SCHEME & SYLLABUS
Bachelor in Medical Laboratory Technology

(Four Year Program as per NEP2020)
Program Code: UG062

Department of Life Sciences & Allied Health Sciences

(UIS)

Sant Baba Bhag Singh University
2024

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. MLT (Bachelor of Medical Laboratory Technology)

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.

ELIGIBILITY CRITERIA

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

DURATION

4 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.

Course Scheme

B.Sc. MLT (SEMESTER I-VIII)

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	MLT161	Anatomy & Physiology – I	4:0:0	4:0:0	4	4	CC
2	MLT165	Basics of Hematology	3:0:0	3:0:0	3	3	CC
3	MLT169	Microbiology	4:0:0	4:0:0	4	4	CC
4	MLT173	Fundamentals of Medical Lab Technology	3:0:0	3:0:0	3	3	CC
5	MLT177	Medical Laws & Ethics	2:0:0	2:0:0	2	2	Foundation course
6	AEC0010	Communication Skills in English – I	2:0:0	2:0:0	2	2	AECC

II. Practical Subjects

1	MLT163	Anatomy & Physiology – I Practical	0:0:2	0:0:1	2	1	CC
2	MLT167	Basics of Hematology Practical	0:0:3	0:0:1.5	3	1.5	CC
3	MLT171	Microbiology Practical	0:0:3	0:0:1.5	3	1.5	CC
4	MLT175	Fundamentals of Medical Lab Technology Practical	0:0:2	0:0:2	2	1	CC
5	PT 161/ 163/ 165	Physical Training- 1 (NSO/NCC/NSS)	0:0:2	Non Credits	2	NC	
Total					**30**	**23**	

Total Contact hrs: 30
Total Credit Hours: 23

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	MLT162	Anatomy & Physiology – II	4:0:0	4:0:0	4	4	CC
2	MLT166	Basics of Haematological Diseases	3:0:0	3:0:0	3	3	CC
3	MLT170	Bacteriology	4:0:0	4:0:0	4	4	CC
4	MLT174	Basic Biochemistry	4:0:0	4:0:0	4	4	CC
5	MLT178	Analytical Biochemistry	3:0:0	3:0:0	3	3	CC
6	AEC0011	Communication Skills in English – II	2:0:0	2:0:0	2	2	AECC/ LS

II. Practical Subjects

1	MLT164	Anatomy & Physiology – II Practical	0:0:2	0:0:1	2	1	CC
2	MLT168	Basics of Haematological Diseases Practical	0:0:3	0:0:1.5	3	1.5	CC
3	MLT172	Bacteriology Practical	0:0:3	0:0:1.5	3	1.5	CC
4	MLT176	Basic Biochemistry Practical	0:0:2	0:0:1	2	1	CC
5	MLT180	Analytical Biochemistry Practical	0:0:2	0:0:1	2	1	CC
6	PT 162/ 164/ 166	Physical Training- 2 (NSO/NCC/NSS)	0:0:2	Non Credits	2	NC	PT
Total					**34**	**26**	

Total Contact hrs: 34
Total Credit Hours: 26

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	MLT261	Biochemical Metabolism	4:0:0	4:0:0	4	4	CC
2	MLT265	Parasitology	4:0:0	4:0:0	4	4	CC
3	MLT269	Cellular Pathology	4:0:0	4:0:0	4	4	CC
4	MLT273	Introduction to Quality and Patient safety	2:0:0	2:0:0	2	2	SECC
5	SSC001	Gender Equity	3:0:0	3:0:0	3	3	ID
6	EVS200	Environment Education	4:0:0	4:0:0	4	4	AECC

II. Practical Subjects

1	MLT263	Biochemical Metabolism Practical	0:0:3	0:0:1.5	3	1.5	CC
2	MLT267	Parasitology Practical	0:0:2	0:0:1	2	1	CC
3	MLT271	Cellular Pathology Practical	0:0:2	0:0:1	2	1	CC
4	CSE213	Basics of Computers Practical	0:0:3	0:0:1.5	3	1.5	ID
5	PT 261/263/265	Physical Training- 3 (NSO/NCC/NSS)	0:0:2	Non Credits	2	NC	PT
Total					**33**	**26**	

Total Contact hrs: 33
Total Credit Hours: 26

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	MLT262	Clinical Biochemistry	3:0:0	3:0:0	3	3	CC
2	MLT266	Applied Haematology – I	3:0:0	3:0:0	3	3	CC
3	MLT270	Immunology & Bacterial Serology	4:0:0	4:0:0	4	4	CC
4	MLT274	Histopathology- I	3:0:0	3:0:0	3	3	CC
5	MLT278	Applications of Bacteriology	2:0:0	2:0:0	2	2	SECC
6	MLT282	Indian Knowledge System- Introduction To National Healthcare Delivery System in India	2:0:0	2:0:0	2	2	VAC
7	MLT284	Medical Terminology and Record Keeping	2:0:0	2:0:0	2	2	AECC

II. Practical Subjects

1	MLT264	Clinical Biochemistry Practical	0:0:2	0:0:1	2	1	CC
2	MLT268	Applied Hematology - I Practical	0:0:3	0:0:1.5	3	1.5	CC
3	MLT272	Immunology & Bacterial Serology Practical	0:0:3	0:0:1.5	3	1.5	CC
4	MLT276	Histopathology- I Practical	0:0:2	0:0:1	2	1	CC
5	MLT280	Applications of Bacteriology Practical	0:0:2	0:0:1	2	1	SECC
6	PT262/ 264/266	Physical Training- 4 (NSO/NCC/NSS)	0:0:2	Non Credits	2	NC	PT
Total					**33**	**25**	

Total Contact hrs: 33
Total Credit Hours: 25

SEMESTER-V

I. Theory Subjects

Sr. No.	Subject Code	Subject Name	L:T:P	Credit hours	Total Contact Hours	Total Credits	Course Type
1	MLT361	Applied Clinical Biochemistry	3:0:0	3:0:0	3	3	CC
2	MLT365	Applied Haematology – II	3:0:0	3:0:0	3	3	CC
3	MLT369	Histopathology- II	4:0:0	4:0:0	4	4	CC
4	MLT373	Health Systems and Laboratory Ethics	3:0:0	3:0:0	3	3	CC
5	MLT375	Virology	3:0:0	3:0:0	3	3	CC
6	MLT379	Endocrinology and Toxicology	2:0:0	2:0:0	2	2	SECC
7	COM317	Generic skills and Entrepreneurship	2:0:0	2:0:0	2	2	ID

II. Practical Subjects

1	MLT363	Applied Clinical Biochemistry Practical	0:0:3	0:0:1.5	3	1.5	CC
2	MLT367	Applied Haematology – II Practical	0:0:3	0:0:1.5	3	1.5	CC
3	MLT371	Histopathology II Practical	0:0:2	0:0:1.0	2	1.0	CC
Total					**28**	**24**	

Total Contact hrs:28
Total Credit Hours: 24

SEMESTER-VI

Sr. No.	Subject Code	Subject Name	L:T:P	Credit hours	Total Contact Hours	Total Credits	Course Type
1	MLT362	Medical Mycology	3:0:0	3:0:0	3	3	CC
2	MLT366	Blood Banking & Genetics	3:0:0	3:0:0	3	3	CC
3	MLT370	Molecular Biology	3:0:0	3:0:0	3	3	CC
4	MLT374	Cytopathology	3:0:0	3:0:0	3	3	DSE
5	MLT378	Advanced Haematology					
6	MLT382	Biostatistics and Research Methodology	3:0:0	3:0:0	3	3	SECC

