DNA library and cDNA library, applications of genetic engineering

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

#### **Suggested Readings**

Ramawat, K. G., & Goyal, S. (2004). *Comprehensive biotechnology*. S. Chand Publishing.

Pierce, B. A. (2018). *Genetics essentials: concepts and connections* (p. 488). WH Freeman.

Nelson, D. L., Cox, M. M., & Freeman, W. H. (2000). *Lehninger Principles of Biochemistry*. Third. Worth Publishers. N. Y.

Morange, M. (2000). *A history of molecular biology*. Harvard University Press.

Watson, J. D. (1970). *Molecular biology of the gene*. *Molecular biology of the gene.*, (2nd edn).

#### **Semester-5<sup>th</sup>**

**Course Title: METABOLISM**

**Course Code: BML504**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr.</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Identify disorders of Gluconeogenesis, Glycogenolysis, Glycogenesis
- 2 Assess mechanism of protein synthesis, metabolic process and disorders.
- 3 Narrate the role nucleic acids as genetic material- DNA/RNA
- 4 Understand mechanism of enzyme action, Factors affecting, Enzyme kinetics & enzyme inhibitors

**Course Contents**

**UNIT 1**

**12 Hours**

Carbohydrate Metabolism, Introduction, Importance and Classification, Digestion and Absorption Metabolism: - Glycolysis, Citric acid cycle, Gluconeogenesis, Glycogenolysis, Glycogenesis, Disorders of carbohydrate metabolism.

**UNIT II**

**08 Hours**

Protein Metabolism, Introduction, Importance and classification, Important properties of proteins, Digestion & absorption of Proteins, Protein synthesis, Metabolism of proteins, Disorders of protein metabolism and Urea Cycle

**UNIT III**

**08 Hours**

Lipid, Introduction & Classification, Digestion & absorption of fats, Lipoproteins, Fatty acid biosynthesis & fatty acid oxidation, Nucleic Acid, Introduction, Functions of Nucleic acid, Functions of energy carriers.

**UNIT IV**

**08 Hours**

Enzymes Introductions, Importance & Classifications, Properties of enzymes, Mechanism of enzyme action, Factors affecting enzyme action, Enzyme kinetics & enzyme inhibitors.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

L Mukherjee, K., Swarajit. G. (2010). Medical Laboratory Technology (Volume I).

Varley, H., Gowenlock, A. H., McMurray, J. R., and McLauchlan, D. M. (1988). *Varley's practical clinical biochemistry*. London: Heinemann Medical Books.

Siddiqi, M.A. (2006). *Principal of Biochemistry*.

Chatwal, G.R. and Anand, S.K. (1979). Text book of Medical Biochemistry, Himlayan

publishinghouse.

Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry* (7th ed.). W.H. Freeman

Voet, D., and Voet, J. G. (1995). *Biochemistry*. New York: J. Wiley & Sons.

Berg, J. M., Tymoczko, J. L., Stryer, L., & Stryer, L. (2002). *Biochemistry*. New York: W.H. FreemanBiochemistry by Strye

### Semester-5th

**Course Title: APPLIED CLINICAL BIOCHEMISTRY -III**

**Course Code:** BML505

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Perform Glucose tolerance test, Insulin tolerance test, Xylose excretion test.
- 2 Estimate and assessment of creatinineclearance test for renal function.
- 3 Learn the principles, Clinical significance and Procedures for estimation of enzymes.
- 4 Evaluate chemical examination of Cerebrospinal fluid.

### Course Contents

#### UNIT 1

**12 Hours**

Automation in clinical biochemistry, Method of estimation and assessment for: Glucose tolerance test, Insulin tolerance test, Xylose excretion test.

#### UNIT II

**11 Hours**

Gastric analysis, Clearance test for renal function. Qualitative test for: Urobilinogens Barbiturates, T3, T4 and TSH, Ketosteroids

#### UNIT III

**11 Hours**

Enzymes: Principles, Clinical significance and Procedures for estimation- Acid phosphatase, Alkaline phosphatase, Lactate dehydrogenase, Aspartate transaminase, Alanine transaminase Creatine phosphokinase.

