GURU KASHI UNIVERSITY

B.VOC. in Medical Laboratory Technology

Session 2025-26

Faculty of Health and Allied Sciences

Graduates Attributes

The programme B.VOC. in Medical Laboratory Technology imparts to the students strong foundational and practical knowledge to perform essential diagnostic and laboratory procedures. Graduates develop skills in handling laboratory equipment, conducting tests with accuracy, maintaining quality control, and ensuring patient safety. They are trained to apply ethical practices, follow biomedical waste management protocols, and contribute effectively to healthcare teams by providing reliable laboratory data that supports patient care and clinical decision-making.

Programme Learning Outcomes: After Completion Of this Course Gradates will able to:

- Carry out routine and advanced laboratory investigations in hematology, microbiology, biochemistry, and pathology with accuracy and precision.
- Handle, calibrate, and maintain laboratory instruments and technologies following standard operating procedures.
- Implement quality control measures, adhere to biomedical waste management protocols, and ensure patient and staff safety in laboratory practices.
- Analyze test findings, prepare accurate reports, and support clinicians in disease diagnosis and treatment planning.
- Exhibit ethical responsibility, maintain confidentiality of patient data, and communicate effectively as part of a healthcare team.

Programme Structure

Semester 1st										
S. No.	**Course Code**	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Cr.**	**Int**	**Ext**	**Total Marks**
1	BMD101	Anatomy & Physiology	Core Based	2	0	0	2	15	35	50
2	BMD102	Basic Biochemistry	Core Based	2	0	0	2	15	35	50
3	BMD103	Fundamentals of Medical Laboratory Technology	Core Based	2	0	0	2	15	35	50
4	BMD104	Basic Microbiology	Core Based	2	0	0	2	15	35	50
5	BMD105	Entrepreneurship Setup & Lauch	Skill Based	0	0	4	2	15	35	50
6	BMD106	Anatomy & Physiology Practical	Skill Based	0	0	4	2	15	35	50
7	BMD107	Basic Biochemistry Practical	Skill Based	0	0	4	2	15	35	50
8	BMD108	Fundamentals of Medical Laboratory Technology Practical	Skill Based	0	0	4	2	15	35	50
9	BMD109	Basic Microbiology Practical	Skill Based	0	0	4	2	15	35	50
10	BMD110	Communication and Soft Skills	Compulsory Foundation	2	0	0	2	15	35	50
11	BMD111	Human Rights and Duties	Multi-Disciplinary	3	0	0	3	25	50	75
Total				**13**	**0**	**20**	**23**	**175**	**400**	**575**

Semester 2nd										
S. No.	**Course Code**	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Cr.**	**Int**	**Ext**	**Total Marks**
1	BMD201	Clinical Pathology	Core Based	2	0	0	2	15	35	50
2	BMD202	Hematology–I	Core Based	2	0	0	2	15	35	50
3	BMD203	Computer Applications in Healthcare	Core Based	2	0	0	2	15	35	50
4	BMD204	Immunology & Serology	Core Based	2	0	0	2	15	35	50
5	BMD205	Basic Instrumentation in MLT	Core Based	2	0	0	2	15	35	50
6	BMD206	Clinical Pathology Practical	Skill Based	0	0	4	2	15	35	50
7	BMD207	Hematology–I Practical	Skill Based	0	0	4	2	15	35	50
8	BMD208	Computer Applications in Healthcare Practical	Skill Based	0	0	4	2	15	35	50
9	BMD209	Immunology & Serology Practical	Skill Based	0	0	4	2	15	35	50
10	BMD210	Basic Instrumentation in MLT Practical	Skill Based	0	0	4	2	15	35	50
11	BMD211	Environmental Sciences	Compulsory Foundation	2	0	0	2	15	35	50
12	BMD212	First Aid	Value Added Courses	2	0	0	2	15	35	50

Total	**14**	**0**	**20**	**24**	**180**	**420**	**600**

Semester 3rd										
S. No.	**Course Code**	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Cr.**	**Int**	**Ext**	**Total Marks**
1	BMD301	Biomedical Waste Management	Core Based	2	0	0	2	15	35	50
2	BMD302	Hematology–II	Core Based	2	0	0	2	15	35	50
3	BMD303	Clinical Biochemistry–I	Core Based	2	0	0	2	15	35	50
4	BMD304	Clinical Microbiology–I	Core Based	2	0	0	2	15	35	50
5	BMD305	Histopathology–I	Core Based	2	0	0	2	15	35	50
6	BMD306	Biomedical Waste Management Practical	Skill Based	0	0	4	2	15	35	50
7	BMD307	Hematology–II Practical	Skill Based	0	0	4	2	15	35	50
8	BMD308	Clinical Biochemistry–I Practical	Skill Based	0	0	4	2	15	35	50
9	BMD309	Clinical Microbiology–I Practical	Skill Based	0	0	4	2	15	35	50
10	BMD310	Histopathology–I Practical	Skill Based	0	0	4	2	15	35	50
11	BMD311	Community Health & Primary Care	Compulsory Foundation	3	0	0	3	25	50	75
Total				**13**	**0**	**20**	**23**	**175**	**400**	**575**

Semester 4th										
S. No.	**Course Code**	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Cr.**	**Int**	**Ext**	**Total Marks**
1	BMD401	Parasitology	Core Based	2	0	0	2	15	35	50
2	BMD402	Clinical Biochemistry–II	Core Based	2	0	0	2	15	35	50
3	BMD403	Clinical Microbiology–II	Core Based	2	0	0	2	15	35	50
4	BMD404	Histopathology–II	Core Based	2	0	0	2	15	35	50
5	BMD405	Cytology & Cytogenetics	Core Based	2	0	0	2	15	35	50
6	BMD406	Research Methodology & Biostatistics	Core Based	2	0	0	2	15	35	50
7	BMD407	Parasitology Practical	Skill Based	0	0	4	2	15	35	50
8	BMD408	Clinical Biochemistry–II Practical	Skill Based	0	0	4	2	15	35	50
9	BMD409	Clinical Microbiology–II Practical	Skill Based	0	0	4	2	15	35	50
10	BMD410	Histopathology–II Practical	Skill Based	0	0	4	2	15	35	50
11	BMD411	Cytology & Cytogenetics Practical	Skill Based	0	0	4	2	15	35	50
12	BMD412	Research Methodology & Biostatistics Practical	Skill Based	0	0	4	2	15	35	50
Total				**12**	**0**	**24**	**24**	**180**	**420**	**600**

Semester 5th										
S. No.	**Course Code**	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Cr.**	**Int**	**Ext**	**Total Marks**
1	BMD501	Advanced Hematology & Blood Banking	Core Based	2	0	0	2	15	35	50
2	BMD502	Molecular Biology Techniques	Core Based	2	0	0	2	15	35	50
3	BMD503	Clinical Biochemistry–III (Special Tests)	Core Based	2	0	0	2	15	35	50
4	BMD504	Clinical Microbiology–III (Virology & Mycology)	Core Based	2	0	0	2	15	35	50
5	BMD505	Medical Ethics & Legal Issues	Multidisciplinary	3	0	0	3	25	50	75
6	BMD506	Diagnostic Molecular Biology	Core Based	2	0	0	2	15	35	50
7	BMD507	Advanced Hematology & Blood Banking Practical	Skill Based	0	0	4	2	15	35	50
8	BMD508	Molecular Biology Techniques Practical	Skill Based	0	0	4	2	15	35	50
9	BMD509	Clinical Biochemistry–III (Special Tests) Practical	Skill Based	0	0	4	2	15	35	50
10	BMD510	Clinical Microbiology–III (Virology & Mycology) Practical	Skill Based	0	0	4	2	15	35	50
11	BMD511	Diagnostic Molecular Biology Practical	Skill Based	0	0	4	2	15	35	50
Total				**13**	**0**	**20**	**23**	**175**	**400**	**575**

Semester 6th										
S. No.	**Course Code**	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Cr.**	**Int**	**Ext**	**Total Marks**
1	BMD601	Internship	Skill Based	0	0	40	20	150	350	500
Total				**0**	**0**	**40**	**20**	**150**	**350**	**500**
Grand Total				**65**	**0**	**144**	**137**	**1035**	**2390**	**3425**

Semester 1st

Course Title: Anatomy & Physiology	L	T	P	Cr
Course Code: BMD101	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the basic organization of the human body and levels of structural organization.
2. Describe the structure and functions of different organ systems.
3. Correlate normal anatomical structures with their physiological functions.
4. Apply the knowledge of anatomy and physiology to clinical and paramedical practices.
5. Demonstrate understanding of homeostatic mechanisms and their importance in health.

Course Contents

UNIT I (10 Hours)

- Introduction to human anatomy and physiology
- Levels of structural organization: cell, tissue, organ, system
- Anatomical terminology, body planes, cavities, positions
- Cell structure and function, cell division (mitosis, meiosis)
- Tissues: epithelial, connective, muscular, nervous

UNIT II (10 Hours)

- Skeletal system: classification, structure, functions, major bones and joints
- Muscular system: types of muscles, physiology of muscle contraction
- Cardiovascular system: heart structure, cardiac cycle, blood vessels, circulation
- Lymphatic system and immunity basics

UNIT III (5 Hours)

- Respiratory system: structure of respiratory tract, mechanism of breathing, lung volumes, transport of gases
- Digestive system: organs of digestion, process of digestion and absorption

UNIT IV (5 Hours)

- Nervous system: central and peripheral divisions, basic functions
- Endocrine system: major glands and hormones, role in homeostasis
- Urinary system: kidney structure, nephron, urine formation
- Reproductive system: male and female reproductive organs, menstrual cycle

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *TORTORA GJ, DERRICKSON B. Principles of Anatomy and Physiology. 15th ed. Hoboken: Wiley; 2017.*
- *MARIEB EN, HOEHN K. Human Anatomy & Physiology. 11th ed. New York: Pearson; 2018.*
- *ROSS MH, PAWLINA W. Histology: A Text and Atlas. 8th ed. Philadelphia: Wolters Kluwer; 2020.*
- *HALL JE. Guyton and Hall Textbook of Medical Physiology. 14th ed. Philadelphia: Elsevier; 2021.*
- *CHOUDHURY R, GHOSH S. Anatomy and Physiology for Nurses. 3rd ed. New Delhi: Jaypee Brothers; 2019.*
- *SNELL RS. Clinical Anatomy by Regions. 9th ed. Philadelphia: Wolters Kluwer; 2019.*

Course Title: Basic Biochemistry	L	T	P	Cr
Course Code: BMD102	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the chemical basis of life and biomolecules essential for cellular functions.
2. Describe the structure and functions of carbohydrates, lipids, proteins, nucleic acids, and enzymes.
3. Understand the principles of bioenergetics and metabolism.
4. Relate biochemical concepts to health, nutrition, and disease processes.
5. Apply fundamental biochemical knowledge in clinical and laboratory settings.

Course Contents

UNIT I (10 Hours)

- Introduction to Biochemistry: scope and significance
- Structure of atom, chemical bonds (ionic, covalent, hydrogen, Van der Waals, hydrophobic interactions)
- Water: properties, pH, buffers, and biological importance
- Carbohydrates: classification, structure, functions, and examples (glucose, glycogen, starch)

UNIT II (10 Hours)

- Proteins: amino acids, classification, peptide bond, protein structure (primary, secondary, tertiary, quaternary)
- Lipids: classification, structure, functions, and role in membrane formation
- Nucleic Acids: DNA, RNA – structure and functions, central dogma of molecular biology

UNIT III (5 Hours)

- Enzymes: properties, classification, mechanism of enzyme action, factors affecting enzyme activity

- Coenzymes and cofactors, enzyme inhibition (competitive and non-competitive)

UNIT IV (5 Hours)

- Bioenergetics: concept of free energy, ATP as energy currency
- Overview of metabolism: catabolism and anabolism
- Clinical correlations: diabetes, protein-energy malnutrition, enzyme deficiency disorders (brief introduction)

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *SATYANARAYANA U, CHAKRAPANI U. Biochemistry. 5th ed. New Delhi: Elsevier; 2021.*
- *VASUDEVAN DM, SREEKUMARI S, VYSHNAVI S. Textbook of Biochemistry for Medical Students. 9th ed. New Delhi: Jaypee Brothers; 2023.*
- *HARPER HA, MURRAY RK, GRANNER DK, RODWELL VW. Harper's Illustrated Biochemistry. 31st ed. New York: McGraw-Hill; 2018.*
- *NELSON DL, COX MM. Lehninger Principles of Biochemistry. 8th ed. New York: W.H. Freeman; 2021.*
- *JAIN JL, JAIN S, JAIN N. Fundamentals of Biochemistry. 9th ed. New Delhi: S. Chand; 2022.*

Course Title: Fundamentals of Medical Laboratory Technology	L	T	P	Cr
Course Code: BMD103	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the role and scope of medical laboratory technology in healthcare.
2. Understand laboratory organization, safety measures, and biomedical waste disposal.
3. Describe the principles of commonly used laboratory instruments.
4. Apply basic knowledge of specimen collection, handling, and preservation.
5. Demonstrate understanding of quality control and ethics in laboratory practice.

Course Contents

UNIT I (10 Hours)

- Introduction to Medical Laboratory Technology: scope and responsibilities of MLTs
- Organization of a clinical laboratory: departments (hematology, biochemistry, microbiology, pathology)
- Laboratory ethics, professional conduct, and patient safety
- Basic laboratory glassware, plasticware, and their care

UNIT II (10 Hours)

- Laboratory safety: chemical, biological, and physical hazards
- Biosafety levels and infection control practices
- Biomedical waste management: classification, segregation, disposal methods
- First aid and emergency management in laboratory accidents

UNIT III (5 Hours)

- Specimen collection: blood, urine, sputum, stool, body fluids
- Anticoagulants, preservatives, and transport of samples

- Pre-analytical errors and their prevention

UNIT IV (5 Hours)

- Introduction to laboratory instruments: microscope, centrifuge, balances, colorimeter, spectrophotometer, incubator, autoclave
- Calibration and maintenance of equipment
- Basics of quality control, accuracy, and precision in laboratory reporting

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *RANJNA C. Practical Clinical Biochemistry: Methods and Interpretations. 4th ed. New Delhi: Jaypee Brothers; 2019.*
- *ANANATANARAYAN R, PANIKER CKJ. Textbook of Microbiology. 10th ed. Hyderabad: Universities Press; 2017.*
- *DHIRAJ B, KHANNA P. Medical Laboratory Technology Methods and Interpretations. 2nd ed. New Delhi: Jaypee Brothers; 2021.*
- *TURGEON ML. Clinical Laboratory Science: Concepts, Procedures, and Clinical Applications. 8th ed. St. Louis: Elsevier; 2022.*
- *HENRY JB. Clinical Diagnosis and Management by Laboratory Methods. 23rd ed. Philadelphia: Elsevier; 2016.*

Course Title: Basic Microbiology	L	T	P	Cr
Course Code: BMD104	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the history, scope, and importance of microbiology in health sciences.
2. Describe the morphology, structure, and classification of microorganisms.
3. Understand microbial nutrition, growth, and methods of reproduction.
4. Demonstrate knowledge of sterilization, disinfection, and infection control practices.
5. Correlate the role of microbes in disease, immunity, and laboratory diagnosis.

Course Contents

UNIT I (10 Hours)

- History and scope of microbiology (contributions of Louis Pasteur, Robert Koch, etc.)
- Classification of microorganisms: bacteria, viruses, fungi, protozoa
- Microscopy: types of microscopes and applications in microbiology
- Structure and morphology of bacteria

UNIT II (10 Hours)

- Bacterial physiology: nutrition, growth curve, reproduction (binary fission, spore formation)
- Culture media: types (simple, enriched, selective, differential, transport)
- Cultivation techniques: aerobic, anaerobic methods
- Normal microbial flora of the human body

UNIT III (5 Hours)

- Sterilization and disinfection: physical methods (heat, filtration, radiation), chemical agents
- Aseptic techniques in laboratory and hospital settings

UNIT IV (5 Hours)

- Introduction to infection and immunity
- Pathogenic microorganisms (bacteria, viruses, fungi, protozoa) – general overview
- Basic principles of laboratory diagnosis of infectious diseases

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *ANANTHANARAYAN R, PANIKER CKJ. Textbook of Microbiology. 10th ed. Hyderabad: Universities Press; 2017.*
- *PRESCOTT LM, HARLEY JP, KLEIN DA. Microbiology. 10th ed. New York: McGraw-Hill; 2017.*
- *TORTORA GJ, FUNKE BR, CASE CL. Microbiology: An Introduction. 13th ed. New York: Pearson; 2021.*
- *PELCZAR MJ, CHAN ECS, KRIEG NR. Microbiology: Concepts and Applications. 5th ed. New York: McGraw-Hill; 2016.*
- *WILLEY JM, SHERWOOD L, WOOLVERTON CJ. Prescott's Principles of Microbiology. 10th ed. New York: McGraw-Hill; 2021.*

Course Title: Entrepreneurship Setup & Lauch	L	T	P	Cr.
Course Code: BMD105	0	0	4	2

Introduction: This semester lays the foundation for the learner to understand what entrepreneurship is, beyond just starting a business. It introduces key ideas like problem-solving, value creation, and self-awareness. The learner will begin exploring basic business concepts while discovering their own interests and strengths.