III. Practical Subjects

1	MLT364	Medical Mycology Practical	0:0:3	0:0:1.5	3	1.5	CC
2	MLT368	Blood Banking & Genetics Practical	0:0:2	0:0:1	2	1.0	CC
3	MLT372	Molecular Biology Practical	0:0:3	0:0:1.5	3	1.5	CC
4	MLT376	Cytopathology Practical	0:0:2	0:0:1	2	1.0	DSE
5	MLT380	Advanced Haematology Practical					
6	MLT384	Community Orientation and Clinical visit	0:0:2	0:0:1	2	1.0	SECC
7	MLT386	Seminar	0:0:2	0:0:1	2	1.0	CC
Total					**29**	**22**	

Total Contact hrs: 29
Total Credit Hours: 22

SEMESTER-VII

Sr. No.	Subject Code	Subject Name	L:T:P	Credit hours	Total Contact Hours	Total Credits	Course Type
1	MLT461	Professional Training- I	0:0:0	0:0:0	6 Months (720 Hrs)	20	CC

Professional Training

- There shall be six months of professional training after the sixth semester for candidates declaredto have passed the examination in all the subjects.
- During the training, candidate shall have to work full time average 8 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.
- As a part of this, the students will maintain a work logbook which will be duly endorsed by the supervisor or trainer.
- At the end of internship the candidate shall submit the work log book along with certificate from the training institute. Finally the training of candidate shall be evaluated by the internal and external examiners deputed by University/Board in the form of practical / viva examination.

SEMESTER – VIII

1. Theory Subjects/Training

Sr. No.	Subject Code	Subject Name	L:T:P	Credit hours	Total Contact Hours	Total Credits	Course Type
1	MLT462	Professional Training- II	0:0:0	0:0:0	6 Months (720 Hrs)	20	CC

Professional Training

- There shall be six months of professional training after the seventh semester for candidates declared to have passed the examination in all the subjects.
- During the training, candidate shall have to work full time average 8 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 Technology Degree or declare the candidate eligible for the same.

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

Course Scheme Summary

Semester	L	T	P	Contact hrs/wk	Credits	Project Training
1	18	0	12	30	23	-
2	20	0	14	34	26	-
3	21	0	12	33	26	-
4	19	0	14	33	25	-
5	20	0	08	28	24	-
6	15	0	14	29	22	-
7	0	0	0	20	20	6 months
8	0	0	0	20	20	6 months
TOTAL	**113**	**0**	**74**	**227**	**186**	

Total Contact hrs for I-VIII semester: 227

Total Credit Hours for I-VIII semester: 186

FIRST SEMESTER

Anatomy & Physiology-I

Course Code	MLT161
Course Title	Anatomy & Physiology-I
Type of course	CC
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	• To identify and relate basic concepts of structure and function of cells, tissues and organs. • To understand the anatomical organization, coordination and integrated functions of human body.
Course Outcomes	At the conclusion of the course the students will: 1. Understand the basic principles of anatomy and anatomical organization of the human body and Identify anatomical terms, positions, planes and relate them to location of organs and structures. 2. Describe cell, tissues, their types, characteristics, classification, location and functions. 3. Understand the composition and function of blood and also Analyze the structure and functions of cardiovascular system 4. Able to understand the structure and function of sense organs and Explain the structure and functions of musculoskeletal system, and molecular mechanisms underlying muscle contraction. 5. Analyze the structure and functions of respiratory system and its inter-relationship with the cardiovascular system in maintaining homeostasis.

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.

Cells: Introduction, structure, classification and function

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

Blood: Composition and Function of blood

UNIT-II

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.

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-III

Structure and function of sense organ: Eye, Ear, Nose and Tongue

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-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.

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	Willium Davis	McGraw Hill

Basics of Hematology

Course Code	MLT165
Course Title	Basics of Hematology
Type of course	CC
L T P	3 0 0
Credits	3
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	Students will be made aware of the composition of blood and methods of estimating different components of blood.
Course Outcomes	At the conclusion of the course, the students will: 1. Able to understand the medical laboratory organization, equipments used, principles of protection and quality assurance in Hematology. 2. Learn the composition, function of blood and also understand the types and mode of action of anticoagulants 3. Accomplish and describe ideologies and process of hematopoiesis & hemostasis. 4. Learn the basic concepts of Haematology & routine clinical investigations.

UNIT-I

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

UNIT-II

Introduction to blood: composition, function and normal cellular components.
Hemoglobin: definition, types, structure, synthesis and degradation. Morphology of normal blood cells

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

UNIT- III

Formation of cellular components of blood (Haemopoiesis): Erythropoiesis, Leucopoiesis, Thrombopoiesis. Normal Hemostasis & physiological properties of coagulation factors.

UNIT- IV

Radioactivity: definition, half-life, physical decay and units.
Urine analysis.
Quality assurance in Haematology.
Internal and external quality control including reference preparation.
Routine quality assurance protocol.
Statistical analysis i.e. Standard deviation, Co-efficient of variation, accuracy and precision

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 cruickshanl	Churchill Living Stone
6.	A Manual of Laboratory & Diagnostic Tests(6th edition)	Frances Fischbach	Lippin Cott, wiliam & wilkins

Microbiology

Course Code	MLT169
Course Title	Microbiology
Type of course	CC
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	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.
Course Outcomes	At the conclusion of the course: 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. 2. Develop a working knowledge of different types of microscopes, including their magnification, numerical aperture, resolution, and components. Learn how to properly care and handle glassware. 3. Understand the various methods of sterilization and disinfection including pasteurization and serum inspirator. 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. 5. Learn about the structure and function of bacterial cells including the collection, transport, and processing of specimens. Also, develop an understanding of bacterial growth and metabolism, culture media, bacterial toxins, and antimicrobial agents and quality control and safety measures.

UNIT-I

Introduction: Nomenclature & Classification of micro-organisms, Historical review (Contributions of E. Jenner, L. Pasteur, Robert Koch and postulates, Antony 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, antisepsis 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, negative staining**,** Gram staining, ZN 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, 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

Fundamentals of Medical Lab Technology

Course Code	MLT173
Course Title	Fundamentals of Medical Lab Technology
Type of course	CC
L T P	3 0 0
Credits	3
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	• To understand the role of healthcare professional. • To impart basic knowledge of laboratory principles, procedures and techniques.
Course Outcomes (CO)	At the conclusion of the course, students will; 1. Understand the basic laboratory techniques and comply with safety regulations and universal precautions. 2. Acquire precautionary and corrective maintenance of apparatus and instruments. 3. Understand the concepts of mole, mole fraction, molarity etc. And applying them in preparation of solution and reagents. 4. Understand the concept of pH and role of electrolytes in body fluid balancing

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: Unit's of weight and volume, methods of expressing concentration of solution: Molarity, Normality, Molality, percent solution, saturated solutions and standard solutions.

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.

