

# **SCHEME & SYLLABUS**

## **Bachelor in Medical Laboratory Sciences**

**(Choice Based Credit  
System)**  
**Program Code: UG027**



**Department of Life Sciences & Allied Health  
Sciences (UIS)**

**Sant Baba Bhag Singh  
University 2023**

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## **ABOUT THE DEPARTMENT**

The department of Life Sciences formerly known as the Department of Natural Sciences was established in the year 2015 with only two UG programmes. Over the years this department has flourished and is offering various Programmes and courses at graduate, post-graduate and doctorate level in field of Botany, Zoology, Biotechnology, Biochemistry, Microbiology and Laboratory Sciences. The department is nurtured by the highly qualified and dedicated Faculty, honored by various international and national awards. The department is blessed to have specialized faculties in various fields of Life Sciences viz. Plant physiology, Plant Biochemistry, Plant Microbe interaction, Stress Physiology, Chemical ecology, Microbial Physiology, Industrial Microbiology, Clinical microbiology, Microbial Biotechnology, Animal Biotechnology, Fisheries, Parasitology, Molecular biology, Entomology, Sericulture, Animal toxicology, Endocrinology, Biochemistry and Biodiversity.

## **SALIENT FEATURES OF THE DEPARTMENT**

1. At SBBS University the focus of Department is on conducting innovative teaching, fundamental multidisciplinary research in life sciences.
2. The department is disseminating various educational missions via e-learning platform in the form of SWAYAM, Virtual lab etc.
3. The department is equipped with a number of instruments and facilities like, UV- Visible Spectrophotometer, High Speed Centrifuge, Deep Freezer, Laminar Air flow, Air Samplers, Autoclave, Incubator, Photoactometer, Air condition Labs, Wi-Fi, Library etc.
4. The department has organized a large number of conferences, seminars, symposia and workshops. National and International eminent scientists of the country have been associated with the Department as visiting and honorary professors.



## **B.Sc. MLS (Bachelor of Medical Laboratory Sciences)**

B. Sc. MLS is a route for the medical, non-medical and diploma students of 10+2 to join the community of medical laboratory professionals. The program is designed to build theoretical knowledge and practical skill set for performing & developing efficient and resource optimized medical testing procedures.

### **VISION**

To bridge the gap between demand and supply for Life Sciences, Allied Health Sciences & Agriculture Professionals with grooming young generations, empowering them to become socially responsible leaders.

### **MISSION**

To radiate the knowledge of Life Sciences, Allied Health Sciences & Agriculture Sciences through quality education by using latest technology, modern infrastructure and the framework needed for the development of professionals.

### **ELIGIBILITY CRITERIA**

10+2 Medical/ Dip in MLT with 50% marks.

### **DURATION**

3 Years

### **CAREER PATHWAYS**

The program is designed to meet the growing requirement of qualified professionals in field of IT industry and education. B.Sc. graduates are hired both by Government and private organizations. They may join Post Graduation Courses further.

1. Government Jobs: Prepare students for various government jobs such as at govt. hospitals, military and other public sectors etc.
2. Higher Studies: This pathway prepares students for Higher Studies and helps in their research also.
3. Entrepreneurship: To set up new ventures.

**PROGRAMME EDUCATIONAL OBJECTIVE (PEO)**

**PEO1.** To provide a hands-on experience of the latest techniques.

**PEO2.** To improve critical and analytical abilities.

**PEO3.** To inculcate management and evaluation of laboratory information systems.

**PEO4.** To apply the subject related knowledge towards professional growth.

**PROGRAMME OUTCOMES (PO):**

**PO1 Disciplinary Knowledge:** Students will be able to understand specialized areas and explain major concepts in the medical lab sciences and its applications.

**PO2: Critical Thinking:** Critical thinking as an attribute will enable students to develop competency to think creatively, identify, formulate and analyze complex variety of problem of diagnostic healthcare domain.

**PO3: Problem Solving:** Students will be well-equipped to solve complex problems related to appropriate methods of specimen collection, handling, testing and reporting of clinical investigation.

**PO4: Practical skills:** Students will be able to identify and analyze clinical data and results by applying acquired knowledge and skills.

**PO5: Modern Tool Usage:** Students will be familiar with the usage of advanced diagnostic tools and techniques, having interface with computers for clinical data analysis.

**PO6: Multicultural Competence:** Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity to assess societal, health, safety, legal and cultural issues. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables and by creating an environment that is welcoming for all students.

**PO7: Environment & Sustainability:** Understand the impact of the scientific and professional responsibilities, considering the impact on society and environment.

**PO8: Research related skills & Ethics:** Students will be able to communicate scientific knowledge in oral and written form accurately using a range of formats/tools.

**PO9: Self-directed Learning:** Students will be encouraged to accept challenges/latest advancement in laboratory diagnostic methods. Various activities/advanced ideas will equip the students to find relevant information and educate themselves.

**PO10: Individual and Teamwork:** Students will acquire the ability to perform effectively as a team to accomplish common goals in classroom learning, laboratory as well as other diverse fields. The students will be capable of contributing meaningfully to team ethos and goals.

**PO11: Communication Skills:** Students will be able to communicate effectively and sensibly with a broad range of health care workers, co-workers as well as patients both orally and in writing in an intelligible manner.

**PO12: Lifelong Learning:** The students will exhibit a strong conceptual framework in the subject along with the skills of teamwork, analytical reasoning, problem solving, critical thinking etc. make the students lifelong learners.



**PROGRAMME SPECIFIC OUTCOMES (PSO):**

**PSO1.** Graduates will be able to demonstrate the ability to critically evaluate and effectively communicate laboratory data and information from scientific literature.

**PSO2.** Graduates will be able to evaluate and relate clinical laboratory data to various disease progression and diagnosis.

**PSO3.** Graduates will acquire an understanding of a variety of laboratory and computer skills/techniques/calculations that are used in biomedical research and clinical laboratories.

**PSO4.** Graduates will be able to understand and identify potential hazards and follow safe laboratory practices.

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4	MLS109	General Microbiology	5-6	1
5	MLS113	Hematology – I	7-8	1
6	ENG121	Communication Skills – I	9	1
7	MLS103	Human Anatomy & Physiology – I Practical	10	1
8	MLS111	General Microbiology Practical	11	1
9	MLS115	Hematology – I Practical	12	1
10	ENG123	Communication Skills – I Lab	13	1
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13	MLS110	Medical Parasitology	18-19	2
14	MLS114	Hematology –II	20-21	2
15	MLS118	Human Anatomy & Physiology II	22-23	2
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17	MLS104	Biochemistry I Practical	25	2
18	MLS108	Basics of Medical Laboratory Technology Practical	26	2
19	MLS112	Medical Parasitology Practical	27	2
20	MLS116	Hematology-II Practical	28	2
21	MLS120	Human Anatomy & Physiology – II Practical	29	2
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23	MLS201	Biochemistry II	31-32	3
24	MLS205	Systematic Bacteriology	33-34	3
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26	EVS001	Environmental Science	37-38	3
27	SSC001	Gender Equity	39	3
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29	MLS215	First Aid	41	3
30	MLS203	Biochemistry -II Practical	42	3
31	MLS207	Systematic Bacteriology Practical	43	3
32	MLS211	Basics of Biochemical & Biophysical techniques Practical	44	3
33	CSE213	Basics of Computers Practical	45-47	3
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36	MLS210	Immunology and Mycology	52-53	4



37	MLS214	Histopathology & Histopathological Techniques	54-55	4
38	MLS218	Basics of Virology	56	4
39	MLS220	Applied Bacteriology	57-58	4
40	MLS224	Introduction to Healthcare Delivery System	59-60	4
41	MLS226	Medical Terminology and Medical Records	61-62	4
42	MLS204	Clinical Biochemistry-I Practical	63	4
43	MLS208	Hematology - III Practical	64	4
44	MLS212	Immunology & Mycology Practical	65	4
45	MLS216	Histopathology & Histopathological Techniques Practical	66	4
46	MLS222	Applied Bacteriology Practical	67	4
47	MLS301	Clinical Biochemistry –II	68-69	5
48	MLS305	Cellular and Histopathology	70-71	5
49	MLS 309	Blood Banking and Transfusion Reactions	72-73	5
50	MLS313	Health Systems and Laboratory Ethics	74-75	5
51	MLS315	Endocrinology and Toxicology	76	5
52	MLS317	Histotechnology and Cytology	77-78	5
53	COM317	Generic skills and Entrepreneurship	79	5
54	MLS 303	Clinical Biochemistry - II Practical	80	5
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56	MLS311	Blood Banking and Transfusion Reactions Practical	82	5
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58	MLS302	Professional Training	84	6

# Course Scheme B.Sc. MLS (Semester I-VI)

## SEMESTER I

### I. Theory Subjects

S. No	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credits Hours	Course Type
1	MLS101	Human Anatomy & Physiology – I	4:0:0	4:0:0	4	4	CC
2	MLS105	Fundamentals of Biology	4:0:0	4:0:0	4	4	CC
3	MLS109	General Microbiology	4:0:0	4:0:0	4	4	CC
4	MLS113	Hematology – I	3:0:0	3:0:0	3	3	CC
5	ENG121	Communication Skills – I	2:0:0	2:0:0	2	2	AECC

### II. Practical Subjects

1	MLS103	Human Anatomy & Physiology – I Practical	0:0:2	0:0:1	2	1	CC
2	MLS111	General Microbiology Practical	0:0:3	0:0:1.5	3	1.5	CC
3	MLS115	Hematology – I Practical	0:0:3	0:0:1.5	3	1.5	CC
4	ENG123	Communication Skills – I Lab	0:0:2	0:0:2	2	1	AECC
<b>Total</b>					<b>27</b>	<b>21</b>	

Total Contact hrs: 27  
Total Credit Hours: 21

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**SEMESTER-II****I. Theory Subjects**

S. No	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credits Hours	Course Type
1	MLS102	Biochemistry – I	4:0:0	4:0:0	4	4	CC
2	MLS106	Basics of Medical Lab Technology	3:1:0	3:1:0	4	4	CC
3	MLS110	Medical Parasitology	4:0:0	4:0:0	4	4	CC
4	MLS114	Hematology –II	3:0:0	3:0:0	3	3	CC
5	MLS118	Human Anatomy & Physiology – II	4:0:0	4:0:0	4	4	CC
6	ENG114	Communication Skills- II	2:0:0	2:0:0	2	2	AECC

**II. Practical Subjects**

1	MLS104	Biochemistry -I Practical	0:0:3	0:0:1.5	3	1.5	CC
2	MLS108	Basics of Medical lab Technology Practical	0:0:2	0:0:1	2	1	CC
3	MLS112	Medical Parasitology Practical	0:0:2	0:0:1	2	1	CC
4	MLS116	Hematology-II Practical	0:0:3	0:0:1.5	3	1.5	CC
5	MLS120	Human Anatomy & Physiology – II Practical	0:0:2	0:0:1	2	1	CC
6	ENG116	Communication Skills – II Lab	0:0:2	0:0:2	2	1	AECC
<b>Total</b>					<b>35</b>	<b>28</b>	

**Total Contact hrs:35**  
**Total Credit Hours:28**

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**SEMESTER III****I. Theory Subjects**

S.No	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credits Hours	Course Type
1	MLS201	Biochemistry –II	3:0:0	3:0:0	3	3	CC
2	MLS205	Systematic Bacteriology	4:0:0	4:0:0	4	4	CC
3	MLS209	Basics of Biochemical & Biophysical Techniques	3:0:0	3:0:0	3	3	CC
4	EVS001	Environmental Science	3:0:0	3:0:0	3	3	AECC
5	SSC001	Gender Equity	3:0:0	3:0:0	3	3	AECC
6	MLS213	Biomedical Waste Management	2:0:0	2:0:0	2	2	DSE
	MLS215	First Aid					

**II. Practical Subjects**

1	MLS203	Biochemistry II Practical	0:0:3	0:0:1.5	3	1.5	CC
2	MLS207	Systematic Bacteriology Practical	0:0:3	0:0:1.5	3	1.5	CC
3	MLS211	Basics of Biochemical & Biophysical Techniques Practical	0:0:3	0:0:1.5	3	1.5	CC
4	CSE213	Basics of Computers Practical	0:0:3	0:0:1.5	3	1.5	ID
5	PT 201/203/205	Physical Training (NSO/NCC/NSS)	0:0:2	Non Credits	2	NC	
<b>Total</b>					<b>32</b>	<b>24</b>	

**Total Contact hrs: 32**  
**Total Credit Hours: 24**

II



**SEMESTER-IV****I. Theory Subjects**

Sr. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Course Type
1	MLS202	Clinical Biochemistry-I	3:0:0	3:0:0	3	3	CC
2	MLS206	Hematology - III	3:0:0	3:0:0	3	3	CC
3	MLS210	Immunology & Mycology	4:0:0	4:0:0	4	4	CC
4	MLS214	Histopathology & Histopathological Techniques	3:0:0	3:0:0	3	3	CC
5	MLS218	Basics of Virology	2:1:0	3:0:0	3	3	CC
6	MLS220	Applied Bacteriology	2:0:0	2:0:0	2	2	SECC
7	MLS224	Introduction To Healthcare Delivery System	2:0:0	2:0:0	2	2	DSE
	MLS226	Medical Terminology and Medical Records					

**II. Practical Subjects**

1	MLS204	Clinical Biochemistry-I Practical	0:0:2	0:0:1	2	1	CC
2	MLS208	Hematology - III Practical	0:0:3	0:0:1.5	3	1.5	CC
3	MLS212	Immunology & Mycology Practical	0:0:3	0:0:1.5	3	1.5	CC
4	MLS216	Histopathology & Histopathological Techniques Practical	0:0:2	0:0:1	2	1	CC
5	MLS222	Applied Bacteriology Practical	0:0:2	0:0:1	2	1	SECC
6	PT202/204/206	Physical Training (NSO/NCC/NSS)	0:0:2	Non Credits	2	NC	
<b>Total</b>					<b>34</b>	<b>26</b>	

**Total Contact hrs: 34**  
**Total Credit Hours: 26**

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**SEMESTER-V****I. Theory Subjects**

Sr. No.	Subject Code	Subject Name	L:T:P	Credit hours	Total Contact Hours	Total Credits	Course Type
1	MLS301	Clinical Biochemistry -II	3:0:0	3:0:0	3	3	CC
2	MLS305	Cellular and Histopathology	3:0:0	3:0:0	3	3	CC
3	MLS309	Blood Banking and Transfusion Reactions	3:0:0	3:0:0	3	3	CC
4	MLS313	Health Systems and Laboratory Ethics	3:0:0	3:0:0	3	3	CC
5	MLS315	Endocrinology and Toxicology	2:0:0	2:0:0	2	2	SECC
6	MLS317	Histotechnology and Cytology	4:0:0	4:0:0	4	4	CC
7	COM317	Generic skills and Entrepreneurship	2:0:0	2:0:0	2	2	ID

**II. Practical Subjects**

1	MLS303	Clinical Biochemistry - II Practical	0:0:2	0:0:1.0	2	1.0	CC
2	MLS307	Cellular and Histopathology Practical	0:0:2	0:0:1.0	2	1.0	CC
3	MLS311	Blood Banking and Transfusion Reactions Practical	0:0:2	0:0:1.0	2	1.0	CC
4	MLS319	Histotechnology & Cytology Practical	0:0:2	0:0:1.0	2	1.0	CC
5	PT301/303/305	Physical Training (NSO/NCC/NSS)	0:0:2	Non Credits	2	NC	
<b>Total</b>					<b>30</b>	<b>24</b>	

**Total Contact hrs: 30**  
**Total Credit Hours:24**



**SEMESTER-VI****1.Theory Subjects /Training**

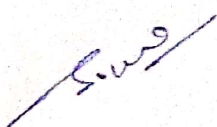
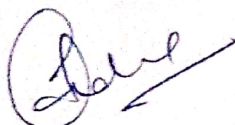
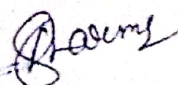
Sr. No.	Subject Code	Subject Name	L:T:P	Credit hours	Total Contact Hours	Total Credits	Course Type
1	MLS302	Professional Training	0:0:26	0:0:26	6 Months (720 Hrs)	26	

**Professional Training**

- There shall be six months of professional training after the fifth semester for candidates declared to have passed the examination in all the subjects.
- During the training, candidate shall have to work full time average 5 hours per day (each working day) for 6 calendar months.
- The Internship should be rotatory and cover Hematology, Histology & Cytology, Biochemistry, Microbiology, Endocrinology & Automation sections of Pathology laboratory.
- Based on the attendance and work done during posting the Director/Principal/Head of Institution/Department shall issue 'Certificate of Satisfactory Completion' of training following which the University shall award the B.Sc. in Medical Laboratory Science Degree or declare the candidate eligible for the same.

No candidate shall be awarded degree without successfully completing six months internship.

**Total Credit Hours: 26**




## Human Anatomy & Physiology-I

<b>Course Code</b>	MLS101
<b>Course Title</b>	Human Anatomy & Physiology-I
<b>Type of course</b>	Theory
<b>L T P</b>	4      0      0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	<ul style="list-style-type: none"> <li>To identify and relate basic concepts of structure and function of cells, tissues and organs.</li> <li>To understand the anatomical organization, coordination and integrated functions of human body.</li> </ul>
<b>Course Outcomes</b>	<p>At the conclusion of the course the students will:</p> <ol style="list-style-type: none"> <li>Understand the basic principles of anatomy and anatomical organization of the human body.</li> <li>Identify anatomical terms, positions, planes and relate them to location of organs and structures.</li> <li>Describe tissues, their types, characteristics, classification, location and functions.</li> <li>Explain the structure and functions of musculoskeletal system, and molecular mechanisms underlying muscle contraction.</li> <li>Analyze the structure and functions of cardiovascular, respiratory, digestive and lymphatic systems, and their inter-relationship in maintaining homeostasis.</li> </ol>

### UNIT-I

**General anatomy:** Introduction to anatomical terms and organization of the human body, Definition of anatomy and its divisions, Terms of location, positions and planes.

**Tissues** –Definitions, Types, characteristics, classification, location and functions.

### UNIT-II

**Musculoskeletal system:** Bones – types, structure, Bone formation and growth, Axial & appendicular skeleton, Joints–classification and structure, Types and structure of skeletal muscles, mechanism of muscle contraction, isotonic and isometric contractions, energy sources of muscle contractions, motor UNIT, Movements at the joints and muscles producing movements.