Learners Objective: After Completion of this course, the learner will be able to:

1. Understand the core concepts of entrepreneurship through relatable, real-life examples.
2. Begin to see themselves as problem-solvers and creators.
3. Learn about business paths and choose one to try based on interest or local fit.
4. Launch a micro-hustle (online or offline) to earn their first income.
5. Build confidence and self-belief by doing.

Outcome: By the end of this semester, learners will start a simple business activity, earn their first income, and build belief in their ability to do business.

Guiding Principles/Approach: This syllabus is built on principles of experiential learning, growth mindset development, and identity-first learning. Drawing from learning science and behavior design, the course shifts students from passive learning to active doing, where they try out small business activities in real contexts. The design helps students not just learn entrepreneurship, but begin to see themselves as entrepreneurs. Emphasis is placed on small wins, peer collaboration, and locally relevant opportunities to ensure learning feels achievable and connected to their realities. The curriculum focuses on conceptual understanding without heavy theory, combining

practical action, reflection, and collaboration. By making progress visible and success feel possible, it plants the seeds of self-reliance, initiative, and long-term motivation.

Semester Syllabus:

Format: 12 weeks, 4 hours/week | 2 credits

Revenue Target: ₹10,000

Week	Learning Goal	Measurable Outcome
1	Understand what entrepreneurship is and who can be an entrepreneur	Students define entrepreneurship in their own words and list 2 entrepreneurs from their local area or community
2	Connect personal identity to entrepreneurship (strengths, interests, struggles)	Students create a "value map" showing how a skill/interest/problem from their life could become a business opportunity
3	Learn about 5 business paths: content creation, dropshipping, cloud kitchen/food business, gig economy and local services	Students explore 1–2 examples from each domain and share one they're most curious to try and why
4	Choose a path and generate a basic business idea	Students write down a clear offer (what, for whom, why) and one way to reach their customer
5	Take first real action: message, post, pitch, or sell	Students reach out to or serve 1 real potential customer and record what happened
6	Reflect on first attempt and share with peers	Students share their result, a challenge faced, and one idea to improve next time

7	Improve and try again: aim for first ₹100	Students apply a change, try again, and aim to make their first ₹100 or get meaningful response
8	Learn how to identify and understand your target customer	Students talk to 2 potential customers or observe them and list 3 insights about their needs
9	Learn how to serve your target audience better	Students improve one part of their offer (product, delivery, messaging, or interaction) based on customer feedback or need
10	Explore core entrepreneurial values (resilience, honesty, effort)	Students reflect on 1 value they're building and show it in a business task or peer story
11	Focus on earning and staying consistent	Students complete a second earning task and track their consistency (e.g., same product or message for 3 days)
12	Reflect on earnings, grit, and how to keep going	Students record total earnings, one resilience moment, and one support system or habit they'll continue with

Weekly Component:

Component	Duration	Description
Learning Module	~1.5 hrs	• Introduces key concepts in a simple and engaging way • Includes, examples, and 1–2 interactive discussions or quizzes

Action Lab	~2 hrs	• Hands-on task on the weekly concept • Includes step-by-step guidance, templates, and worksheets • Ends with a submission (e.g., video, reflection, or proof of action)
Resources	Self-paced	• Supplementary videos, short readings, real- life stories, and tools to deepen understanding at their own pace

Evaluation Criteria

Evaluation Component	**Description**	**Weightage**
Weekly Task Completion	Timely submission of weekly tasks including reflections, activities, quizzes etc.	40%
Target Completion	Performance-based evaluation on hitting **revenue or profit targets** (e.g., generating ₹10,000 revenue)	30%
Final Project	A comprehensive project based on the semester's theme	30%

ourse Title: Anatomy & Physiology Practical	L	T	P	Cr.
Course Code: BMD106	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Identify major bones, muscles, and organs using models, charts, and specimens.
2. Demonstrate basic skills in physiological experiments related to blood pressure, pulse, and respiratory rate.
3. Perform simple hematological tests such as hemoglobin estimation and blood group determination.
4. Correlate anatomical structures with their physiological functions.
5. Apply theoretical knowledge of anatomy and physiology to practical and clinical settings.

Course Content

List of Practicals / Experiments (60 Hours)

- Study of human skeleton: identification of major bones and joints.
- Demonstration of body cavities and organ systems using charts and models.
- Identification of tissues under the microscope (epithelial, connective, muscular, nervous).
- Study of blood: collection of samples, precautions, anticoagulants.
- Hemoglobin estimation by Sahli's method.
- Determination of blood group and Rh typing.
- Measurement of blood pressure and pulse rate.
- Recording of respiratory rate and demonstration of spirometry.
- Measurement of body temperature and clinical correlations.
- Demonstration of reflexes (knee jerk, plantar reflex, pupillary reflex).
- Demonstration of compound microscope and its use in anatomy & physiology.

- Spotting of organs, tissues, and anatomical models (heart, kidney, lungs, brain, liver, etc.).

Suggested Readings

- *CHHATERJEE CC. Human Physiology. 13th ed. Kolkata: New Central Book Agency; 2018.*
- *TORTORA GJ, DERRICKSON B. Principles of Anatomy and Physiology. 15th ed. Hoboken: Wiley; 2017.*
- *MARIEB EN, HOEHN K. Human Anatomy & Physiology Laboratory Manual. 13th ed. New York: Pearson; 2019.*
- *HALL JE. Guyton and Hall Textbook of Medical Physiology. 14th ed. Philadelphia: Elsevier; 2021.*
- *SNELL RS. Clinical Anatomy by Regions. 9th ed. Philadelphia: Wolters Kluwer; 2019.*

Course Title: Basic Biochemistry Practical	L	T	P	Cr.
Course Code: BMD107	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate safe laboratory practices while handling chemicals and biological samples.
2. Perform qualitative tests for carbohydrates, proteins, and lipids.
3. Carry out quantitative estimation of biomolecules such as glucose and proteins.
4. Understand principles of pH, buffers, and their role in biological systems.
5. Apply biochemical techniques for clinical and diagnostic purposes.

Course Content

List of Practicals / Experiments (60 Hours)

- Introduction to biochemistry laboratory: safety rules, use of glassware, preparation of solutions.
- Preparation and standardization of buffer solutions; determination of pH using pH meter.
- Qualitative analysis of carbohydrates: Molisch's test, Benedict's test, Barfoed's test, Iodine test.
- Qualitative analysis of proteins: Biuret test, Xanthoproteic test, Millon's test, Ninhydrin test.
- Qualitative analysis of lipids: Solubility test, Sudan III test, Saponification test.
- Demonstration of enzyme activity (e.g., effect of temperature and pH on salivary amylase).
- Quantitative estimation of glucose by Benedict's method/Glucose oxidase method.
- Quantitative estimation of proteins by Biuret method/Lowry's method.
- Estimation of hemoglobin (biochemical principle).

- Demonstration of electrophoresis for proteins (if facilities available).
- Spotting of biochemical charts, normal and abnormal metabolic conditions.

Suggested Readings

- *SATYANARAYANA U, CHAKRAPANI U. Biochemistry. 5th ed. New Delhi: Elsevier; 2021.*
- *VASUDEVAN DM, SREEKUMARI S, VYSHNAVI S. Textbook of Biochemistry for Medical Students. 9th ed. New Delhi: Jaypee Brothers; 2023.*
- *JAIN JL, JAIN S, JAIN N. Fundamentals of Biochemistry. 9th ed. New Delhi: S. Chand; 2022.*
- *PLUMMER DT. An Introduction to Practical Biochemistry. 3rd ed. New Delhi: Tata McGraw-Hill; 2017.*
- *NELSON DL, COX MM. Lehninger Principles of Biochemistry. 8th ed. New York: W.H. Freeman; 2021.*

Course Title: Fundamentals of Medical Laboratory Technology Practical	L	T	P	Cr.
Course Code: BMD108	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Handle laboratory glassware, instruments, and specimens safely and efficiently.
2. Demonstrate basic skills in specimen collection, labeling, and preservation.
3. Apply methods of sterilization, disinfection, and biosafety in laboratory practice.
4. Perform preliminary clinical laboratory tests (urine, blood, and basic microscopy).
5. Maintain laboratory records, follow quality control, and practice ethical conduct.

Course Content

List of Practicals / Experiments (60 Hours)

- Introduction to clinical laboratory: layout, departments, safety rules, and ethics.
- Identification, handling, and cleaning of laboratory glassware and plasticware.
- Demonstration and use of laboratory instruments: Microscope, centrifuge, water bath, autoclave, hot air oven, incubator.
- Specimen collection and preservation: Venous and capillary blood, urine, sputum, stool.
- Preparation of peripheral blood smear and identification of normal blood cells.
- Estimation of hemoglobin (Sahli's method).
- Determination of packed cell volume (hematocrit).
- Determination of blood group and Rh typing.

- Routine urine analysis: Physical, chemical (Benedict's test, heat test, Rothera's test), and microscopic examination.
- Demonstration of sterilization and disinfection techniques.
- Hand washing techniques and use of personal protective equipment (PPE).
- Record keeping, labeling, and documentation of laboratory findings.

Suggested Readings

- *DHIRAJ B, KHANNA P. Medical Laboratory Technology Methods and Interpretations. 2nd ed. New Delhi: Jaypee Brothers; 2021.*
- *RANJNA C. Practical Clinical Biochemistry: Methods and Interpretations. 4th ed. New Delhi: Jaypee Brothers; 2019.*
- *TURGEON ML. Clinical Laboratory Science: Concepts, Procedures, and Clinical Applications. 8th ed. St. Louis: Elsevier; 2022.*
- *HENRY JB. Clinical Diagnosis and Management by Laboratory Methods. 23rd ed. Philadelphia: Elsevier; 2016.*
- *ANANTHANARAYAN R, PANIKER CKJ. Textbook of Microbiology. 10th ed. Hyderabad: Universities Press; 2017.*

Course Title: Basic Microbiology Practical	L	T	P	Cr.
Course Code: BMD109	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate safe handling of microorganisms, media, and laboratory equipment.
2. Prepare and sterilize culture media using aseptic techniques.
3. Perform staining methods to study morphology of bacteria and fungi.
4. Isolate, culture, and identify microorganisms using standard laboratory techniques.
5. Apply antimicrobial sensitivity testing and correlate with infection control practices.

Course Content

List of Practicals / Experiments (60 Hours)

- Introduction to microbiology laboratory: safety, biosafety levels, PPE, and waste disposal.
- Familiarization with laboratory instruments: microscope, autoclave, incubator, hot air oven, laminar air flow.
- Preparation and sterilization of culture media (nutrient agar, broth, selective and differential media).
- Aseptic techniques: handling of pipettes, inoculating loops, and sample transfer.
- Pure culture techniques: streak plate, spread plate, and pour plate methods.
- Simple staining and differential staining: Gram stain, Acid-fast stain.
- Negative staining and spore staining.
- Observation of fungal morphology using Lactophenol Cotton Blue mount.
- Motility tests: hanging drop method and semi-solid agar method.

- Bacterial growth curve demonstration.
- Antibiotic sensitivity testing (Kirby–Bauer disk diffusion method).
- Examination of prepared slides (bacteria, fungi, protozoa, helminths).

Suggested Readings

- *ANANTHANARAYAN R, PANIKER CKJ. Textbook of Microbiology. 10th ed. Hyderabad: Universities Press; 2017.*
- *PRESCOTT LM, HARLEY JP, KLEIN DA. Microbiology. 10th ed. New York: McGraw-Hill; 2017.*
- *TORTORA GJ, FUNKE BR, CASE CL. Microbiology: An Introduction. 13th ed. New York: Pearson; 2021.*
- *PELCZAR MJ, CHAN ECS, KRIEG NR. Microbiology: Concepts and Applications. 5th ed. New York: McGraw-Hill; 2016.*
- *WILLEY JM, SHERWOOD L, WOOLVERTON CJ. Prescott's Principles of Microbiology. 10th ed. New York: McGraw-Hill; 2021.*

Course Title: Communication and Soft Skills	L	T	P	Cr
Course Code: BMD110	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate effective verbal and non-verbal communication in academic and professional settings.
2. Apply principles of active listening, presentation, and interpersonal communication.
3. Develop soft skills such as teamwork, leadership, and conflict management.
4. Use written communication effectively in academic, workplace, and healthcare contexts.
5. Build self-confidence, professional etiquette, and workplace ethics.

Course Contents

UNIT I (10 Hours)

- Introduction to communication: definition, process, types, and barriers.
- Verbal and non-verbal communication.
- Essentials of effective communication in healthcare and professional settings.
- Listening skills and feedback mechanisms.

UNIT II (10 Hours)

- Written communication: email etiquette, report writing, resume preparation, formal letters.
- Oral communication: public speaking, presentations, group discussions.
- Telephone and virtual communication skills.

UNIT III (5 Hours)

- Soft skills for workplace success: adaptability, time management, decision-making.
- Teamwork and leadership: roles, styles, and collaboration in healthcare teams.

UNIT IV (5 Hours)

- Professional ethics, grooming, and workplace etiquette.
- Conflict management and negotiation skills.
- Personality development and confidence building.

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings (Vancouver Style)

- *BISWAS A. Communication Skills for Professionals. 3rd ed. New Delhi: PHI Learning; 2019.*
- *BOYER L. Soft Skills for the Workplace. 2nd ed. Boston: Cengage Learning; 2021.*
- *SHARMA RC, MOHAN K. Business Correspondence and Report Writing. 5th ed. New Delhi: McGraw-Hill; 2019.*
- *PEASE A, PEASE B. The Definitive Book of Body Language. London: Orion; 2016.*
- *KATZ J. Communication Skills Handbook: Tools, Techniques, and Applications. 4th ed. New York: Routledge; 2020.*

Course Title: Human Rights and Duties	L	T	P	Cr
Course Code: BMD111	3	0	0	3

Total Hours 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the concept, origin, and importance of human rights and duties in a democratic society.
2. Understand constitutional provisions relating to fundamental rights and duties in India.
3. Analyze the role of international organizations, conventions, and declarations on human rights.
4. Recognize the challenges, violations, and mechanisms for the protection of human rights.
5. Apply human rights principles in healthcare, workplace, and community practices.

Course Contents

UNIT I (15 Hours)

- Concept, definition, and evolution of human rights.
- Classification of rights: civil, political, economic, social, and cultural rights.
- Importance of human rights in a democratic and multicultural society.
- Introduction to Fundamental Duties.

UNIT II (10 Hours)

- **Human rights in the Indian Constitution: Fundamental Rights and Directive Principles of State Policy.**
- **Fundamental Duties: scope, importance, and implementation.**
- **Role of judiciary in protection of human rights.**

UNIT III (10 Hours)

- Universal Declaration of Human Rights (1948).

- International Covenant on Civil and Political Rights (ICCPR).
- International Covenant on Economic, Social and Cultural Rights (ICESCR).
- Role of United Nations and National Human Rights Commission (NHRC).

UNIT IV (10 Hours)

- Human rights and vulnerable groups: women, children, minorities, disabled, refugees.
- Human rights issues in healthcare and workplace settings.
- Human rights violations and redressal mechanisms.
- Role of NGOs and civil society in human rights promotion.

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings (Vancouver Style)

- *MEHTA P. Human Rights under the Indian Constitution. 3rd ed. New Delhi: Deep & Deep Publications; 2020.*
- *PATHAK RS. Introduction to Human Rights and Duties. 2nd ed. New Delhi: Pearson; 2019.*
- *SAHU SC. Human Rights in India. New Delhi: Sage Publications; 2018.*
- *JAGANNATH M. Fundamental Rights and Duties in India. Hyderabad: Orient Blackswan; 2017.*
- *UNITED NATIONS. The Universal Declaration of Human Rights. New York: UN Publications; 2015.*

Semester 2nd

Course Title: Clinical Pathology	L	T	P	Cr
Course Code: BMD201	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the principles and scope of clinical pathology.
2. Describe common laboratory tests used for blood, urine, and body fluid examination.
3. Interpret basic pathological findings in relation to clinical conditions.
4. Correlate laboratory results with underlying disease processes.
5. Demonstrate knowledge of quality control and biosafety in clinical laboratories.