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

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. Chaterjee 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 Laws & Ethics

Course Code	MLT177
Course Title	Medical Laws & Ethics
Type of course	Foundation course
L T P	2 0 0
Credits	2
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	• To improve the quality of patient care by identifying, analyzing, and attempting to resolve the ethical problems that arise in practice. • To develop understanding among students about the latest regulations in the field of medical laws & ethics.
Course Outcomes (CO)	At the conclusion of the course, students will; 1. Understand the rights and duties of a healthcare professional as a citizen of India. 2. Understanding how to deal with situations arising out of negligence, malpractices and unethical practices in the context of Indian Legal System. 3. Appreciate and understand the legal framework surrounding medical education and Profession.

UNIT-I

Medical ethics: Definition - Goal - Scope, Introduction to Code of conduct. Basic principles of medical ethics – Confidentiality.

Malpractice and negligence - Rational and irrational drug therapy.

Autonomy and informed consent - Right of patients

Care of the terminally ill- Euthanasia

Organ transplantation

UNIT - II

Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.

Professional Indemnity insurance policy.

Development of standardized protocol to avoid near miss or sentinel events

Obtaining an informed consent.

Ethics in the profession of Medical Laboratory Science

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Medical Law and Ethics	Bonnie F Fremgen	Bhalani Publisher
2.	Medical Law and Ethics	Jonathan Herring	Tata McGraw Hill
3.	Medical Law and Ethics	Purosottam Behera	Mittal Publications
4.	Reflections on Medical Law and Ethics in India	Bismi Gopalakrishnan, Mercy Khaute, B. Sandeepa Bhat	Eastern Law House

Communication Skills in English- I

Course Code	AEC0010
Course Title	Communication Skills in English -I
Type of course	AECC
L T P	2:0:0
Credits	2
Course prerequisite	+2 in any stream
Course Objective (CO)	1. Equip the learner with proficiency in reading comprehension. 2. Enable the learner with improved writing skills and command over official/ corporate communication. 3. Enhance the learners' range of vocabulary and knowledge of the essentials of grammar.
Course Outcomes	At the conclusion of the course the student will be able to: 1. Have fairly good proficiency in reading comprehension. 2. Have enhanced writing skills and command in official/ corporate communication. 3. Develop confidence in making presentation: oral or documentary.

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

Anatomy & Physiology- I Practical

Course Code	MLT163
Course Title	Anatomy & Physiology -I Practical
Type of course	CC
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	Students will be able to learn the basic terminology of anatomy, architecture and functional details of cells, tissues, organs and organ systems.
Course Outcomes	At the conclusion of the course, Students will: 1. Able to identify and label all major bones and joints of the musculo-skeletal system on charts and models. 2. Develop an understanding of blood circulation in the cardiovascular system, including the functions of the heart, arteries, and veins. 3. Analyze the structure and function of the respiratory system, including the trachea and lungs. 4. Compare and contrast the four body systems studied, identifying shared and unique characteristics of each.

LIST OF PRACTICALS

1. Demonstration of body systems showing all parts through charts, models or videos.
2. Histological study of various tissues (Epithelial, Muscular and Connective tissue)
3. To study circulatory system from charts and transverse section (TS) of artery, vein and spleen from permanent slides.
4. Blood pressure estimation.
5. Demonstration of parts of skin.
6. Study of structure of various sensory organs from charts/ models
   - Eye
   - Ear
   - Nose
7. Demonstration of structural differences between skeletal, smooth and cardiac muscles (permanent mounts)
8. Demonstration of various bones and joints
9. To study respiratory system from charts and transverse section (TS) of trachea and alveolar tissue from permanent slides.

Note: Demonstrations can be done with the help of models, charts and histological slides and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.

Basics of Hematology Practical

Course Code	MLT167
Course Title	Basics of Hematology Practical
Type of course	CC
L T P	0 0 3
Credits	1.5
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	To provide hands on training to perform various hematological procedures used as diagnostic tools for screening of hematological abnormalities.
Course Outcomes	At the conclusion of the course, students will; 1. Understand the handling techniques of the instruments used in hematological investigations. 2. Learn the various methods of blood collection and Preparation of various anticoagulants. 3. Familiarize with the performance of routine and specialized laboratory techniques for the identification of various blood cells.

LIST OF PRACTICALS

1. Demonstration of routine Haematology Lab. Instruments
   a) Microscopes
   b) Haemocytometers
   c) Colorimeter
   d) Spectrophotometer
   e) Glass pipettes & Auto pipettes
   f) Glassware
   g) Sahli‘s Apparatus
2. Preparation of various anticoagulants :
   a) EDTA
   b) Sodium Citrate
   c) Oxalate with Fluoride
3. Collection of blood sample for various Laboratory Investigations
4. Identification of Normal blood cells
5. Urine Analysis:
   a) Routine biochemistry of Urine for:
   b) pH
   c) Specific Gravity
   d) Glucose
   e) Ketones
   f) Bilirubin
   g) Albumin
   h) Microscopic Examination of Urine

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

Microbiology Practical

Course Code	MLT171
Course Title	Microbiology Practical
Type of course	CC
L T P	0 0 3
Credits	1.5
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	• To impart skills in essential microbiological techniques and to demonstrate the principle and working of various equipment used in microbiology • To provide hands on training to perform various microbiological tests in medical microbiology laboratory.
Course Outcomes	At the conclusion of the course: 1. Understand the basic safe code of practice for a Microbiology laboratory 2. Apply the knowledge for preparing the cleaning agents & familiarize with the technique for cleaning & sterilization 3. Learn the theory, principle, working, maintenance and precautions of different equipments. 4. Familiarize with the isolation methods of bacteria such as culture and staining techniques.

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 working & handling of Compound microscope.
4. To demonstrate the method of sterilization by autoclave and hot air oven including its efficacy testing.
5. To demonstrate the method of sterilization of media/solution by filtration.
6. To prepare working dilution of commonly used disinfectants.
7. Preparation of basic media for different microbial organisms
8. Isolation and enumeration of bacteria by spread plate method using different streaking formats.
9. To prepare a bacterial smear and perform simple staining.
10. To perform negative staining of bacteria.
11. To demonstrate the different morphological types 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

Fundamentals of Medical Lab Technology Practical

Course Code	MLT175
Course Title	Fundamentals of Medical Lab Technology Practical
Type of course	CC
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	To impart hands on practice on general laboratory procedures and techniques.
Course Outcomes	At the conclusion of the course, students will; 1. Learn the calibration of volumetric glass-wares. 2. Understand the preparations of standard solutions, stock solutions, buffer solution, distilled and de-ionised water. 3. Understand the principle, operation, care and maintenance of laboratory equipments.

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 laboratory 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.

SECOND SEMESTER

Anatomy & Physiology-II

Course Code	MLT162
Course Title	Anatomy & Physiology-II
Type of course	CC
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course objective	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.
Course Outcome	At the conclusion of the course, students will: 1. Understand the structure and functions of digestive system, urinary system and also knows the mechanism of urine formation. 2. Able to understand the detailed structure of male & female reproductive system and role of hormones. Also learn the process of spermatogenesis. 3. Understand the basic structure, function, classification of nervous system. 4. Analyze the structure, secretions and functions of endocrine and exocrine glands.

UNIT-I

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.