**UNIT IV****11 Hours**

Qualitative analysis of renal calculi, Chemical examination of Cerebrospinal fluid, Brief knowledge about rapid techniques in clinical biochemistry.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Godkar, P. B. and Godkar, P. (2014). *Textbook Of Medical Laboratory Technology*. Bhalani Publishing House

L Mukherjee, K., Swarajit. G. (2010). *Medical Laboratory Technology (Volume I)*.

Varley, H., Gowenlock, A. H., McMurray, J. R., and McLauchlan, D. M. (1988). *Varley's practical clinical biochemistry*. London: Heinemann Medical Books.

Siddiqi, M.A. (2006). *Principal of Biochemistry*.

Chatwal, G.R. and Anand, S.K. (1979). *Text book of Medical Biochemistry*, Himlayan publishing house.

Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry (7th ed.)*. W.H. Freeman

Voet, D., and Voet, J. G. (1995). *Biochemistry*. New York: J. Wiley & Sons.

Berg, J. M., Tymoczko, J. L., Stryer, L., & Stryer, L. (2002). *Biochemistry*. New York: W.H. Freeman

**Semester-5th****Course Title: HUMAN VALUES AND PROFESSIONAL ETHICS****Course Code: BML506**

L	T	P	Cr.
3	0	0	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Understand basic need for Value education
- 2 Learn the meaning of self-exploration
- 3 Knowledge of Harmony in family and society
- 4 Analyze the difference between intention and competence

**Course Contents****UNIT-I****12 Hours**

Need, Basic Guidelines, Content and Process for Value Education, Self Exploration, Natural Acceptance' and Experiential Validation- as the mechanism for self

exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly.

**UNIT-II****11 Hours**

Understanding humanbeing as a co-existence of the sentient, Understanding the needs of self, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I' , Understanding the harmony of I with the Body.

**Unit-III****12 Hours**

Understanding harmony in the Family- the basic unit of human interaction, Understanding values in human-human relationship, Difference between intention and competence, Difference between respect and differentiation, Understanding the harmony in the society (society being an extension of family),

**UNIT-IV****10 Hours**

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Case studies of typical holistic technologies, management models and production systems.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Semester-5th****Course Title: FUNDAMENTALS OF NURSING****Course Code: BML507**

L	T	P	Cr.
2	0	0	2

**Total Hours 30**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**



- 1 Understand basic introduction to Nursing
- 2 Learn the meaning ethical aspects of nursing
- 3 Knowledge of ICN Code of ethics for nurses in Nursing
- 4 Analyze the identification ,evaluation and model of nursing care plan

### **Course Contents**

#### **UNIT 1**

**07 Hours**

Introduction to Nursing, Nursing Care of the patient, Meeting the needs of a patient, Assessment of patient, Infection control, Therapeutic Nursing Care, Introduction to Clinical Pharmacology, First Aid Need for First Aid, Minor injuries and ailments, Fractures, Life threatening conditions, Community emergencies & community resources

#### **UNIT II**

**08 Hours**

An Introduction to Nursing. Definition of Nursing - a profession: qualities of a nurse , Professional etiquettes for Nurses. Ethical Aspects of Nursing. ICN code of Ethics for Nurses. Nurses role in safeguarding the clients rights

#### **UNIT III**

**08 Hours**

Terminology, spirituality in Nursing, factors which effect spiritual health, Goals of spiritual care nursing process: Assessment, nursing diagnosis, planning, intervention, evaluation.

#### **UNIT IV**

**07 Hours**

Nursing process. Description of nursing process-definitions, characteristics of nursing process-phases of nursing process-assessment-nursing diagnosis,- outcome.

#### **Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

#### **Suggested Readings**

Bessesen, D. H. (2008). *Update on obesity. J ClinEndocrinolMetab.*93(6), 2027-2034.  
Butryn, M.L., Phelan, S., & Hill, J. O.(2007). Consistent self-monitoring of weight: a key component of successful weight loss maintenance. *Obesity(Silver Spring)*. 15(12), 3091-3096.