Course Contents

UNIT I (10 Hours)

- Introduction to Clinical Pathology: scope and importance
- Specimen collection, preservation, and transport
- Quality assurance in laboratory practice
- Hematology:
  - Composition and function of blood
  - Complete blood count (CBC): methods and interpretation
  - Peripheral smear examination

UNIT II (10 Hours)

- Urine analysis:
  - Physical, chemical, and microscopic examination
  - Abnormal constituents of urine (proteinuria, glycosuria, hematuria, etc.)
- Examination of body fluids (CSF, pleural, pericardial, ascitic, synovial): Collection, appearance, routine tests, and clinical significance

UNIT III (5 Hours)

- Clinical biochemistry overview: Blood glucose, urea, creatinine, liver function tests, lipid profile

- Correlation of biochemical tests with disease conditions

UNIT IV (5 Hours)

- Clinical relevance of pathological tests in diagnosis and patient management
- Biosafety measures and biomedical waste management in pathology labs

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings (Vancouver Style)

- *ROBBINS SL, COTRAN RS, KUMAR V. Robbins and Cotran Pathologic Basis of Disease. 10th ed. Philadelphia: Elsevier; 2020.*
- *DUTTA DC. Textbook of Pathology. 8th ed. New Delhi: Jaypee Brothers Medical Publishers; 2022.*
- *HARSH MOHAN. Textbook of Pathology. 8th ed. New Delhi: Jaypee Brothers Medical Publishers; 2019.*
- *HENRY JB. Clinical Diagnosis and Management by Laboratory Methods. 23rd ed. Philadelphia: Elsevier; 2017.*
- *TIETZ NW. Fundamentals of Clinical Chemistry and Molecular Diagnostics. 8th ed. St. Louis: Elsevier; 2019.*

Course Title: Hematology–I	L	T	P	Cr
Course Code: BMD202	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Describe the composition and functions of blood and its cellular elements.
2. Explain hematopoiesis and normal development of blood cells.
3. Identify and classify common hematological disorders.
4. Demonstrate knowledge of laboratory tests used in hematology.
5. Correlate hematological findings with clinical conditions.

Course Contents

UNIT I (10 Hours)

- Introduction to hematology and its scope
- Composition and functions of blood
- Hematopoiesis: sites, stages, and regulation
- Structure and function of red blood cells (RBCs)
- Hemoglobin: synthesis, types, and functions

UNIT II (10 Hours)

- White blood cells (WBCs): types, structure, and functions
- Platelets: morphology, functions, and disorders of platelet number/function
- Blood groups: ABO and Rh system, significance in transfusion
- Erythrocyte sedimentation rate (ESR), packed cell volume (PCV), and hematocrit

UNIT III (5 Hours)

- Anemia: definition, classification, and general features
- Polycythemia: types and clinical relevance
- Basic introduction to hemoglobinopathies (thalassemia, sickle cell disease)

UNIT IV (5 Hours)

- Leukocytosis, leukopenia, and differential leukocyte count (DLC)

- Clinical significance of common hematological investigations
- Principles of biosafety and quality control in hematology laboratory

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings (Vancouver Style)

- *HOFFBRAND AV, MOSS PAH. Essential Haematology. 8th ed. Oxford: Wiley-Blackwell; 2019.*
- *HOFFBRAND AV, HIGGS DR, KEELING DM, MEHTA AB. Postgraduate Haematology. 7th ed. Oxford: Wiley-Blackwell; 2016.*
- *RODAK BF, CARR JH. Clinical Hematology Atlas. 6th ed. Philadelphia: Elsevier; 2020.*
- *HARMENING DM. Clinical Hematology and Fundamentals of Hemostasis. 6th ed. Philadelphia: F.A. Davis Company; 2019.*
- *TURGEON ML. Clinical Hematology: Theory and Procedures. 6th ed. Philadelphia: Wolters Kluwer; 2018.*

Course Title: Computer Applications in Healthcare	L	T	P	Cr
Course Code: BMD203	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the role and importance of computers in healthcare.
2. Use basic computer applications (word processing, spreadsheets, presentations) relevant to healthcare documentation.
3. Describe electronic health records (EHRs) and hospital information systems.
4. Apply computer-based tools for medical data analysis, imaging, and telemedicine.
5. Demonstrate awareness of cybersecurity and ethical issues in healthcare informatics.

Course Contents

UNIT I (10 Hours)

- Basics of computers: hardware, software, input/output devices
- Operating systems and file management
- MS Office applications in healthcare:
  - Word processing for medical documentation
  - Spreadsheets for data entry and analysis
  - Presentations for health education and reporting

UNIT II (10 Hours)

- Hospital Information Systems (HIS)
- Laboratory Information Systems (LIS)
- Radiology Information Systems (RIS) and PACS (Picture Archiving and Communication Systems)
- Electronic Health Records (EHRs): structure, functions, and benefits

UNIT III (5 Hours)

- Telemedicine: concepts, applications, and benefits
- Use of mobile applications in patient care and health education
- Introduction to artificial intelligence in healthcare

UNIT IV (5 Hours)

- Cybersecurity in healthcare: data privacy, confidentiality, and ethical issues
- Legal aspects of digital health records
- Future trends in healthcare IT and digital health innovations

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings (Vancouver Style)

- *SHORTLIFFE EH, CIMINO JJ. Biomedical Informatics: Computer Applications in Health Care and Biomedicine. 5th ed. New York: Springer; 2021.*
- *HOBO J. Health Information Systems: Concepts, Methodologies, Tools, and Applications. IGI Global; 2018.*
- *KULKARNI RV, KULKARNI R. Introduction to Health Informatics. New Delhi: Elsevier; 2020.*
- *COIERA E. Guide to Health Informatics. 3rd ed. Boca Raton: CRC Press; 2015.*
- *LEHNE RA, ADAMS JY. Electronic Health Records for Allied Health Careers. 2nd ed. Boston: Cengage Learning; 2019.*

Course Title: Immunology & Serology	L	T	P	Cr
Course Code: BMD204	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Describe the basic concepts and components of the immune system.
2. Differentiate between innate and adaptive immunity.
3. Explain the principles and clinical applications of antigen–antibody reactions.
4. Perform and interpret common serological tests.
5. Correlate immunological mechanisms with disease processes and diagnostic methods.

Course Contents

UNIT I (10 Hours)

- Introduction to immunology: scope and significance
- Cells and organs of the immune system
- Innate immunity: barriers, phagocytosis, complement system
- Adaptive immunity: humoral and cell-mediated responses

UNIT II (10 Hours)

- Antigens: types, properties, and determinants
- Antibodies: structure, types, and functions
- Major Histocompatibility Complex (MHC)
- Cytokines and their role in immune regulation
- Hypersensitivity: types and mechanisms (overview)

UNIT III (5 Hours)

- Antigen–antibody interactions: principles and applications
- Serological techniques:
  - Agglutination
  - Precipitation
  - Complement fixation test
  - Neutralization test

UNIT IV (5 Hours)

- Advanced serological techniques: ELISA, Western blot, RIA, Immunofluorescence
- Immunology of infections, autoimmunity, and immunodeficiency (overview)
- Clinical applications of immunology in diagnosis and patient management

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings (Vancouver Style)

- *ABBAS AK, LICHTMAN AH, PILLAI S. Cellular and Molecular Immunology. 10th ed. Philadelphia: Elsevier; 2021.*
- *MALE D, BROSTOFF J, ROTH DB, ROITT I. Immunology. 9th ed. Elsevier; 2019.*
- *PARIJKH R, PARIJKH C. Textbook of Medical Laboratory Technology. 3rd ed. New Delhi: CBS Publishers; 2021.*
- *KINDT TJ, GOLDSBY RA, OSBORNE BA, KUBY J. Kuby Immunology. 7thed. New York: W.H. Freeman and Company; 2013.*
- *TURGEON ML. Immunology & Serology in Laboratory Medicine. 6th ed. St. Louis: Elsevier; 2018.*

Course Title: Basic Instrumentation in MLT	L	T	P	Cr
Course Code: BMD205	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Describe the working principles of basic laboratory instruments used in Medical Laboratory Technology (MLT).
2. Operate, maintain, and calibrate common laboratory equipment.
3. Apply knowledge of instrumentation in hematology, biochemistry, and microbiology labs.
4. Follow safety guidelines and quality control measures during instrument use.
5. Troubleshoot common errors in the functioning of laboratory instruments.

Course Contents

UNIT I (10 Hours)

- Introduction to laboratory instrumentation
- Basic principles of optics and photometry
- Microscope: types, parts, principle, and applications in MLT
- Centrifuge: principles, types, care, and maintenance

UNIT II (10 Hours)

- Colorimeter: principle, operation, and clinical applications
- Spectrophotometer: principle, working, and significance in clinical biochemistry
- pH meter: principle, calibration, and uses
- Flame photometer: principle and applications

UNIT III (5 Hours)

- Electrolyte analyzers: principle and clinical importance
- Automated hematology analyzers: overview and working principles
- Blood gas analyzers: introduction and applications

UNIT IV (5 Hours)

- Laboratory balances and pipettes: types, use, and calibration

- Safety measures in handling instruments
- Quality assurance and preventive maintenance of laboratory equipment

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings (Vancouver Style)

- *CLARK M, ANTHONY C. Clinical Laboratory Instrumentation. 2nd ed. Philadelphia: F.A. Davis; 2018.*
- *BASAK S, DAS S, PAUL R. Textbook of Medical Laboratory Technology. 2nd ed. New Delhi: CBS Publishers; 2021.*
- *BISHOP ML, FODY EP, SCHOEFF LE. Clinical Chemistry: Principles, Techniques, and Correlations. 8th ed. Philadelphia: Wolters Kluwer; 2018.*
- *TURGEON ML. Clinical Laboratory Science: Concepts, Procedures, and Clinical Applications. 9th ed. St. Louis: Elsevier; 2022.*
- *CLINICAL AND LABORATORY STANDARDS INSTITUTE (CLSI). Laboratory Instrumentation and Quality Assurance Guidelines. Wayne: CLSI; 2020.*

Course Title: Clinical Pathology Practical	L	T	P	Cr.
Course Code: BMD206	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Collect, preserve, and process clinical specimens (blood, urine, and body fluids) safely.
2. Perform routine hematology, urine, and body fluid tests.
3. Identify normal and abnormal findings in laboratory investigations.
4. Apply biosafety and waste disposal protocols in the clinical pathology laboratory.
5. Correlate laboratory results with common clinical conditions.

Course Content

List of Practicals / Experiments (60 Hours):

- Collection and preservation of blood and urine samples.
- Preparation of peripheral blood smear and staining (Leishman/Giemsa).
- Estimation of hemoglobin (Sahli's/Drabkin's method).
- Determination of RBC count using hemocytometer.
- Determination of WBC count (total and differential).
- Estimation of packed cell volume (PCV) and erythrocyte sedimentation rate (ESR).
- Routine urine examination: physical, chemical (sugar, protein, ketone), and microscopic analysis.
- Detection of abnormal urinary constituents (albumin, glucose, bile salts, bile pigments, ketone bodies, blood).
- Examination of body fluids (CSF, pleural, ascitic): appearance and routine biochemical/ microscopic analysis (demonstration).
- Quality control procedures in clinical pathology laboratory.
- Biomedical waste management in pathology laboratory.

Suggested Readings

- *HARSH MOHAN. Textbook of Pathology. 8th ed. New Delhi: Jaypee Brothers Medical Publishers; 2019.*
- *DUTTA DC. Textbook of Pathology. 8th ed. New Delhi: Jaypee Brothers Medical Publishers; 2022.*
- *PARIJKH R, PARIJKH C. Textbook of Medical Laboratory Technology. 3rd ed. New Delhi: CBS Publishers; 2021.*
- *HENRY JB. Clinical Diagnosis and Management by Laboratory Methods. 23rd ed. Philadelphia: Elsevier; 2017.*
- *TURGEON ML. Clinical Laboratory Science: Concepts, Procedures, and Clinical Applications. 9th ed. St. Louis: Elsevier; 2022.*

Course Title: Hematology I Practical	L	T	P	Cr.
Course Code: BMD207	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Collect and handle blood samples safely and effectively.
2. Perform routine hematological investigations using manual methods.
3. Prepare and stain peripheral blood smears for microscopic study.
4. Differentiate and identify normal blood cells microscopically.
5. Apply quality control and biosafety measures in the hematology laboratory.

Course Content

List of Practicals / Experiments (60 Hours):

- Collection of blood samples: venipuncture and capillary methods (demonstration).
- Study of anticoagulants used in hematology.
- Estimation of hemoglobin (Sahli's/Drabkin's method).
- Determination of red blood cell (RBC) count using hemocytometer.
- Determination of total white blood cell (WBC) count.
- Preparation of peripheral blood smear and staining (Leishman's/Giemsa stain).
- Differential leukocyte count (DLC).
- Determination of packed cell volume (PCV).
- Erythrocyte sedimentation rate (ESR) – Wintrobe and Westergren methods.
- Determination of absolute eosinophil count.
- Platelet count (manual method).
- Calculation and interpretation of red cell indices (MCV, MCH, MCHC).
- Identification of normal blood cells under microscope.
- Demonstration of quality control procedures in hematology.
- Biosafety measures and biomedical waste disposal in hematology lab.

Suggested Readings

- *HOFFBRAND AV, MOSS PAH. Essential Haematology. 8th ed. Oxford: Wiley-Blackwell; 2019.*
- *RODAK BF, CARR JH. Clinical Hematology Atlas. 6th ed. Philadelphia: Elsevier; 2020.*
- *HARMENING DM. Clinical Hematology and Fundamentals of Hemostasis. 6th ed. Philadelphia: F.A. Davis Company; 2019.*
- *TURGEON ML. Clinical Hematology: Theory and Procedures. 6th ed. Philadelphia: Wolters Kluwer; 2018.*
- *PARIJKH R, PARIJKH C. Textbook of Medical Laboratory Technology. 3rd ed. New Delhi: CBS Publishers; 2021.*

Course Title: Computer Applications in Healthcare Practical	L	T	P	Cr.
Course Code: BMD208	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate proficiency in using MS Office applications for healthcare documentation and reporting.
2. Apply spreadsheets for data entry, analysis, and interpretation of healthcare-related data.
3. Prepare presentations for patient education and professional communication.
4. Navigate basic features of Hospital Information Systems (HIS) and Electronic Health Records (EHRs).
5. Implement data security and safe digital practices in healthcare settings.

Course Content

List of Practicals / Experiments (60 Hours):

- Introduction to computer hardware, software, and operating systems.
- File management: creating, saving, retrieving, and organizing files.
- MS Word:
  - Preparing clinical case reports and discharge summaries
  - Designing patient information leaflets and health education material
- MS Excel:
  - Creating spreadsheets for laboratory data entry
  - Performing basic calculations (averages, percentages, trends)
  - Using formulas for statistical analysis (mean, median, standard deviation)
  - Preparing graphs and charts for medical data representation
- MS PowerPoint:
  - Creating case presentations for seminars
  - Designing patient awareness presentations

- Internet applications in healthcare:
  - Literature search for medical research
  - Online resources for patient education
- Introduction to Hospital Information Systems (HIS) and Laboratory Information Systems (LIS) (demonstration).
- Demonstration of Electronic Health Records (EHR) – basic data entry and retrieval.
- Introduction to telemedicine software platforms (demonstration).
- Cybersecurity in healthcare: safe browsing, password management, and data confidentiality practices.

Suggested Readings

- *SHORTLIFFE EH, CIMINO JJ. Biomedical Informatics: Computer Applications in Health Care and Biomedicine. 5th ed. New York: Springer; 2021.*
- *KULKARNI RV, KULKARNI R. Introduction to Health Informatics. New Delhi: Elsevier; 2020.*
- *COIERA E. Guide to Health Informatics. 3rd ed. Boca Raton: CRC Press; 2015.*
- *LEHNE RA, ADAMS JY. Electronic Health Records for Allied Health Careers. 2nd ed. Boston: Cengage Learning; 2019.*
- *HOBO J. Health Information Systems: Concepts, Methodologies, Tools, and Applications. IGI Global; 2018.*

Course Title: Immunology & Serology Practical	L	T	P	Cr.
Course Code: BMD209	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Collect and handle serum samples safely for immunological and serological testing.
2. Perform basic antigen–antibody reaction–based laboratory tests.
3. Interpret the results of common serological tests used in diagnosis.
4. Apply biosafety and quality control principles in immunology and serology laboratories.
5. Correlate serological test results with clinical conditions.

Course Content

List of Practicals / Experiments (60 Hours):

- Collection, separation, and preservation of serum samples.
- Demonstration of antigen–antibody reactions (agglutination, precipitation).
- Widal test for typhoid fever.
- VDRL test for syphilis.
- C-reactive protein (CRP) test.
- Rheumatoid arthritis (RA) factor test.
- ASO (Antistreptolysin O) test.
- Blood grouping and Rh typing (as immuno-serological exercise).
- Enzyme-linked immunosorbent assay (ELISA) – principle and demonstration.
- Immunodiffusion and immunoelectrophoresis (demonstration).
- Detection of hepatitis B surface antigen (HBsAg) – rapid card method.
- HIV antibody detection (demonstration/rapid kit method).
- Biosafety measures and biomedical waste management in serology labs.
- Internal quality control in immunology and serology.

Suggested Readings

- *ABBAS AK, LICHTMAN AH, PILLAI S. Cellular and Molecular Immunology. 10th ed. Philadelphia: Elsevier; 2021.*
- *TURGEON ML. Immunology & Serology in Laboratory Medicine. 6th ed. St. Louis: Elsevier; 2018.*
- *ROITT I, BROSTOFF J, MALE D. Immunology. 9th ed. London: Elsevier; 2019.*
- *PARIJKH R, PARIJKH C. Textbook of Medical Laboratory Technology. 3rd ed. New Delhi: CBS Publishers; 2021.*
- *KINDT TJ, GOLDSBY RA, OSBORNE BA, KUBY J. Kuby Immunology. 7th ed. New York: W.H. Freeman and Company; 2013.*

Course Title: Basic Instrumentation in MLT Practical	L	T	P	Cr.
Course Code: BMD210	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Identify, handle, and operate basic laboratory instruments used in Medical Laboratory Technology.
2. Demonstrate calibration and routine maintenance of essential instruments.
3. Apply knowledge of instrumentation to hematology, biochemistry, and microbiology investigations.
4. Follow biosafety standards and quality control while handling equipment.
5. Troubleshoot common problems encountered in laboratory instruments.