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

UNIT-IV

Endocrine system: Endocrine & exocrine glands, their location, structure & functions

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

Basics of Haematological Diseases

Course Code	MLT166
Course Title	Basics of Haematological Diseases
Type of course	CC
L T P	3 0 0
Credits	3
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	This subject aims to aware the students regarding various diseases like anemia, quantitative disorders of Leucocytes, morphological alterations in blood cells, bleeding disorders.
Course Outcomes	At the conclusion of the course, the students will: 1. Aware of various hematological condition like anemia, 2. Learn about causes and significance of quantitative disorders of Leucocytes. 3. Know about the morphological alterations in blood cells, 4. Familiar about bleeding disorders and anticoagulants.

UNIT-I

Anemia: Introduction, Classification: Microcytic hypochromic anemia, Macrocytic anemia, Normocytic normochromic anemia.

Quantitative disorders of Leukocytes: Cause and significance, Granulocytic and Monocytic Disorders, Lymphocytic Disorders

UNIT-II

Morphologic Alterations in Neutrophils, Toxic granulation, Cytoplasmic vacuoles, Döhle bodies, May–Hegglin anomaly, Alder–Reilly anomaly, Pelger–Huët anomal, Chédiak–Higashi syndrome.

UNIT- III

Bleeding disorders: Introduction: Clotting factors and intrinsic & extrinsic pathway, Causes of bleeding disorders. Vascular defect, Platelet defect, Factor deficiency, Inhibitors, Hyper fibrinolysis. Types of bleeding disorders: Inherited bleeding disorders, Acquired bleeding disorders

UNIT- IV

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

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^{th} 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

Bacteriology

Course Code	MLT170
Course Title	Bacteriology
Type of course	CC
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course objective (CO)	To impart the knowledge about the different types of bacterial culture procedures, staining procedures and other morphological, cultural and biochemical tests used for identification of bacteria.
Course Outcome	At the conclusion of the course, students will; 1. Understand the role of instruments and types of culture methods used for the cultivation of bacteria. 2. Able to identify and distinguish the bacteria with the help of various staining techniques and biochemical characterization. 3. Able to differentiate a large number of bacteria by their salient characteristic features & classify them into groups. 4. Apply the knowledge for the identification of various bacterial disease by following laboratory practices.

UNIT-I

Bacterial culture

a. Instruments used to seed culture media

b. Culture procedures - spread plate method, pour plate method and lawn culture

UNIT-II

Staining techniques in bacteriology

a) Significance of staining in bacteriology

b) Principle, procedures and interpretation of various staining techniques used in bacteriology.

- Gram stain
- Albert‘s stain
- Neisser‘s stain
- Capsule staining
- Flagella staining
- Fontana stain for spirochetes

UNIT-III

Principle, procedures and interpretation of the following biochemical tests for the Identification of different bacteria: Catalase, Coagulase, Indole, Methyl Red, VogesProskauer, Urease, Citrate, Oxidase.

UNIT-IV

Various characteristics (morphological, cultural and biochemical) and laboratory diagnosis of the following bacteria

a) *Staphylococcus aureus*
b) *Streptococcus pyogenes and Streptococcus pneumoniae*
c) *Neisseria gonorhoeae and Neisseria meningitis*
d) *Haemophilis influenzae*
e) *Corynebacterium diptheriae*
f) *Enterobacteriaceae: Escherichia coli, Klebsiella, Enterobacter, Proteus, Salmonella, Shigella*
g) *Vibrio cholera*
h) *Clostridium tetani and Clostridium botulinum*
i) *Mycobacterium tuberculosis*

j) Spirochetes
k) Bordetella pertusis
l) Brucella abortus
m) Rickettsia
n) 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 Micrbiology	Universities Press
3.	Text book of Microbiology	Michael J. Pelczar, JR. E.C.S Chan & NoelR. 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

Basic Biochemistry

Course Code	MLT174
Course Title	Basic Biochemistry
Type of course	CC
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	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.
Course Outcomes	At the conclusion of the course, students will; 1. Understand the structure and function of Cell and cell organelles. 2. Learn about the chemical structures of carbohydrate, and their structural and metabolic role in cellular system. 3. Know about structure and function of various classes of lipids, sterols, terpenes and lipoproteins etc. 4. Understand about primary, secondary, tertiary, quaternary structure of proteins and their functions. 5. Understand about the structure and function of nucleosides and nucleotides. 6. Familiarize with the biochemical role of vitamins and minerals.

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

Analytical Clinical Biochemistry

Course Code	MLT178
Course Title	Analytical Clinical Biochemistry
Type of course	CC
L T P	3 0 0
Credits	3
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective (CO)	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.
Course outcomes	At the conclusion of the course, students will; 1. Learn the principles, components and applications of various spectrophotometers used in medical laboratories. 2. Be able to explain the principles, types and applications of chromatographic techniques used for biochemical investigations. 3. Understand the working principles and applications of electrophoretic techniques pertaining to biological samples. 4. Acquire the knowledge of various types of centrifuges and their applications in the domain of clinical sciences.

UNIT-I

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

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.

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

UNIT-II

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

UNIT-III

Electrophoresis: Introduction, principle, Instrumentation and Applications.
Types of electrophoresis: Paper electrophoresis, Gel electrophoresis

UNIT-IV

Centrifugation: Basic principle of sedimentation, relative centrifugal force (RCF), sedimentation rate, sedimentation co-efficient, Principle of differential centrifugation and density gradient centrifugation. Types of rotor, care and maintenance of rotors. Theory and applications of ultra-centrifugation.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Text book of Medical Laboratory Technology	P. B. Godker	Bhalani Publishing House
2	Handbook of Biochemistry, 15th edition	M. A. Siddiqi	Scientific Book Company
3	Instrumental Analysis	Chatwal Anand	
4.	Principles and techniques of practical biochemistry, 5th edition	Wilson & Walker	Cambridge University Press
5.	Text book of Medical Biochemistry	Chatterjee, Shinde	Jaypee Brothers Publishers(P) Ltd.

Communication Skills in English-II

Course Code	AEC0011
Course Title	Communication Skills in English -II
Type of Course	AECC
LTP	2:0:0
Credits	2
Course pre-requisite	NA
Course Objectives (CO)	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.
Course Outcomes	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/ corporatecommunication. 3. Develop confidence in making presentation; oral or documentary.

UNIT-I
Public Speaking: Introduction to Public Speaking, Business Conversation, Effective Public Speaking Art of Persuasion

UNIT II
Interview Skills: Types of Interview, Styles of Interview, Facing Interviews-Fundamentals and Practice Session ,Conducting Interviews- Fundamentals and Practice Session, Mock interview sessions

UNIT III
Writing Skills: Resume Writing, Covering Letters, Interview Follow Up Letters, Email, Fax, Assessment through employability score card

UNIT IV
Etiquettes: Business Etiquette, Dressing up Sense, Exchanging Business card, Shaking hands, Dining etiquette.