Chu, S.Y. & Kim, L. J. (2007). *Maternal obesity and risk of stillbirth: a metaanalysis*. Am J Obstet Gynecol, 197(3), 223-228.

DeMaria, E. J. (2007). *Bariatric surgery for morbid obesity*. N Engl J Med, 356(21), 2176-2183.

### Semester -5th

**Course Title: APPLIED CLINICAL BIOCHEMISTRY-III  
(PRACTICAL)**

**Course Code:** BML508

L	T	P	Cr.
0	0	6	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Process clinical samples for culture and identification of bacterial pathogens.
- 2 Automation in bacterial culture detection and antimicrobial susceptibility testing
- 3 Preparation and standardization of inoculum
- 4 Find means and methods adaptable for MIC and MBC of known bacteria against a known antibiotic.

**List of Practical's / Experiments:** Demonstration of-

Estimation of SGOT in blood.

Estimation of SGPT in blood.

Estimation of ALP in blood.

Estimation of ACP in blood.

Estimation of Amylase in blood.

Estimation of Total Cholesterol in blood.

Estimation of HDL Cholesterol.

Estimation of LDL Cholesterol.

Estimation of TG

Estimation of Creatinine in Blood

Estimation of serum calcium, Inorganic phosphate

Estimation of electrolytes Sodium, Potassium & Chloride.

**Transactional modes**

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

Godkar, P. B. and Godkar, P. (2014). *Textbook of Medical Laboratory Technology*. Bhalani Publishing House

- Mukherjee, K., Swarajit. G. (2010). *Medical Laboratory Technology (Volume I)*.
- Varley, H., Gowenlock, A. H., McMurray, J. R., and McLauchlan, D. M. (1988). *Varley's practical clinical biochemistry*. London: Heinemann Medical Books.
- Siddiqi, M.A. (2006). *Principal of Biochemistry*.
- Chatwal, G.R. and Anand, S.K. (1979). *Text book of Medical Biochemistry*, Himlayan publishing house.
- Nelson, D. L., & Cox, M. M. (2017). *Lehninger principles of biochemistry (7th ed.)*. W.H. Freeman
- Voet, D., and Voet, J. G. (1995). *Biochemistry*. New York: J. Wiley & Sons.
- Berg, J. M., Tymoczko, J. L., Stryer, L., & Stryer, L. (2002). *Biochemistry*. New York: W.H. Freeman

### Semester -5th

**Course Title: APPLIED BACTERIOLOGY (PRACTICAL)**

**Course Code:** BML509

L	T	P	Cr.
0	0	6	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Process clinical samples for culture and identification of bacterial pathogens.
- 2 Automation in bacterial culture detection and antimicrobial susceptibility testing
- 3 Preparation and standardization of inoculum
- 4 Find means and methods adaptable for MIC and MBC of known bacteria against a known antibiotic.

**List of Practical's / Experiments:** Demonstration of-

Inoculation of different culture media

Isolation of pure cultures. Processing of following clinical samples for culture and identification of bacterial pathogens: Blood, Throat swab, Sputum, Pus, Urine, Stool for Salmonella, Shigella and Vibrio cholera, C.S.F. and other body fluids

Demonstration of PCR

Demonstration of automation in bacterial culture detection and antimicrobial susceptibility testing

Antimicrobial susceptibility testing

Introduction and terms used

Preparation and standardization of inoculums.

To demonstrate reference bacterial strains

To determine MIC and MBC of known bacteria against a known antibiotic

To perform antibiotic susceptibility testing of clinical isolates by using

Stokes method, Kirby-Bauer method

Collection, transportation and processing of following articles for bacteriological examination:

Water, Milk, Food and Air

To demonstrate sterility testing of intravenous fluid with positive and negative controls

Demonstration of serotyping and bacteriocin typing

Demonstration of lyophilization and other available preservation methods

### Semester -5th

**Course Title: CLINICAL HISTOPATHOLOGY (PRACTICAL)**

**Course Code:** BML510

L	T	P	Cr.
0	0	6	3

**Total Hours 45**

**Course Learning Outcomes: On completion of this course, the successful students will be able to:**

- 1 Prepare various types of fixatives.
- 2 Embedding of given tissue in paraffin block.
- 3 Process tissue by manual and automated processor method.
- 4 Perform & practice the Haematoxylin and Eosin staining technique and special staining.