Course Content

List of Practicals / Experiments (60 Hours):

- Demonstration of common laboratory glassware and plasticware.
- Study and handling of laboratory balances and micropipettes.
- Proper use, cleaning, and maintenance of the compound microscope.
- Operation and applications of the centrifuge (clinical and refrigerated).
- Calibration and use of the colorimeter.
- Operation and interpretation using spectrophotometer.
- Determination of pH using pH meter (calibration and measurement).
- Demonstration of flame photometer: estimation of sodium and potassium.
- Introduction to automated hematology analyzer (demonstration).
- Use of electrolyte analyzer – principle and demonstration.
- Blood gas analyzer – principle and demonstration.
- Handling, safety, and preventive maintenance of laboratory instruments.

- Demonstration of laboratory safety equipment (biosafety cabinet, autoclave).
- Internal quality control in laboratory instrumentation.

Suggested Readings

- *BASAK S, DAS S, PAUL R. Textbook of Medical Laboratory Technology. 2nd ed. New Delhi: CBS Publishers; 2021.*
- *BISHOP ML, FODY EP, SCHOEFF LE. Clinical Chemistry: Principles, Techniques, and Correlations. 8th ed. Philadelphia: Wolters Kluwer; 2018.*
- *TURGEON ML. Clinical Laboratory Science: Concepts, Procedures, and Clinical Applications. 9th ed. St. Louis: Elsevier; 2022.*
- *CLARK M, ANTHONY C. Clinical Laboratory Instrumentation. 2nd ed. Philadelphia: F.A. Davis; 2018.*
- *CLINICAL AND LABORATORY STANDARDS INSTITUTE (CLSI). Laboratory Instrumentation and Quality Assurance Guidelines. Wayne: CLSI; 2020.*

Course Title: Environmental Sciences	L	T	P	Cr
Course Code: BMD211	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the structure and functions of ecosystems.
2. Identify natural resources and discuss sustainable management practices.
3. Analyze the causes and consequences of environmental pollution.
4. Understand the impact of population growth on the environment and public health.
5. Apply principles of environmental conservation and sustainability in healthcare and society.

Course Contents

UNIT I (10 Hours)

- Introduction to environment and ecosystems
- Structure and function of ecosystems: producers, consumers, decomposers
- Types of ecosystems: forest, grassland, desert, aquatic
- Biodiversity and its conservation: in-situ and ex-situ strategies

UNIT II (10 Hours)

- Natural resources: renewable and non-renewable
- Forest resources: use, overexploitation, deforestation
- Water resources: utilization, conflicts, water conservation
- Energy resources: conventional and non-conventional sources
- Sustainable development and environmental ethics

UNIT III (5 Hours)

- Environmental pollution: causes, effects, and control of air, water, soil, and noise pollution
- Solid waste management: biomedical waste and its safe disposal
- Role of healthcare professionals in pollution control

UNIT IV (5 Hours)

- Population and environment: population growth, human health, and urbanization
- Global environmental issues: climate change, ozone depletion, global warming
- Disaster management: natural and man-made disasters, mitigation strategies
- Role of information technology in environment and health

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings (Vancouver Style)

- *KAUSHIK A, KAUSHIK CP. Environmental Studies. 5th ed. New Delhi: New Age International Publishers; 2019.*
- *AGARWAL KC. Environmental Biology. 5th ed. New Delhi: Nidhi Publishers; 2020.*
- *ODUM EP, BARRETT GW. Fundamentals of Ecology. 5th ed. Belmont: Cengage Learning; 2017.*
- *RAO MN, DUTTA AK. Wastewater Treatment and Pollution Control. 3rd ed. New Delhi: Oxford & IBH; 2018.*
- *CLARK RS. Marine Pollution. 5th ed. Oxford: Clarendon Press; 2018.*

Course Title: First Aid	L	T	P	Cr
Course Code: BMD212	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the basic principles and importance of first aid in emergencies.
2. Demonstrate essential first aid skills for common injuries and accidents.
3. Provide immediate care in medical emergencies until professional help arrives.
4. Apply cardiopulmonary resuscitation (CPR) and basic life support (BLS) techniques.
5. Practice safety measures and prevention strategies to reduce accidents and injuries.

Course Contents

UNIT I (10 Hours)

- Introduction to first aid: definition, aims, and principles
- Role of a first aider and medico-legal aspects
- First aid kit: contents and uses
- Patient assessment: ABC (Airway, Breathing, Circulation) and primary survey

UNIT II (10 Hours)

- First aid for bleeding and shock
- First aid for burns, scalds, and frostbite
- First aid for fractures, dislocations, and sprains
- Bandaging techniques and immobilization
- First aid in poisoning (general principles)

UNIT III (5 Hours)

- First aid in common medical emergencies: fainting, seizures, asthma, diabetic emergencies, cardiac arrest
- Drowning, choking, and suffocation: recognition and management

UNIT IV (5 Hours)

- Cardiopulmonary resuscitation (CPR) and Basic Life Support (BLS) (theory and demonstration)
- Transport of injured patients and triage principles
- Disaster preparedness and role of first aid in mass casualties

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *AMERICAN RED CROSS. First Aid/CPR/AED Participant's Manual. 4th ed. Washington DC: StayWell Publishing; 2016.*
- *AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS (AAOS). First Aid, CPR, and AED Standard. 7th ed. Burlington: Jones & Bartlett Learning; 2021.*
- *ST JOHN AMBULANCE, ST ANDREW'S FIRST AID, BRITISH RED CROSS. First Aid Manual. 11th ed. London: Dorling Kindersley; 2021.*
- *TINTINALLI JE, STAPCZYNSKI JS, MA OJ. Tintinalli's Emergency Medicine: A Comprehensive Study Guide. 9th ed. New York: McGraw Hill; 2020.*
- *WHO. Emergency and Essential Surgical Care: First Aid and Trauma Care. Geneva: World Health Organization; 2018.*

Semester 3rd

Course Title: Biomedical Waste Management	L	T	P	Cr
Course Code: BMD301	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Define biomedical waste and its sources in healthcare facilities.
2. Classify different categories of biomedical waste as per national guidelines.
3. Explain the hazards and health risks associated with improper waste disposal.
4. Describe the methods of segregation, collection, transport, treatment, and disposal.
5. Apply biomedical waste management rules and regulations in healthcare settings.

Course Contents

UNIT I (10 Hours)

- Introduction to Biomedical Waste
- Definition, sources, and types of biomedical waste
- Need for biomedical waste management in healthcare facilities
- Public health hazards of improper waste management

UNIT II (10 Hours)

- Categories of biomedical waste (as per Biomedical Waste Management Rules, Govt. of India)
- Color coding and segregation of waste
- Collection, storage, and transportation methods
- Role of healthcare workers in waste management

UNIT III (5 Hours)

- Treatment and disposal methods: incineration, autoclaving, microwaving, chemical disinfection, deep burial, shredding
- Merits and demerits of different disposal techniques

UNIT IV (5 Hours)

- Biomedical Waste Management Rules (2016 and amendments)
- Roles and responsibilities of hospitals, administrators, and waste handlers
- Awareness, training, and safety measures for healthcare personnel

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *PARK K. Park's Textbook of Preventive and Social Medicine. 27th ed. Jabalpur: Banarsidas Bhanot; 2023.*
- *GOVT. OF INDIA. Biomedical Waste Management Rules, 2016 and Amendments. Ministry of Environment, Forest and Climate Change. New Delhi; 2016.*
- *WHO. Safe management of wastes from health-care activities. 2nd ed. Geneva: World Health Organization; 2014.*
- *VESLEY D, Waste Management in Healthcare Facilities. 1st ed. New Delhi: Jaypee Brothers; 2020.*
- *ALLEN A, Hospital Waste Management: Principles and Guidelines. New York: Springer; 2019.*

Course Title: Hematology–II	L	T	P	Cr
Course Code: BMD302	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the pathophysiology and laboratory findings of common anemias.
2. Describe the classification, clinical features, and laboratory diagnosis of leukemia and lymphoma.
3. Interpret hematological findings in hemolytic disorders and bleeding disorders.
4. Perform and evaluate special hematological tests for diagnosis and monitoring.
5. Correlate laboratory findings with clinical conditions for effective patient care.

Course Contents

UNIT I (10 Hours)

- Anemias: classification and pathogenesis
- Iron deficiency anemia, megaloblastic anemia, hemolytic anemia, aplastic anemia
- Laboratory diagnosis and interpretation of anemia profiles

UNIT II (10 Hours)

- Leukemias: acute and chronic, myeloid and lymphoid
- Myeloproliferative and lymphoproliferative disorders
- Lymphomas and plasma cell dyscrasias
- Diagnostic techniques: peripheral smear, bone marrow aspiration, cytochemistry

UNIT III (5 Hours)

- Hemolytic disorders: hereditary spherocytosis, G6PD deficiency, sickle cell anemia, thalassemia
- Hemoglobinopathies: laboratory diagnosis and interpretation

UNIT IV (5 Hours)

- Hemostasis and coagulation disorders: hemophilia, von Willebrand disease, DIC
- Laboratory evaluation of bleeding disorders (clotting time, PT, APTT, fibrinogen assay, platelet function tests)
- Recent advances in hematology (flow cytometry, immunophenotyping, molecular tests)

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *HOFFBRAND AV, MOSS PAH. Essential Haematology. 8th ed. Oxford: Wiley-Blackwell; 2019.*
- *GREER JP, ARBER DA, GLADER B, et al. Wintrobe's Clinical Hematology. 14th ed. Philadelphia: Wolters Kluwer; 2018.*
- *HARMENING DM. Clinical Hematology and Fundamentals of Hemostasis. 6th ed. Philadelphia: F.A. Davis Company; 2018.*
- *HOFFMAN R, BENNETT J, FURIE B, et al. Hematology: Basic Principles and Practice. 7th ed. Philadelphia: Elsevier; 2018.*
- *RODAK BF, FROOMAN CR, KAPLAN LA. Hematology: Clinical Principles and Applications. 6th ed. St. Louis: Elsevier; 2020.*

Course Title: Clinical Biochemistry–I	L	T	P	Cr
Course Code: BMD303	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

- Explain the basic concepts of carbohydrates, proteins, and lipids in health and disease.
- Understand the role of enzymes in biochemical reactions and their clinical significance.
- Describe the principles and interpretation of commonly performed biochemical tests.
- Correlate biochemical parameters with normal physiology and pathological conditions.
- Apply knowledge of clinical biochemistry in laboratory diagnosis and patient care.

Course Contents

UNIT I (10 Hours)

- Introduction to Clinical Biochemistry
- Carbohydrate metabolism: glycolysis, gluconeogenesis, glycogen metabolism
- Disorders of carbohydrate metabolism: diabetes mellitus, hypoglycemia
- Laboratory evaluation of blood glucose (FBS, PPBS, HbA1c, GTT)

UNIT II (10 Hours)

- Proteins: structure, function, and metabolism
- Plasma proteins and their clinical importance
- Disorders of protein metabolism: proteinuria, multiple myeloma, hypo/hyperproteinemia
- Laboratory evaluation: serum protein estimation, electrophoresis

UNIT III (5 Hours)

- Lipids: classification, metabolism, and biological significance
- Lipoproteins and their role in cardiovascular diseases
- Laboratory investigations: serum cholesterol, triglycerides, HDL, LDL, VLDL

UNIT IV (5 Hours)

- Enzymes: properties, kinetics, and diagnostic significance
- Isoenzymes (CK, LDH, ALP, AST, ALT)
- Clinical significance of enzymes in liver, heart, and muscle diseases
- Overview of point-of-care biochemical tests in clinical practice

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *SATYANARAYANA U, CHAKRAPANI U. Biochemistry. 6th ed. New Delhi: Elsevier; 2019.*
- *VASUDEVAN DM, SREEKUMARI S, VARGHESE K. Textbook of Biochemistry for Medical Students. 9th ed. New Delhi: Jaypee Brothers; 2022.*
- *MURRAY RK, BENDER DA, BOTHAM KM, et al. Harper's Illustrated Biochemistry. 32nd ed. New York: McGraw Hill; 2021.*
- *TIETZ NW. Fundamentals of Clinical Chemistry and Molecular Diagnostics. 8th ed. St. Louis: Elsevier; 2017.*
- *BISHOP ML, FAHENKRUZ AM, SCHOEFF LE. Clinical Chemistry: Principles, Techniques, and Correlations. 9th ed. Philadelphia: Wolters Kluwer; 2023.*

Course Title: Clinical Microbiology–I	L	T	P	Cr
Course Code: BMD304	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the morphology, structure, and classification of medically important microorganisms.
2. Understand the basic principles of host–pathogen interaction and microbial pathogenicity.
3. Describe the laboratory diagnosis of common bacterial infections.
4. Apply aseptic techniques and biosafety measures in microbiology laboratories.
5. Correlate microbiological findings with clinical conditions for accurate diagnosis.

Course Contents

UNIT I (10 Hours)

- Introduction to Clinical Microbiology
- Morphology and classification of bacteria
- Bacterial cell structure: cell wall, capsule, spores, flagella, pili
- Growth, nutrition, and cultivation of bacteria
- Sterilization and disinfection: principles and applications

UNIT II (10 Hours)

- Pathogenesis of bacterial infections: mechanisms of bacterial virulence
- Host defense mechanisms: innate and adaptive immunity overview
- Laboratory diagnosis of bacterial diseases: specimen collection, transport, culture, and staining
- Common diagnostic techniques: Gram stain, acid-fast stain, culture methods

UNIT III (5 Hours)

- Clinical microbiology of common bacterial infections: Staphylococcus, Streptococcus, Neisseria, Corynebacterium
- Pathogenesis, clinical features, and laboratory diagnosis

UNIT IV (5 Hours)

- Principles of biosafety and infection control in microbiology labs
- Antibiotic sensitivity testing: disk diffusion, MIC determination
- Emerging antimicrobial resistance and its clinical implications

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *ANANTHANARAYAN R, PANIKER CKJ. Textbook of Microbiology. 12th ed. Hyderabad: Universities Press; 2022.*
- *BROOKS GF, CARROLL KC, BUTEL JS, MORSE SA, MIETZNER TA. Jawetz, Melnick & Adelberg's Medical Microbiology. 28th ed. New York: McGraw Hill; 2019.*
- *WILLEY JM, SHERWOOD LM, WOOLVERTON CJ. Prescott's Microbiology. 11th ed. New York: McGraw Hill; 2020.*
- *MURRAY PR, ROSENTHAL KS, PFALLER MA. Medical Microbiology. 9th ed. Philadelphia: Elsevier; 2020.*
- *LEVINSON W. Review of Medical Microbiology and Immunology. 16th ed. New York: McGraw Hill; 2020.*

Course Title: Histopathology–I	L	T	P	Cr
Course Code: BMD305	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the principles and scope of histopathology in medical diagnostics.
2. Describe methods of tissue collection, fixation, and processing.
3. Understand embedding, microtomy, and routine staining techniques.
4. Identify common histological artifacts and their causes.
5. Apply quality control measures in histopathology laboratories.

Course Contents

UNIT I (10 Hours)

- Introduction to histopathology: definition, scope, and significance
- Handling of surgical specimens: collection, labeling, transport, and documentation
- Principles of fixation: types of fixatives, preparation, and properties
- Common fixatives: formalin, Bouin's, Zenker's, glutaraldehyde –merits and demerits

UNIT II (10 Hours)

- Tissue processing: dehydration, clearing, infiltration, embedding
- Embedding media: paraffin wax, resin, celloidin
- Microtomy: rotary and sledge microtomes, knife sharpening, section cutting
- Mounting of sections and common artifacts in sectioning

UNIT III (5 Hours)

- Staining: principles of staining and classification of stains
- Routine stains: Hematoxylin and Eosin (H&E) – preparation, procedure, uses

- Special stains: PAS, trichrome, reticulin (overview only)

UNIT IV (5 Hours)

- Frozen section techniques and cryostat
- Cytological techniques: imprint, crush, and exfoliative cytology (basics)
- Quality control in histopathology
- Safety measures in histopathology laboratories

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *BANCROFT JD, LAYTON C. Bancroft's Theory and Practice of Histological Techniques. 8th ed. London: Elsevier; 2019.*
- *LUNA LG. Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology. 3rd ed. New York: McGraw Hill; 2014.*
- *CARSON FL, HRUBAN RH. Histotechnology: A Self-Instructional Text. 4th ed. Chicago: ASCP Press; 2015.*
- *KIERAN MW. Histopathology Techniques and Practice. 2nd ed. New Delhi: Jaypee Brothers; 2020.*
- *AVWORSU AB. Basic Histopathology Techniques. 1st ed. London: Springer; 2018.*

Course Title: Biomedical Waste Management Practical	L	T	P	Cr.
Course Code: BMD306	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate proper segregation of biomedical waste according to color coding.
2. Identify and classify different categories of biomedical waste generated in healthcare facilities.
3. Perform safe collection, labeling, transport, and storage of biomedical waste.
4. Apply appropriate methods for treatment and disposal of biomedical waste.
5. Follow biosafety measures and infection control practices while handling biomedical waste.