Text and Reference Books

S.No	Name	Author(s)	Publisher
1	Speaking Effectively	Jeremy Comfort	CUP
2	Creative English for Communication	N.Krishnaswamy	Macmillan
3	Business Communication	Raman Prakash	CUPi
4	Business Communication	Anjanee Sethi & Bhavana Adhikari	Tata McGraw Hill

Anatomy & Physiology-II Practical

Course Code	MLT164
Course Title	Anatomy & Physiology-II Practical
Type of course	CC
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course objective	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.
Course Outcome	At the conclusion of the course, Students will: 1. Identify parts of the digestive and excretory system through permanent slides. 2. Able to identify and distinguish male & female reproductive system through slides, charts and models. 3. Develop an understanding of the histology of nervous sytem through permanent slides/ chart 4. Able to identify endocrine system through histological slides

LIST OF PRACTICALS

1. Demonstration of parts of digestive system
   - Oesophagus (TS)
   - Stomach (TS)
   - Deudenum (TS)
2. Demonstration of parts of Excretory system: LS & TS of-
   - kidney
   - Ureters
   - Urinary bladder
3. Male reproductive system: Testes and vas deferens
4. Female reproductive system: ovaries, uterus, fallopian tubes
5. Demonstration of various parts of nervous system (brain and spinal cord) (Model)
6. Study of histology of endocrine system from permanent slides:
   - Thyroid gland (TS)
   - Adrenal gland (TS)
   - Pancreas (TS)

Note: Demonstrations can be done with the help of models, charts and histological slides any other material or medium including videos

Basics of Haematological Diseases Practical

Course Code	MLT168
Course Title	Basics of Haematological Diseases Practical
Type of course	CC
L T P	0 0 3
Credits	1.5
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective	This subject aims to aware the students regarding various diseases like anemia, quantitative disorders of Leukocyte, morphological alterations in blood cells, bleeding disorders.
Course Outcomes	At the conclusion of the course, the students will: 1. Aware of handling and maintenance of hematological instruments. 2. Learn about the techniques of preparation of various anticoagulants, stains. 3. Understand the routine hematological test procedure 4. Familiar about preparation & staining of blood films for the diagnosis of normal & abnormal cells and also for the detection of malarial parasite.

LIST OF PRACTICALS

1. Parts of centrifuge; its functioning and care
2. Preparation of various anticoagulants
3. Collection of venous and capillary blood
4. Preparation of the stains and other reagents
5. Haemoglobin estimation methods (Sahli's, Oxyhaemoglobin, and cyanmethaemoglobin)
6. Differential leukocyte count (DLC)
7. Recognition and staining of various types of blood cells (normal and abnormal)
8. Preparation of thick and thin blood smear (Leishman/Giemsa/JSB)
9. RBC counting
10. WBC counting
11. Platelet counting
12. Demonstration of tests for bleeding disorders (BT/CT, APTT, PTI-INR, PTTK)

Bacteriology Practical

Course Code	MLT172
Course Title	Bacteriology Practical
Type of course	CC
L T P	0 0 3
Credits	1.5
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course objective	To provide hands on training on techniques related to characterization and lab diagnosis of medically important bacteria and understand the basic laboratory practices in the field of bacteriology
Course Outcome	At the conclusion of the course, Students will: 1. Learn the techniques of isolation of bacteria. 2. Apply the knowledge to identify the bacteria through staining techniques. 3. Apply this knowledge to isolate the pathogens from different types of samples such as blood, urine, sputum and pus. 4. Confirm the isolated bacterial species with phenotypic characterization (biochemical)

LIST OF PRACTICALS

1. Isolation of bacteria by pour plate method.
2. To learn techniques for Inoculation of bacteria on culture media
3. To prepare agar slants for culturing microorganisms.
4. To perform Gram staining of different bacterial cultures
5. To perform Ziehl-Neelsen staining of bacteria
6. To perform Albert staining of bacteria
7. Processing of blood sample for culture and identification of pathogen.
8. Processing of urine sample for culture and identification of pathogen.
9. Processing of Sputum sample for culture and identification of pathogen
10. Processing of Pus sample for culture and identification of pathogen
11. To perform Indole production, Methyl red, Voges-Proskauer and citrate utilization tests (I M V i C) for biochemical characterization of bacteria.
12. To perform urease, catalase and oxidase tests for biochemical characterization of bacteria.
13. 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

Basic Biochemistry Practical

Course Code	MLT176
Course Title	Basic Biochemistry Practical
Type of course	CC
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks.
Course Objective (CO)	The lab is designed to train the students in basic and some advanced techniques of Biochemistry like isolation, purification, and estimation of biomolecules.
Course Outcomes	At the conclusion of the course, the students will be able to : 1. Understand the qualitative tests of carbohydrates, proteins & Amino Acids and Lipids 2. Learn the uantitative estimations of biomolecules like carbohydrates and proteins through spectrophotometric analyses. 3. Comparative evaluation of different methods of protein analysis: UV, Lowry, Biuret, Bradford

LIST OF PRACTICALS

1. Qualitative analysis of carbohydrates (atleast one test for each aldo, keto sugar, reducing sugars and non-reducing sugars)
    - Molisch Test
    - Fehling Test
    - Benedict Test
    - Seliwanofft Test
    - Barfoed Test
    - Iodine test
2. Qualitative analysis of aminoacids and proteins:
    - Biuret Test
    - Millon`s Test
    - Ninhydrin Test
    - Xanthoprotic Tests
3. General tests for lipids:
    - Solubility Test
    - Emulsification Test
    - Sudan-III Test
4. Verification of Lambert-Beer's Law Spectrophotometrically
5. Quantitative estimation of sugars by
    - Dubois method
    - Anthrone method
    - DNS method
6. 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.

Analytical Clinical Biochemistry Practical

Course Code	MLT180
Course Title	Analytical Biochemistry Practical
Type of course	CC
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT with 50% marks./ Lateral Entry
Course Objective (CO)	To provide hands-on training on operational use of various equipments such as spectrophotometers, flame photometers, electrophoretic units etc. used in analytical techniques.
Course Outcome	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. 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

THIRD SEMESTER

Biochemical Metabolism

Course Code	MLT261
Course Title	Biochemical Metabolism
Type of course	CC
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT / Lateral Entry with 50% marks.
Course objectives	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.
Course Outcome	At the conclusion of the course;student will 1. Able to learn about the general principles of intermediary metabolism, types of biological oxidations and role of electron carriers in biochemical reactions. 2. Learn major pathways of carbohydrate catabolism and their association with cellular energy production and carbohydrate anabolism in animal cells and metabolic disorders and also understand lipid biosynthesis, Degradation of fatty acids and cholesterol, formation of ketone bodies &; their significance and their metabolic disorders. 3. 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. 4. 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 Km and Vmax. They will also learn about fundamentals of enzyme regulation and inhibition.

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, 8(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 Km, 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 Publishers(P) Ltd.
6.	Practical Biochemistry, 3rd Ed.	D. T. plummer	Mc Graw Hill

Parasitology

Course Code	MLT265
Course Title	Parasitology
Type of course	CC
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT / Lateral Entry with 50% marks.
Course Objective	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.
Course Outcomes	At the conclusion of the course, students will: 1. Understand the characteristics, types of parasites and also familiarize with the host-parasite relationship. Also determine the role of vectors as transmitters. 2. Classify different types of parasites and their hosts, including protozoan, cestode, trematode, and nematode. 3. Understand the general characteristics, morphology, life cycle, and laboratory diagnosis of cestodes, trematodes and nematodes. 4. Apply this knowledge to understand the pathogenicity and diagnosis of parasite infection. 5. Learn about culture, collection, handling, transportation and examination of clinical samples.