### UNIT-III

**Cardiovascular System:** Circulatory system – Structure of the Heart, Structure of Blood Vessels – arterial and venous system. Anatomy of heart, cardiac cycle, heart sounds, definitions of cardiac output, stroke volume, principles of measurements of cardiac output, ECG – methods of recording and ECG waves. Normal values of blood pressure, heart rate and their regulation in brief.

**Structure and Functions of Blood:** Components, names of developmental stages of RBC, functions and fate of RBC, functions of WBC and platelets, Basis of blood coagulation and blood groups – ABO & Rh.

**Lymphatic System:** Gross and microscopic structure of lymphatic tissue - lymph vessels and lymph nodes, functions of lymph, structure and function of thymus and spleen.

### UNIT-IV

**Respiratory System:** Parts; Nasal cavity and Paranasal air sinuses, trachea, Gross and microscopic

structure of lungs, Diaphragm and Pleura, Principles of respiration, respiratory muscles, lung volumes and capacities, collection and composition of inspired alveolar and expired airs, transport of oxygen and carbon dioxide, brief account of respiratory regulation, Definition of hypoxia, Cyanosis and asphyxia, Methods of artificial respiration.

**Digestive System:** Parts of alimentary canal, structure and functions of tongue, pharynx, oesophagus, stomach, small and large intestine and anus, principles of secretion and movements of gastrointestinal tract. (G.I tract)

**Digestive Glands:** Structure and function of Salivary glands, liver and pancreas, functional anatomy of G.I.T and functions of G.I secretions.

### Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Anatomy & Physiology- Ross and Wilson	Anne Waugh & Allison Grant	Churchill Living Stone
2	Anatomy and physiology: The Understanding Human Body	Robert Clark	Jones & Bartlett publishers
3.	Functional Histology	James S. lowe, Barbara young, Allen Stevens & John W heath	Elsevier
4.	Text book of human Histology with color Atlas and Practical Guide	Inderjit singh	Jaypee Brothers Medical publishers
5.	Understanding Human Anatomy and Physiology	William Davis	McGraw Hill

### Fundamentals of Biology

<b>Course Code</b>	MLS105
<b>Course Title</b>	Fundamentals of Biology
<b>Type of course</b>	Theory
<b>L T P</b>	4      0      0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT with 50% marks.
<b>Course Objective</b>	To impart introductory knowledge about <ul style="list-style-type: none"> <li>• Biology of the cell- the basic building Units of an organism,</li> <li>• Human physiology- a glimpse at the orchestrated functioning of organ systems and</li> <li>• Basic principles of genetics as seen in nature and diversity in life forms to the students.</li> </ul>
<b>Course Outcomes</b>	At the conclusion of the course, the students; <ol style="list-style-type: none"> <li>1. Identify the principal divisions in biology and its importance.</li> <li>2. Understand the basic structure, function &amp; types of cell and cell organelles.</li> <li>3. Classify and analyze the microscopic structure and function of various types of tissues: epithelial, muscular, connective and nervous tissue.</li> <li>4. Analyze the stages of cell cycle, mitosis, meiosis, and cell differentiation and understand the processes of senescence and death.</li> <li>5. Analyze and describe the basics of genetics and evolution, including Mendel's experiments, genetic concepts, and modern evolution theories.</li> </ol>

#### UNIT-I

**Introductory Biology:** Definition of life, characteristics of life, differences between animals and plants, principal divisions in biology and importance of biology.

**Cell Biology:** Definition of cell, Cell as a basic UNIT of living systems, fundamental cell types (PPLO's, bacteria, eukaryotic microbes, plant and animal cells), difference between prokaryotic and eukaryotic cells, Structure and function of cell organelles, ultra-structure of cell membrane, cytosol, Golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes, cytoskeletal structures (actin, microtubules etc.), Mitochondria, lysosomes, nucleus.

**Tissue:** Definition, classification, microscopic structure & function of epithelial, muscular, connective & nervous tissue. Levels of organization.

#### UNIT-II

**Cell Cycle:** Cell division; mitosis, meiosis, stages of cell cycle, Cell Senescence and Death (Apoptosis and necrosis), Cell Differentiation in Animals: Totipotent, multipotent, pluripotent cells.

**Physiology:** Introduction to various systems in human body-Digestive system, respiratory system, circulatory system, endocrine system, reproductive system.

#### UNIT-III

**Basics of genetics:** Mendel's work and experiments, gene: bearer of heredity character, chemical basis of heredity. Chromosome structure, structural aberrations and human karyotype.

**Evolution:** Origin of life, theories of evolution, evidences of evolution from plant and animal kingdom, modern concept in Evolution and concept of speciation.



**UNIT-IV**

**Biodiversity:** Variety of living organisms, Systematic, need, history and types of classifications (artificial, natural, phylogenetic), biosystematics; binomial nomenclature; Two kingdom system, Five kingdom system, their merits and demerits.

**Text and Reference Books**

S. No	Name	Author(S)	Publisher
1.	Cell Biology, Genetics, Molecular Biology, Evolution & Ecology	PS Verma & VK Aggarwal	S.Chand
2	Fundamentals of genetics	Peter J Russell	
3	Fundamentals of genetics	G.S Miglani	
4.	Cytogenetics, Molecular Biology and Evolution	KN Bhatia	Trueman Publishers
5.	Cell Biology and Genetics	KN Bhatia and Neelam Dhand	



### General Microbiology

<b>Course Code</b>	MLS109
<b>Course Title</b>	General Microbiology
<b>Type of course</b>	Theory
<b>L T P</b>	4      0      0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	To introduce basic principles and core concepts of microbiology, including the evolution and diversity of microbes; cell structure and function; metabolism; information flow and the role of microbes.
<b>Course Outcomes</b>	<p>At the conclusion of the course:</p> <ol style="list-style-type: none"> <li>1. Gain an understanding of the history and scope of microbiology, including the major contributions of prominent scientists and the role of medical microbiology in diagnosing and controlling infections.</li> <li>2. Develop a working knowledge of different types of microscopes, including their magnification, numerical aperture, resolution, and components. Learn how to properly care for and handle glassware.</li> <li>3. Understand the various methods of sterilization and disinfection, including heat, radiation, filtration, chemical methods, antiseptics, and asepsis. Learn about pasteurization and serum inspirator.</li> <li>4. Gain knowledge of different staining methods and their procedures, including simple staining, Gram staining, negative staining, fluorochrome staining, and stains for spirochetes and spores.</li> <li>5. Learn about the structure and function of bacterial cells and their anatomy, including the collection, transport, and processing of specimens. Also, develop an understanding of bacterial growth and metabolism, culture media, bacterial toxins, and antimicrobial agents, including susceptibility tests and quality control and safety measures.</li> </ol>

#### UNIT-I

**Introduction:** Nomenclature & Classification of micro-organisms, Historical review (Contributions of E. Jenner, L. Pasteur, Robert Koch and postulates, Anton van Leeuwenhoek, Alexander Fleming) and scope of microbiology, Role of medical microbiology in diagnosis and control of infections.

#### UNIT-II

**Microscopy:** Study of compound microscope – magnification, numerical aperture, resolution and components of microscope. Dark ground illumination, care of microscope. Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Transmission Electron Microscope, Scanning Electron Microscope

**Safety Measures in Medical Microbiology:** Introduction- Care and handling of glassware, cleaning of glassware

#### UNIT-III

**Sterilization and Disinfection Methods:** Classification of sterilization and Disinfection, Different methods of sterilization: Heat, radiation, filtration, chemical methods, antiseptics and asepsis. Pasteurization and serum inspirator

**Staining Methods:** Types of stains; acidophilic, basophilic and neutral Staining procedures: principle, procedures, uses, advantages and disadvantages of simple staining, Gram staining, negative staining, fluorochrome staining, stains for spirochetes and spores.

#### UNIT-IV

**Morphology of Bacteria:** structure and function of bacterial cell, anatomy of bacterial cell including collection, transport and processing of specimens.

**Growth and Nutrition:** Culture media and culture methods-aerobic and anaerobic, Metabolism of bacteria, growth curve of bacteria, use of culture media in diagnostic bacteriology, Bacterial toxins, Anti-microbial agents, Antimicrobial susceptibility tests, Quality control and safety.

#### Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Practical Medical Microbiology Volume 1 and Volume 2	Mackie & MacCartney	Churchill Living Stone
2	Text book of Microbiology	Ananthanereyan and Paniker	Universities Press
3	Medical Microbiology	Paniker & Satish Gupte	Universities Press
4	Text book of Microbiology	Michael J. Pelczar, JR. E.C.S Chan & Noel R. Krieg	Tata McGraw Hill
5.	Text book of Microbiology	D.R Arora & B. Arora	CBS Publishers





**Hematology-I**

<b>Course Code</b>	MLS113
<b>Course Title</b>	Hematology-I
<b>Type of course</b>	Theory
<b>L T P</b>	3 0 0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	To study the components, characteristics and functions of human blood and to identify principles and procedures of routine hematological tests including sources of error and clinical significance of results.
<b>Course Outcomes</b>	At the conclusion of the course, the students will: <ol style="list-style-type: none"> <li>1. Able to understand the laboratory organization, principles of protection, quality declaration and excellence regulation in Hematology.</li> <li>2. Accomplish and describe ideologies and process of hematopoiesis.</li> <li>3. Learn the method of various smear preparation and its staining techniques.</li> <li>4. Understand the principle, procedure normal value and clinical significance of routine hematological tests.</li> </ol>

**UNIT-I**

**Introduction to Hematology:** Importance, laboratory organization and equipment used, safety measurements in hematology laboratory.

**UNIT-II**

**Hematopoiesis:** Erythropoiesis, leucopoiesis, thrombopoiesis, Stem cells, formed elements and their functions, Anticoagulants used in various haematological studies.

**UNIT-III**

**Preparation of smears:** Thick and Thin, fixation and processing.

**Staining Techniques in Hematology:** Principle, procedure and preparation of following stains:

- Giemsa stain
- Leishman stain
- Wright's stain
- Field's stain
- JSB stain

**UNIT-IV**

**Routine hematological tests: Principle, procedures, normal values and clinical significance:**

- Determination of Haemoglobin by Sahli's method and Cyanmethemoglobin method
- Determination of Haematocrit
- Enumeration of RBC, WBC & Platelets
- Absolute Eosinophil count
- Reticulocyte count
- Calculation of Red cell Indices
- Preparation of blood film
- Staining of blood film for morphology of red cells and Differential count

**Text and Reference Books**

S. No	Name	Author(S)	Publisher
1.	Hematology for students Practitioners	Ramnik Sood	Jaypee Brothers Medical Publishers
2	Hematology (International edition)	Emmanuel C. Besa	Harwal Publisher
3	Practical Hematology (8th edition)	Sir John V Dacie & S Mitchell Lewis	Churchill Living Stone
4.	Clinical Hematology	Christopher A Ludlam	Churchill Living Stone
5.	Atlas of hematology (5th edition)	G.A. McDonald, James Paul & Bruce Cruickshank	Churchill Living Stone
6.	A Manual of Laboratory & Diagnostic Tests(6th edition)	Frances Fischbach	Lippincott, Williams & Wilkins





### Communication Skills-I

<b>Course Code</b>	ENG121
<b>Course Title</b>	Communication skills-I
<b>Type of course</b>	Theory
<b>L T P</b>	2:0:0
<b>Credits</b>	2
<b>Course prerequisite</b>	+2 in any stream
<b>Course Objective (CO)</b>	<ol style="list-style-type: none"> <li>1. Equip the learner with proficiency in reading comprehension.</li> <li>2. Enable the learner with improved writing skills and command over official/ corporate communication.</li> <li>3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.</li> </ol>
<b>Course Outcomes</b>	<p>At the conclusion of the course the student will be able to:</p> <ol style="list-style-type: none"> <li>1. Have fairly good proficiency in reading comprehension.</li> <li>2. Have enhanced writing skills and command in official/ corporate communication.</li> <li>3. Develop confidence in making presentation: oral or documentary.</li> </ol>

#### UNIT-I

**Basics of Communication Skills:** Communication, Process of Communication, Types of Communication-Verbal and Non-verbal communication, Channels of Communication- Upward, Downward, Horizontal, Barriers to Communication, Role of Communication in society.

#### UNIT-II

**Listening Skills:** Listening Process, Hearing and Listening, Types of Listening, Effective Listening, Barriers of Effective Listening, Note Taking

**Reading Skills:** Purpose of reading, Process of reading, reading skills Models and strategies, scanning, skimming, SQ3R, Approaches of Reading, Comprehension passages for practice.

#### UNIT III

**Writing Skills:** Purpose of writing, Effective writing, Types of writing, Business Correspondence, Precise writing, Memo writing, minutes of meeting.

#### UNIT-IV

**Speaking Skills:** Speech process, Skills of effective speaking, Role of audience, Feedback Skill, Oral Presentation.

#### Text and Reference Books:

Sr No	Author(s)	Title	Publisher
1.	Bhupender Kour	Effectual Communication Skills	S.K. Kataria and Sons
2.	R. Datta Roy and K.K. Dheer	Communications Skills	Vishal Publishing Company
3	The Essence of Effective Communication	Ludlow and Panton	Prentice Hall of India
4	Essentials of Business Communication	Pal and Korlahalli	S. Chand and Sons. New Delhi

### Human Anatomy & Physiology- I Practical

<b>Course Code</b>	MLS103
<b>Course Title</b>	Human Anatomy & Physiology -I Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	Students will be able to learn the basic terminology of anatomy, architecture and functional details of cells, tissues, organs and organ systems.
<b>Course Outcomes</b>	At the conclusion of the course, Students will: <ol style="list-style-type: none"> <li>1. Able to identify and label all major bones and joints of the musculo-skeletal system on charts and models.</li> <li>2. Develop an understanding of blood circulation in the cardiovascular system, including the functions of the heart, arteries, and veins.</li> <li>3. Analyze the structure and function of the respiratory system, including the trachea and lungs.</li> <li>4. Identify parts of the alimentary canal and digestive glands in the digestive system, and explain the process of digestion.</li> <li>5. Compare and contrast the four body systems studied, identifying shared and unique characteristics of each.</li> </ol>

#### LIST OF PRACTICALS

1. Study of following body systems showing all parts through charts and models:

- Musculo-skeletal system: bones and joints
- Cardiovascular system: heart, artery and vein, blood circulation
- Respiratory system: trachea and lungs
- Digestive system: parts of alimentary canal and digestive glands

2. Study of histology of following from permanent slides:

- a. Types of epithelial tissue
- b. Skeletal, smooth & cardiac muscle (TS & LS)
- c. Compact bone (TS & LS)
- d. Cartilages (hyalin, elastic and fibro-cartilage)
- e. Artery & vein (TS)
- f. Spleen (TS)
- g. Oesophagus (TS)
- h. Stomach (TS)
- i. Deudenum (TS)
- j. Liver (TS)
- k. Pancreas (TS)

**Note:** Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.



### General Microbiology Practical

<b>Course Code</b>	MLS111
<b>Course Title</b>	General Microbiology Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	<ul style="list-style-type: none"> <li>To impart skills in essential microbiological techniques and to demonstrate the principle and working of various equipment used in microbiology</li> <li>To provide hands on training to perform various microbiological tests in medical microbiology laboratory.</li> </ul>
<b>Course Outcomes</b>	<p>At the conclusion of the course:</p> <ol style="list-style-type: none"> <li>1. Understand the basic safe code of practice for a Microbiology laboratory</li> <li>2. Apply the knowledge for preparing the cleaning agents &amp; familiarize with the technique for cleaning &amp; sterilization</li> <li>3. Learn the theory, principle, working, maintenance and precautions of different equipments.</li> <li>4. Familiarize with the isolation methods of bacteria such as culture and staining techniques.</li> </ol>

#### LIST OF PRACTICALS

1. To demonstrate safety measures for a Microbiology laboratory.
2. To prepare cleaning agents & to study the technique for cleaning & sterilization.
3. To demonstrate the theory, principle, working, maintenance and precautions of Compound Microscope, Autoclave, Laminar Air Flow, Incubator.
4. Preparation of basic media for different microbial organisms
5. Isolation and enumeration of bacteria by spread plate method.
6. To obtain isolated pure colonies using different streaking formats.
7. To prepare agar slants and agar deeps for culturing microorganisms.
8. Isolation of bacteria by pour plate method.
9. To prepare a bacterial smear and perform simple staining.
10. To perform negative staining of bacteria.

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

### Hematology - I Practical

<b>Course Code</b>	MLS115
<b>Course Title</b>	Hematology - I Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	To provide hands on training to perform various hematological procedures used as diagnostic tools for screening of hematological abnormalities.
<b>Course Outcomes</b>	At the conclusion of the course, students will; 1. Understand the handling techniques of the instruments used in hematological investigations. 2. Learn the methods of blood sample collection. 3. Familiarize with the performance of routine and specialized laboratory techniques for the identification of various blood cells. 4. Able to perform and elucidate principles and procedures of tests and characterize the errors that may occur during manual blood testing.

#### LIST OF PRACTICALS

1. Study of laboratory equipments pertaining to hematological investigations.
2. Venipuncture and collection of blood samples.
3. Preparation of blood smear and staining using Geimsa stain and Leishmann stain.
4. Identify blood cells by using microscope.
5. Preparation of diluting fluids for RBC and WBC counts.
6. Demonstrate the Principles and working of hemocytometry
7. RBC count
8. WBC count
9. Differential Leucocyte count
10. Platelet count
11. Calculation of Red Cell Indices
12. Estimation of Haemoglobin
13. Determination of ESR

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**



### Communication Skills-I Lab

<b>Course Code</b>	ENG123
<b>Course Title</b>	Communication Skills-I Lab
<b>Type of Course</b>	HS
<b>L T P</b>	0:0:2
<b>Credits</b>	1
<b>Course pre-requisite</b>	+2 in any stream
<b>Course Objectives</b>	<ol style="list-style-type: none"> <li>1. Equip the learner with proficiency in reading comprehension.</li> <li>2. Enable the learner with improved writing skills and command over official/ corporate communication.</li> <li>3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.</li> </ol>
<b>Course Outcomes</b>	<p>At the conclusion of the course, the student will be;</p> <ol style="list-style-type: none"> <li>1. Have fairly good proficiency in reading comprehension.</li> <li>2. Have enhanced writing skills and have command in official/ corporate communication.</li> <li>3. Develop confidence in making presentation; oral or documentary</li> </ol>

#### UNIT-I

**Speaking and Discussion Skills:** Oral Presentation, Planning and organizing content for presentation, Use of audio /Visual Aids, Making Slides for presentation, Group Discussion, Debate, Extempore speaking, Interview Skills, Mock interview, Mock Dialogues (Pair Speaking), Cue Card Speaking, Meeting/ Conferences.