Course Content

List of Practicals / Experiments (60 Hours):

- Demonstration of different categories of biomedical waste with examples.
- Practical training on segregation of waste using color-coded bins and bags.
- Handling and disposal of sharps (needles, syringes, blades).
- Demonstration of methods of disinfection (chemical treatment, autoclaving).
- Visit to hospital waste management unit / incineration facility.
- Practical demonstration of collection, labeling, and barcoding of biomedical waste bags.
- Exercise on filling biomedical waste records and documentation registers.
- Case-based exercises on risks associated with improper waste disposal.
- Demonstration of personal protective equipment (PPE) use while handling biomedical waste.

- Waste audit practice in a healthcare unit (identification and quantification of waste types).

Suggested Readings

- *GOVT. OF INDIA. Biomedical Waste Management Rules, 2016 and Amendments. Ministry of Environment, Forest and Climate Change. New Delhi; 2016.*
- *WORLD HEALTH ORGANIZATION (WHO). Safe Management of Wastes from Health-Care Activities. 2nd ed. Geneva: WHO; 2014.*
- *PARK K. Park's Textbook of Preventive and Social Medicine. 27th ed. Jabalpur: Banarsidas Bhanot; 2023.*
- *VESLEY D. Waste Management in Healthcare Facilities. New Delhi: Jaypee Brothers; 2020.*
- *ALLEN A. Hospital Waste Management: Principles and Guidelines. Springer; 2019.*

Course Title: Hematology–II Practical	L	T	P	Cr.
Course Code: BMD307	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Perform advanced hematological laboratory investigations for diagnosis of anemia, leukemia, and hemolytic disorders.
2. Prepare and interpret peripheral blood smears and bone marrow aspirates.
3. Carry out special staining techniques and cytochemical tests in hematology.
4. Apply laboratory methods for evaluation of bleeding and coagulation disorders.
5. Maintain quality assurance, biosafety, and proper reporting in hematology laboratories.

Course Content

List of Practicals / Experiments (60 Hours):

- Preparation and examination of peripheral blood smears – identification of abnormal cells.
- Reticulocyte count and its interpretation.
- Osmotic fragility test for diagnosis of hemolytic anemias.
- Sickling test for sickle cell anemia.
- Hemoglobin electrophoresis for thalassemia and hemoglobinopathies (demonstration).
- Bone marrow aspiration smear preparation and staining (demonstration).
- Cytochemical staining in hematology: Sudan Black B, PAS, Peroxidase.
- Coagulation studies: bleeding time, clotting time, PT, APTT, thrombin time.
- Platelet count and platelet function tests (demonstration).
- Identification of leukemias through peripheral smear morphology.

- Quality control in hematology laboratory – preparation of control samples.
- Safety and waste management practices in hematology laboratories.

Suggested Readings

- *HOFFBRAND AV, MOSS PAH. Essential Haematology. 8th ed. Oxford: Wiley-Blackwell; 2019.*
- *GREER JP, ARBER DA, GLADER B, et al. Wintrobe's Clinical Hematology. 14th ed. Philadelphia: Wolters Kluwer; 2018.*
- *RODAK BF, FROOMAN CR, KAPLAN LA. Hematology: Clinical Principles and Applications. 6th ed. St. Louis: Elsevier; 2020.*
- *HARMENING DM. Clinical Hematology and Fundamentals of Hemostasis. 6th ed. Philadelphia: F.A. Davis Company; 2018.*
- *HOFFMAN R, BENNETT J, FURIE B, et al. Hematology: Basic Principles and Practice. 7th ed. Philadelphia: Elsevier; 2018.*

Course Title: Clinical Biochemistry–I Practical	L	T	P	Cr.
Course Code: BMD308	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Perform routine biochemical tests on blood and urine samples.
2. Estimate carbohydrates, proteins, lipids, and metabolites in biological fluids.
3. Interpret biochemical test results in relation to health and disease.
4. Demonstrate proper use of colorimeters, spectrophotometers, and semi-auto analyzers.
5. Apply quality control and biosafety practices in clinical biochemistry laboratories.

Course Content

List of Practicals / Experiments (60 Hours):

- Introduction to laboratory safety, glassware, and equipment in clinical biochemistry.
- Preparation of buffers and standard solutions.
- Estimation of blood glucose by GOD-POD method.
- Glucose tolerance test (GTT) – plotting and interpretation.
- Estimation of serum total protein by Biuret method.
- Albumin estimation and calculation of A/G ratio.
- Estimation of serum urea by Diacetyl monoxime or enzymatic method.
- Estimation of serum creatinine by Jaffe's method.
- Estimation of serum uric acid.
- Estimation of serum cholesterol.
- Estimation of triglycerides and calculation of VLDL, LDL, and HDL.
- Demonstration of electrophoresis for serum proteins / lipoproteins.
- Enzyme assays: AST, ALT, ALP, and LDH (demonstration/estimation).
- Quality control in biochemistry – preparation of control sera, Levy–Jennings charts.

- Visit/demonstration of semi-auto analyzer and automated biochemistry analyzer.

Suggested Readings

- *SATYANARAYANA U, CHAKRAPANI U. Biochemistry. 6th ed. New Delhi: Elsevier; 2019.*
- *VASUDEVAN DM, SREEKUMARI S, VARGHESE K. Textbook of Biochemistry for Medical Students. 9th ed. New Delhi: Jaypee Brothers; 2022.*
- *TIETZ NW. Fundamentals of Clinical Chemistry and Molecular Diagnostics. 8th ed. St. Louis: Elsevier; 2017.*
- *BISHOP ML, FAHENKRUZ AM, SCHOEFF LE. Clinical Chemistry: Principles, Techniques, and Correlations. 9th ed. Philadelphia: Wolters Kluwer; 2023.*
- *MURRAY RK, BENDER DA, BOTHAM KM, et al. Harper's Illustrated Biochemistry. 32nd ed. New York: McGraw Hill; 2021.*

Course Title: Clinical Microbiology–I Practical	L	T	P	Cr.
Course Code: BMD309	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate safe handling of clinical specimens in a microbiology laboratory.
2. Perform basic staining techniques (Gram stain, acid-fast stain, simple stains) for bacterial identification.
3. Isolate and culture bacteria using different media and methods.
4. Conduct biochemical tests for preliminary identification of bacteria.
5. Perform antibiotic sensitivity testing and interpret results.
6. Apply biosafety and infection control practices in clinical microbiology.

Course Content

List of Practicals / Experiments (60 Hours):

- Introduction to laboratory safety, biosafety levels, and handling of specimens.
- Demonstration and practice of sterilization methods: autoclaving, hot air oven, filtration.
- Preparation of culture media: nutrient agar, MacConkey agar, blood agar.
- Simple staining and negative staining of bacteria.
- Gram staining of bacterial smears.
- Acid-fast staining (Ziehl–Neelsen method).
- Culture techniques: streak plate, spread plate, pour plate.
- Study of colony morphology of common bacterial cultures.
- Motility testing (hanging drop method / semi-solid agar).
- Biochemical tests – IMViC tests (Indole, Methyl Red, Voges-Proskauer, Citrate).
- Biochemical tests – Catalase, Oxidase, Urease, TSI, Coagulase.
- Identification of common pathogenic bacteria (Staphylococcus, Streptococcus, E. coli, Klebsiella, Pseudomonas).

- Antibiotic sensitivity testing by Kirby–Bauer disk diffusion method.
- Demonstration of anaerobic culture methods.
- Maintenance of laboratory records, waste disposal, and quality control practices.

Suggested Readings

- *ANANTHANARAYAN R, PANIKER CKJ. Textbook of Microbiology. 12th ed. Hyderabad: Universities Press; 2022.*
- *BROOKS GF, CARROLL KC, BUTEL JS, MORSE SA, MIETZNER TA. Jawetz, Melnick & Adelberg's Medical Microbiology. 28th ed. New York: McGraw Hill; 2019.*
- *MURRAY PR, ROSENTHAL KS, PFALLER MA. Medical Microbiology. 9th ed. Philadelphia: Elsevier; 2020.*
- *FORBES BA, SAHM DF, WEISSFELD AS. Bailey & Scott's Diagnostic Microbiology. 14th ed. St. Louis: Elsevier; 2017.*
- *LEVINSON W. Review of Medical Microbiology and Immunology. 16th ed. New York: McGraw Hill; 2020.*

Course Title: Histopathology–I Practical	L	T	P	Cr.
Course Code: BMD310	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate proper collection, labeling, and handling of histopathological specimens.
2. Perform fixation of tissues using commonly employed fixatives.
3. Carry out steps of tissue processing, embedding, section cutting, and mounting.
4. Apply routine staining techniques (H&E) and identify common histological artifacts.
5. Follow quality control and biosafety measures in a histopathology laboratory.

Course Content

List of Practicals / Experiments (60 Hours):

- Introduction to histopathology laboratory safety and handling of specimens.
- Demonstration of methods of grossing and specimen labeling.
- Preparation and use of fixatives (10% formalin, Bouin's, Zenker's, etc.).
- Tissue processing: dehydration, clearing, infiltration (demonstration & hands-on).
- Embedding of tissues in paraffin wax blocks.
- Introduction to microtome – principles, parts, and safety measures.
- Section cutting using rotary microtome – practice sessions.
- Mounting of tissue sections on slides (egg albumin method, adhesives).
- Routine staining – Hematoxylin and Eosin (H&E) staining procedure.
- Identification of histological artifacts in tissue sections.
- Demonstration of special stains (PAS, trichrome, reticulin – overview).
- Frozen section preparation using cryostat (demonstration).
- Cytological techniques: imprint and exfoliative cytology (demonstration).

- Quality control in histopathology – preventive and corrective measures.
- Record keeping, documentation, and biomedical waste disposal in histopathology labs.

Suggested Readings

- *BANCROFT JD, LAYTON C. Bancroft's Theory and Practice of Histological Techniques. 8th ed. London: Elsevier; 2019.*
- *CARSON FL, HRUBAN RH. Histotechnology: A Self-Instructional Text. 4th ed. Chicago: ASCP Press; 2015.*
- *LUNA LG. Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology. 3rd ed. New York: McGraw Hill; 2014.*
- *KIERAN MW. Histopathology Techniques and Practice. 2nd ed. New Delhi: Jaypee Brothers; 2020.*
- *AVWORSU AB. Basic Histopathology Techniques. 1st ed. London: Springer; 2018.*

Course Title: Community Health & Primary Care	L	T	P	Cr
Course Code: BMD311	3	0	0	3

Total Hours 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the concepts of health, disease, and determinants of health in the community.
2. Describe the structure and functions of healthcare delivery systems in India.
3. Apply principles of primary health care in planning and delivering community-based services.
4. Identify major national health programmes and their role in disease prevention and control.
5. Demonstrate skills in health education, communication, and community participation.

Course Contents

UNIT I (15 Hours)

- Concepts of health and disease: definitions, dimensions, determinants
- Natural history of disease and levels of prevention
- Principles of epidemiology: measures of disease frequency, morbidity and mortality indicators
- Role of social and environmental factors in health

UNIT II (10 Hours)

- Primary Health Care: definition, principles, and components (Alma Ata declaration)
- Structure of healthcare delivery in India: sub-centre, PHC, CHC, district hospital
- Role of health workers and multipurpose workers in community health
- Health planning and national health policies

UNIT III (10 Hours)

- Maternal and child health services: antenatal care, postnatal care, immunization
- School health services and adolescent health
- Nutrition and health: common nutritional problems in India, national nutrition programmes
- Communicable disease control: TB, malaria, HIV/AIDS, leprosy (overview of national programmes)

UNIT IV (10 Hours)

- Non-communicable diseases in the community: diabetes, hypertension, cancer, mental health
- Occupational health and safety
- Health education, IEC (Information, Education, Communication), and community participation
- Emerging health issues: urban health, environmental health, lifestyle disorders

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings (Vancouver Style)

- *PARK K. Park's Textbook of Preventive and Social Medicine. 27th ed. Jabalpur: Banarsidas Bhanot; 2023.*
- *GHAI OP, PAUL VK, BAGGA A. Ghai Essential Pediatrics. 10th ed. New Delhi: CBS Publishers; 2021.*
- *GUPTA MC, MAHESHWARI M, GUPTA S. Textbook of Preventive and Social Medicine. 4th ed. New Delhi: Jaypee Brothers; 2021.*
- *DETELS R, GULLIFORD M, KANNY C, QUADAGNO J. Oxford Textbook of Global Public Health. 7th ed. Oxford: Oxford University Press; 2022.*
- *GOVT. OF INDIA. National Health Policy 2017. Ministry of Health and Family Welfare. New Delhi; 2017.*

Semester 4th

Course Title: Parasitology	L	T	P	Cr
Course Code: BMD401	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the general characteristics and classification of parasites.
2. Describe the morphology, life cycle, pathogenesis, and laboratory diagnosis of medically important protozoa, helminths, and arthropods.
3. Correlate clinical features of parasitic diseases with causative organisms.
4. Apply knowledge of parasitology in prevention and control of parasitic infections.
5. Interpret basic diagnostic techniques used in parasitology.

Course Contents

UNIT–I (10 Hours)

- Introduction to Parasitology: Definitions, scope, and terminologies.
- Host–parasite relationships, pathogenicity, and immunity in parasitic infections.
- General laboratory methods in parasitology (sample collection, processing, and staining).

UNIT–II (10 Hours)

- Protozoa of Medical Importance:
  - Entamoeba histolytica, Giardia lamblia, Trichomonas vaginalis.
  - Plasmodium species (malaria) – morphology, life cycle, clinical features, diagnosis, prevention.
  - Opportunistic protozoa (Toxoplasma gondii, Cryptosporidium parvum).

UNIT–III (5 Hours)

- Helminths of Medical Importance:
  - Nematodes: Ascaris lumbricoides, hookworm, Enterobius vermicularis, Wuchereria bancrofti.

- Trematodes: Schistosomes, liver flukes.
- Cestodes: Taenia solium, Echinococcus granulosus.

UNIT–IV (5 Hours)

- Arthropods of Medical Importance:
  - Vectors: Mosquitoes, sandflies, houseflies, ticks, mites.
  - Role in transmission of diseases.
  - Prevention and control strategies.

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- CHANDLER AC, REED C. Introduction to Parasitology. 10th ed. New York: Wiley; 1961.
- PANIKER CKJ, GHOSH S. Paniker's Textbook of Medical Parasitology. 8th ed. New Delhi: Jaypee Brothers; 2017.
- ARORA DR, ARORA BB. Medical Parasitology. 4th ed. New Delhi: CBS Publishers; 2012.
- CHIODINI PL, MOODY AH, MANI V. Clinical Parasitology. London: Baillière Tindall; 2001.
- GUPTA N, MANDAL J. Textbook of Medical Parasitology. New Delhi: Universities Press; 2020.

Course Title: Clinical Biochemistry–II	L	T	P	Cr
Course Code: BMD402	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Describe the biochemical basis and clinical significance of carbohydrate, lipid, protein, and nucleic acid metabolism.
2. Explain the biochemical alterations in metabolic and endocrine disorders.
3. Interpret biochemical test results in relation to common clinical conditions.
4. Correlate biochemical parameters with disease diagnosis, prognosis, and monitoring.
5. Apply knowledge of clinical biochemistry in laboratory investigations for patient care.

Course Contents

UNIT–I (10 Hours)

- Carbohydrate metabolism: Glycolysis, gluconeogenesis, glycogen metabolism, HMP shunt.
- Diabetes mellitus: biochemical changes, diagnostic criteria, complications.
- Laboratory investigations in carbohydrate disorders (blood glucose, HbA1c, glucose tolerance test, urine sugar).

UNIT–II (10 Hours)

- Lipid metabolism: β-oxidation, ketogenesis, cholesterol and lipoprotein metabolism.
- Disorders: hyperlipidemia, atherosclerosis, fatty liver, ketoacidosis.
- Laboratory investigations in lipid disorders (serum cholesterol, triglycerides, HDL/LDL).

UNIT–III (5 Hours)

- Protein and amino acid metabolism.
- Disorders: inborn errors of metabolism, urea cycle defects, phenylketonuria, alkaptonuria.

- Clinical assessment: serum proteins, plasma amino acids, urea, creatinine, uric acid.

UNIT–IV (5 Hours)

- Nucleic acid metabolism and associated disorders (gout, immunodeficiency syndromes).
- Endocrine biochemistry: thyroid, adrenal, pituitary hormones and related disorders.
- Biochemical basis of cancer markers (CEA, AFP, PSA, CA–125).