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 and P. falciparum*

Coccidia: Morphology, life cycle and laboratory diagnosis of *Toxoplasma gondii*

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 *Ancyclostoma 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 flotation methods, Blood examination.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Medical parasitology	D. Arora	CBS Publishers
2	Parasitology	Chaterjee	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.	Medical Microbiology	Pannier &Satish Gupte	Universities press
6.	Text book of Microbiology	Michael J. Pelczar, JR. E.C.S Chan & Noel R. Krieg	Tata McGraw Hill
7.	Text book of Microbiology	Ananthanarayan And Paniker's Text Book of Micrbiology	Universities Press
8.	Medical Microbiology	Paniker &Satish Gupte	Universities Press
9.	Medical Entomology	A.K. Hati	Pub. Allied Book Agency

Cellular Pathology

Course Code	MLT269
Course Title	Cellular Pathology
Type of course	CC
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT / Lateral Entry with 50% marks.
Course Objective (CO)	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.
Course Outcome	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 system: Diseases of mouth, disease of oesophagus; oesophageal varices,
Digestive system: Gastritis, Peptic ulceration, Appendicitis, Microbial disease, food poisoning, hernia, intestinal obstructions and malabsorption

Accessory digestive glands: mumps, hepatitis, liver failure, cirrhosis, pancreatitis, Gall stones and jaundice

Circulatory system: Cardiovascular diseases, Diseases of blood vessels- Atheroma, Arteriosclerosis, heart block. Disorders of Blood Pressure-Hyper & Hypotension

Diseases of Respiratory system: 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

Diseases of Nervous system: 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
6.	Anatomy & Physiology	Ross and Wilson	

Introduction to Quality and Patient Safety

Course Code	MLT273
Course Title	Introduction to Quality and Patient Safety
Type of course	SECC
L T P	2 0 0
Credits	2
Course prerequisite	10+2 Medical/ Dip in MLT / Lateral Entry with 50% marks.
Course objective	To sensitize the students in basic emergency care, Infection prevention & control with knowledge of Bio-medical waste management
Course Outcome	At the conclusion of the course, students will : 1. Understand the basic concepts of quality in health care and develop skills to implement sustainable quality assurance program in the health system. 2. Learn about basic emergency care including first aid and triage. 3. Apply the knowledge to prevent harm to workers, property, the environment and the general public via segregation, collection & transportation of Biomedical Waste. 4. Apply the knowledge to reduce the incidence of hospital acquired infections and improve health outcomes.

UNIT I

Quality and Patient safety: Discussion on Concepts of Quality of Care, Approaches to Quality Improvement, Standards and Norms, Quality Improvement Tools, Discussion on NABH guidelines and its exercises

UNIT II

Basics of emergency care and life support skills: Vital signs and primary assessment, Basic emergency care – first aid and triage, Ventilations including use of bag-valve-masks (BVMs), Choking, rescue breathing, methods, One- and Two-rescuer CPR, Using an AED (Automated external defibrillator), Managing an emergency including moving a patient

UNIT III

Bio medical waste management and environment safety: Definition of Biomedical Waste, Waste minimization, BMW – Segregation, collection, transportation, treatment and disposal (including color coding) Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste.

BMW Management & methods of disinfection, Modern Technology for handling BMW

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

UNIT IV

Infection prevention and control: Evidence-based infection control principles and practices [such as Sterilization, Disinfection, Effective hand hygiene and use of Personal Protective Equipment (PPE)]

Prevention & control of common healthcare associated infections, Components of an effective infection control program, and Guidelines (NABH and JCI) for Hospital Infection Control.

Text and Reference Books:

S. No.	Name	Author(S)	Publisher
1	The Essentials of Patient Safety	Charles Vincent	
2	Laboratory quality control and patient safety	De Gruyter	
3	Text book of Preventive Medicine (For IPC)	Par and Park	

Gender Equity

Course Code	SSC001
Course Title	Gender Equity
Type of course	AECC
L T P	3 0 0
Credits	3
Course prerequisite	10+2 Medical
Course objective	● To develop gender sensitive pedagogy and knowledge system. ● 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. ● To comprehend the issues and challenges faced by women in a holistic manner through deliberations, research work, theory building and information dissemination.
Course Outcome	At the conclusion of the course, students will: 1. Able to acquire knowledge and understanding of theory and concepts related to gender and gender relations. 2. Able to critically reflect how gender is a development issue. 3. Analyse the evolution of thinking and approaches around gender and development.

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 inquality 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.

Biochemical Metabolism Practical

Course Code	MLT263
Course Title	Biochemical Metabolism Practical
Type of course	CC
L T P	0 0 3
Credits	1.5
Course prerequisite	10+2 Medical/ Dip in MLT / Lateral Entry with 50% marks.
Course objective	The lab is designed to train the students in basic and some advanced techniques of Biochemistry like isolation, purification, and estimation of biomolecules.
Course Outcome	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

Parasitology Practical

Course Code	MLT267
Course Title	Parasitology Practical
Type of course	CC
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT / Lateral Entry with 50% marks.
Course Objective	The students will learn techniques related to collection, transportation and preservation and processing of specimens for routine parasitological investigations.
Course Outcome	At the conclusion of the course, Students will be able to: 1. Understand the basic laboratory practices in Parasitology. 2. Apply the knowledge for the isolation of parasites by various concentration methods 3. Perform the examination of blood and stool samples for the diagnosis of disease. 4. Identify the parasites by various methods including staining, concentration techniques and with models /specimens/slides.

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

Cellular Pathology Practical

Course Code	MLT271
Course Title	Cellular Pathology Practical
Type of course	CC
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT/ Lateral entry with 50% marks
Course Objective (CO)	The students will learn to differences between the normal and pathological specimens by critically analyzing the morphological changesand functional de-arrangements.
Course Outcome	At the conclusion of the course, Students will: 1. Understand the morphology and arrangement of cheek cells 2. Familiar with the diseases of different systems such as Digestive System, Cardio-Vascular System, Respiratory System, , Reproductive system, Nervous system and Urinary system through stained slides 3. Able to process the urine sample for physio-chemical & microbiological examination.

LIST OF PRACTICALS

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

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

Basics of Computers Lab

Course Code	CSE213
Course Title	Basics of Computers Lab
Type of course	ID
L T P	0 0 3
Credits	1.5
Course prerequisite	10+2 Medical/ Dip in MLT / Lateral Entry with 50% marks.
Course Objective (CO)	The objective of the course is to 1. Provide students with a basic understanding of computer hardware, software, and operating systems. 2. Introduce students to common programming languages, multimedia, and networking. 3. Enhance students' knowledge of number systems and arithmetic. 4. Familiarize students with word processing, spreadsheet, and presentation software. 5. Teach students how to use the internet for information seeking and communication.
Course Outcome	At the conclusion of the course, students will 1. Identify and explain computer components and their functions 2. Install and operate common operating systems and software applications. 3. Perform basic text and data entry and editing tasks using word processing software. 4. Proficient in creating charts and spreadsheets using Excel and Open Office. 5. Able to create engaging multimedia presentations and understand basic data processing concepts.