#### UNIT-II

**Listening Skills:** Listening to any recorded material and asking oral/written questions for listening comprehension.

**Reading Skills:** Active Reading of passages for Reading comprehensions, paraphrase, Summary writing.

#### UNIT-III

**Writing Skills:** Guidelines of effective writing, Paragraph Writing, Email Writing.

#### UNIT-IV

**Grammar and Vocabulary:**

Parts of Speech, Tenses, GRE words (List of 50 Words).

#### Text and Reference Books:

Sr No	Author(s)	Title	Publisher
1.	Bhupender Kour	Effectual Communication Skills	S.K. Kataria and Sons
2.	R. Datta Roy and K.K. Dheer	Communications Skills	Vishal Publishing Company
3	The Essence of Effective Communication	Ludlow and Panton	Prentice Hall of India
4	Essentials of Business Communication	Pal and Korlahalli	S. Chand and Sons. New Delhi

**Biochemistry I**

<b>Course Code</b>	MLS102
<b>Course Title</b>	Biochemistry I
<b>Type of course</b>	Theory
<b>L T P</b>	4 0 0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	This course is designed to introduce the organic structure of living systems mainly dealing with biomolecules like carbohydrates, proteins, lipids, and nucleic acids laying the foundation for other advanced courses like physiology, cell biology, molecular biology, and immunology.
<b>Course Outcomes</b>	At the conclusion of the course, students will; <ol style="list-style-type: none"> <li>1. Learn about the chemical structures of carbohydrate, and their structural and metabolic role in cellular system.</li> <li>2. Know about structure and function of various classes of lipids, sterols, terpenes and lipoproteins etc. They will also learn about primary, secondary, tertiary, quaternary structure of proteins and their functions.</li> <li>3. Understand about the structure and function of nucleosides and nucleotides.</li> <li>4. Familiarize with the biochemical role of vitamins and minerals.</li> </ol>

**UNIT-I**

**Cellular and Molecular Basis of Life:** Introduction to the Chemistry of the living beings, Elementary knowledge of Cell and cell organelles: structure and function, cellular compartmentalization.

**UNIT-II**

**Carbohydrates:** Structural aspects; Introduction & Occurrence, Classification of Mono-, Di- and Polysaccharides, Reducing & Non-reducing Sugars, properties of monosaccharides (Osazone formation, Pyranose & Furanose forms, mutarotation) Inter-conversion of monosaccharides and functions of carbohydrates.

**Lipids:** Structural aspects; General introduction, Classification & Structure of Simple & Compound lipids, Properties of Lipid aggregates (elementary idea), Biological membranes, Membrane protein – structural aspects, functions of lipids, Lipoproteins: structure, types and functions.

**UNIT-III**

**Proteins:** Structural aspects – General introduction, Classification & General characteristics, Structure of Primary, Secondary, Tertiary & Quaternary proteins, Classification of Amino acids and functions of proteins

**Nucleic acid:** Structural aspects – Components of DNA and RNA, Nucleosides & Nucleotides (introduction, structure & bonding), Double helical structure of DNA (Watson-Crick model), various forms of DNA, functions of DNA and RNA.

**UNIT-IV**

**Macro and micro nutrients:** Vitamins & Minerals.

**Vitamins:** Fat soluble vitamins and water soluble vitamins; sources, Biochemical role, RDA and Deficiency manifestations.

**Minerals:** Calcium, phosphorous, iron, copper, zinc, magnesium, manganese, iodine.



**Text and Reference Books:**

S. No	Name	Author(S)	Publisher
1	Text book of Medical Biochemistry	M N Chaterjee and R. Shinde	Jaypee Brothers Medical Publishers(P) Ltd.
2	Principal of Biochemistry	A. Lehninger	WH Freeman Publisher & Co.
3.	Biochemistry	U. Satayanarayana and U. Chakarpani	Reed Elsevier India Pvt. Ltd
4.	Biochemistry	Voet & Voet	John Willey
5.	Practical Biochemistry	D. Plummer	Tata Mc Graw Hill
6.	Harper's Bio Chemistry	Robert K. Murray, David A. Bender, Kathleen M. Gotham, Peter J. Kennelly, victor W. Rodwell & P.Anthony.Weil.	Mc Graw Hill



### Basics of Medical Lab Technology

<b>Course Code</b>	MLS106
<b>Course Title</b>	Basics of Medical Lab Technology
<b>Type of course</b>	Theory
<b>L T P</b>	3 1 0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	<ul style="list-style-type: none"> <li>To understand the role of healthcare professional.</li> <li>To impart basic knowledge of laboratory principles, procedures and techniques.</li> </ul>
<b>Course Outcomes (CO)</b>	<p>At the conclusion of the course, students will;</p> <ol style="list-style-type: none"> <li>Students are exposed to basic laboratory techniques on biological specimens and comply with safety regulations and universal precautions.</li> <li>Students will achieve precautionary and corrective maintenance of apparatus and instruments or refer to appropriate source for repairs.</li> <li>Students will be able to develop specialized and interpersonal communication skills with patients, laboratory staffs, other health care authorities, and the community.</li> </ol>

#### UNIT-I

**General overview:** classification and organization of medical laboratories, Role of medical laboratory services, lab technologists, lab rules, professional ethics and professional code of conduct.

**Laboratory Safety:** General principles, laboratory hazards and factors contributing to laboratory hazards, universal safety measures and First aid in the laboratory.

**Laboratory ware:** Types, use and calibration of following; pipettes, burettes, flasks, beakers, cylinders, test tubes, petri-dishes etc. Plastic ware: PVC, polycarbonate, Teflon; composition, properties, varieties, grades of glass wares. Advantages and disadvantages of various disposable lab ware.

**Cleaning of laboratory wares:** Preparation of cleaning solutions, general and specific cleaning procedures, care of laboratory wares and utensils, grades of chemicals, storage and handling of chemicals and reagents.

#### UNIT-II

**Equipments:** Introduction to common equipments used in laboratory: Principles, operation, use, care and maintenance of pH meter, centrifuge, hot air oven, water bath and colorimeter, laminar air flow and autoclave, Incubators, Quebec colony counter

#### UNIT-III

**Solution preparation:** UNITS of weight and volume, methods of expressing concentration of solution: Molarity, Normality, Molality, percent solution, saturated solutions and standard solutions.

**Buffers:** Buffer solutions and their storage, preparation of commonly used laboratory buffers.

**Distillation:** preparation and use of distilled water, storage and type of distillation units.

#### UNIT-IV

**Concept of pH:** dissociation of water, ionic product, pH concept, Henderson Hassel balch equation, pH measurements, Buffer solutions and buffering capacity



**Electrolyte Balance:** types of body fluids, distribution of body water and electrolytes, normal water balance, normal electrolyte balance, regulatory mechanism, pathological variations of water and electrolytes and water intoxication.

### Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Text book of Medical Laboratory Technology	P. B. Godker and Darshan P. Godkar	Bhalani Publisher
2.	Medical Laboratory Technology, Volume 3	KL Mukherjee & S.Ghosh	Tata McGraw Hill
3.	Practical Clinical Biochemistry	Harold Varley	CBS Publishers & Distributers
4.	Text book of Medical Biochemistry	M.N. Chatterjee and R. Shinde	Jaypee Brothers Medical Publishers(P) Ltd.
5.	Principles of Biochemistry	A.Lehninger	WH Freeman Publisher & Co.
6.	Biochemistry	Lubert Stryer.	WH Freeman Publisher



## Medical Parasitology

<b>Course Code</b>	MLS110
<b>Course Title</b>	Medical Parasitology
<b>Type of course</b>	Theory
<b>L T P</b>	4 0 0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	The course is intended to impart knowledge related to geographical distribution, morphology, life history and pathogenesis of medically important parasites. Students will also learn the techniques pertaining to their diagnosis.
<b>Course Outcomes</b>	At the conclusion of the course, students will: <ol style="list-style-type: none"> <li>1. Classify different types of parasites and their hosts, including protozoan, cestode, trematode, and nematode.</li> <li>2. Understand the general characteristics, morphology, life cycle, and laboratory diagnosis of cestodes, trematodes and nematodes.</li> <li>3. Apply this knowledge to understand the pathogenicity and diagnosis of parasite infection.</li> <li>4. Learn about culture, collection, handling, transportation and examination of clinical samples.</li> </ol>

### UNIT-I

**Introduction:** General characteristics of parasites, types of parasites, hosts of parasites, host-parasite relationship, Routes of transmission, organs and tissues affected by parasites, host response to parasite infections, Role of vectors in transmission of parasites

### UNIT -II

**Protozoan parasites:** Introduction and classification of protozoa, Morphology, life cycle and laboratory diagnosis of *Entamoeba histolytica*, *Giardia lamblia*, *Trichomonas vaginalis*

**Intracellular protozoan parasites:** Morphology, life cycle and laboratory diagnosis of *Trypanosoma brucei gambiense*, *Leishmania donovani*.

**Malaria parasite:** Morphology, life cycle and laboratory diagnosis of *Plasmodium vivax*, *P. ovale*, *P. malariae*, *P. falciparum*

### UNIT - III

**Cestodes:** General characteristics and classification of cestodes, morphology, life cycle and laboratory diagnosis of *Taenia saginata*, *Taenia solium*,

**Trematodes:** General characteristics and classification of trematodes, morphology, life cycle and laboratory diagnosis of *Schistosoma haematobium* and *Fasciola hepatica*

### UNIT IV

**Nematodes- I:** General characteristics and classification of nematodes, morphology, life cycle and laboratory diagnosis of *Ascaris lumbricoides* and *Ancylostoma duodenale*

**Nematodes-II:** Morphology, life cycle and laboratory diagnosis of *Enterobius vermicularis*, *Wuchereria bancrofti*



**Diagnosis of parasitic infections:** Gross and microscopic examination of stool samples, sedimentation and floatation methods, Blood examination.

### Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Medical parasitology	D. Arora	CBS Publishers
2	Parasitology	Chatterjee	CBS Publishers
3	Medical Parasitology	RL Ichhpujani and Rajesh Bhatia	Jaypee brothers Medical Publishers
4.	Text book of Parasitology	NC Dey & D Sinha	New central book agency
5.	Oxford handbook of clinical pathology	James carton	Oxford handbook of clinical pathology
6.	Medical Microbiology	Pannier & Satish Gupte	Universities press
7.	Text book of Microbiology	Michael J. Pelczar, JR. E.C.S Chan & Noel R. Krieg	Tata McGraw Hill
8.	Text book of Microbiology	Ananthanarayan And Paniker's Text Book of Microbiology	Universities Press
9.	Medical Microbiology	Paniker & Satish Gupte	Universities Press



## Hematology – II

<b>Course Code</b>	MLS114
<b>Course Title</b>	Hematology – II
<b>Type of course</b>	Theory
<b>L T P</b>	3      0      0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	This subject aims to enable the students to carry out routine clinical laboratory investigation (blood, urine etc). He/she should be able to provide technical help for sophisticated hematological techniques with adequate knowledge of various principles.
<b>Course Outcomes</b>	At the conclusion of the course, the students will: <ol style="list-style-type: none"> <li>1. Able to define, describe, and evaluate the advanced principles of hematology as it relates to white blood cells and platelets development and maturation.</li> <li>2. Compare and contrast the requirements mandated by the blood coagulation test, hemostasis techniques and other safety protocols applicable to the hematology laboratory.</li> <li>3. Apply the knowledge to compare and contrast the primary and secondary disorders of hemostasis and the laboratory tests used to identify them.</li> <li>4. Gain practical knowledge to maintain quality control and its assurance.</li> </ol>

### UNIT-I

**Hematopoiesis:** Overview, Regulation of erythrocyte production, distribution morphology, kinetics of haemoglobin synthesis, Haemoglobin: structure, function, normal and abnormal haemoglobin pigments and their measurement

**Leucopoiesis:** WBC production, distribution, morphology, kinetics

**Thrombopoiesis:** Platelet Production, distribution, morphology, kinetics.

### UNIT-II

**Blood Coagulation:** Theory of hemolysis, Theories of blood coagulation, Normal haemostatic mechanism, Classification of coagulation factors, Physiological properties of various coagulation factors.

**Haemostasis:** Investigation of haemostatic mechanism: BT, CT, whole blood coagulation time test, PT, PTT, Platelet function tests, Screening coagulation tests such as Bleeding and clotting Time, Hess test, prothrombin time (PT), Activated Partial Thromboplastin time (APTT) and other tests.

### UNIT-III

**Hematological Disorders:** Anemias - Classification and approach to diagnosis and diagnostic tests, Polycythemia, Neoplastic and non-neoplastic disorders of WBC, Classification and lab diagnosis of leukemias, chronic myeloproliferative disorders and other malignant disorders of the haemopoietic system.

**Quantitative and qualitative abnormalities** and inherited and acquired disorders of platelets.

### UNIT-IV

**Automation:** Introduction to automation in hematology, Principle, advantages, cautions and types of autoanalysers.

**Quality assurance and quality control ( 5Q chart) .**

**Text and Reference Books**

S. No	Name	Author(S)	Publisher
1.	Text book of Medical Laboratory Technology	Paraful B. Godkar, Darshan P. Godkar	Bhalani Publisher
2.	Hand book of Medical Laboratory Technology (2nd Ed)	V.H. Talib	CBS Publishers & Distributors
3.	Medical Laboratory Technology Methods & Interpretation (5th Ed)	Ramnik Sood	Jaypee Brothers Medical publishers
4.	A Manual of Laboratory & Diagnostic Tests (6 <sup>th</sup> Ed)	Frances Fischbach	Lippin Cott wiliam & wilkins
5.	Hematology (Pathophysiological basis for clinical practices)	Paul R Reich and Stephen M. Robinson	Lippin Cott wiliam & wilkins





## Human Anatomy & Physiology-II

<b>Course Code</b>	MLS118
<b>Course Title</b>	Human Anatomy & Physiology-II
<b>Type of course</b>	Theory
<b>L T P</b>	4 0 0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course objective</b>	Students will learn the concepts of anatomical structures in relationship to their physiological functions. They will also learn the integration and coordination of body functions and their dependence on endocrine and nervous system to regulate the physiological activities.
<b>Course Outcome</b>	At the conclusion of the course, students will: <ol style="list-style-type: none"> <li>1. Understand the structure and functions of urinary system and also knows the mechanism of urine formation.</li> <li>2. Able to understand the detailed structure of male &amp; female reproductive system and role of hormones. Also learn the process of spermatogenesis.</li> <li>3. Understand the basic structure, function, classification of nervous system and sensory organs.</li> <li>4. Analyze the structure, secretions and functions of endocrine glands and disorders of endocrine system.</li> </ol>

### UNIT-I

**Urinary System:** Parts, Gross structure of kidney, ureters, urinary bladder and urethra, structure of nephron, measurement and regulation of GFR and mechanism of urine formation.

### UNIT-II

**Reproductive System:** Parts of the system, gross structure of both male and female reproductive organs, reproductive cycle in female including menstrual cycle, pregnancy, parturition, lactation, male sex hormones and spermatogenesis and Basis of contraception.

### UNIT-III

**Nervous System:** Structure of neuroglia and neurons, nerve impulse, myelinated and non-myelinated nerve parts and classification:

- CNS – Structure of Brain and spinal cord and their functions.
- PNS - Cranial nerves and spinal nerves
- ANS - Sympathetic and Parasympathetic

Brief account of resting membrane potential, action potential and conduction of nerve impulse across synapse and neuromuscular junction and role of neurotransmitters

**Sensory Organs:** Structure and functions of Skin, Eye, Nose, Ear and Tongue (Auditory and Olfactory apparatus)

### UNIT-IV

**Endocrine System:** Gross structure of pituitary, thyroid, parathyroid, pancreas and adrenal glands, Names of endocrine glands - their secretions and functions, Brief account of endocrine disorders.

**Text and Reference Books**

S. No	Name	Author(S)	Publisher
1.	Anatomy & Physiology- Ross and Wilson	Anne Waugh & Allison Grant	Churchill Living Stone
2	Anatomy and Physiology: Understanding the Human Body	Robert Clark	Jones & Bartlett publishers
3	Anatomy and Physiology for nurses	Evelyn Pearce	Faber & Faber
4.	Functional Histology	James S. lowe, Barbara young, Allen Stevens & John W heath	Elsevier
5.	Text book of human Histology with color Atlas and Practical Guide	Inderjit singh	Jaypee Brothers Medical publishers
6.	Understanding Human Anatomy and Physiology	Willium Davis	Mc Graw Hill



### Communication Skills-II

<b>Course Code</b>	ENG114
<b>Course Title</b>	Communication Skills-II
<b>Type of Course</b>	Theory
<b>LTP</b>	2:0:0
<b>Credits</b>	2
<b>Course pre-requisite</b>	+2 in any stream
<b>Course Objectives (CO)</b>	Objectives of the course is to: 1. Equip the learner with proficiency in reading comprehension. 2. Enable the learner with improved writing skills and command over official/ corporate communication. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
<b>Course Outcomes</b>	At the conclusion of the course the learner will be able to: 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and have command in official/ corporate communication. 3. Develop confidence in making presentation; oral or documentary.

#### UNIT-I

**Grammar:** Parts of Speech, Use of appropriate tense, Voice , Reported Speech, Sentence Structure; Simple, Compound, Complex, Vocabulary-One word substitution.

#### UNIT-II

**Writing Skills:** Application for employment , Resume Writing ,Paragraph Writing Construction-Kinds of Paragraphs, Preparing of Matter for meeting : Notice, agenda, Conference

#### UNIT-III

**Speaking Skills:** Effective oral Presentation, Slide making, Use of audio Visual aids.

#### UNIT-IV

##### **Oral Communication and its Application:**

Group Discussion, Customer Care Relations (PR Skills), Interview Skills (Conducting and appearing for interviews), and Telephone handling manners.