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *SATYANARAYANA U, CHAKRAPANI U. Biochemistry. 5th ed. Hyderabad: Elsevier; 2021.*
- *DEVLIN TM. Textbook of Biochemistry with Clinical Correlations. 8th ed. Hoboken: Wiley; 2018.*
- *HARPER HA, RODWELL VW, BENDER DA. Harper's Illustrated Biochemistry. 32nd ed. New York: McGraw-Hill; 2021.*
- *VASUDEVAN DM, SREEKUMARI S, VENKATARAMAN K. Textbook of Biochemistry for Medical Students. 9th ed. New Delhi: Jaypee Brothers; 2019.*
- *TIETZ NW. Fundamentals of Clinical Chemistry and Molecular Diagnostics. 8th ed. St. Louis: Elsevier; 2019.*

Course Title: Clinical Microbiology–II	L	T	P	Cr
Course Code: BMD403	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the morphology, cultural characteristics, pathogenicity, and laboratory diagnosis of medically important bacteria, viruses, and fungi.
2. Correlate microbial pathogens with clinical diseases and their epidemiology.
3. Interpret diagnostic reports for infectious diseases.
4. Describe antimicrobial resistance and its clinical significance.
5. Apply infection prevention and control measures in healthcare settings.

Course Contents

UNIT–I (10 Hours)

- Gram-negative bacteria of medical importance: Salmonella, Shigella, Vibrio cholerae, Escherichia coli, Pseudomonas aeruginosa.
- Gram-positive bacteria of medical importance: Staphylococcus aureus, Streptococcus pyogenes, Clostridium species.
- Laboratory diagnosis and biochemical tests.

UNIT–II (10 Hours)

- Medically important viruses:
  - DNA viruses: Hepatitis B virus, Herpesviruses.
  - RNA viruses: Hepatitis C virus, Influenza, HIV.
- Laboratory diagnosis of viral infections (serology, antigen detection, PCR).
- Antiviral therapy and vaccines.

UNIT–III (5 Hours)

- Medically important fungi:
  - Superficial mycoses: Dermatophytes.
  - Systemic mycoses: Candida albicans, Aspergillus, Cryptococcus.

- Laboratory diagnosis of fungal infections (KOH mount, culture, serology).

UNIT–IV (5 Hours)

- Antimicrobial resistance: mechanisms, detection, and clinical implications.
- Hospital-acquired infections: common pathogens, diagnosis, and prevention.
- Infection control practices: hand hygiene, sterilization, disinfection, biosafety.

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *JAWETZ E, MELNICK JL, ADELBERG EA. Medical Microbiology. 28th ed. New York: McGraw-Hill; 2019.*
- *ANANTHANARAYAN R, PANIKER CKJ. Textbook of Microbiology. 10th ed. Hyderabad: Universities Press; 2017.*
- *BROOKS GF, CARROLL KC, BUTEL JS, MORSE SA, MIETZNER TA. Jawetz, Melnick & Adelberg's Medical Microbiology. 27th ed. New York: McGraw-Hill; 2016.*
- *KONEMAN EW, ALLEN SD, JANDA WM, SCHRECKENBERGER PC, WINN WC. Color Atlas and Textbook of Diagnostic Microbiology. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2017.*
- *MURRAY PR, ROSENTHAL KS, PFALLER MA. Medical Microbiology. 9th ed. Philadelphia: Elsevier; 2020.*

Course Title: Histopathology–II	L	T	P	Cr
Course Code: BMD404	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain advanced tissue processing techniques and their applications in diagnostic histopathology.
2. Describe histochemical and immunohistochemical methods and their role in disease diagnosis.
3. Recognize microscopic features of common pathological conditions in different organ systems.
4. Correlate histopathological findings with clinical features and laboratory results.
5. Apply quality control measures in histopathology laboratories.

Course Contents

UNIT–I (10 Hours)

- Special staining techniques: PAS, reticulin, Masson's trichrome, Ziehl–Neelsen, Congo red.
- Principles, procedures, and interpretation of results.
- Applications in diagnosis of infections, amyloidosis, and connective tissue disorders.

UNIT–II (10 Hours)

- Histochemistry and enzyme histochemistry: principles and methods.
- Immunohistochemistry (IHC): basic concepts, commonly used markers, diagnostic significance.
- Frozen sections and cryostat techniques in intraoperative pathology.

UNIT–III (5 Hours)

- Electron microscopy in histopathology: principles, techniques, and applications.
- Role in diagnosis of renal, neuromuscular, and oncological disorders.

UNIT–IV (5 Hours)

- Quality control in histopathology laboratory.

- Common artifacts in tissue processing and staining.
- Recent advances in histopathology (digital pathology, automation, molecular pathology basics).

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *BANCROFT JD, GAMBLE M. Theory and Practice of Histological Techniques. 8th ed. London: Churchill Livingstone; 2018.*
- *KUMAR V, ABBAS AK, ASTER JC. Robbins and Cotran Pathologic Basis of Disease. 10th ed. Philadelphia: Elsevier; 2020.*
- *CARSON FL, HRUSKA D. Histotechnology: A Self-Instructional Text. 5th ed. Chicago: ASCP Press; 2021.*
- *LESTER SC. Manual of Surgical Pathology. 4th ed. Philadelphia: Elsevier; 2017.*
- *DABBS DJ. Diagnostic Immunohistochemistry. 5th ed. Philadelphia: Elsevier; 2019.*

Course Title: Cytology & Cytogenetics	L	T	P	Cr
Course Code: BMD405	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the structure, function, and organization of the cell and its organelles.
2. Describe the principles of cell cycle regulation, cell division, and their abnormalities.
3. Demonstrate knowledge of the structure and function of chromosomes and their role in inheritance.
4. Interpret chromosomal abnormalities and their clinical significance.
5. Apply cytological and cytogenetic techniques in disease diagnosis and research.

Course Contents

UNIT–I (10 Hours)

- Fundamentals of Cytology: Structure and functions of cell and organelles.
- Cell cycle and regulation: interphase, mitosis, meiosis.
- Apoptosis and necrosis – mechanisms and significance.

UNIT–II (10 Hours)

- Cytogenetics: Structure and classification of chromosomes.
- Karyotyping and banding techniques.
- Chromosomal aberrations: structural and numerical.
- Applications in medical genetics and oncology.

UNIT–III (5 Hours)

- Techniques in cytology: Pap smear, exfoliative cytology, fine-needle aspiration cytology (FNAC).

- Applications in screening and diagnosis (e.g., cervical cancer, hematological disorders).

UNIT–IV (5 Hours)

- Molecular cytogenetics: Fluorescence in situ hybridization (FISH), comparative genomic hybridization (CGH).
- Clinical cytogenetics: Genetic counseling, prenatal diagnosis, congenital anomalies.
- Recent advances: Role of cytogenetics in personalized medicine.

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *DE ROBERTIS EDP, DE ROBERTIS EMF. Cell and Molecular Biology. 8th ed. Philadelphia: Lippincott Williams & Wilkins; 2018.*
- *GARTNER LP, HIATT JL. Color Textbook of Histology. 4th ed. Philadelphia: Elsevier; 2017.*
- *TURNPENNY P, ELLARD S. Emery's Elements of Medical Genetics. 15th ed. Philadelphia: Elsevier; 2017.*
- *THOMPSON MW, THOMPSON JS, THOMPSON MW. Genetics in Medicine. 8th ed. Philadelphia: Elsevier; 2016.*
- *ISENBERG SA. Cytopathology. 2nd ed. Oxford: Oxford University Press; 2015.*

Course Title: Research Methodology & Biostatistics	L	T	P	Cr.
Course Code: BMD406	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Formulate research problems, objectives, and hypotheses.
2. Design research studies using appropriate methodologies.
3. Collect, organize, and analyze data using statistical tools.
4. Interpret statistical results and present findings effectively.
5. Prepare research reports and apply ethical principles in biomedical research.

Course Content

List of Practicals (60 Hours)

- Introduction to research methodology: Identifying research problems and writing objectives.
- Designing research studies: observational, experimental, cross-sectional, cohort, case–control.
- Literature search methods: PubMed, Google Scholar, reference management tools.
- Preparation of data collection tools: questionnaire, schedule, checklist.
- Data entry in MS Excel/SPSS/R.
- Descriptive statistics: Mean, median, mode, standard deviation, variance.
- Graphical representation of data: bar chart, pie chart, histogram, scatter plot.
- Probability distributions (normal, binomial, Poisson).
- Hypothesis testing: concepts of null and alternative hypothesis.
- t-tests (paired and unpaired), chi-square test, ANOVA (one-way).
- Correlation (Pearson's, Spearman's) and regression analysis (simple linear).
- Non-parametric tests: Mann–Whitney U, Wilcoxon signed rank.
- Sampling methods: simple random, stratified, cluster, systematic.

- Determining sample size and power of a study.
- Measures of disease frequency: incidence, prevalence, odds ratio, relative risk.
- Basics of epidemiological study designs.
- Preparation of research proposal.
- Writing and presentation of research report (abstract, introduction, methods, results, discussion).
- Use of plagiarism detection and referencing software.
- Ethical issues in biomedical research and informed consent.

Suggested Readings

- *MAHAJAN BK. Methods in Biostatistics for Medical Students and Research Workers. 8th ed. New Delhi: Jaypee Brothers; 2016.*
- *INDERJEET K. Textbook of Biostatistics. 2nd ed. New Delhi: PHI Learning; 2015.*
- *DANIEL WW, CROSS CL. Biostatistics: A Foundation for Analysis in the Health Sciences. 10th ed. Hoboken: Wiley; 2013.*
- *CRESWELL JW, CRESWELL JD. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 5th ed. Los Angeles: Sage; 2018.*
- *PARAHOO K. Nursing Research: Principles, Process and Issues. 3rd ed. London: Palgrave Macmillan; 2014.*

Course Title: Parasitology Practical	L	T	P	Cr.
Course Code: BMD407	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate correct methods of collection, preservation, and processing of parasitological specimens.
2. Identify protozoa, helminths, and arthropods of medical importance using microscopic and macroscopic techniques.
3. Perform diagnostic tests for parasitic infections in stool, blood, and urine samples.
4. Differentiate parasites from artifacts in clinical specimens.
5. Apply knowledge of parasitology in laboratory diagnosis and control of parasitic diseases.

Course Content

List of Practicals (60 Hours)

- Introduction to parasitology laboratory: Safety, specimen handling, and disposal.
- Collection and preservation of clinical specimens (stool, blood, urine, sputum).
- Preparation and examination of saline and iodine wet mounts for protozoa.
- Concentration techniques for stool examination (formalin–ether sedimentation, flotation).
- Identification of cysts and trophozoites of Entamoeba histolytica and Giardia lamblia.
- Identification of oocysts of Cryptosporidium by modified acid-fast stain.
- Demonstration of Plasmodium species in peripheral blood smear (thick and thin films, Giemsa stain).
- Identification of Trypanosoma and Leishmania donovani in stained smears.
- Demonstration of microfilaria in blood smears (Wuchereria bancrofti).

- Identification of helminth ova in stool samples: Ascaris lumbricoides, hookworm, Trichuris trichiura, Taenia species.
- Identification of larvae of Strongyloides in stool.
- Examination of urine for Schistosoma haematobium ova.
- Identification of cestode and trematode segments in preserved specimens.
- Demonstration of arthropods of medical importance: mosquito, sandfly, housefly, tick, mite (mounts and specimens).
- Differentiation of parasite stages from common artifacts.
- Case-based interpretation of parasitological reports.

Suggested Readings

- *PANIKER CKJ, GHOSH S. Paniker's Textbook of Medical Parasitology. 8th ed. New Delhi: Jaypee Brothers; 2017.*
- *ARORA DR, ARORA BB. Medical Parasitology. 4th ed. New Delhi: CBS Publishers; 2012.*
- *CHIODINI PL, MOODY AH, MANI V. Clinical Parasitology. London: Baillière Tindall; 2001.*
- *CHANDLER AC, REED C. Introduction to Parasitology. 10th ed. New York: Wiley; 1961.*
- *GUPTA N, MANDAL J. Textbook of Medical Parasitology. New Delhi: Universities Press; 2020.*

Course Title: Clinical Biochemistry–II Practical	L	T	P	Cr.
Course Code: BMD408	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Perform biochemical tests for assessment of carbohydrate, lipid, protein, and nucleic acid metabolism.
2. Carry out routine biochemical investigations for diagnosis of common metabolic and endocrine disorders.
3. Analyze and interpret biochemical test results in clinical scenarios.
4. Apply quality control measures in biochemical laboratory testing.
5. Demonstrate professional and ethical practices in handling patient samples.

Course Content

List of Practicals (60 Hours)

- Estimation of blood glucose (glucose oxidase/peroxidase method).
- Oral glucose tolerance test (OGTT) – demonstration and interpretation.
- Estimation of glycosylated hemoglobin (HbA1c) – demonstration.
- Estimation of serum cholesterol (CHOD–PAP method).
- Estimation of serum triglycerides.
- Determination of HDL cholesterol; calculation of LDL and VLDL.
- Estimation of serum urea (diacetyl monoxime/urease method).
- Estimation of serum creatinine (Jaffe's reaction).
- Estimation of serum uric acid.
- Estimation of serum proteins (Biuret method).
- Determination of albumin/globulin ratio.
- Liver function tests: estimation of serum bilirubin, ALT, AST, ALP.
- Kidney function tests: urea, creatinine clearance (demonstration/calculation).
- Enzyme assays: demonstration of CPK, LDH, amylase, lipase.
- Estimation of calcium and phosphorus in serum.
- Demonstration of thyroid function tests (T3, T4, TSH – ELISA kits).

- Case-based interpretation of lipid profile reports.
- Case-based interpretation of renal function tests.
- Case-based interpretation of liver function test reports.
- Introduction to quality control charts and internal QC in clinical biochemistry.

Suggested Readings

- *VASUDEVAN DM, SREEKUMARI S, VENKATARAMAN K. Textbook of Biochemistry for Medical Students. 9th ed. New Delhi: Jaypee Brothers; 2019.*
- *SATYANARAYANA U, CHAKRAPANI U. Biochemistry. 5th ed. Hyderabad: Elsevier; 2021.*
- *TIETZ NW. Fundamentals of Clinical Chemistry and Molecular Diagnostics. 8th ed. St. Louis: Elsevier; 2019.*
- *PRAKASH S. Practical Clinical Biochemistry: Methods and Interpretations. New Delhi: Jaypee Brothers; 2014.*
- *MURRAY RK, GRANNER DK, RODWELL VW. Harper's Illustrated Biochemistry. 32nd ed. New York: McGraw-Hill; 2021.*

Course Title: Clinical Microbiology–II Practical	L	T	P	Cr.
Course Code: BMD409	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate culture techniques for medically important bacteria, viruses, and fungi.
2. Perform diagnostic tests for identification of bacterial, viral, and fungal pathogens.
3. Conduct antimicrobial sensitivity testing and interpret results.
4. Apply standard biosafety measures in handling infectious specimens.
5. Correlate laboratory findings with clinical conditions and epidemiological data.

Course Content

List of Practicals (60 Hours)

- Collection, transport, and processing of clinical specimens (blood, urine, sputum, pus, stool, swabs).
- Culture of pathogenic bacteria on selective and differential media (MacConkey, Blood agar, Chocolate agar).
- Identification of Escherichia coli, Salmonella, Shigella, Vibrio cholerae (biochemical tests).
- Identification of Staphylococcus aureus and Streptococcus pyogenes.
- Demonstration of Pseudomonas aeruginosa and Clostridium species.
- Antibiotic sensitivity testing (Kirby–Bauer disk diffusion method).
- Detection of β-lactamase producing organisms.
- Serological tests: Widal test for enteric fever, VDRL for syphilis, ELISA for HIV/Hepatitis.
- Demonstration of rapid antigen detection tests (e.g., malaria, dengue).
- Preparation and examination of KOH mount for fungal elements.
- Culture of fungi on Sabouraud's Dextrose Agar; identification of Candida, Aspergillus.

- Staining methods: Gram staining, Ziehl–Neelsen staining, Albert staining.
- Observation of cytopathic effect (CPE) of viruses – demonstration (slides/video-based).
- Case-based interpretation of bacteriology, virology, and mycology lab reports.
- Infection control demonstration: hand hygiene, PPE, sterilization, and disinfection techniques.

Suggested Readings

- *ANANTHANARAYAN R, PANIKER CKJ. Textbook of Microbiology. 10th ed. Hyderabad: Universities Press; 2017.*
- *JAWETZ E, MELNICK JL, ADELBERG EA. Medical Microbiology. 28th ed. New York: McGraw-Hill; 2019.*
- *KONEMAN EW, ALLEN SD, JANDA WM, SCHRECKENBERGER PC, WINN WC. Color Atlas and Textbook of Diagnostic Microbiology. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2017.*
- *BROOKS GF, CARROLL KC, BUTEL JS, MORSE SA, MIETZNER TA. Jawetz, Melnick & Adelberg's Medical Microbiology. 27th ed. New York: McGraw-Hill; 2016.*
- *MURRAY PR, ROSENTHAL KS, PFALLER MA. Medical Microbiology. 9th ed. Philadelphia: Elsevier; 2020.*

Course Title: Histopathology–II Practical	L	T	P	Cr.
Course Code: BMD410	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate the preparation and application of special histological stains.
2. Perform and interpret histochemical and immunohistochemical techniques.
3. Operate and maintain cryostat and frozen section techniques for rapid diagnosis.
4. Recognize tissue artifacts and apply quality control procedures in histopathology.
5. Correlate practical findings with clinical and diagnostic applications.