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

differentfile(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 envelops and lables
   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

FOURTH SEMESTER

Clinical Biochemistry

Course Code	MLT262
Course Title	Clinical Biochemistry
Type of course	CC
L T P	3 0 0
Credits	3
Course prerequisite	10+2 Medical/ Dip in MLT/ Lateral entry with 50% marks.
Course Objective (CO)	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.
Course Outcome	At the conclusion of the course, the students will: 1. Learn Hazards & safety measures in clinical biochemistry laboratory, Quality control and quality assurance. 2. Understand the concept of pH and importance of various buffers. 3. Understand the routine biochemical investigation and metabolic disorders associated with electrolyte imbalance. 4. Students can demonstrate the physical and chemical examination of various body fluids and know the significance of glycemic disorders.

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 (2nd 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

Applied Haematology – I

Course Code	MLT266
Course Title	Applied Haematology – I
Type of course	CC
L T P	3 0 0
Credits	3
Course prerequisite	10+2 Medical/ Dip in MLT/ Lateral entry with 50% marks.
Course Objective (CO)	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
Course Outcome	At the conclusion of the course, students will; • The students will be made aware of the methods of estimating different Components of blood. • Students will learn the basic concepts of staining techniques. • The students will be aware of the coagulation study and methods . 1. Students will learn the estimation of body fluids

UNIT-I

Haemoglobinometry: Different methods to measure Haemoglobin with merits and demerits.

Haemocytometery: Introduction, Principle, Reagent preparation, procedure, errors involved and means to minimize errors-: RBC Count, Total leucocyte count(TLC), Platelet Count, Absolute Eosinophil count, Differential leucocyte count (DLC), Normal and absolute values in Haematology.

UNIT-II

Principle mechanism and different methods with merit and demerits for the measuring Erythrocyte Sedimentation Rate (ESR) and its significance, packed cell volume/ Haematocrit value.
Physiological variations in Hb, PCV, TLC and Platelets.

UNIT- III

Preparation of blood films: Types, Methods of preparation (Thick and thin smear/film) and utility.
Staining techniques in Haematology (Romanowsky‘s stains): Principle, composition, preparation of staining reagents and procedure of the following:-

- Giemsa‘s stain
- Leishman‘s stain
- Wright‘s stain
- Field‘s stain
- JSB stain.

UNIT: IV

Body fluids-: Macroscopic and microscopic examination of seminal fluid . Examination of CSF and other body fluids for cytology i.e. pleural, peritoneal and synovial fluid etc.

Preparation of Reagents for coagulation studies: M/40 Calcium chloride, Brain Thromboplastin, Cephalin, Adsorbed Plasma.. Screening Tests for coagulation Studies and their significance.

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Text and Reference Books

S. No	Name	Author	Publisher
1	Textbook of Medical Laboratory Technology	Praful B. Godkar	Bhalani
2	Medical Laboratory Technology	K L Mukherjee Volume-I	CBS Publishers & Distributors Pvt.lid.
3	Practical Haematology	J.B. Dacie	Churchill Living Stone
4	Clinical Diagnosis & Management by Laboratory methods (20thedition)	John Bernard	Churchill Living Stone
5	Atlas of Haematology	G.A. McDonald	Churchill Living Stone

Immunology & Bacterial Serology

Course Code	MLT270
Course Title	Immunology & Bacterial Serology
Type of course	CC
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT/ Lateral entry with 50% marks.
Course Objective (CO)	This part will cover the basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.
Course Outcome	At the conclusion of the course, Students will: 1. Able to outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate. 2. Understand the rationale behind various assays used in immunodiagnosis of diseases and will be able to transfer knowledge of immunology in clinical perspective. 3.

UNIT- I

Overview to Immunology: History, cells of immune system; T- Cells, B- Cells, null Cells; monocytes, polymorphs, primary and secondary lymphoid organs.

Immunity: Types of immunity- innate and adaptive. Primary and secondary immune response and effector mechanism.

Antigen: Definition, types and determinants of antigenicity.

Antibody: Definition, types, structure and properties of immunoglobulin

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

UNIT-II

Celll 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

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

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

UNIT-III

Immunotechnology: Principle, procedure and applications of Precipitation and agglutination reactions: bacterial haemagglutination haemagglutination inhibition; Immuno-diffusion (Radial and double diffusion) and electro- immunodiffusion, Immunoelectrophoresis, Radioimmuno assay, ELISA, Complement fixation test, Immuno- fluorescence, SDS-PAGE and Western blotting

UNIT-IV

Principle, procedure and interpretation of various serological tests: Widal, VDRL, ASO, CRP, Brucella tube agglutination, Rose-Waaler.

Automation in diagnostic serology

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.	Medical laboratory Technology Vol. I ,II, III	Mukherjee	

Histopathology- I

Course Code	MLT274
Course Title	Histopathology - I
Type of course	Theory
L T P	3 0 0
Credits	3
Course prerequisite	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
Course Objective (CO)	• To study pathologically altered structure and function of diseased cells, tissuesand organs • To understand the importance of tissue as a key resource for investigation and toevaluate the efficacy of future treatment modalities.
Course Outcome	At the conclusion of the course, students will; 1. Able to explain the theoretical background to tissue fixation, tissue processing, microtomy and staining using routine and specialized techniques 2. Able to illustrate the pathological condition of tissue and relate it with diseased condition 3. Identify and explain the causes of technical defects in histological preparations, and rectify such defects and know its influence on the diagnostic process

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

Applications of Bacteriology

Course Code	MLT278
Course Title	Applications of Bacteriology
Type of course	SECC
L T P	2 0 0
Credits	2
Course prerequisite	10+2 Medical/ Dip in MLT, Lateral entry with 50% marks.
Course Objective (CO)	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
Course Outcome	At the conclusion of the course: 1. Demonstrate antibiotic susceptibility testing in bacteriology. 2. Familiarization with the concept of bacteriological examination of air. 3. Acquire the knowledge about the collection, transportation, processing and reporting of I/v fluids 4. Elaborate the various techniques of microbial preservation & nosocomial infection.

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 β-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 Iyophilisation 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

Indian Knowledge System- Introduction to National Healthcare Delivery System in India

Course Code	MLT282
Course Title	Indian Knowledge System- Introduction to National Healthcare Delivery System in India
Type of course	CC
L T P	2 0 0
Credits	2
Course prerequisite	10+2 Medical/ Dip in MLT/ Lateral entry with 50% marks.
Course Objective (CO)	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.
Course Outcome	At the conclusion of the course, students will 1. Able to compare and contrast the Indian healthcare delivery system with other healthcare systems in the world. 2. Get knowledge about national policies and healthcare programmes. 3. Understand various systems of medicine such as Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homeopathy. 4. Gain knowledge of the demography, vital statistics, and public health in India. 5. Know about the principles, methods of epidemiological studies and types of diseases.

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 Heath 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 & Vital Statistics

- Demography – its concept
- 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. Silverto	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

Course Code	MLT284
Course Title	Medical Terminology and Record Keeping
Type of course	DSE
L T P	2 0 0
Credits	2
Course prerequisite	10+2 Medical/ Dip in MLT/ Lateral entry with 50% marks..
Course Objective (CO)	This subject introduces the elements of medical terminology
Course Outcome	At the conclusion of the course students will: 1. Acquire the knowledge of terminology and understand the anatomy and medical codes use in medical science. 2. Apply the knowledge of terminology used by various domain doctors and practitioners for the diagnosis, treatment of disease. 3. Understand the importance and maintenance of medical records. 4. Familiarization with the legal aspects of Medical Records.