#### Text and Reference Books

S.No	Name	Author(s)	Publisher
1	Business Communication	K. K. Sinha	Galgotia Publishing Company,
2	Media and Communication Management	C. S. Rayudu	- Himalaya Publishing House,
3	Essentials of Business Communication	Rajendra Pal and J. S. Korlahalli	Sultan Chand & Sons, New Delhi



**Biochemistry –I Practical**

<b>Course Code</b>	MLS104
<b>Course Title</b>	Biochemistry –I Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	The lab is designed to train the students in basic and some advanced techniques of Biochemistry like isolation, purification, and estimation of biomolecules.
<b>Course Outcomes</b>	At the conclusion of the course: 1. The student will get practical knowledge of preparation of buffers and measurement of pH 2. Qualitative tests of carbohydrates, proteins & Amino Acids and Lipids 3. Quantitative estimations of biomolecules like carbohydrates and proteins through spectrophotometric analyses. 4. Comparative evaluation of different methods of protein analysis: UV, Lowry, Biuret, Bradford

**LIST OF PRACTICALS**

- Qualitative analysis of carbohydrates (atleast one test for each aldo, keto sugar, reducing sugars and non-reducing sugars)
  - Molisch Test
  - Fehling Test
  - Benedict Test
  - Seliwanoff Test
  - Barfoed Test
  - Iodine test
- Qualitative analysis of aminoacids and proteins:
  - Biuret Test
  - Millon's Test
  - Ninhydrin Test
  - Xanthoprotic Tests
- General tests for lipids:
  - Solubility Test
  - Emulsification Test
  - Sudan-III Test
- Preparation of common anticoagulants used in laboratory.
- Verification of Lambert-Beer's Law Spectrophotometrically
- Quantitative estimation of sugars by
  - Dubois method
  - Anthrone method
  - DNS method
- Quantitative estimation of proteins by
  - Biuret method
  - Folin- lowry's method

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.**

### Basics of Medical Lab Technology Practical

<b>Course Code</b>	MLS108
<b>Course Title</b>	Basics of Medical Lab Technology Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	To impart hands on practice on general laboratory procedures and techniques.
<b>Course Outcomes</b>	At the conclusion of the course, students will; <ol style="list-style-type: none"> <li>1. Able to recognize factors that affect laboratory procedures and results.</li> <li>2. Perform preventive and corrective maintenance of equipment and instruments or refer to appropriate source for repairs.</li> <li>3. Learn the calibration of volumetric glass-ware.</li> <li>4. Able to comply with safety regulations and universal precautions.</li> </ol>

#### LIST OF PRACTICALS

1. Measurement of liquids and weighing of solids
2. Calibration of volumetric glassware; pipettes, flasks, burettes etc.
3. To demonstrate the cleaning of lab wares and laboratory utensils
  - Preparation of cleaning fluids (chromic acid)
4. Preparation of standard solutions (w/v, v/v, molar, normal and percent solutions)
  - 0.1M NaOH
  - 0.1N HCl
  - 10% NaCl
5. To make suitable dilutions by diluting the standard stock solution.
6. Measurement of pH and preparation of buffer solution (any one buffer acetate or phosphate buffer)
7. To demonstrate the principle, operation, use, care and maintenance of following lab equipments:
  - pH meter
  - Centrifuge
  - Water bath
  - Hot air oven
8. To demonstrate the preparation of distilled and de-ionised water

**Note:** Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos.

### Medical Parasitology Practical

<b>Course Code</b>	MLS112
<b>Course Title</b>	Medical Parasitology Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	The students will learn techniques related to collection, transportation and preservation and processing of specimens for routine parasitological investigations.
<b>Course Outcome</b>	At the conclusion of the course, Students will be able to: <ol style="list-style-type: none"> <li>1. Understand the basic laboratory practices in Parasitology.</li> <li>2. Apply the knowledge for the isolation of parasites by various concentration methods</li> <li>3. Perform the examination of blood and stool samples for the diagnosis of disease.</li> <li>4. Identify the parasites by various methods including staining, concentration techniques and with models /specimens/slides.</li> </ol>

### LIST OF PRACTICALS

1. Routine stool examination for detection of intestinal parasites: Preparation of slide; Saline and Iodine mount
2. Concentration methods: simple flotation, Lane's direct centrifugal flotation. Zinc sulphate centrifugation
3. Sedimentation method: simple sedimentation and Formal ether concentration method
4. Study of parasite life stages (eggs, cysts, adult worms, larvae) by chart and permanent slides
5. Detection of different stages of Plasmodium species in permanent slides of blood sample.
6. Detection of malaria parasites in peripheral blood smear by Giemsa staining and Leishman's stain
7. Identification of adult worms from Model/specimens/slides: (morphology, stages of life cycle, pathogenicity and clinical features)
  - a. *T. solium* and *T. saginata*
  - b. *Ascaris lumbricoides*
  - c. Pinworms

**Note:** Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos



**Hematology – II Practical**

<b>Course Code</b>	MLS116
<b>Course Title</b>	Hematology – II Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	To impart hands-on training for identifying blood cell abnormalities for the diagnosis of disease and to provide skills necessary to perform blood cell count and evaluation of blood elements within stated limits of accuracy.
<b>Course Outcome</b>	At the conclusion of the course, Students will: <ol style="list-style-type: none"> <li>1. Understand the basic steps for drawing a blood specimen by different methods</li> <li>2. Learn the methods of preparation of various blood smear and anticoagulants</li> <li>3. Able to perform and elucidate principles and procedures of tests to include causes of error and clinical consequence of results.</li> </ol>

**LIST OF PRACTICALS**

1. Basic steps for drawing a blood specimen by vein puncture and Complications of vein puncture.
2. Blood collection by Capillary Blood method.
3. Deciding specimen types and selection of - Anticoagulant- EDTA, Citrate, Oxalate, Heparin, sodium fluoride.
4. Preparation of thin, thick, & wet blood films.
5. Perform BT & CT test.
6. Packed cell volume
7. Erythrocyte Indices- MCV, MCH, MCHC.
8. Reticulocyte Count.
9. Absolute Eosinophil Count
10. Estimation of serum iron

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

### Human Anatomy & Physiology-II Practical

<b>Course Code</b>	MLS120
<b>Course Title</b>	Human Anatomy & Physiology-II Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course objective</b>	The concepts related to anatomical details of human organ systems and integration and coordination between them will be demonstrated through charts, models and permanent slides.
<b>Course Outcome</b>	At the conclusion of the course, Students will: <ol style="list-style-type: none"> <li>1. Able to compare and contrast the four body systems studied and identify unique characteristics of each.</li> <li>2. Develop an understanding of the histology of various tissues &amp; organs through permanent slides.</li> <li>3. Able to identify and label all major parts of the sensory system through charts and models.</li> </ol>

#### LIST OF PRACTICALS

1. Study of body systems showing all parts through charts and models
2. Excretory system: kidney, ureters and urinary bladder
3. Male reproductive system: Testes and vas deferens
4. Female reproductive system: ovaries, uterus, fallopian tubes
5. Nervous system: parts of brain; cerebellum, cerebrum, Pons and medulla oblongata
6. Study of histology of following tissues and organs from permanent slides:
  - Kidney (LS)
  - T.S of cortex part of kidney
  - T.S of medulla part of kidney
  - T.S of testes
  - T.S of ovaries
  - Myelinated and non-myelinated nerve fibres
  - T.S of spinal cord
  - Thyroid gland (TS)
  - Adrenal gland (TS)
  - Pancreas (TS)
7. Study of structure of various sensory organs from charts.
  - Eye
  - Ear
  - Nose

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

**Communication Skills-II Lab**

<b>Course Code</b>	ENG116
<b>Course Title</b>	Communication Skills-II Lab
<b>Type of Course</b>	Practical
<b>L T P</b>	0:0:2
<b>Credits</b>	1
<b>Course pre-requisite</b>	+ 2 with any stream
<b>Course Objectives</b>	Objectives of the course is to: <ol style="list-style-type: none"> <li>1. Equip the learner with proficiency in reading comprehension.</li> <li>2. Enable the learner with improved writing skills and command over official/ corporate communication.</li> <li>3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.</li> </ol>
<b>Course Outcomes</b>	At the conclusion of the course the learner will be able to: <ol style="list-style-type: none"> <li>1. Have fairly good proficiency in reading comprehension.</li> <li>2. Have enhanced writing skills and have command in official/ corporate communication.</li> <li>3. Develop confidence in making presentation; oral or documentary.</li> </ol>

**UNIT-I****Grammar**

To recognize part of speech of particular word in given sentence, To use appropriate tense, Exercise on-Voice, Reported speech and Sentence Structure, Vocabulary-One word substitution.

**UNIT- II****Writing Skills**

Job Application, Resume Writing, Paragraph Writing, Preparing of Matter for meeting: Notice, agenda, Conference.

**UNIT- III**

**Speaking Skills:** How to deliver an effective power point Presentation, Slide making, Effective use of audio Visual aids,

**UNIT-IV****Oral Communication and its Application:**

Group Discussion, Mock Interview (Conducting and appearing for interviews), and Role plays. Conducting a successful official meeting.

**Text & Reference Books**

S. No	Name	Author(s)	Publisher
1	Business Communication	K. K. Sinha	Galgotia Publishing Company,
2	Media and Communication Management	C. S. Rayudu	Himalaya Publishing House, Bombay.
3	Essentials of Business Communication	Rajendra Pal and J. S. Korlahalli	Sultan Chand & Sons, New Delhi



**Biochemistry – II**

<b>Course Code</b>	MLS201
<b>Course Title</b>	Biochemistry – II
<b>Type of course</b>	Theory
<b>L T P</b>	3      0      0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks./ Lateral Entry
<b>Course objectives</b>	The course aims to provide students with a basic understanding of principles of bioenergetics and enzyme catalysis, metabolism of dietary and endogenous carbohydrate, lipid, and protein and major mechanisms of metabolic control.
<b>Course Outcome</b>	At the conclusion of the course; <ol style="list-style-type: none"> <li>1. The student will be able to learn about the general principles of intermediary metabolism, types of biological oxidations and role of electron carriers in biochemical reactions.</li> <li>2. The student will be able to learn major pathways of carbohydrate catabolism and their association with cellular energy production and carbohydrate anabolism in animal cells and metabolic disorders.</li> <li>3. Lipid biosynthesis, Degradation of fatty acids and cholesterol, formation of ketone bodies &amp; their significance and their metabolic disorders.</li> <li>4. The student will learn and understand about the Biosynthesis of purines and pyrimidine nucleotides, degradation of nucleotides, salvage pathways, biosynthesis and biodegradation of amino acids. Inborn errors of metabolism.</li> <li>5. Acquire the knowledge of enzymes their properties and classification, Mode of action, Basics of Enzyme kinetics: Michaelis-Menten initial rate equation for single substrate reactions and methods for the determination of <math>K_m</math> and <math>V_{max}</math>. They will also learn about fundamentals of enzyme regulation and inhibition.</li> </ol>

**UNIT-I**

**Principle of Intermediary Metabolism:** catabolism and anabolism, Biological oxidations & electron carriers and general concept of metabolic regulation.

**UNIT-II**

**Carbohydrate Metabolism:** Digestion and absorption of carbohydrates, major catabolic routes of glucose; glycolysis, TCA, glycogenolysis & HMP shunt pathway, anaerobic breakdown of glucose (alcoholic and lactic acid fermentation), anabolism of carbohydrates; gluconeogenesis and glycogenesis, homeostasis and metabolic disorders of carbohydrate metabolism

**Lipid Metabolism:** Digestion and absorption of lipids, role of lipoproteins in transportation of lipids, fatty acid oxidation, ketone body formation and ketosis, fatty acid synthesis, metabolism of cholesterol (biosynthesis and degradation), bile acids and their functions, disorders of lipid metabolism.

**UNIT-III**

**Protein Metabolism:** Digestion and absorption of proteins, catabolism of amino acids; Deamination, Transamination and Decarboxylation reactions, transport of ammonia and Urea cycle, biosynthesis of amino acids (elementary idea), metabolic disorders of amino acids and proteins.

**Metabolism of Nucleic Acids:** Catabolism and biosynthesis of nucleotides, nucleosides and purine and pyrimidine bases, clinical disorders of purine and pyrimidine metabolism.

**UNIT-IV**

**Enzymes:** Nomenclature and classification of enzymes, general properties of enzymes; specificity, mechanism of action (Lock and key & induced fit hypothesis) and factors affecting enzyme action

**Enzyme kinetic:** Michaelis-Menten equation, significance of  $K_m$ , enzyme inhibition and enzyme regulation.

### Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Biochemistry	Voet & Voet	John Willey
2	Biochemistry	Lubert Stryer, Jeremy Berg & John L tymoczko	WH Freeman & Co.
3	Harper's Bio Chemistry	Robert K Murray, David A Bender, Kathleen M. Gotham, Peter J Kennelly, victor W.Rodwell & P.Anthony.Weil.	McGraw Hill
4	Principles of Biochemistry	David.L Nelson & Albert Lehninger	WH Freeman Publisher & Co.
5.	Text book Of Medical Biochemistry	M N Chaterjee and R. Shinde	Jaypee Brothers Medical Publishers(P) Ltd.
6.	Practical Biochemistry, 3 <sup>rd</sup> Ed.	D. T. plumber	Mc Graw Hill



### Systematic Bacteriology

<b>Course Code</b>	MLS205
<b>Course Title</b>	Systematic Bacteriology
<b>Type of course</b>	Theory
<b>L T P</b>	4 0 0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks./ Lateral Entry
<b>Course objective (CO)</b>	To impart the knowledge of causative agents, pathogenesis, biochemical assays and lab diagnosis for characterization of pathogenic bacteria.
<b>Course Outcome</b>	At the conclusion of the course, students will; <ol style="list-style-type: none"> <li>1. Understand the morphological, cultural and biochemical characteristics of bacteria</li> <li>2. Able to differentiate a large number of bacteria by their salient characteristic features &amp; classify them into groups.</li> <li>3. Apply the knowledge to identify pathogenic bacteria and diagnose the diseases</li> </ol>

#### UNIT-I

**Pathogenic Gram-positive cocci:** Morphology, culture characteristics, biochemical features and laboratory diagnosis of *Staphylococcus aureus*, *Streptococcus pyogenes* and *Streptococcus pneumoniae*.

**Pathogenic Gram-negative cocci:** Morphology, culture characteristics, biochemical features and laboratory diagnosis of *Neisseria gonorrhoeae* and *Neisseria meningitidis*

#### UNIT-II

**Pathogenic Gram-negative bacilli-I:** Morphology, culture characteristics, biochemical features and laboratory diagnosis of *Hemophilus influenzae*, Pathogenic *E. coli* and *Salmonella typhi*

**Pathogenic Gram-negative bacilli-II:** Morphology, culture characteristics, biochemical features and laboratory diagnosis of *Helicobacter pylori*, *Shigella dysenteriae*

#### UNIT-III

**Pathogenic Gram-positive bacilli-I:** Morphology, culture characteristics, biochemical features and laboratory diagnosis of *Corynebacterium diphtheriae*, *Clostridium tetani* and *Clostridium botulinum*.

**Pathogenic Gram-positive bacilli-II:** Morphology, culture characteristics, biochemical features and laboratory diagnosis of *Listeria monocytogenes* and *Bacillus anthracis*

#### UNIT-IV

**Other pathogenic bacteria:** Morphology, culture & biochemical features and laboratory diagnosis of *Mycobacterium tuberculosis*, *Vibrio cholerae*.

**Mycoplasmas and rickettsias:** Morphology, culture & biochemical features and laboratory diagnosis of *Mycoplasma pneumoniae* and *Chlamydia trachomatis*



**Text and Reference Books**

S. No	Name	Author(S)	Publisher
1.	Clinical Pathology and Bacteriology 8th Ed,	K.N. Sachdev	J.P. Bros, New Delhi-1991.
2	Text book of Microbiology	Ananthanereyan And Paniker's Text Book of Microbiology	Universities Press
3.	Text book of Microbiology	Michael J. Pelczar, JR. E.C.S Chan & Noel R. Krieg	Tata McGraw Hill
4.	Clinical Diagnosis & Management by Laboratory methods (20th edition)	John Bernard Henary	Sounder Publisher
5.	Medical laboratory Technology Volume-I	KL Mukherjee	Tata McGraw Hill



### Basics of Biochemical & Biophysical Techniques

<b>Course Code</b>	MLS209
<b>Course Title</b>	Basics of Biochemical & Biophysical Techniques
<b>Type of course</b>	Theory
<b>L T P</b>	3 0 0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks./ Lateral Entry
<b>Course Objective (CO)</b>	<ul style="list-style-type: none"> <li>To provide insights into the complex biochemical and biophysical principles and procedures used for extraction, separation, purification, estimation and characterization of compounds of clinical importance in analytical biochemistry.</li> <li>To impart knowledge about radio diagnostic techniques.</li> </ul>
<b>Course outcomes</b>	At the conclusion of the course, students will; <ol style="list-style-type: none"> <li>1. Able to monitor quality control within pre-determined limits.</li> <li>2. Accomplish precautionary and counteractive care of equipment and apparatuses suitable source for maintenance.</li> <li>3. Demonstrate the use of different techniques like spectrophotometry, flame photometry, AAS, centrifugation, radioisotopes techniques and electrophoresis etc.</li> </ol>

#### UNIT-I

**Spectrophotometry:** Introduction, theory, principle and applications of spectrophotometry, applications and limitations of Lambert Beer's law, types (single and double beam) and operational use of Spectrophotometers.

**AAS:** Introduction to principle, instrumentation and applications of atomic absorption spectrophotometers.

#### UNIT-II

**Colorimetry:** Theory, principle and applications of photo colorimeter, Introduction to optical filters, operational use and limitations of colorimeters.

**Flame photometry:** Principle, instrumentation and applications of flame photometers in clinical sciences.

#### UNIT-III

**Chromatography:** Basic Principle, theory, modes and types of chromatographic techniques, Principle, procedure and applications of paper chromatography, TLC, column chromatography (LPLC & HPLC), ion exchange chromatography, Gas chromatography and gel exclusion chromatography.

**Centrifugation:** Basic principles, theory and applications of preparative and analytical centrifugation, rotor types, sedimentation co-efficient, care and maintenance of rotors.

#### UNIT-IV

**Radioisotopic Techniques:** Basic concepts of radioisotopy- decay constant, decay series, theory and applications of Geiger-Muller tube counter, solid and liquid scintillation counters, primary and secondary fluors, safety rules for radioisotopic studies, radioisotopes used in medicine.

**Electrophoresis:** Basic principles, theory and application of native, SDS-PAGE and agarose gel

electrophoresis, Introduction to IEF (Iso-electric focusing) 2-D gel electrophoresis and its applications in diagnosis.

#### Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd edition	D. Freifelder (1982)	W.H. Freeman & Company
2	Biologist's Guide to Principles and Techniques of Practical Biochemistry. 3rd.	Wilson, K and Goulding, K.H. (1991).	Edward Arnold, London.
3	Introductory Practical Biochemistry	Sawhney, S.K. and Singh, R. (2001)	Narosa Publishing House, New Delhi
4.	Principles and Techniques of Practical Biochemistry and Molecular Biology, 7 <sup>th</sup> Edition	Wilson, K and Walker, J (2010)	Cambridge University Press, New Delhi



### Environmental Science

<b>Course Code</b>	EVS001
<b>Course Title</b>	Environmental Science
<b>Type of course</b>	Theory
<b>L T P</b>	3 0 0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks./ Lateral Entry
<b>Course objective</b>	To connect and sensitize the students towards the environment and prevailing environmental issues (natural, physical, social and cultural).
<b>Course Outcome</b>	At the conclusion of the course, students will : <ol style="list-style-type: none"> <li>1. Critically examine all sides of environmental issues and apply understanding from disciplines such as history, economics, psychology, law, literature, politics, sociology, philosophy, and religion to create informed opinions about how to interact with the environment on both a personal and a social level.</li> <li>2. Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.</li> <li>3. Able to suggest ways for hygiene, reduce, reuse, recycle and takes care of different living beings (plants, animals, and the elderly, differently-abled people), resources (food, water, and public property).</li> <li>4. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.</li> </ol>

#### UNIT I

**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.

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

#### UNIT II

**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

**Social Issues and the Environment:** From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems 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**

**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.

**Text and Reference Books:**

S. No.	Name	Author(S)	Publisher
1	Environmental Biology	Agarwal, K.C. 2001	Nidi Publ. Ltd. Bikaner.
2	Environmental Science	Miller T.G. Jr.	Wadsworth
3	Perspectives in Environmental Studies	Anubha Kaushik and Gaurav Garg	New Age International Publishers



## Gender Equity

<b>Course Code</b>	SSC001
<b>Course Title</b>	Gender Equity
<b>Type of course</b>	Theory
<b>L T P</b>	3 0 0
<b>Credits</b>	3
<b>Course prerequisite</b>	AECC
<b>Course objective</b>	<ul style="list-style-type: none"> <li>To develop gender sensitive pedagogy and knowledge system.</li> <li>To make participants understand the nuances of gender justice and its significance so that they can spread awareness among students and civil society against systemic gender discrimination embedded in our culture.</li> <li>To comprehend the issues and challenges faced by women in a holistic manner through deliberations, research work, theory building and information dissemination.</li> </ul>
<b>Course Outcome</b>	<p>At the conclusion of the course, students will:</p> <ol style="list-style-type: none"> <li>1. Able to acquire knowledge and understanding of theory and concepts related to gender and gender relations.</li> <li>2. Able to critically reflect how gender is a development issue.</li> <li>3. Analyse the evolution of thinking and approaches around gender and development.</li> </ol>

### UNIT I

Concept of sex and gender

Gender attributes and questions of identity.

### UNIT II

Empowerment- concept and meaning.

Definition of feminism, feminist and women movements in U.S.A, U.K., France and India

### UNIT III

Women development and development organizations.

Impact of development on gender.

### UNIT IV

Policies and current debates on women rights.

Role of UN in establishing gender equality.

Violence against women and need for reforms.

### Text and Reference Books:

S. No.	Name	Author(S)	Publisher
1	The Roots of Gender inequality in Developing Countries	Jayachandran, Seema- 2014	NBER Working Paper No.20380. Issued in August 2014
2	Women's Empowerment and Economic Development	Duflo, Esther-2012	Journal of Economic Literature, 50(4): 1051-79.



### Biomedical Waste Management

<b>Course Code</b>	MLS213
<b>Course Title</b>	Biomedical Waste Management
<b>Type of course</b>	Theory
<b>L T P</b>	2 0 0
<b>Credits</b>	2
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks./ Lateral Entry
<b>Course objective</b>	To sensitize the students towards the management of biomedical waste
<b>Course Outcome</b>	At the conclusion of the course, students will : 1. Able to define & classify Biomedical waste. 2. Learn about segregation, collection & transportation of Biomedical Waste. 3. Know the methods of management of Biomedical Waste. 4. Aware about modern technologies used in Handling and controlling of infection.

#### UNIT I

Definition of Biomedical Waste, Types of waste generated from Health Care Facility  
Waste minimization

#### UNIT II

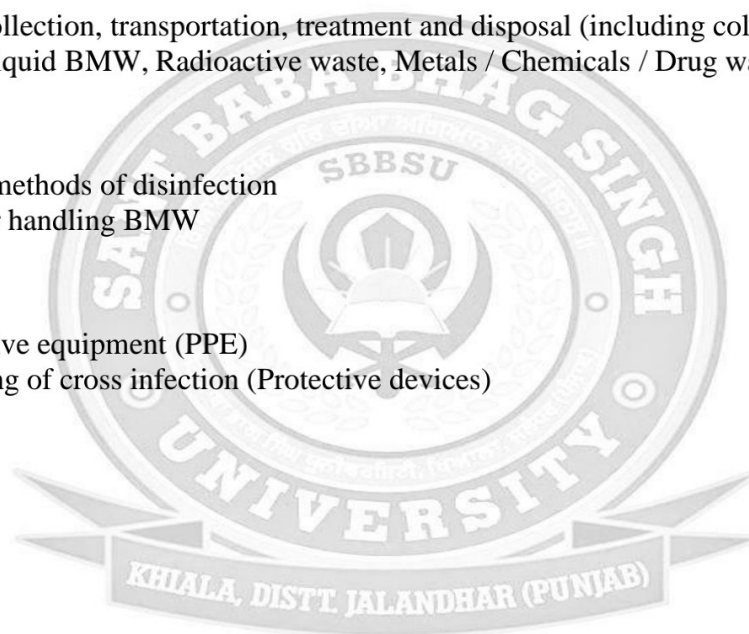
BMW – Segregation, collection, transportation, treatment and disposal (including color coding)  
BMW Classification: Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste

#### UNIT III

BMW Management & methods of disinfection  
Modern Technology for handling BMW

#### UNIT IV

Use of Personal protective equipment (PPE)  
Monitoring & controlling of cross infection (Protective devices)



**First Aid**

<b>Course Code</b>	MLS215
<b>Course Title</b>	First Aid
<b>Type of course</b>	Theory
<b>L T P</b>	2 0 0
<b>Credits</b>	2
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks./ Lateral Entry
<b>Course objective</b>	To aware students regarding basic first aid techniques
<b>Course Outcome</b>	At the conclusion of the course, students will: <ol style="list-style-type: none"> <li>1. Able to understand the aims &amp; objectives of First-Aid and learn techniques for Respiratory &amp; Cardiac Conditions.</li> <li>2. Familiar about wounds &amp; injuries &amp; their Management and able to prepare appropriate dressings &amp; bandages for different types of injuries.</li> <li>3. Safely and effectively assess and manage gastrointestinal &amp; burns emergencies.</li> <li>4. Identify and respond appropriately to drug toxicity and other poisoning incidents and skillfully handle foreign objects in the ear, nose, and throat, as well as in the skin.</li> </ol>

**UNIT I**

First aid: Aims and objectives of first aid

Basic first aid techniques on Respiratory system & breathing

Cardiac condition, blood circulation & Shock

**UNIT- II**

Wounds & injuries

Dressing and bandages

Fractures & dislocation of the bone & joints.

Neurological conditions & unconsciousness

**UNIT- III**

Abnormality of the gastrointestinal tract & food poisoning

Electric shock; burns, hemorrhage.

**UNIT- IV**

Drug toxicity & poisoning, Bites & stings, Foreign body in ENT & Skin

**Biochemistry – II Practical**

<b>Course Code</b>	MLS203
<b>Course Title</b>	Biochemistry – II Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT with 50% marks./ Lateral Entry
<b>Course objective</b>	The lab is designed to train the students in basic and some advanced techniques of Biochemistry like isolation, purification, and estimation of biomolecules.
<b>Course Outcome</b>	At the conclusion of the course, Students will : 1. Understand the basic laboratory practices in biochemistry such as reagent and buffer preparations 2. Apply this knowledge to quantify and to evaluate clinical samples for diagnosis 3. Able to perform complex enzymes assays

**LIST OF PRACTICALS**

1. Estimation of blood Glucose by
  - Folin Wu method
  - Glucose oxidase method.
2. Determination of Total serum proteins.
3. Determination of Uric acid in serum or plasma
4. Determination of Urea in serum or plasma
5. Determination of total Cholesterol in serum or plasma
6. Determination of enzyme activity of salivary amylase or acid phosphatase
7. To study effect of pH on enzyme activity
8. To study effect of temperature on enzyme activity

**Note:** Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos



### Systematic Bacteriology Practical

<b>Course Code</b>	MLS207
<b>Course Title</b>	Systematic Bacteriology Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0      0      3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks./ Lateral Entry
<b>Course objective</b>	To provide hands on training on techniques related to characterization and lab diagnosis of medically important bacteria.
<b>Course Outcome</b>	At the conclusion of the course, Students will: <ol style="list-style-type: none"> <li>1. Able to understand the basic laboratory practices in the field of bacteriology.</li> <li>2. Apply this knowledge to isolate the pathogens from</li> <li>3. different types of samples such as blood, urine, Sputum and Pus.</li> <li>4. Perform antibiotic sensitivity test and other biochemical tests for the detection of pathogens</li> <li>5. Evaluate the laboratory results to clinical diagnosis and analyze the test results with common diseases or conditions.</li> </ol>

#### LIST OF PRACTICALS

1. To perform Gram staining of different bacterial cultures
2. To perform Ziehl-Neelsen staining of bacteria
3. To perform Alberts staining of bacteria
4. Processing of blood sample for culture and identification of pathogen.
5. Processing of urine sample for culture and identification of pathogen.
6. Processing of Sputum sample for culture and identification of pathogen
7. Processing of Pus sample for culture and identification of pathogen
8. To perform Indole production, Methyl red, Voges-Proskauer and citrate utilization tests ( I M V i C ) for biochemical characterization of bacteria.
9. To perform urease, catalase and oxidase tests for biochemical characterization of bacteria.
10. To perform motility test of bacteria by hanging drop preparation

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

### Basics of Biochemical and Biophysical Techniques Practical

<b>Course Code</b>	BML211
<b>Course Title</b>	Basics of Biochemical and Biophysical Techniques Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks./ Lateral Entry
<b>Course Objective (CO)</b>	To provide hands-on training on operational use of various equipments such as spectrophotometers, flame photometers, electrophoretic units etc. used in analytical techniques.
<b>Course Outcome</b>	At the conclusion of the course, students will: 1. Understand the principle, working & maintenance of different techniques such as spectrophotometer, colorimeter, flame photometer, electrophoresis and centrifuges. 2. Learn various chromatography techniques. 3. Able to prepare polyacrylamide gel and perform SDS-PAGE.

#### LIST OF PRACTICALS

1. Demonstration of principle, working & maintenance of spectrophotometer.
2. Preparation of standard curve by measurement of the transmission of light through different solutions or substances at different wavelengths of light.
3. Demonstration of principle, working & maintenance of colorimeter.
4. Demonstration of principle, working & maintenance of flame photometer
5. To demonstrate the principle and working of centrifuges.
6. To demonstrate the separation of amino acids by paper chromatography.
7. To demonstrate the principle & demonstration of TLC.
8. To demonstrate theory, principle and procedure for preparation of agarose and polyacrylamide gels.
9. To demonstrate the principle and procedure for separation of proteins on SDS-PAGE.
10. Demonstration of serum electrophoresis.

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

### Basics of Computers Lab

<b>Course Code</b>	CSE213
<b>Course Title</b>	Basics of Computers Lab
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks./ Lateral Entry
<b>Course Objective (CO)</b>	<p>The objective of the course is to</p> <ol style="list-style-type: none"> <li>1. Provide students with a basic understanding of computer hardware, software, and operating systems.</li> <li>2. Introduce students to common programming languages, multimedia, and networking.</li> <li>3. Enhance students' knowledge of number systems and arithmetic.</li> <li>4. Familiarize students with word processing, spreadsheet, and presentation software.</li> <li>5. Teach students how to use the internet for information seeking and communication.</li> </ol>
<b>Course Outcome</b>	<p>At the conclusion of the course, students will</p> <ol style="list-style-type: none"> <li>1. Identify and explain computer components and their functions</li> <li>2. Install and operate common operating systems and software applications.</li> <li>3. Perform basic text and data entry and editing tasks using word processing software.</li> <li>4. Proficient in creating charts and spreadsheets using Excel and Open Office.</li> <li>5. Able to create engaging multimedia presentations and understand basic data processing concepts.</li> </ol>

### LIST OF PRACTICALS

1. Given a PC, name its various components and peripherals. List their functions
2. Practice in installing a computer system by giving connection and loading the system software and application software
3. Exercises on entering text and data (Typing Practice)
4. Installation of operating System viz. Windows XP, Windows 2007 etc.  
Features of Windows as an operating system
  - Start
  - Shutdown and restore
  - Creating and operating on the icons
  - Opening closing and sizing the windows
  - Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file
  - Creating and operating on a folder
  - Changing setting like, date, time, colour (back ground and fore ground)
  - Using short cuts
  - Using on line help
5. Word Processing (MS Office/Open Office)



**1. File Management:**

Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file

**2. Page Set up:**

Setting margins, tab setting, ruler, indenting

**3. Editing a document:**

Entering text, Cut, copy, paste using tool- bars

**4. Formatting a document:**

Using different fonts, changing font size and colour, changing the appearance through bold/ italic/ underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods

Aligning of text in a document, justification of document, Inserting bullets and numbering

Formatting paragraph, inserting page breaks and column breaks, line spacing

Use of headers, footers: Inserting footnote, end note, use of comments

Inserting date, time, special symbols, importing graphic images, drawing tools

**5. Tables and Borders:**

Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table

Print preview, zoom, page set up, printing options

Using Find, Replace options

**6. Using Tools like:**

Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and labels

Using shapes and drawing toolbar,

Working with more than one window in MS Word,

How to change the version of the document from one window OS to another

Conversion between different text editors, software and MS word

**6. Spread Sheet Processing (MS Office/Open Office)**

1. Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, create chart, printing chart, save worksheet, switching between different spread sheets

**2. Menu commands:**

Create, format charts, organise, manage data, solving problem by analyzing data, exchange with other applications. Programming with Excel Work Sheet, getting information while working

**3. Work books:**

**Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations, working with arrays**

1. Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet

2. Creating a chart:

3. Working with chart types, changing data in chart, formatting a chart, use chart to analyze data

4. Using a list to organize data, sorting and filtering data in list

5. Retrieve data with query: Create a pivot table, customising a pivot table. Statistical

6. analysis of data

7. Exchange data with other application: embedding objects, linking to other applications, import, export document.

**7. PowerPoint Presentation (MS Office/Open Office)**

## a) Introduction to PowerPoint

- How to start PowerPoint
- Working environment: concept of toolbars, slide layout, templates etc.
- Opening a new/existing presentation
- Different views for viewing slides in a presentation: normal, slide sorter etc.

## b) Addition, deletion and saving of slides

## c) Insertion of multimedia elements

- Adding text boxes
- Adding/importing pictures
- Adding movies and sound
- Adding tables and charts etc.
- Adding organizational chart

## d) Formatting slides

- Using slide master
- Text formatting
- Changing slide layout
- Changing slide colour scheme
- Changing background
- Applying design template

## e) How to view the slide show?

- Viewing the presentation using slide navigator
- Slide transition
- Animation effects etc.

**8. Working with Data Processing (MS Office/Open Office)**

## a) Understanding different data types

## b) Creation of table

## c) Entering data in a table and modify it.

## d) Creating simple Queries

**9. Internet and its Applications**

## a) Log-in to internet

## b) Navigation for information seeking on internet

## c) Browsing and down loading of information from internet

## d) Sending and receiving e-mail

- Creating a message
- Creating an address book
- Attaching a file with e-mail message
- Receiving a message
- Deleting a message

## Clinical Biochemistry I

<b>Course Code</b>	MLS202
<b>Course Title</b>	Clinical Biochemistry-I
<b>Type of course</b>	Theory
<b>L T P</b>	3      0      0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	The course is intended to make the students familiar with various methods of clinical sample analysis for biochemical parameters which are the basis for diagnosis of various diseases.
<b>Course Outcome</b>	At the conclusion of the course, the students will: <ol style="list-style-type: none"> <li>1. Learn Hazards &amp; safety measures in clinical biochemistry laboratory, Quality control and quality assurance.</li> <li>2. Understand the concept of pH and importance of various buffers.</li> <li>3. Understand the routine biochemical investigation and metabolic disorders associated with electrolyte imbalance.</li> <li>4. Students can demonstrate the physical and chemical examination of various body fluids and know the significance of glycemic disorders.</li> </ol>

### UNIT-I

**Introduction to Clinical laboratory:** Laboratory organization, management and maintenance of records, Hazards & safety measures in clinical biochemistry laboratory, Quality control and quality assurance.

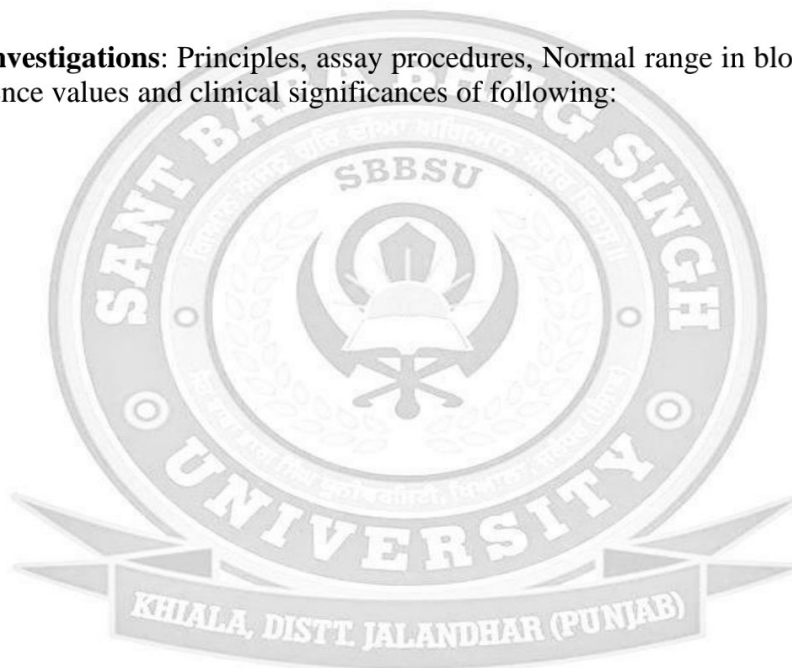
### UNIT-II

**Acid Base Balance Concepts & Disorders** - pH, buffers, acidosis and alkalosis: types, causes and health complications.