Course Content

List of Practicals (60 Hours)

- Demonstration of special stains:
  - Periodic Acid–Schiff (PAS) for carbohydrates.
  - Masson's Trichrome for connective tissue.
  - Reticulin stain for reticular fibers.
  - Congo red for amyloid.
  - Ziehl–Neelsen stain for acid-fast bacilli.
- Histochemistry and enzyme histochemistry:
  - Demonstration of alkaline phosphatase and acid phosphatase activity.
  - Esterase and peroxidase reactions.
- Immunohistochemistry (IHC):
  - Principles of antigen–antibody reactions.
  - Demonstration of common markers (cytokeratin, vimentin, CD markers).
  - Interpretation of stained slides.
- Frozen section preparation using cryostat:
  - Principles, technique, and troubleshooting.

  - Application in intraoperative pathology.
- Electron microscopy in histopathology (demonstration using electron micrographs).
- Quality control in histopathology laboratory:
  - Identification of tissue artifacts.
  - Corrective measures and documentation.
- Case-based demonstrations:
  - Histopathological features of selected lesions (liver, kidney, lung, tumors).
  - Clinicopathological correlation.

Suggested Readings

- *BANCROFT JD, GAMBLE M. Theory and Practice of Histological Techniques. 8th ed. London: Churchill Livingstone; 2018.*
- *CARSON FL, HRUSKA D. Histotechnology: A Self-Instructional Text. 5th ed. Chicago: ASCP Press; 2021.*
- *LESTER SC. Manual of Surgical Pathology. 4th ed. Philadelphia: Elsevier; 2017.*
- *DABBS DJ. Diagnostic Immunohistochemistry. 5th ed. Philadelphia: Elsevier; 2019.*
- *KUMAR V, ABBAS AK, ASTER JC. Robbins and Cotran Pathologic Basis of Disease. 10th ed. Philadelphia: Elsevier; 2020.*

Course Title: Cytology & Cytogenetics Practical	L	T	P	Cr
Course Code: BMD411	3	0	0	3

Total Hours 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Describe the structure and function of the cell and its organelles in health and disease.
2. Explain the principles and significance of cytological techniques in clinical diagnosis.
3. Discuss the structure, classification, and abnormalities of chromosomes.
4. Interpret chromosomal aberrations and their clinical correlations.
5. Demonstrate knowledge of molecular cytogenetic techniques and their applications in medicine.

Course Contents

List of Practicals (60 Hours)

- Introduction to laboratory safety, equipment, and handling in cytology and cytogenetics.
- Preparation of smears from body fluids and fine needle aspiration samples.
- Staining methods in cytology: Papanicolaou, Giemsa, and H&E stains.
- Identification of normal epithelial, inflammatory, and malignant cells under the microscope.
- Sputum cytology for detection of malignant cells.
- Vaginal smear preparation and cytological evaluation (Pap smear).
- Preparation of peripheral blood smear for cytogenetic study.
- Preparation of buccal smear for Barr body demonstration.
- Lymphocyte culture technique for chromosome analysis.
- Harvesting and slide preparation for metaphase chromosomes.
- G-banding technique for karyotyping.
- Analysis of normal human karyotype.

- Identification of numerical chromosomal abnormalities (e.g., trisomy 21, monosomy X).
- Identification of structural chromosomal abnormalities (e.g., translocations, deletions).
- Case discussions on clinical cytogenetics and cytology findings.

Suggested Readings

- *DE ROBERTIS EDP, DE ROBERTIS EMF. Cell and Molecular Biology. 8th ed. Philadelphia: Lippincott Williams & Wilkins; 2018.*
- *TURNPENNY P, ELLARD S. Emery's Elements of Medical Genetics. 15th ed. Philadelphia: Elsevier; 2017.*
- *THOMPSON MW, THOMPSON JS, THOMPSON MW. Genetics in Medicine. 8th ed. Philadelphia: Elsevier; 2016.*
- *ISENBERG SA. Cytopathology. 2nd ed. Oxford: Oxford University Press; 2015.*
- *BROWNING BL, BROWNING SR. Applied Statistical Genetics with R. New York: Springer; 2011.*

Course Title: Research Methodology & Biostatistics Practical	L	T	P	Cr
Course Code: BMD412	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the fundamental concepts of research methodology in biomedical sciences.
2. Design research studies using appropriate methods and sampling techniques.
3. Apply descriptive and inferential statistical methods to analyze data.
4. Interpret statistical results and relate them to research objectives.
5. Prepare research reports with ethical considerations.

Course Contents

List of Practicals (60 Hours)

- Introduction to research methodology: framing research questions and hypotheses.
- Literature search using PubMed, Google Scholar, and other databases.
- Designing data collection tools: questionnaires, proformas, and checklists.
- Methods of sampling and calculation of sample size.
- Data entry and coding using Microsoft Excel/SPSS/R.
- Summarization of data: preparation of tables, charts, and graphs.
- Measures of central tendency: mean, median, and mode (manual and software-based).
- Measures of dispersion: range, variance, standard deviation.
- Probability concepts and distribution (normal, binomial, Poisson).
- Correlation and regression analysis (manual and software-based).
- Tests of significance: t-test, chi-square test, ANOVA.
- Non-parametric tests: Mann–Whitney U test, Wilcoxon signed-rank test.
- Interpretation of p-values, confidence intervals, and effect size.

Basics of epidemiological statistics: incidence, prevalence, relative risk, odds ratio.

Preparation of research proposal and report writing (ICMR/UGC style).

Presentation of research findings using PowerPoint and poster formats.

Suggested Readings

1. MAHAJAN BK. Methods in Biostatistics for Medical Students and Research Workers. 8th ed. New Delhi: Jaypee Brothers; 2016.
2. DANIEL WW, CROSS CL. Biostatistics: A Foundation for Analysis in the Health Sciences. 10th ed. Hoboken: Wiley; 2013.
3. CRESWELL JW, CRESWELL JD. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 5th ed. Los Angeles: Sage; 2018.
4. INDERJEET K. Textbook of Biostatistics. 2nd ed. New Delhi: PHI Learning; 2015.
5. PARAHOO K. Nursing Research: Principles, Process and Issues. 3rd ed. London: Palgrave Macmillan; 2014.

Semester 5th

Course Title: Advanced Hematology & Blood Banking	L	T	P	Cr
Course Code: BMD501	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain advanced concepts of hematopoiesis, blood cell morphology, and hematological disorders.
2. Apply principles of advanced hematological investigations in diagnosis and prognosis.
3. Understand immunohematology, blood grouping, and cross-matching techniques.
4. Demonstrate knowledge of blood banking, transfusion practices, and hemovigilance.
5. Apply quality control and biosafety measures in hematology and blood banking laboratories.

Course Contents

UNIT I (10 Hours)

- Advanced hematopoiesis and stem cell biology
- Red cell disorders: hemoglobinopathies, thalassemia, sickle cell anemia
- White cell disorders: leukemia, lymphoma, myeloproliferative and myelodysplastic syndromes
- Platelet and coagulation disorders

UNIT II (10 Hours)

- Laboratory diagnosis of hematological disorders: peripheral smear, bone marrow aspiration/biopsy, cytochemical staining, immunophenotyping
- Molecular diagnostics in hematology (PCR, FISH, Flow cytometry)
- Automation in hematology: principles and interpretation of results

UNIT III (5 Hours)

- Basics of immunohematology: antigens, antibodies, blood group systems (ABO, Rh, minor groups)
- Blood typing and cross-matching techniques
- Direct and Indirect antiglobulin test

UNIT IV (5 Hours)

- Principles of blood banking and transfusion medicine
- Donor selection, blood collection, storage, and component preparation
- Adverse transfusion reactions and hemovigilance
- Quality assurance and biosafety in blood banking

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

1. HOFFBRAND AV, MOSS PAH. Essential Haematology. 8th ed. Wiley Blackwell; 2019.
2. HOFFBRAND AV, HIGGS DR, KEELING DM, MEHTA AB. Postgraduate Haematology. 7th ed. Wiley Blackwell; 2016.
3. HARMENING DM. Modern Blood Banking & Transfusion Practices. 7th ed. F.A. Davis; 2018.
4. RODAK BF, CARR JH, GEORGE T. Hematology: Clinical Principles and Applications. 6th ed. Elsevier; 2020.
5. DENNY SJ. Blood Transfusion in Clinical Medicine. 12th ed. Wiley Blackwell; 2017.

Course Title: Molecular Biology Techniques	L	T	P	Cr
Course Code: BMD502	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the fundamental principles of molecular biology and its laboratory applications.
2. Perform and interpret basic molecular biology techniques such as DNA, RNA, and protein analysis.
3. Apply molecular methods in diagnosis, research, and biotechnology.
4. Evaluate the role of molecular biology in personalized medicine and genomics.
5. Ensure adherence to biosafety and quality control measures in molecular laboratories.

Course Contents

UNIT I (10 Hours)

- Central dogma of molecular biology: DNA replication, transcription, translation
- DNA isolation and purification techniques (phenol-chloroform, column-based, magnetic bead-based)
- RNA isolation and handling of RNase contamination
- Gel electrophoresis: agarose and polyacrylamide gels

UNIT II (10 Hours)

- Polymerase Chain Reaction (PCR): principle, types (conventional, RT-PCR, qPCR, digital PCR)
- Restriction digestion and ligation
- Cloning techniques: plasmid vectors, transformation, selection
- Blotting techniques: Southern, Northern, Western

UNIT III (5 Hours)

- Sequencing techniques: Sanger sequencing, Next-Generation Sequencing (NGS) overview
- DNA fingerprinting and forensic applications
- Molecular markers: RFLP, AFLP, microsatellites

UNIT IV (5 Hours)

- Applications of molecular biology in medicine: cancer biology, infectious diseases, genetic disorders
- Molecular diagnostics and personalized medicine
- Biosafety, contamination control, and quality assurance in molecular labs

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *BROWN TA. Genomes 4. 4th ed. Garland Science; 2017.*
- *NELSON DL, COX MM. Lehninger Principles of Biochemistry. 8th ed. W.H. Freeman; 2021.*
- *ALBERTS B, JOHNSON A, LEWIS J, et al. Molecular Biology of the Cell. 7th ed. Garland Science; 2022.*
- *KREUZER H, MASSEY A. Molecular Biology and Biotechnology: A Guide for Teachers. 5th ed. ASM Press; 2021.*
- *RAPLEY R. Molecular Biology Techniques: A Classroom Laboratory Manual. 4th ed. Academic Press; 2017.*

Course Title: Clinical Biochemistry–III (Special Tests)	L	T	P	Cr
Course Code: BMD503	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the principles and clinical significance of advanced biochemical tests.
2. Perform and interpret special biochemical investigations in metabolic and systemic disorders.
3. Correlate biochemical parameters with disease diagnosis, prognosis, and monitoring.
4. Apply biochemical tests in endocrinology, oncology, nephrology, hepatology, and cardiology.
5. Ensure quality assurance, calibration, and biosafety in specialized biochemical testing.

Course Contents

UNIT I (10 Hours)

- Endocrine function tests: thyroid (T3, T4, TSH), adrenal (cortisol, ACTH, catecholamines), reproductive hormones (FSH, LH, estrogen, testosterone, prolactin)
- Immunoassay techniques: ELISA, CLIA, RIA (principles, applications, limitations)
- Tumor markers: PSA, CEA, AFP, CA-125, CA-19.9

UNIT II (10 Hours)

- Renal function tests: clearance tests (inulin, creatinine, urea), microalbuminuria, Bence Jones proteins
- Liver function tests: bilirubin, enzymes (ALT, AST, ALP, GGT), serum proteins, prothrombin time correlation
- Cardiac markers: CK-MB, troponins, myoglobin, BNP

UNIT III (5 Hours)

- Special tests in metabolic disorders: glucose tolerance, glycated hemoglobin (HbA1c), lactate, ammonia, ketone bodies

- Inborn errors of metabolism: screening and biochemical markers (PKU, galactosemia, maple syrup urine disease)

UNIT IV (5 Hours)

- Point-of-care testing (POCT) in critical care units
- Automation and recent advances in clinical biochemistry
- Quality control, internal and external proficiency testing in special biochemistry labs

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *TIETZ NW, BURTIS CA, ASHWOOD ER, BRUNS DE. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 6th ed. Elsevier; 2018.*
- *BISHOP ML, FODY EP, VANNA T. Clinical Chemistry: Techniques, Principles, Correlations. 9th ed. Wolters Kluwer; 2023.*
- *MURRAY RK, BENDER DA, BOTHAM KM, et al. Harper's Illustrated Biochemistry. 32nd ed. McGraw-Hill; 2022.*
- *KAPLAN LA, PESCE AJ. Clinical Chemistry: Theory, Analysis, Correlation. 6th ed. Elsevier; 2010.*
- *HENRY JB. Clinical Diagnosis and Management by Laboratory Methods. 23rd ed. Elsevier; 2017.*

Course Title: Clinical Microbiology–III (Virology & Mycology)	L	T	P	Cr
Course Code: BMD504	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the general properties, classification, and replication of viruses and medically important fungi.
2. Describe the pathogenesis, laboratory diagnosis, prevention, and control of common viral and fungal infections.
3. Perform and interpret special diagnostic tests in virology and mycology.
4. Correlate clinical manifestations with microbiological findings in viral and fungal diseases.
5. Apply biosafety, infection control, and quality assurance practices in virology and mycology laboratories.

Course Contents

UNIT I (10 Hours)

- General properties of viruses: structure, classification, replication, cultivation
- DNA viruses of medical importance: herpesviruses, adenoviruses, poxviruses, papillomaviruses
- RNA viruses of medical importance: orthomyxoviruses (influenza), paramyxoviruses, picornaviruses, retroviruses, coronaviruses

UNIT II (10 Hours)

- Laboratory diagnosis of viral infections: serology, antigen detection, culture methods, molecular diagnostics (PCR, RT-PCR)
- Viral vaccines, antiviral drugs, and resistance mechanisms
- Emerging and re-emerging viral infections (HIV, SARS-CoV-2, dengue, Zika, hepatitis viruses, rabies)

UNIT III (5 Hours)

- General properties of fungi: classification, morphology, pathogenic mechanisms

- Superficial and cutaneous mycoses: dermatophytes, Malassezia, Candida
- Subcutaneous mycoses: sporotrichosis, chromoblastomycosis, mycetoma

UNIT IV (5 Hours)

- Systemic mycoses: histoplasmosis, blastomycosis, cryptococcosis, aspergillosis, mucormycosis
- Opportunistic fungal infections in immunocompromised hosts
- Laboratory diagnosis of mycoses: microscopy, culture, serology, molecular methods
- Antifungal agents and resistance mechanisms

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- MURRAY PR, ROSENTHAL KS, PFALLER MA. Medical Microbiology. 10th ed. Elsevier; 2020.
- JAWETZ E, MELNICK JL, ADELBERG EA. Jawetz, Melnick & Adelberg's Medical Microbiology. 28th ed. McGraw-Hill; 2019.
- BROOKS GF, CARROLL KC, BUTEL JS, MORSE SA, MIETZNER TA. Medical Microbiology. 27th ed. McGraw-Hill; 2021.
- *KONEMAN EW, ALLEN SD, JANDA WM, SCHRECKENBERGER PC, WINN WC. Color Atlas and Textbook of Diagnostic Microbiology. 7th ed. Lippincott Williams & Wilkins; 2017.*
- *KAUFFMAN CA, PAPPAS PG, SOBEL JD, DIXON DM. Clinical Mycology. 3rd ed. Oxford University Press; 2019.*

Course Title: Medical Ethics & Legal Issues	L	T	P	Cr
Course Code: BMD505	3	0	0	3

Total Hours 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the principles of medical ethics and their application in healthcare practice.
2. Identify and analyze ethical dilemmas in clinical and research settings.
3. Understand the legal framework governing medical practice in India, including patient rights and professional responsibilities.
4. Apply ethical decision-making in cases involving consent, confidentiality, end-of-life care, and emerging medical technologies.
5. Recognize medico-legal implications in negligence, malpractice, and professional misconduct, and understand procedures for legal redress.