### List of Practical's / Experiments:

Demonstration of instruments used for dissection

Use of antiseptics, disinfectants and insecticides in a tissue culture processing laboratory

Reception and labeling of histological specimens

Preparation of various fixatives

To process a bone for decalcification

To demonstrate various part and types of microtome

To learn sharpening of microtome knife

To perform section cutting

To practice attachment of tissue sections to glass slides

To learn mounting of stained smears

### Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

**Suggested Readings**

- Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.
- Bancroft, J. D., & Gamble, M. (Eds.). (2008). *Theory and practice of histological techniques*. Elsevier health sciences.
- Culling, C. F. A., Allison, R. T., & Barr, W. T. (2014). *Cellular pathology technique*. Elsevier.
- Mohan, H. (2015). *Textbook of pathology*. Jaypee Brothers Medical Publishers.
- Mohan, H. (2012). *Pathology practical book*. JP Medical Ltd.
- Culling, C. F. A. (2013). *Handbook of histopathological and histochemical techniques: including museum techniques*. Butterworth-Heinemann.

**Semester-6th****Course Title: PROFESSIONAL TRAINING/ INTERNSHIP****Course Code:** BML601

L	T	P	Cr.
NA	NA	NA	20

**Total Hours 300**

**Course Learning Outcomes: On successful completion of this course, the students will be able to**

1. Demonstrate proper technique in the collection, handling, testing, storage and reporting of all biological specimens in the laboratory.
2. Diagnose and Interpret laboratory test data for clinical significance.
3. Maintain the records of diagnostic lab.
4. Calibrate, perform quality control testing on instruments and diagnostic analyzers
5. Demonstrate ethical standards of the laboratory profession in relation to medical information and patient care

**Course Contents**

Students have to carry out a research project (on any topic related to laboratory) under the supervision of a faculty. The project report has to be prepared on the basis of the research work carried out. The assessment is done on the basis of the work done and the presentation and viva.

**Course Learning Outcomes: On completion of this course, the successful students will be able to**

- 1 Demonstrate proper technique in the collection, handling, testing, storage and reporting of all biological specimens in the laboratory.
- 2 Diagnosis: Interpret laboratory test data for clinical significance.
- 3 Data Maintenance: Maintain the records of diagnostic lab.
- 4 Quality Assurance: Calibrate, perform quality control testing on instruments and diagnostic analyzers
- 5 Ethics: Demonstrate ethical standards of the laboratory profession in relation to medical information and patient care.

### **OBJECTIVE**

The objective of providing professional training is to:

1. Create confidence in the students to work in world of work by developing practical skills pertaining to laboratory management and diagnostic skills in the field of clinical hematology, transfusion medicine blood banking, clinical biochemistry, clinical microbiology, histopathology and cytology and ensuring laboratory safety and quality assurance.
2. Create necessary awareness regarding use of various types of diagnostic equipment, particularly sophisticated ones which are used in the field of medical laboratory technology.
3. Develop appreciation regarding size and scale of operations, environment and other related aspects like value of team work, interpersonal relations and professional ethics in the field of medical laboratory technology.
4. Develop necessary traits for starting small clinical laboratories as per requirements.

### **SELECTION OF TRAINING PLACES**

The institute offering diploma Program in Medical Laboratory Technology should establish contact/rapport by personal visit to following types of organizations:

1. Medical Colleges/Research institutions
2. Civil Hospitals at District Headquarters having well equipped laboratory
3. Hospitals in private sector
4. Well established clinical laboratories being run by a qualified person

### **DEPARTMENTS FOR TRAINING IN LAB UNDER MICROBIOLOGY:**

1. Bacteriology
2. Mycology
3. Serology
4. Virology

## 5. Parasitology