### UNIT-III

**Routine Biochemical Investigations:** Principles, assay procedures, Normal range in blood, Serum, Plasma and Urine, reference values and clinical significances of following:

- Glucose
- Proteins
- Urea
- Uric acid
- Creatinine
- Bilirubin
- Cholesterol
- Sodium
- Potassium
- Chloride,
- Iodine
- Calcium
- Phosphorous



### UNIT-IV

**Examination of Body fluids & Glycemic Disorders:**

**Chemical examination of Urine:** composition of urine, collection, preservation and changes in composition of urine in relation to various diseases.



**Cerebrospinal Fluid:** composition, collection and preservation, physical and chemical examination of CSF.

**Hyperglycemia & Hypoglycemia:** Diabetes mellitus - definition, types, features, gestation diabetes mellitus, glucose tolerance test, Causes of glycosuria & hypoglycemia.

#### Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Text book of Medical Laboratory Technology	Paraful B. Godkar, Darshan P. Godkar	Bhalani Publisher
2	Medical laboratory Technology Volume-III (2 <sup>nd</sup> Ed.)	KL Mukherjee	Tata McGraw Hill
3	Practical Clinical Biochemistry	Harold Varley	CBS Publishers & Distributers
4	Text book of Medical Biochemistry	M N Chaterjee and R. Shinde	Jaypee Brothers Medical Publishers(P) Ltd.
5.	Medical Laboratory Sciences, Theory & Practical	Arundhati Kolhatkar & J. ochei	McGraw Hill



**Hematology – III**

<b>Course Code</b>	MLS206
<b>Course Title</b>	Hematology – III
<b>Type of course</b>	Theory
<b>L T P</b>	3 0 0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	The course has been designed to provide students' knowledge related to principle of tests, methodology of routine as well as advanced procedures being carried out in the laboratory by using routine as well as sophisticated instruments. Stress is also given in use of safety measures in the laboratory
<b>Course Outcome</b>	At the conclusion of the course, students will; <ol style="list-style-type: none"> <li>1. Familiar with principles, procedure, normal value and clinical significance and other safety protocols applicable to the hematology laboratory.</li> <li>2. Able to interpret laboratory results for hematology testing and classify them as normal or abnormal.</li> <li>3. Understand the immunohematology principles and bone marrow examination</li> </ol>

**UNIT-I**

**Special Hematological tests: Principle, procedures, normal values and clinical significance of following hematological tests:**

1. Sickling tests
2. Osmotic fragility test
3. Determination of HbF and HbA<sub>2</sub>
4. Haemoglobin Electrophoresis
5. Investigation of Glucose-6-phosphate dehydrogenase deficiency
6. Plasma haptoglobin and demonstration of hemosiderin in urine
7. Tests for Autoimmune haemolytic anaemia
8. Measurement of abnormal Hb pigments
9. Laboratory diagnosis of protozoan blood parasites
10. Preparation and staining of Heinz body
11. Preparation and demonstration of Lupus erythematosus (LE) cell

**UNIT-II**

**Immuno-hematology:** Principles of immunohematology, Human blood group systems (basic genetics of ABO & Rh blood group systems)

Methods of blood group typing: saline method, albumin displacement technique and enzyme techniques.

**UNIT-III**

**Bone Marrow Examination:** Composition and functions, Bone marrow aspiration, Preparation of bone marrow smear for microscopic examination

**UNIT-IV**

**Staining techniques in Haematology (Romanowsky stains):** Principle, composition, preparation of staining reagents and procedure.

**Text and Reference Books**

S. No	Name	Author	Publisher
1.	Text book of Medical Laboratory Technology	Paraful B. Godkar, Darshan P. Godkar	Bhalani Publisher
2.	Hand book of Medical Laboratory Technology (2nd Ed)	V.H. Talib	CBS Publishers & Distributors
3.	Medical Laboratory Science – Theory and Practice	J. Ochei & A Kolhatkar	Mcgraw Hill
4.	Practical Hematology (8th Ed)	Sir John V Dacie & S Mitchell Lewis	Churchill Living Stone
5.	Clinical Hematology	Christopher A. Ludlam	Churchill Living Stone
6.	Clinical Diagnosis & Management by Laboratory methods (20th Ed)	John Bernard Henery	Sounder Publisher
7.	A Manual of Laboratory & Diagnostic Tests (6th Ed)	Frances Fischbach	Lippin Cott wiliam & wilkins





### Immunology and Mycology

<b>Course Code</b>	MLS210
<b>Course Title</b>	Immunology and Mycology
<b>Type of course</b>	Theory
<b>L T P</b>	4 0 0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	<ul style="list-style-type: none"> <li>The student will learn the basics of immunology including structural components, their functions and underlying mechanisms.</li> <li>To impart the knowledge of collection of samples, their processing and identification of various fungal infections and diagnosis of microbial infections by serological methods.</li> </ul>
<b>Course Outcome</b>	<p>At the conclusion of the course, Students will:</p> <ol style="list-style-type: none"> <li>1. Able to outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate.</li> <li>2. Understand the rationale behind various assays used in immunodiagnosis of diseases and will be able to transfer knowledge of immunology in clinical perspective.</li> <li>3. Understand the medical importance of mycology, its classification and chemotherapeutic agents of fungi.</li> <li>4. Apply the knowledge to understand the pathogenesis of fungi, etiological agents and the chief infectious diseases.</li> </ol>

#### UNIT- I

**Overview to Immunology:** Types of immunity: innate and adaptive, cells of immune system; T- Cells, B- Cells, null Cells; monocytes, polymorphs, primary and secondary lymphoid organs.

**Humoral response:** Antigen and Antibody and their characteristics, primary and secondary immune response and effector mechanism.

#### UNIT-II

**Antigen-antibody interaction:** general features, mechanisms and applications of various antigen-antibody interaction techniques.

**Cell mediated Immunity:** Role of MHC in cell mediated IR, T-cell receptor complex and effector mechanism., Immunity to infectious diseases, Tumour Immunology and Immunology of AIDS

**Autoimmunity:** Immunologic tolerance and autoimmunity Immune responses against tumors and transplants Hypersensitivity reaction.

**Immunotechnology:** Precipitation and agglutination reactions: bacterial haemagglutination haemagglutination inhibition; Immuno-diffusion (Radial and double diffusion) and electro-immunodiffusion, Immuno-electrophoresis, Radioimmuno assay, ELISA and immuno histochemical staining methods

#### UNIT-III

**Mycology:** Introduction, general characteristics, classification and medically important fungi, nomenclature, diseases and their characteristics

**Identification and sensitivity:** Staining techniques, culture media, laboratory contaminants, chemotherapeutic agents for fungi

**UNIT-IV**

**Pathogenesis and laboratory diagnosis of Fungi:** Superficial mycoses (*Tinea versicolor*, *Tinea nigra*, *Piedra*, and *Dermatophytoses*), Subcutaneous mycoses (*Mycetoma*, *sporotrichosis*, *Rhinosporidiosis*) and Systemic mycoses (*Candidiasis*, *Cryptococcosis*, *Penicilliosis* and *Aspergillosis*)

**Text and Reference Books**

S. No	Name	Author(S)	Publisher
1.	Text book of Microbiology	Michael J. Pelczar, JR. E.C.S Chan & Noel R. Krieg	Tata McGraw Hill
2.	Text book of Microbiology	Ananthanarayan And Paniker's Text Book of Microbiology	Universities Press
3.	Medical Microbiology	Paniker & Satish Gupte	Universities Press
4.	Immunology, 5th Edition.	Kuby, J.	W.H. Freeman and Company, New York
5.	Roitt's Essentials Immunology, 4th Edition	Roitt, I.M. Brostoff, J. and Male, D.K.	Grower Medical Publishing, New York
6.	Cell and Molecular Biology	De-Robertis, F.D.P. and De-Robertis Jr. E.M.F.	Saunders publishers, Philadelphia



### Histopathology and Histopathological Techniques

<b>Course Code</b>	MLS214
<b>Course Title</b>	Histopathology and Histopathological techniques
<b>Type of course</b>	Theory
<b>L T P</b>	3 0 0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	<ul style="list-style-type: none"> <li>To study pathologically altered structure and function of diseased cells, tissues and organs</li> <li>To understand the importance of tissue as a key resource for investigation and to evaluate the efficacy of future treatment modalities.</li> </ul>
<b>Course Outcome</b>	<p>At the conclusion of the course, students will;</p> <ol style="list-style-type: none"> <li>1. Able to explain the theoretical background to tissue fixation, tissue processing, microtomy and staining using routine and specialized techniques</li> <li>2. Able to illustrate the pathological condition of tissue and relate it with diseased condition</li> <li>3. Identify and explain the causes of technical defects in histological preparations, and rectify such defects and know its influence on the diagnostic process</li> </ol>

#### UNIT-I

**General understanding of the terms** – Histology, histopathology and histopathological techniques.

**Organization of histopathological laboratory:** Basic requirements of histopathology laboratory. (Glass wares, chemical and Reagent, Equipment and Instruments). Responsibilities of a histotechnologist.

#### UNIT-II

**General introduction** to processing of tissues. cell nucleus, cyto Membranes, cytoplasm, cell division). Basic steps in tissue processing fixation, embedding, microtomy, staining, mounting.

**Fixation and fixatives** - Aim of fixation, classification of fixation, classification of fixatives, Different fixatives used, its advantages and disadvantages.

**Decalcification** - Aim of decalcification, selection of tissue, fixation, decalcifying agents used, Decalcification techniques.

**Tissue processing**- Technique of dehydration, clearing (Aim of cleaning, different cleaning agents), Impregnation, techniques of casting Blocking, section cutting. Principles, operation, parts and use of automatic tissue processors.

#### UNIT-III

**Microtomes**- Different types of microtomes, microtone knives.

**Staining**- Principles of staining Basic staining techniques, special stains in histopathological studies.

**Mounting**- Different mounting media and mounting techniques.

#### UNIT-IV

**Museum techniques**- General introduction, organization of museum, mounting of museum specimens.



**Frozen sections-** Principles, methods used, freezing micro sections, staining of frozen sections and application of frozen sections.

### **Immunohistochemistry**

### **Text and Reference Books**

S. No	Name	Author(S)	Publisher
1.	Text book of Medical Laboratory Technology	Paraful B. Godkar, Darshan P. Godkar	Bhalani Publisher
2	Medical Laboratory Science – Theory and Practice	J. Ochei & A Kolhatkar	Mcgraw Hill
3	Hand book of Medical Laboratory Technology (2nd Ed)	V.H. Talib	CBS Publishers & Distributors
4	Medical Laboratory Technology Methods & Interpretation (5th Ed)	Ramnik Sood	Jaypee Brothers Medical publishers
5.	Medical laboratory Technology Volume-I	KL Mukherjee	Tata Mcgraw Hill
6.	Essentials of clinical Pathology	K Shirish	Jaypee Brothers



### Basics of Virology

<b>Course Code</b>	MLS218
<b>Course Title</b>	Basics of Virology
<b>Type of course</b>	Theory
<b>L T P</b>	2 1 0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective</b>	To impart the knowledge of collection of samples, their processing and identification of viral infections
<b>Course Outcomes</b>	At the conclusion of the course, Students will: <ol style="list-style-type: none"> <li>1. Basic knowledge of virology and able to differentiate types of viruses.</li> <li>2. Apply the knowledge to understand the mode of infection.</li> <li>3. Analyze the role of molecular techniques to identify diseases and its diagnosis.</li> <li>4. Learn about culture, collection, handling and transport of clinical samples.</li> </ol>

#### UNIT-I

**Introduction to medical virology:** Nomenclature, classification and general properties (physical, chemical and biological), and general laboratory diagnosis of viral diseases

#### UNIT-II

**DNA viruses:** mode of infection, spread, laboratory Diagnosis of : Pox, Adeno, Papova, Herpes, Parvo, HBV.

#### UNIT III

**RNA viruses:** mode of infection, spread, laboratory Diagnosis of Polio, Influenza, Para influenza, mumps, Measles, Rubella, Respiratory syncytial, Rota, Hepatitis, arbo viruses prevalent in India (Dengue, West Nile, Japanese Encephalitis, KFD)

#### UNIT-IV

**Laboratory collection and processing:** Collection, transportation, processing and storage of samples for viral diagnosis

#### Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Medical Microbiology	Pannier & Satish Gupte	Universities press
2.	Text book of Microbiology	Michael J. Pelczar, JR. E.C.S Chan & Noel R. Krieg	Tata McGraw Hill
3.	Text book of Microbiology	Ananthanereyan And Paniker's Text Book of Microbiology	Universities Press
4.	Medical Microbiology	Paniker & Satish Gupte	Universities Press

### Applied Bacteriology

<b>Course Code</b>	MLS 220
<b>Course Title</b>	Applied Bacteriology
<b>Type of course</b>	Theory
<b>L T P</b>	2 0 0
<b>Credits</b>	2
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	The part will cover the strategy in the Laboratory diagnosis of various infective syndromes i. e. choice of samples, collection and transportation and processing of samples for isolation of bacterial pathogen and then to put antibiotic susceptibility testing. This will also cover bacteriological examination of air and nosocomial infections
<b>Course Outcome</b>	At the conclusion of the course: <ol style="list-style-type: none"> <li>1. Demonstrate antibiotic susceptibility testing in bacteriology.</li> <li>2. Familiarization with the concept of bacteriological examination of air.</li> <li>3. Acquire the knowledge about the collection, transportation, processing and reporting of I/v fluids</li> <li>4. Elaborate the various techniques of microbial preservation &amp; nosocomial infection.</li> </ol>

#### UNIT I

##### Antibiotic susceptibility testing in bacteriology

- a. Definition of antibiotics
- b. Culture medium used for Antibiotic susceptibility testing
- c. Preparation and standardization of inoculums
- d. Control bacterial strains
- e. Choice of antibiotics
- f. MIC and MBC: Concepts and methods for determination
- g. Various methods of Antibiotic susceptibility testing with special reference to Stokes method and Kirby-Bauer method
- h. Tests for production of  $\beta$ -lactamase

#### UNIT II

##### Bacteriological examination of air

- a. Significance of air bacteriology in healthcare facilities
- b. Settle plate method
- c. Types of air sampling instrument
- d. Collection processing and reporting of an air sample

#### UNIT III

##### Sterility testing of I/v fluids

- a. Collection, transportation and processing of I/v fluids for bacterial contamination
- b. Recording the result and interpretation

#### UNIT IV

##### Nosocomial Infection

- a. Bacteriological surveillance of hospital environment.
- b. Role of microbiology laboratory in control of nosocomial infections

##### Preservation of microbes and Lyophilisation methods.



**Text and Reference Books**

S. No.	Author(s)	Title	Publisher
1	Ananthanereyan and Paniker	Text book of Microbiology	Universities Press
2	Michael J. Pelczar, JR. E.C.S Chan & Noel R. Krieg	Text book of Microbiology	Tata McGraw Hill
3	D.R Arora& B. Arora	Text book of Microbiology	CBS Publisher



### Introduction to National Healthcare Delivery System in India

<b>Course Code</b>	MLS 224
<b>Course Title</b>	Introduction to National Healthcare Delivery System in India
<b>Type of course</b>	DSE
<b>L T P</b>	2 0 0
<b>Credits</b>	2
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	The course provides the students a basic insight into the main features of the Indian health care delivery system and how it compares with the other systems of the world.
<b>Course Outcome</b>	At the conclusion of the course, students will <ol style="list-style-type: none"> <li>1. Able to compare and contrast the Indian healthcare delivery system with other healthcare systems in the world.</li> <li>2. Get knowledge about national policies and healthcare programmes.</li> <li>3. Understand various systems of medicine such as Ayurveda, Yoga &amp; Naturopathy, Unani, Siddha, and Homeopathy.</li> <li>4. Gain knowledge of the demography, vital statistics, and public health in India.</li> <li>5. Know about the principles, methods of epidemiological studies and types of diseases.</li> </ol>

#### UNIT I

##### Introduction to healthcare delivery system

- Healthcare delivery system in India at primary, secondary and tertiary care
- Community participation in healthcare delivery system
- Health system in developed countries.
- Private Sector
- National Health Mission
- National Health Policy
- Issues in Health Care Delivery System in India
- National Health Programmes – Background objectives, action plan, targets, operations, achievements and constraints in various National Health Programmes.

#### UNIT II

##### Introduction to AYUSH system of medicine

- Introduction to Ayurveda
- Yoga and Naturopathy
- Unani
- Siddha
- Homeopathy
- Need for integration of various systems of medicine

#### UNIT III

##### Health scenario of India – past, present and future. Public health in India (epidemiology and demography)

- Demography – its concept
- Demography & Vital Statistics
- Vital events of life & its impact on demography
- Significance and recording of vital statistics
- Census & its impact on health policy

**UNIT IV****Epidemiology**

- Principles of epidemiology
- Natural history of disease
- Methods of epidemiological studies
- Epidemiology of communicable & non-communicable diseases, disease transmission, host defense immunizing agents, cold chain, immunization, disease monitoring and surveillance.