Course Contents

UNIT I (15 Hours)

- Introduction to ethics: definition, principles, and theories (autonomy, beneficence, non-maleficence, justice)
- History and evolution of medical ethics (Hippocratic Oath, Declaration of Geneva, NMC Code of Ethics)
- Doctor–patient relationship: rights and duties of doctors and patients, informed consent, confidentiality

UNIT II (10 Hours)

- Ethical issues in healthcare practice: end-of-life care, euthanasia, palliative care, organ donation and transplantation
- Ethics in reproductive medicine: abortion, surrogacy, assisted reproductive technologies
- Ethical challenges in emerging technologies: stem cell research, genetic engineering, cloning, artificial intelligence in medicine

UNIT III (10 Hours)

- Introduction to medical law: sources of law, Indian Penal Code (IPC), Criminal Procedure Code (CrPC), Consumer Protection Act
- Medico-legal cases: injury, assault, poisoning, sexual offences, custodial deaths
- Medical negligence and malpractice: definitions, examples, defenses, and legal consequences

UNIT IV (10 Hours)

- Regulatory bodies and legal frameworks: National Medical Commission (NMC), Indian Medical Council, Clinical Establishments Act
- Documentation and maintenance of medical records as legal evidence
- Professional misconduct, disciplinary control, and code of conduct
- Ethical and legal considerations in biomedical research and clinical trials

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

1. *BEAUCHAMP TL, CHILDRESS JF. Principles of Biomedical Ethics. 8th ed. Oxford University Press; 2019.*
2. *MASON JK, LAURIE GT, FISHER A. Mason & McCall-Smith's Law and Medical Ethics. 11th ed. Oxford University Press; 2019.*
3. *RAO NG. Medical Ethics, Health Law and Medical Negligence. 2nd ed. Jaypee Brothers; 2016.*
4. *SINGH Y. Legal Aspects of Medicine in India. 1st ed. Universal Law Publishing; 2015.*
5. *PARK K. Park's Textbook of Preventive and Social Medicine. 27th ed. Banarsidas Bhanot; 2023. (for Indian context of ethics & laws)*

Course Title: Diagnostic Molecular Biology	L	T	P	Cr
Course Code: BMD506	2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the principles of molecular biology techniques applied in clinical diagnosis.
2. Perform and interpret molecular assays for detection of genetic and infectious diseases.
3. Apply molecular tools in oncology, hematology, microbiology, and personalized medicine.
4. Understand the role of molecular biomarkers in disease prognosis and treatment monitoring.
5. Follow quality assurance, biosafety, and ethical practices in diagnostic molecular biology laboratories.

Course Contents

UNIT I (10 Hours)

- Introduction to diagnostic molecular biology
- Nucleic acid isolation from clinical samples (blood, tissue, body fluids)
- PCR-based methods: conventional PCR, RT-PCR, real-time PCR, multiplex PCR
- Gel electrophoresis and interpretation of PCR products

UNIT II (10 Hours)

- Hybridization-based methods: Southern, Northern, and dot-blot techniques
- DNA sequencing: Sanger sequencing and Next-Generation Sequencing (NGS) in diagnostics
- Microarray technology and its diagnostic applications
- Molecular markers in diagnosis: RFLP, VNTR, STR

UNIT III (5 Hours)

- Molecular diagnosis of infectious diseases: bacterial, viral (HIV, HBV, HCV, SARS-CoV-2), and fungal pathogens
- Molecular assays in hematological disorders: thalassemia, sickle cell anemia, leukemia

UNIT IV (5 Hours)

- Molecular oncology: tumor suppressor genes, oncogenes, fusion genes (BCR-ABL)
- Pharmacogenomics and personalized medicine
- Biosafety, quality assurance, and ethical considerations in molecular diagnostics

Transaction Modes: Video-based teaching, Collaborative teaching, Case-based teaching, Question–Answer sessions

Suggested Readings

- *RAPLEY R, MULLEN J. Molecular Biology and Diagnostics: Methods and Applications. 2nd ed. Academic Press; 2021.*
- *FLETCHER J, MURRAY GI. Molecular Diagnostic Pathology: A Practical Handbook for Pathologists. 2nd ed. Springer; 2018.*
- *LODISH H, BERK A, KAISER CA, et al. Molecular Cell Biology. 9th ed. Macmillan; 2021.*
- *KREUZER H, MASSEY A. Molecular Biology and Biotechnology: A Guide for Teachers. 5th ed. ASM Press; 2021.*
- *TIETZ NW, BURTIS CA, BRUNS DE. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics. 8th ed. Elsevier; 2023.*

Course Title: Advanced Hematology & Blood Banking Practical	L	T	P	Cr.
Course Code: BMD507	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Perform advanced hematological techniques for the diagnosis of blood disorders.
2. Carry out blood grouping, cross-matching, and antibody detection with accuracy.
3. Demonstrate preparation, storage, and quality control of blood and blood components.
4. Recognize and manage transfusion reactions through laboratory testing.
5. Apply biosafety and quality assurance standards in hematology and blood banking laboratories.

Course Content

List of Practicals / Experiments (60 Hours):

- Preparation and microscopic examination of peripheral blood smears – identification of abnormal cells.
- Bone marrow smear preparation and interpretation of normal and abnormal findings.
- Hemoglobin electrophoresis and detection of hemoglobinopathies.
- Coagulation studies – Prothrombin Time (PT), Activated Partial Thromboplastin Time (APTT), Bleeding Time (BT), and Clotting Time (CT).
- Platelet count and platelet function tests.
- Blood grouping (ABO and Rh) using slide, tube, and gel card methods.
- Cross-matching techniques – major and minor cross-matches.
- Antibody screening and identification tests.
- Direct and Indirect Coombs (Antiglobulin) test.

- Donor screening and selection procedures.
- Blood collection procedures and use of anticoagulants.
- Preparation of blood components: Packed RBCs, Platelet concentrates, Fresh Frozen Plasma (FFP), Cryoprecipitate.
- Quality control of blood products and storage conditions.
- Detection and laboratory workup of transfusion reactions.
- Hemovigilance and record-keeping practices in blood banking.

Suggested Readings

- *HOFFBRAND AV, HIGGS DR, KEELING DM, MEHTA AB. Postgraduate Haematology. 7th ed. Wiley Blackwell; 2016.*
- *RODAK BF, CARR JH, GEORGE T. Hematology: Clinical Principles and Applications. 6th ed. Elsevier; 2020.*
- *HARMENING DM. Modern Blood Banking & Transfusion Practices. 7th ed. F.A. Davis; 2018.*
- *DENNY SJ. Blood Transfusion in Clinical Medicine. 12th ed. Wiley Blackwell; 2017.*
- *TURGEON ML. Clinical Hematology: Theory and Procedures. 6th ed. Wolters Kluwer; 2017.*

Course Title: Molecular Biology Techniques Practical	L	T	P	Cr.
Course Code: BMD508	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Perform basic and advanced molecular biology laboratory techniques.
2. Isolate and analyze DNA, RNA, and proteins from different biological samples.
3. Apply molecular methods such as PCR, electrophoresis, and blotting for diagnostic and research purposes.
4. Interpret experimental results and troubleshoot common laboratory problems.
5. Follow biosafety and quality control practices in molecular biology laboratories.

Course Content

List of Practicals / Experiments (60 Hours):

- Laboratory safety guidelines and preparation of buffers and reagents for molecular biology work.
- Isolation of genomic DNA from blood/tissue samples.
- Isolation of plasmid DNA from bacteria.
- Isolation of total RNA from biological samples and assessment of purity.
- Quantification of nucleic acids using spectrophotometry and fluorometry.
- Agarose gel electrophoresis of DNA and determination of fragment size.
- Polyacrylamide gel electrophoresis (PAGE) for DNA/protein separation.
- Restriction enzyme digestion of DNA and analysis of fragments.
- Polymerase Chain Reaction (PCR): amplification of target DNA sequence.
- Reverse transcription PCR (RT-PCR) demonstration.
- Real-time PCR (qPCR) – principles and data interpretation.
- DNA ligation and transformation in bacterial cells (E. coli).
- Screening of recombinant clones (blue–white selection/colony PCR).

- Southern blotting: principle and demonstration.
- Western blotting: principle and demonstration.
- DNA sequencing: Sanger method (simulation or demonstration).
- Introduction to bioinformatics tools for sequence analysis (NCBI BLAST, genome databases).
- Troubleshooting and quality control measures in molecular biology experiments.

Suggested Readings (Vancouver Style)

- *RAPLEY R. Molecular Biology Techniques: A Classroom Laboratory Manual. 4th ed. Academic Press; 2017.*
- *ALBERTS B, JOHNSON A, LEWIS J, et al. Molecular Biology of the Cell. 7th ed. Garland Science; 2022.*
- *BROWN TA. Gene Cloning and DNA Analysis: An Introduction. 8th ed. Wiley Blackwell; 2021.*
- *KREUZER H, MASSEY A. Molecular Biology and Biotechnology: A Guide for Teachers. 5th ed. ASM Press; 2021.*
- *SAMBROOK J, RUSSELL DW. Molecular Cloning: A Laboratory Manual. 4th ed. Cold Spring Harbor Laboratory Press; 2021.*

Course Title: Clinical Biochemistry–III (Special Tests) Practical	L	T	P	Cr.
Course Code: BMD509	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Perform special biochemical tests for endocrine, hepatic, renal, cardiac, and metabolic disorders.
2. Apply immunoassay techniques such as ELISA, CLIA, and RIA for hormone and tumor marker estimation.
3. Interpret laboratory results in relation to disease diagnosis, prognosis, and monitoring.
4. Carry out point-of-care biochemical testing in clinical settings.
5. Follow biosafety, quality control, and good laboratory practices in clinical biochemistry labs.

Course Content

List of Practicals / Experiments (60 Hours):

- Estimation of thyroid hormones (T3, T4, TSH) by ELISA/CLIA method.
- Estimation of cortisol and other adrenal hormones using immunoassay.
- Determination of reproductive hormones (FSH, LH, estrogen, testosterone, prolactin).
- Assay of common tumor markers (PSA, AFP, CEA, CA-125) by immunoassay techniques.
- Estimation of cardiac biomarkers: CK-MB, troponins, myoglobin.
- Renal function tests – creatinine clearance, urea clearance, microalbuminuria detection.
- Liver function tests – serum bilirubin, transaminases (ALT, AST), ALP, GGT.
- Estimation of glycated hemoglobin (HbA1c) and glucose tolerance test (GTT).
- Detection of Bence Jones proteins in urine.
- Estimation of serum lactate and ammonia.

- Screening for inborn errors of metabolism (PKU, galactosemia) – demonstration methods.
- Point-of-care testing (POCT) – blood glucose, urine dipstick, cardiac marker test kits.
- Demonstration of automation in special biochemistry (autoanalyzers, immunoassay analyzers).
- Internal quality control and external quality assessment in special biochemistry tests.
- Case-based interpretation of special biochemical investigations.

Suggested Readings

- *TIETZ NW, BURTIS CA, ASHWOOD ER, BRUNS DE. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 6th ed. Elsevier; 2018.*
- *BISHOP ML, FODY EP, VANNA T. Clinical Chemistry: Principles, Techniques, and Correlations. 9th ed. Wolters Kluwer; 2023.*
- *MURRAY RK, BENDER DA, BOTHAM KM, et al. Harper's Illustrated Biochemistry. 32nd ed. McGraw-Hill; 2022.*
- *KAPLAN LA, PESCE AJ. Clinical Chemistry: Theory, Analysis, Correlation. 6th ed. Elsevier; 2010.*
- *HENRY JB. Clinical Diagnosis and Management by Laboratory Methods. 23rd ed. Elsevier; 2017.*

Course Title: Clinical Microbiology–III (Virology & Mycology) Practical	L	T	P	Cr.
Course Code: BMD510	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate laboratory techniques for diagnosis of viral and fungal infections.
2. Perform direct and indirect methods for detection of viruses and medically important fungi.
3. Identify common fungal pathogens using microscopy and culture.
4. Apply serological and molecular techniques in virology and mycology.
5. Follow biosafety, infection control, and quality assurance practices in microbiology laboratories.

Course Content

List of Practicals / Experiments (60 Hours):

- Laboratory biosafety practices in virology and mycology laboratories.
- Preparation of viral transport media and handling of clinical specimens for viral diagnosis.
- Demonstration of viral culture methods (embryonated eggs, cell culture systems).
- Detection of viral antigens by ELISA.
- Detection of viral nucleic acids using PCR/RT-PCR (demonstration).
- Serological tests in virology – hemagglutination inhibition test, neutralization test.
- Rapid antigen detection tests for common viral infections (e.g., dengue, influenza, HIV, HBsAg).
- KOH mount preparation for fungal elements in skin/hair/nail samples.
- Lactophenol cotton blue (LPCB) mount for identification of fungi.
- Culture of fungi on Sabouraud's Dextrose Agar (SDA) – demonstration and identification.

- Identification of common dermatophytes (Trichophyton, Microsporum, Epidermophyton).
- Identification of yeast species (Candida spp.) by germ tube test and chromogenic agar.
- Identification of opportunistic fungi (Aspergillus, Mucor, Cryptococcus) by microscopy and culture.
- Antifungal susceptibility testing – demonstration.
- Case-based correlation of virology and mycology laboratory findings with clinical conditions.

Suggested Readings

- *MURRAY PR, ROSENTHAL KS, PFALLER MA. Medical Microbiology. 10th ed. Elsevier; 2020.*
- *KONEMAN EW, ALLEN SD, JANDA WM, SCHRECKENBERGER PC, WINN WC. Color Atlas and Textbook of Diagnostic Microbiology. 7th ed. Lippincott Williams & Wilkins; 2017.*
- *JAWETZ E, MELNICK JL, ADELBERG EA. Jawetz, Melnick & Adelberg's Medical Microbiology. 28th ed. McGraw-Hill; 2019.*
- *KAUFFMAN CA, PAPPAS PG, SOBEL JD, DIXON DM. Clinical Mycology. 3rd ed. Oxford University Press; 2019.*
- *BROOKS GF, CARROLL KC, BUTEL JS, MORSE SA, MIETZNER TA. Medical Microbiology. 27th ed. McGraw-Hill; 2021.*

Course Title: Diagnostic Molecular Biology Practical	L	T	P	Cr.
Course Code: BMD511	0	0	4	2

Total Hours 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Perform molecular biology techniques used in clinical diagnostics.
2. Isolate, amplify, and detect nucleic acids from clinical specimens.
3. Apply molecular assays for detection of genetic, infectious, and neoplastic diseases.
4. Interpret results of diagnostic molecular tests for clinical correlation.
5. Follow biosafety, contamination control, and quality assurance measures in diagnostic molecular laboratories.

Course Content

List of Practicals / Experiments (60 Hours):

- Laboratory biosafety guidelines in diagnostic molecular biology.
- Preparation of buffers and reagents for molecular diagnostics.
- Collection, transport, and storage of clinical samples for molecular testing.
- Isolation of DNA from blood and tissue samples.
- Isolation of RNA from clinical specimens and assessment of purity.
- Quantification of nucleic acids using spectrophotometry/fluorometry.
- Agarose gel electrophoresis for analysis of DNA fragments.
- Conventional PCR amplification of a diagnostic target (e.g., β-globin gene).
- Reverse transcriptase PCR (RT-PCR) demonstration for RNA viruses.
- Real-time PCR (qPCR) – principle, demonstration, and data interpretation.
- Restriction Fragment Length Polymorphism (RFLP) analysis for genetic diagnosis.
- DNA sequencing demonstration (Sanger method or NGS overview).

- Molecular detection of infectious diseases (HIV, HBV, HCV, SARS-CoV-2 – demonstration/simulation).
- Detection of genetic mutations: thalassemia/sickle cell anemia by PCR-based methods.
- Case-based interpretation of diagnostic molecular biology results (oncology, hematology, infectious disease).

Suggested Readings

- *RAPLEY R, MULLEN J. Molecular Biology and Diagnostics: Methods and Applications. 2nd ed. Academic Press; 2021.*
- *FLETCHER J, MURRAY GI. Molecular Diagnostic Pathology: A Practical Handbook for Pathologists. 2nd ed. Springer; 2018.*
- *SAMBROOK J, RUSSELL DW. Molecular Cloning: A Laboratory Manual. 4th ed. Cold Spring Harbor Laboratory Press; 2021.*
- *TIETZ NW, BURTIS CA, BRUNS DE. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics. 8th ed. Elsevier; 2023.*
- *BROWN TA. Gene Cloning and DNA Analysis: An Introduction. 8th ed. Wiley Blackwell; 2021.*

Semester 6th

Course Title: Internship	L	T	P	Cr
Course Code: BMD601	0	0	40	20

Total Hours 600

Learning Outcomes: After Completion of this course, the learner will be able to:

1. Perform routine laboratory investigations in hematology, biochemistry, microbiology, and pathology.
2. Apply biosafety guidelines, infection control practices, and biomedical waste management effectively.
3. Operate and maintain laboratory instruments with accuracy and care.
4. Demonstrate competency in patient sample collection, processing, and reporting under supervision.
5. Integrate theoretical knowledge with laboratory practice to function as a skilled and ethical medical laboratory technologist.

Course Contents

List of Practical's / Experiments: 600 Hours

The internship in Medical Laboratory Technology is designed to provide students with practical exposure to diagnostic laboratories in hospitals, medical colleges, or private diagnostic centers. During the training, students will work under professional supervision in various laboratory departments such as hematology, clinical pathology, biochemistry, microbiology, histopathology, and blood banking. They will learn to perform routine and specialized laboratory investigations, operate laboratory equipment, prepare reagents, and ensure quality control in test procedures. Emphasis will be placed on patient sample collection, processing, analysis, and result interpretation. Students will also gain knowledge of biosafety practices, infection control, biomedical waste management, and documentation of laboratory records. Exposure to real patient samples and case-based learning will help them integrate theoretical knowledge with practical application. Each

student is required to maintain a logbook of activities, submit case records, and prepare a comprehensive internship report for assessment.