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. Silverto	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

Environmental Education

Course Code	EVS200
Course Title	Environmental Education
Type of course	Theory (Compulsory for undergraduate students)
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical/ Dip in MLT/ Lateral entry with 50% marks.
Course objective	To connect and sensitize the students towards the environment and prevailing environmental issues (natural, physical, social and cultural).
Course Outcome	At the conclusion of the course, students will : 1. Appreciate the historical context of human interactions with the environment. 2. Develop an understanding of pollution and its types 3. Learn about the concept of Ecosystem, Ecosystem services 4. Learn about climate change and biodiversity conservation 5. Understand the relation between social issues and environment. 6. Learn about the major international treaties and our country's stand on and responses to the major international agreements.

UNIT I

Historical Prospective: Brief introduction of Humans as hunter-gatherers; Mastery of fire; Origin of agriculture, Emergence of city-states; Indic Knowledge and Culture of sustainability, Industrial revolution and its impact on the environment; Population growth and natural resource exploitation. Environment Definition and scope and importance. Environmental Ethics and emergence of environmentalism: World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

Natural Resources: Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources, soil and mineral resources. Sustainable Development Goals (SDGs)-targets and indicators, challenges and strategies for SDGs.

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.

Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact

Global change: Ozone layer depletion; Climate change. Disasters – Natural and Man-made (Anthropogenic).

Biodiversity and its distribution: Biodiversity as a natural resource. Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories.

Ecosystems in brief: forests, wetlands, grasslands, agriculture, coastal and marine.

Ecosystem services- classification and their Significance, Threats to biodiversity and ecosystems Biodiversity Conservation: Major conservation policies: in-situ and ex-situ conservation approaches the role of traditional knowledge, community-based conservation.

UNIT III

Understanding climate change: Anthropogenic climate change from greenhouse gas emissions, Climate change impact on global warming and its effect on Indian Subcontinent, rise of sea level, Changes in marine and coastal ecosystems, Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment. Mitigation of climate change, National climate action plan.

Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control. Environmental management system: ISO 14001
Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis. Environmental audit and impact assessment; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme.

UNIT IV

Social Issues and the Environment: 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. Environmental ethics: Issues and possible solutions. Major International Environmental Agreements and National Acts: CBD, Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing, (CITES); Ramsar Convention on Wetlands of International Importance; 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.

Case Studies and Field Work (Any two): Discussion on one national and one international case study related to the environment and sustainable development. Or Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report. Or Participation in plantation drive and nature camps. Or Documentation of campus biodiversity

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
4	A Handbook on International Environment Conventions & Programmes	2019	Ministry of Environment, Forest and Climate Change
5	Introduction to Environmental Management 2nd Edition	Theodore, M. K. and Theodore, Louis (2021)	CRC Press.
6	Climate Change: The Science, Impacts and Solutions. 2nd Edition	Pittock, Barrie (2009)	Routledge
7	Textbook of Biodiversity	Krishnamurthy, K.V. (2003)	Science Publishers, Plymouth, U

Clinical Biochemistry- I Practical

Course Code	MLS 204
Course Title	Clinical Biochemistry Practical
Type of course	Practical
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
Course Objective (CO)	To impart hands on training on sample collection, preservation and operational procedures of routine biochemical tests performed in clinical laboratory
Course Outcome	At the conclusion of the course, students will be: 1. Able to carry out sample collection & specimen labeling of clinical samples. 2. Differentiate between normal and diseased condition based on biochemical analysis 3. Get the importance of Glucose tolerance test for the investigation of glycemic disorder. 4. Perform the clinical biochemical analysis of biological fluid samples.

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

Applied Hematology - I Practical

Course Code	MLT268
Course Title	Applied Hematology - I Practical
Type of course	CC
L T P	0 0 3
Credits	1.5
Course prerequisite	10+2 Medical/ Dip in MLT/Lateral entry with 50% marks.
Course Objective (CO)	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.
Course Outcome	At the conclusion of the course, students will; 1. Familiar with the mechanism of ABO grouping and Rh typing. 2. Learn blood collection & preservation using different anticoagulants & preservative solutions 3. Able to investigate blood and perform special hematological tests

LIST OF PRACTICALS

1. Hb Estimation
   - Sahli‘s method
   - Cyanmetha haemoglobin method
   - Oxy -haemoglobin method
2. Total leukocyte count
3. Platelets count
4. Absolute Eosinophil count
5. Preparation of smear and staining with Giemsa and Leishman stain.
6. ESR (Wintrobe and Westergren method)
7. Packed cell volume(Macro&Micro)
8. Cytological examination of CSF and other body fluids
9. Physical and Microscopic examination of seminal fluid including sperm count
10. Perform normal DLC
11. Preparation of M/40 Calcium chloride
    - Brain thromboplastin and standardization
    - Cephalin
    - Adsorbed plasma
12. Perform BT, CT, Hess test, PT and APTT tests.

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

Immunology & Bacterial Serology Practical

Course Code	MLT272
Course Title	Immunology & Bacterial Serology Practical
Type of course	CC
L T P	0 0 3
Credits	1.5
Course prerequisite	10+2 Medical/ Dip in MLT/ Lateral entry with 50% marks.
Course Objective (CO)	The practical is aimed to make the students competent to isolate and identify fungi and viruses and do serological tests for various microbial infections.
Course Outcome	At the conclusion of the course, Students will: 1. Able to understand the basic laboratory practices in the field of immunoserology . 2. Learn the concepts of antigen- antibody interaction via various immunological techniques for the diagnosis of disease. 3. Learn the methods of preparation of buffers 4. Perform serological tests for the confirmation of diseases.

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 Immunoflourescence, Immunodiffusion, precipitation in agarose gel (ouchterlony), CCIEP, ELISA. SDS -PAGE and Western blotting.
4. Preparation of Phosphate buffers, Verinol buffer, ASO buffer, Richardson‘s buffer, Buffers of different pH and Molarity, Tris buffer, Standardization of cell concentration by Spectrophotometer.
5. Performance of Serological tests i.e.
   - Widal,
   - Brucella Tube Agglutination,
   - VDRL (including Antigen Preparation),
   - ASO (Anti-Streptolysin _O‘)
   - C-Reactive Protein (Latex agglutination)
   - Rheumatoid factor (RF) Latex agglutination

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

Histopathology - I

Course Code	MLT276
Course Title	Histopathology- I Practical
Type of course	Practical
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks
Course Objective (CO)	This part of the subject is aimed at exposing the students to the latest advancements and automation in the field of histopathology.
Course Outcome	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

Applications of Bacteriology Practical

Course Code	MLT280
Course Title	Applications of Bacteriology Practical
Type of course	SECC
L T P	0 0 2
Credits	1
Course prerequisite	10+2 Medical/ Dip in MLT/ Lateral entry with 50% marks.
Course Objective (CO)	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.
Course Outcome	At the conclusion of the course, Students will : 1. Understand the basic laboratory practices in the field ofbacteriology. 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 β-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.

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