**Text and Reference Books**

S. No.	Author(s)	Title	Publisher
1	F.J. Baker & R.E. Silvert	An introduction to Med. Lab. Technology	Pb. London Butterworth and Co.Ltd.
2	B. M. Sakharkar	Principles of Hospital Administration & Planning	Jaypee Brothers
3	C. M.Francis	Hospital Administration	Jaypee Brothers
4	G.D. Mogli	Medical Records	Jaypee Brothers
5	Tabish	Hospital Administration	O.U.P.
6	C.M. Francis & D'Souza	Hospital Administration & Management	Jaypee Brothers
7	Goel& Kumar	Management of Hospitals	(Deep & Deep





### Medical Terminology and Medical Records

<b>Course Code</b>	MLS 226
<b>Course Title</b>	Medical Terminology and Medical Records
<b>Type of course</b>	DSE
<b>L T P</b>	2 0 0
<b>Credits</b>	2
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	This subject introduces the elements of medical terminology
<b>Course Outcome</b>	At the conclusion of the course students will: <ol style="list-style-type: none"> <li>1. Acquire the knowledge of terminology and understand the anatomy and medical codes use in medical science.</li> <li>2. Apply the knowledge of terminology used by various domain doctors and practitioners for the diagnosis, treatment of disease.</li> <li>3. Understand the importance and maintenance of medical records.</li> <li>4. Familiarization with the legal aspects of Medical Records.</li> </ol>

#### UNIT I

- A. Introduction to medical terminology
- B. Word formation & syntax
  - Greek alphabet
  - Greek & Latin prepositional & adverbial prefixes
  - Singular & plural endings
- C. Commonly used prefixes, suffixes and root words in medical terminology
- D. Common Latin term used in prescription writing
- E. Study of standard abbreviations
- F. Commonly used medical terms to define different parts of the body

#### UNIT II

**Medical terminology used by:** Cardiologist, Neurologist, Nephrologist, Gastro-intestinologist, ENT surgeon, Dentist, Orthopedic surgeon, Gynecologist, Oncologist, Dermatologist and Endocrinologist.

#### UNIT III

**Medical record:** Definition and Types of medical record, Importance of medical record, Flow chart of function, Statutory requirements of maintenance, coding, indexing and filing, Computerization of record, Report and returns by the record department, Statistical information and ICD.

#### UNIT IV

Utility & functions of Medical Records in Health care delivery System. Organizations & management of Medical Records Department, Role of Hospital managers & MRD personnel in Medical record keeping. Reports & returns in Medical Record System.

Basic knowledge of legal aspects of Medical Records including Factories Act, Workmen Compensation Act & Consumer Protection Act. Procedures of Medical Auditing & its importance, Government Regulations & requirements

**Text and Reference Books**

S. No.	Title	Author(s)	Publisher
1	An introduction to Med. Lab. Technology	F.J. Baker & R.E. Silvert	Pb. London Butterworth and Co.Ltd.
2	Principles of Hospital Administration & Planning	B. M. Sakharkar	Jaypee Brothers
3	Hospital Administration	C. M.Francis	Jaypee Brothers
4	Medical Records	G.D. Mogli	Jaypee Brothers
5	Hospital Administration	Tabish	O.U.P.
6	Hospital Administration & Management	C.M. Francis & D'Souza	Jaypee Brothers
7	Management of Hospitals	Goel& Kumar	(Deep & Deep



**Clinical Biochemistry- I Practical**

<b>Course Code</b>	MLS 204
<b>Course Title</b>	Clinical Biochemistry Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
<b>Course Objective (CO)</b>	To impart hands on training on sample collection, preservation and operational procedures of routine biochemical tests performed in clinical laboratory
<b>Course Outcome</b>	At the conclusion of the course, students will be: <ol style="list-style-type: none"> <li>1. Able to carry out sample collection &amp; specimen labeling of clinical samples.</li> <li>2. Differentiate between normal and diseased condition based on biochemical analysis</li> <li>3. Get the importance of Glucose tolerance test for the investigation of glycemic disorder.</li> <li>4. Perform the clinical biochemical analysis of biological fluid samples.</li> </ol>

**LIST OF PRACTICALS**

1. Sample collection & specimen labeling of clinical samples
2. Interpretation and quoting of results of following routine tests performed in clinical biochemistry laboratory:
 

Estimation of Serum

  - a. Total proteins – albumins and globulins
  - b. Creatinine
  - c. Bilirubin
  - d. HDL and LDL
  - e. Total porphyrins
  - f. Coproporphyrin
  - g. Calcium
  - h. Phosphorus
  - i. Electrolytes – Sodium, Potassium and chloride
3. Determination of Glucose tolerance test.
4. Urine analysis – normal & abnormal constituents of urine
5. CSF analysis – physical and chemical examination.

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**



**Hematology-III Practical**

<b>Course Code</b>	MLS208
<b>Course Title</b>	Hematology-III Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	This subject aims to enable the students to carry out routine clinical laboratory investigation (blood, urine etc). He/she should be able to provide technical help for sophisticated hematological techniques with adequate knowledge of various principles.
<b>Course Outcome</b>	At the conclusion of the course, students will; <ol style="list-style-type: none"> <li>1. Familiar with the mechanism of ABO grouping and Rh typing.</li> <li>2. Learn blood collection &amp; preservation using different anticoagulants &amp; preservative solutions</li> <li>3. Able to investigate blood and perform special hematological tests</li> </ol>

**LIST OF PRACTICALS**

1. Blood collection & preservation using different anticoagulants & preservative solutions
2. Component preparation
3. ABO grouping
4. Rh typing
5. Preparation of bone marrow smear for microscopic examination
6. Processing and staining of smear using Romanowsky stains
7. Investigation of blood from SLE patient for presence of LE cells.
8. Special hematological tests
  - Sickling test
  - Osmotic fragility
  - Hemoglobin electrophoresis
  - Determination of Foetal hemoglobin
  - Demonstration of LE cells
  - Test for Glucose-6-Phosphate dehydrogenase deficiency

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

### Immunology and Mycology Practical

<b>Course Code</b>	MLS212
<b>Course Title</b>	Immunology and Mycology Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 3
<b>Credits</b>	1.5
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	The practical is aimed to make the students competent to isolate and identify fungi and viruses and do serological tests for various microbial infections.
<b>Course Outcome</b>	At the conclusion of the course, Students will: <ol style="list-style-type: none"> <li>1. Able to understand the basic laboratory practices in the field of immunoserology and mycology</li> <li>2. Learn the concepts of antigen- antibody interaction via various immunological techniques for the diagnosis of disease.</li> <li>3. Apply this knowledge for the identification of fungi and learn the process of cultivation on different culture media from various samples.</li> <li>4. Perform the confirmatory tests for the detection of fungi via anti-fungal sensitivity tests.</li> </ol>

#### LIST OF PRACTICALS

1. Collection of blood sample by vein puncture, separation and preservation of serum
2. Raising haemolysin in Rabbit and performing its titration for Rose-Waaler test.
3. Demonstration of antigen / antibody determination by Immunofluorescence, Immunodiffusion, precipitation in agarose gel (Ouchterlony), CIEP, ELISA.
4. To perform the cultivation and identification of fungi on SDA, RSA and CMA.
5. To perform the tease mount of mycelial filaments in Lactophenol cotton blue stain.
6. To perform the isolation and identification of fungi from soil sample.
7. To perform the isolation and identification of fungi from skin, nail & hair sample.
8. To perform the isolation and identification of fungi from air
9. To perform the India ink preparation of the yeast cells.
10. To perform the sensitivity testing of the fungal specimen.

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

### Histopathology and Histopathological Techniques Practical

<b>Course Code</b>	MLS216
<b>Course Title</b>	Histopathology and Histopathological techniques Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	This part of the subject is aimed at exposing the students to the latest advancements and automation in the field of histopathology.
<b>Course Outcome</b>	At the conclusion of the course, students will; 1. Able to perform the basic steps of tissue processing. 2. Understand the various methods of preparation of tissue sections, Paraffin section, celloidin embedding, frozen section.

#### LIST OF PRACTICALS

1. Basic steps of tissue processing
  - a) Preparation of fixatives and fixation.
  - b) Embedding.
  - c) Microtomy.
  - d) Staining.
  - e) Mounting
2. Various methods of preparation of tissue sections.
  - a) Paraffin section,
  - b) celloidin embedding
  - c) frozen section
3. Decalcification.
4. Tissue processing (Manual / Automatic).
5. Section cutting and sharpening of microtone knife.

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**



### Applied Bacteriology Practical

<b>Course Code</b>	MLS 222
<b>Course Title</b>	Applied Bacteriology Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	The main objective of the subject is to impart the knowledge of different microbiological techniques to provide hands on training to perform various microbiological tests.
<b>Course Outcome</b>	At the conclusion of the course, Students will : 1. Understand the basic laboratory practices in the field of bacteriology. 2. Perform antibiotic susceptibility testing of clinical isolates by using standard method. 3. Apply the knowledge for the collection, transportation and processing of various samples & techniques for preservation of the isolates. 4. Learn the method of disposal of bacterial cultures.

### LIST OF PRACTICALS

1. Antimicrobial susceptibility testing
  - a. Introduction and terms used
  - b. Preparation and standardization of inoculum
  - c. To demonstrate reference bacterial strains
  - d. Choice of antibiotics
  - e. To determine MIC and MBC a known bacterium against a known antibiotic
  - f. To perform antibiotic susceptibility testing of clinical isolates by using
    - a) Kirby-Bauer method b) Stokes method
  - g. To perform any one test to demonstrate the production of  $\beta$ -lactamase
2. Collection, transportation and processing of air samples for bacteriological examination
3. To demonstrate sterility testing of intravenous fluid with positive and negative controls
4. Demonstration of lyophilization.
5. To learn 'How to dispose of bacterial cultures

**Clinical Biochemistry – II**

<b>Course Code</b>	MLS301
<b>Course Title</b>	Clinical Biochemistry – II
<b>Type of course</b>	Theory
<b>L T P</b>	3 0 0
<b>Credits</b>	3
<b>Course prerequisite</b>	B.Sc MLS / B.Sc MLT –II
<b>Course Objective (CO)</b>	The students will learn the advanced principles and procedures of clinical biochemistry for diagnosis and monitoring of human disease and their applications to biomedical research.
<b>Course Outcome</b>	At the conclusion of the course, Students will : 1. Able to understand the concepts of blood and body fluids for determining the proper functioning of the system. 2. Get the knowledge of formation and analysis of renal calculi. 3. Apply this knowledge to understand the mechanism of metabolic errors and electrolyte imbalance. 4. Evaluate the clinical significance of enzymes to rule out the disorders.

**UNIT-I**

**Liver Function Tests:** role of the liver in metabolism, formation of bilirubin and mode of excretion. Tests accessing the excretory and synthetic and metabolic function of liver, tests for clearance of exogenous substances from liver

**Gastric Analysis:** composition of gastric juice, concepts of free and combined acids, gastric acid secretion stimulations. Methods of gastric analysis – collection of sample, titration and interpretation of results, Stimulation tests, Hollander's test, tubeless gastric analysis, congo red test during oesophagogastrroduodenoscopy

**UNIT-II**

**Renal Function Tests:** factors affecting renal function, renal function test – test for GFR, inulin clearance, creatinine clearance, urea clearance, clearance of radiolabelled agents.

**Renal Calculi:** theory of formation and analysis, renal clearance concentration and application of phenol sulfonaphthalein.

**UNIT-III**

**Electrolyte Metabolism:** calcium metabolism, phosphate metabolism, sodium-potassium balance and trace element (Fe, Cu).

**Metabolic Disorders** of proteins and amino acids, inborn errors of metabolic disorders

**UNIT-IV**

**Diagnostic Enzyme assays:** Clinical significances of enzyme assays, principle, procedures, normal values and clinical significances of SGOT, SGPT, phosphatases (acid & alkaline), LDH isozymes, Creatinine phosphokinase in liver diseases, myocardial infarctions, muscle and bone diseases and malignancies

**Text and Reference Books**

<b>S. No</b>	<b>Name</b>	<b>Author(S)</b>	<b>Publisher</b>
<b>1.</b>	Text book of Medical Laboratory Technology	Paraful B. Godkar, Darshan P. Godkar	Bhalani Publisher
<b>2</b>	Medical laboratory Technology Volume-III (2 <sup>nd</sup> Ed.)	KL Mukherjee	Tata Mcgraw Hill
<b>3</b>	Practical Clinical Biochemistry	Harold Varley	CBS Publishers & Distributers
<b>4</b>	Text book of Medical Biochemistry	M N Chaterjee and R. Shinde	Jaypee Brothers Medical Publishers(P) Ltd.
<b>5.</b>	Medical Laboratory Sciences, Theory & Practical	Arundhati Kolhatkar & J. ochei	Mcgraw Hill
<b>6.</b>	Basic Medical Laboratory Techniques	Barbara H. Estridge & Anna P. Reynolds	Delmer publishers



### Cellular and Histopathology

<b>Course Code</b>	MLS305
<b>Course Title</b>	Cellular and Histopathology
<b>Type of course</b>	Theory
<b>L T P</b>	3 0 0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	The students will obtain the basic knowledge of core aspects of pathology including, etiology, pathogenesis, morphological changes and functional de-arrangements as well as various causes and consequences of diseases.
<b>Course Outcome</b>	At the conclusion of the course, students will; 1. Able to define the Cell injury, adaptations and cell death. 2. Understand the Cellular and systemic Pathology of digestive glands, Cardiovascular diseases, Diseases of respiratory organs, Diseases of urinary system. 3. Gain knowledge about the Reproductive disorders, Neural disorders, Endocrine disorders.

#### UNIT-I

**Cell Injury and Adaptations:** Normal Cell, types of cell injury, morphology and etiology of cell injury, cellular swelling

**Types of cell death:** autolysis, necrosis, apoptosis and gangrene

**Cellular Adaptations:** atrophy, hypertrophy, hyperplasia and dysplasia

**Inflammation:** types- acute and chronic inflammation, events involved in inflammatory response.

#### UNIT-II

**Haemodynamic Disorders:** Oedema, hyperemia, congestion, hemorrhage, circulatory disturbances, thrombosis, ischemia & infarction

**Neoplasia:** Definition, how does it differ from hyperplasia, difference between benign tumor and malignant tumor

**Healing:** Definition, different phases of healing, factors influencing wound healing

#### UNIT-III

**Cellular and systemic Pathology:** Study of diseases of various body organs and systems

**Alimentary Canal:** diseases of mouth, disease of oesophagus; oesophageal varices, gastritis, peptic ulceration, appendicitis, microbial disease, food poisoning, hernia, intestinal obstructions and malabsorption

**Disease associated with accessory digestive glands:** mumps, hepatitis, liver failure, cirrhosis, pancreatitis, Gall stones and jaundice

**Cardiovascular diseases:** diseases of blood- Atheroma, Arteriosclerosis, heart block. Disorders of Blood Pressure-Hyper & Hypotension

**Diseases of respiratory organs:** Upper respiratory tract infection, Bronchi, Asthma, Pneumonia, Lung abscess, Tuberculosis, Lung Collapse

**Diseases of urinary system:** Glomerulonephritis, Nephrotic syndrome, Renal failure, Renalcalculi, Urinary obstruction, Urinary tract infection.

#### UNIT-IV

**Reproductive disorders:** Sexually transmitted diseases, Pelvic inflammatory disease, disorder of cervix (CIN), Disease of ovaries, ectopic pregnancy, prostatitis, Infertility

**Neural disorders:** Neuronal damage, ICP, Cerebral Infarction, head injury, Alzheimer's disease, dementia.

**Endocrine disorders:** Pituitary: Hyper & Hypo secretions of pituitary, Goiter, Adrenal Cushing Syndrome, Addison Disease, Pancreatic diabetes

#### Text and Reference Books:

S. No	Name	Author(S)	Publisher
1.	Laboratory Technology (Methods and interpretation) 4th Ed	Ramneek Sood	J.P. Bros, New Delhi
2	Short text book of Medical Laboratory for technicians	Satish Gupta	J.P. Bros, New Delhi
3	Clinical Pathology and Bacteriology 8th Ed	Sachdev K.N	J.P. Bros, New Delhi
4	Text book of Pathology	Krishna	Orient Longman PVT Ltd.New Delhi
5.	Basic Pathology, 9th edition	Kumar, Abbas & Aster. Robbins.	Saunders

### Blood Banking and Transfusion reactions

<b>Course Code</b>	MLS309
<b>Course Title</b>	Blood Banking and Transfusion reactions
<b>Type of course</b>	Theory
<b>L T P</b>	3      0      0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	Blood transfusion has become a life saving procedure in modern medical sciences. To avoid any mistake, the students must understand to learn the blood bank procedures, such as ABO & Rh blood grouping carefully, accurately and long-term preservation for safe blood transfusion.
<b>Course Outcome</b>	At the conclusion of the course, students will; <ol style="list-style-type: none"> <li>1. Familiar with standard transfusion facility protocols and procedures in a fashionable blood bank and transfusion service.</li> <li>2. Learn about the importance and requirements of blood donation and also about the principle and practices of blood transfusion.</li> <li>3. Learn how to maintain records and compatibility testing and about the reaction during the blood transfusion reaction.</li> </ol>

#### UNIT-I

**Principle & Practices of Blood Transfusion:** Principle & Practice of blood Transfusion, Blood Transfusion service at District level, Guide lines for the use of Blood, Appropriate use of Blood, Quality Assurance: Antilogous Blood Transfusion practices, Objectives of Quality Assurance in Blood Transfusion services, Standard operating procedures for usage, donation & storage of blood, screening of donor, compatibility testing, safety, procurement of supplies.

**Blood Donation:** Introduction, Blood donor requirements, Criteria for selection & rejection, Medical history & personal details, Self-exclusion. Health checks before donating blood, Screening for TTI.

#### UNIT-II

**Blood Collection:** Blood collection packs, Anticoagulants, Taking & giving sets in Blood transfusion, Techniques of collecting blood from a doctor, Instructions given to the donor after blood donation, Adverse donor reaction.

**Storage & Transport:** Storage of blood, Changes in blood after storage, Gas refrigerator, Lay out of a blood bank refrigerator, Transportation.

#### UNIT-III

**Blood Banking:** Testing Donor Blood- Screening donor's blood for infectious agents - HIV, HCV, HBV, palladium, Plasmodium, HTLV. Bacterially contaminated Blood.

#### Maintenance of Records

Blood Donor Records: Blood donation record book, recording of results, Blood donor card.

Blood Bank Records: Blood bank temperature sheet, Blood bank stock sheet, Blood transfusion request form.

Compatibility Testing: Purpose, Single tube compatibility techniques using AHG reagent, Emergency compatibility testing, Difficulties in cross matching. Labeling & Issuing cross- matched blood.

#### UNIT-IV

**Blood Components:** Collection of blood components for fractional transfusion, Platelets packed Red Cell, Platelet rich Plasma, Platelets concentrate, Preparation of concentrated (packed) Red cells, Techniques of preparation.



**Blood Transfusion Reactions:** Investigation of a Transfusion reaction, Hemolytic transfusion reaction, Actions to take when transfusion reaction occurs.

#### Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Text book of Medical Laboratory Technology	Paraful B. Godkar, Darshan P. Godkar	Bhalani Publisher
2	Medical laboratory Technology Volume-III (2 <sup>nd</sup> Ed.)	KL Mukherjee	Tata Mcgraw Hill
3.	Medical Laboratory Sciences, Theory & Practical	Arundhati Kolhatkar & J. ochei	Mcgraw Hill
4.	Basic Medical Laboratory Techniques	Barbara H. Estridge & Anna P. Reynolds	Delmer publishers



### Health systems and Laboratory Ethics

<b>Course Code</b>	MLS313
<b>Course Title</b>	Health systems and Laboratory Ethics
<b>Type of course</b>	Theory
<b>L T P</b>	3 0 0
<b>Credits</b>	3
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	The course has been designed to provide students knowledge about organization of health services, programmes, principle ethics, good laboratory practices, patient and laboratory management including office, financial and biomedical waste management.
<b>Course Outcome</b>	At the conclusion of the course, Students will : 1. Learn about the importance of health and health related programs runs by the government. 2. Acquaint the knowledge regarding ethics and Accreditation of the labs 3. Understand the role of biomedical waste management, calibration and financial Management. 4. Aware about the laboratory practice and Audit in a Medical Laboratory.

#### UNIT-I

**Introduction:** Definition of Health, Determinants of Health, Health Indicators of India, National Health Policy

**Organization of Health services:** Brief description of organization of health services at the Centre and state levels

**National Health Programmes:** Family Welfare Programme, National Programme for water supply and sanitation, Nutritional Programmes, Immunization and universal immunization programme (Objectives and scope)

**Disease Eradication programme:** Leprosy & Guinea worm.

**Disease control programmes:** Tuberculosis, Malaria, Filariasis, S.T.D, Goitre, Cholera and other diarrhoeal diseases and National Programme for prevention of blindness including trachoma.

#### UNIT-II

**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) Regulations and Accreditation

Introduction to Basics of GLP and Accreditation

Aims of GLP and Accreditation

Advantages of Accreditation

Brief knowledge about National and International Agencies for clinical laboratory accreditation

#### Awareness / Safety in a clinical laboratory

General safety precautions

HIV: pre- and Post-exposure guidelines

Hepatitis B & C: pre & Post-exposure guidelines

Drug Resistant Tuberculosis

**Patient management for clinical samples collection:** collection of sample, transportation and preservation

**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

### UNIT-III

#### Biomedical waste management in a clinical laboratory

#### Introduction and importance of calibration and Validation of Clinical Laboratory instruments

**Laboratory Information system and financial Management:** Introduction, Functions of a laboratory management system, Standards for laboratory management system, Introduction and awareness of financial management in a clinical, laboratory

### UNIT-IV

**Ethics in Medical laboratory Practice:** Understanding the term 'Ethics', Ethics in relation to the following:

Pre-Examination procedures

Examination procedures

Reporting of results

Preserving medical records

Access to Medical laboratory Records

**Audit in a Medical Laboratory:** Introduction and Importance, Responsibility, Planning Horizontal, Vertical and Test audit, Frequency of audit, Documentation

#### Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Medical Laboratory Management	Sangeeta Sharma	Viva Books Pvt Ltd.
2	Clinical laboratory Management	Lynne Shore Garcia	



**Endocrinology and Toxicology**

<b>Course Code</b>	MLS315
<b>Course Title</b>	Endocrinology and Toxicology
<b>Type of course</b>	Theory
<b>L T P</b>	2 0 0
<b>Credits</b>	2
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	This subject is framed to provide basic knowledge of hormones & toxic substances with their determination techniques as well as related disorders
<b>Course Outcome</b>	At the conclusion of the course, Students will : 1. Gain knowledge about hormones, their classification, biological functions and mode of action 2. Able to understand the types, functions and methods for the determination of thyroid hormones and disorders associated with hormonal imbalance. 3. Learn about infertility profile: impact of hormones affecting fertility and their determination and also gain in-depth knowledge about performing estimations of growth hormones: ACTH, Aldosterone and Cortisol and their significance 4. Acquire knowledge about various poisoning/ toxic material, their impact on human health and screening procedures clinical diagnosis. 5. Apply this knowledge for the diagnosis of hormonal imbalance & drug intoxication.

**UNIT -I**

Hormones, Classification of hormones, organs of endocrine system their secretion and function, regulation of hormone secretion, Mechanism of action

**UNIT -II**

Thyroid function test: Thyroid hormones, biological function, hypothyroidism, hyperthyroidism. Determination of T3, T4, TSH, FT3, FT4, TBG, and Disorder associated with thyroid dysfunction.

**UNIT-III**

Infertility profile: LH, FSH, TSH, Estrogen, Progesterone, Total Testosterone, Free testosterone, DHEA-S, Prolactin, their estimation and clinical significance, reference range, hypo and hyper secretion, Triple Test, Growth hormone, ACTH, Aldosterone, Cortisol their estimation and clinical significance, reference range, hypo and hyper secretion.

**UNIT-IV**

Introduction of Toxicology, Alcohol poisoning, Lead poisoning, Zinc poisoning, Mercury poisoning drugs abuse, screening procedure for drug screening, Spot tests, hair and urine test, Immunoassay for drugs.

**Text and Reference Books**

S. No.	Author(s)	Title	Publisher
1.	M N Chatterjea & Rana Shinde	Text book of Medical Biochemistry	Jaypee Publications
2.	Lehninger,	Principles of Biochemistry	W H Freeman
3.	Teitz,	Fundamentals of Clinical Chemistry	Elsevier Publications
4.	D M Vasudevan	Text book of Medical Biochemistry	Jaypee Publications

### Histotechnology and Cytology

<b>Course Code</b>	MLS317
<b>Course Title</b>	Histotechnology and cytology
<b>Type of course</b>	Theory
<b>L T P</b>	4 0 0
<b>Credits</b>	4
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective(CO)</b>	This part of the subject is aimed at introducing the students to the various types of tissue preparations and developing expertise in the students to cut very thin tissue sections from tissue blocks and facilitate visualization using various stains and dyes. Cytology part aims at exposing the students to the latest advancements in cytological investigations.
<b>Course Outcome</b>	At the conclusion of the course, Students will : 1. Understand the basics of cell, its components and their functions 2. Able to demonstrate the routine cytological preparation and their routine & special staining techniques 3. Apply the knowledge to differentiate normal and abnormal cells

#### UNIT-I

**Introduction to Cytology:** Basic terminology, Laboratory equipment for cytology, Normal cell structure, functions, cytologic criteria of malignancy, Types of specimens, methods of collection & preparation of cell block, Different fixatives and methods of fixation.

#### UNIT-II

**Staining Techniques:** Special Staining Procedures for detection of

- a. Connective tissue elements, Trichrome staining, muscle fibers, elastic, reticulin fibres, collagen fibres etc.
- b. Metachromatic staining such as toluidine blue on frozen sections
- c. Principles of metal impregnation techniques.
- d. Demonstration and identification of minerals and pigments, removal of pigments/artifacts in tissue sections
- e. Demonstration of Proteins & nucleic acids.
- f. Demonstration of Carbohydrates, lipids, fat & fat like substances.
- g. Demonstration of bacteria and fungi in tissue section.
- h. Tissue requiring special treatment i.e. eye ball, bone marrow, muscle biopsy, undercalcified or uncalcified bones, whole brain, whole lungs including other large organs.

#### UNIT-III

**Laboratory Techniques in Diagnostic Exfoliative Cytology:** Preparation of specimens for cytological evaluation, Cytological stains and staining techniques, PAP staining and identification of cells in a normal vaginal smear, Characteristics of benign and malignant cells.

#### UNIT-IV

**Fine Needle Aspiration Cytology (FNAC)**

**Automation in Cytology:** Principles, equipments, procedures & evaluation of flow cytometry, Image analysis.

**Text and Reference Books**

S. No	Name	Author(S)	Publisher
1.	Text book of Medical Laboratory Technology	Paraful B. Godkar, Darshan P. Godkar	Bhalani Publisher
2	Medical Laboratory Science – Theory and Practice	J. Ochei & A Kolhatkar	Mcgraw Hill
3	Hand book of Medical Laboratory Technology (2nd Ed)	V.H. Talib	CBS Publishers & Distributors
4	Medical Laboratory Technology Methods & Interpretation (5th Ed)	Ramnik Sood	Jaypee Brothers Medical publishers
5.	Medical laboratory Technology Volume-I	KL Mukherjee	Tata Mcgraw Hill
6.	Essentials of clinical Pathology	K Shirish	Jaypee Brothers





### Generic Skills and Entrepreneurship Development

<b>Course Code</b>	COM317
<b>Course Title</b>	Generic Skills And Entrepreneurship Development
<b>Type of course</b>	Theory
<b>L T P</b>	2 0 0
<b>Credits</b>	2
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	This paper is aimed at developing employability skills and conceptual understanding among students for setting up one's own business venture/enterprise
<b>Course Outcome</b>	At the conclusion of the course, Students will : 1. Able to explain the importance of generic and leadership skills. 2. Demonstrate self-development through task management and manage themselves physically, intellectually and psychologically. 3. Know about concepts of entrepreneurship including identifying a winning business opportunity, gathering funding and launching a business, growing and nurturing the organization and harvesting the rewards

#### UNIT-I

**Introduction to Generic Skills** -Importance of Generic Skill Development (GSD), Global and Local Scenario of GSD, Life Long Learning (LLL) and associated importance of GSD.

**Leadership Skills:** Managing in Team - Team definition, hierarchy, team dynamics, Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background, Communication in group -conversation and listening skills

#### UNIT-II

**Task Management** - Task Initiation, Task Planning, Task execution, Task close out, Exercises/case studies on task planning towards development of skills for task management  
**Problem Solving** - requisites of problem solving-meaningful learning, ability to apply Knowledge in problem solving, different approaches for problem solving. Steps followed in problem solving, Exercises/case studies on problem solving.

#### UNIT-III

**Entrepreneurship:** Introduction, Concept/Meaning and its need, Competencies/qualities of an entrepreneur, Entrepreneurial Support System e.g., District Industry Centers (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

#### UNIT- IV

Market Survey and Opportunity Identification (Business Planning)

- How to start a small scale industry
- Procedures for registration of small-scale industry
- List of items reserved for exclusive manufacture in small -scale industry
- Understanding business opportunity

### Clinical Biochemistry-II Practical

<b>Course Code</b>	MLS303
<b>Course Title</b>	Clinical Biochemistry-II Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	To impart skills to perform complex clinical procedures pertaining to diagnosis of human diseases. The students will also learn to perform all clinical tests on autoanalyzers.
<b>Course Outcome</b>	At the conclusion of the course, Students will: <ol style="list-style-type: none"> <li>1. Learn the method of various sample collection processes in biochemistry lab.</li> <li>2. Perform accuracy, precision and quality control</li> <li>3. Able to perform various biochemical investigation associated with human body organs.</li> <li>4. Demonstration on auto analyzer.</li> </ol>

#### LIST OF PRACTICALS

1. Specimen collections: urine, blood, gastric juice.
2. Accuracy, precision and quality control
3. Estimation of bilirubin – total and conjugates, urobilinogens
4. Determination of free and total acidity
5. Clearance tests: Urea clearance and creatinine clearance
6. Analysis of renal calculi
7. Screening for inborn errors of metabolism.
8. Determination of clinically significant enzymes: principle, procedure and clinical significance of
  - a. Serum alkaline phosphatases
  - b. SGOT
  - c. SGPT
  - d. Creatine phosphokinase
  - e. Lactate dehydrogenase
9. Demonstration on auto analyzer.

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

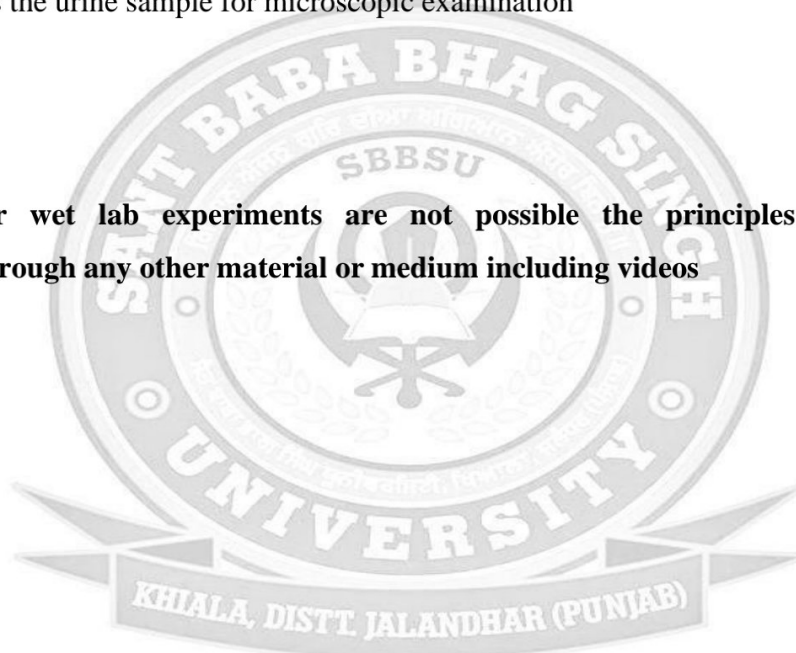
### Cellular Pathology Practical

<b>Course Code</b>	MLS307
<b>Course Title</b>	Cellular Pathology Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	The students will learn to differences between the normal and pathological specimens by critically analyzing the morphological changes and functional de-arrangements.
<b>Course Outcome</b>	At the conclusion of the course, Students will: 1. Able to differentiate pathological conditions of Necrosis and apoptosis, Inflammation and Foot and hand gangrene. 2. Familiar with the diseases of different systems such as Cardio-Vascular System, Respiratory System, Digestive System, Reproductive system through stained slides 3. Able to process the urine sample for physio-chemical & microbiological examination.

### LIST OF PRACTICALS

1. To Study of various types of microscope.
2. To study squamous cell from cheek cells (Buccal mucosa).
3. To study stained slide preparation from organs of digestive system
4. Study of stained slides of liver, pancreas, gall bladder.
5. To study stained slide preparation from organs of circulatory system
6. To study stained slide preparation from organs of Respiratory system
7. To study stained slide preparation from organs of Nervous system
8. To study stained slide preparation from organs of Urinary system
9. To study stained slide preparation from organs of Endocrine system
10. To process the urine sample for microscopic examination

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**





### Blood Banking and Transfusion Reactions Practical

<b>Course Code</b>	MLS311
<b>Course Title</b>	Blood Banking and Transfusion Reactions Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	Students will be able to understand the principles and practices including documentation and maintenance of records related to blood banking carefully and accurately.
<b>Course Outcome</b>	At the conclusion of the course, Students will: <ol style="list-style-type: none"> <li>1. Become capable to take responsibility for examination and decision-making about testing achieved in a contemporary blood bank and transfusion service.</li> <li>2. Collect blood &amp; preserve using different anticoagulants&amp; preservative solutions.</li> <li>3. Gain expertise about component preparation, ABO grouping, Rh typing</li> </ol>

#### LIST OF PRACTICALS

1. Blood collection & preservation using different anticoagulants& preservative solutions
2. Component preparation
3. ABO grouping
4. Rh typing
5. Antibody direction & titration
6. Coombs test
7. Compatibility testing & cross matches
8. Investigation of transfusion reactions
9. Investigation of hemolytic disease of new born
10. HBsAg & HIV antibody testing in blood bank

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

### Histotechnology and Cytology Practical

<b>Course Code</b>	MLS319
<b>Course Title</b>	Histotechnology and Cytology Practical
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 2
<b>Credits</b>	1
<b>Course prerequisite</b>	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
<b>Course Objective (CO)</b>	This part of the subject is aimed at exposing the students to the latest advancements and automation in the field of histopathology and cytology
<b>Course Outcome</b>	At the conclusion of the course, Students will: 1. Able to prepare smear and slides for cytological testing. 2. Perform specialized staining of cytological samples. 3. Apply the knowledge to interpret laboratory results and able to differentiate between malignant and benign tumors.

### LIST OF PRACTICALS

1. Collection of samples and processing.
2. Cytological fixatives and fixation.
3. Special Staining Procedures for detection of
  - a. Connective tissue elements, Trichrome staining, muscle fibers, elastic, reticulin fibres, collagen fibres etc.
  - b. Metachromatic staining such as toluidine blue on frozen sections
  - c. Principles of metal impregnation techniques.
  - d. Demonstration and identification of minerals and pigments, removal of pigments/artifacts in tissue sections
  - e. Demonstration of Proteins & nucleic acids.
  - f. Demonstration of Carbohydrates, lipids, fat & fat like substances.
  - g. Demonstration of bacteria and fungi in tissue section.
  - h. Tissue requiring special treatment i.e. eye ball, bone marrow, muscle biopsy, uncalcified bones, whole brain, whole lungs including other large organs.
4. Collection and preparation of fluid sediment for cytological examination.
5. Preparation and fixation of sputum smears for cytology and preparation.
6. Preparation and fixation of vaginal and cervical smears for cytology.
7. Hormonal evaluation of vaginal smears.
8. Papanicolaou staining-principles and staining procedures.
9. Identification of cells.
10. Differentiation between malignant and benign cells.

**Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos**

### Professional Training

<b>Course Code</b>	MLS302
<b>Course Title</b>	Professional Training
<b>Type of course</b>	Practical
<b>L T P</b>	0 0 26
<b>Credits</b>	26
<b>Course prerequisite</b>	B.Sc MLS / B.Sc MLT – II
<b>Course Objective (CO)</b>	The students will undergo 3 months training to learn about latest diagnostic techniques used in laboratories
<b>Course outcomes</b>	At the conclusion of the course, Students will: <ol style="list-style-type: none"> <li>1. Gain confidence at the workplace and have fruitful interaction with the employer, colleagues and the work force in general .</li> <li>2. It also increases the thinking horizon by helping one arrange different kinds of activities at the workplace for all the employees.</li> <li>3. There is another section of a workplace that can be targeted, i.e. behavioural problems.</li> </ol>

#### Guideline To Carry Out Training

1. **Purpose of training:** The main purpose of training is to make the students familiar with the latest techniques used in the diagnosis. This will not only help train the inquisitive minds of the students, but also inspire them to take up research- oriented higher studies and career.

2. **Duration of training :-** Recommended duration of training is 06 months. The students should undergo training in a reputed hospital with well established laboratories.

#### 3. Submission of training report:-

- a. After completion of training each student should prepare a PowerPoint presentation to be delivered to the respective department committee.
- b. The committee should conduct comprehensive viva-voce of the students.
- c. The final copy of the report (2 Copies) will have to be submitted to the respective CODs.