GURU KASHI UNIVERSITY

B. Voc. in Medical Laboratory Technology

Session: 2024-25

Department of Paramedical Sciences

Graduate Outcomes of the Programme:

The programme B.Sc. MLT imparts to the students an intensive knowledge of Medical Laboratory Technology. Graduates of the programme will be competent enough to perform routine Medical Laboratory procedures within acceptable quality control parameters in Hematology, Clinical-biochemistry, Immunohematology, and Clinical-Microbiology under the supervision of a Medical Laboratory Scientist or Pathologist.

Programme Learning Outcomes:

1. Perform routine medical laboratory procedures within acceptable quality control parameters in hematology, biochemistry, immunohematology, and microbiology.
2. Function in an ethical and professional manner without bias against any ethnicity, race, religion, caste, or gender with a high degree of credibility, integrity, and social concern.
3. Handle, Operate, and maintain laboratory equipment utilizing appropriate quality control and safety procedures.
4. Recognize the impact of laboratory tests in a global and environmental context.
5. Apply problem-solving techniques in the identification and correction of pre-analytical, post-analytical & analytical variables.
6. Formulate technical skills, social behavior, and professional awareness for functioning effectively as a laboratory technician.

Program Structure

Semester -I							
Sr. No.	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	**BVM101**	Anatomy -I	**Core**	**3**	**0**	**0**	**3**
2	**BVM102**	Physiology-I	**Core**	**3**	**0**	**0**	**3**
3	**BVM103**	Routine Laboratory Technology-I	**Core**	**3**	**0**	**0**	**3**
4	**BVM104**	Biochemistry - I	**Core**	**3**	**0**	**0**	**3**
5	**BVM121**	Anatomy-I Practical	**Skill Based**	**0**	**0**	**4**	**2**
6	**BVM122**	Physiology -I Practical	**Skill Based**	**0**	**0**	**4**	**2**
7	**BVM123**	Routine Laboratory Technology-I Practical	**Skill Based**	**0**	**0**	**4**	**2**
8	**BVM124**	Biochemistry - I Practical	**Skill Based**	**0**	**0**	**4**	**2**
9	**BVM125**	Project Work -I	**Research Skill**	**0**	**0**	**6**	**3**
TOTAL				**12**	**0**	**22**	**23**

Semester -II							
Sr. No.	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	**BVM201**	Anatomy -II	**Core**	**3**	**0**	**0**	**3**
2	**BVM202**	Physiology-II	**Core**	**3**	**0**	**0**	**3**
3	**BVM203**	Routine Laboratory Technology-II	**Core**	**3**	**0**	**0**	**3**
4	**BVM204**	Biochemistry - II	**Core**	**3**	**0**	**0**	**3**
5	**BVM221**	Anatomy-II Practical	**Skill Based**	**0**	**0**	**4**	**2**
6	**BVM222**	Physiology -II Practical	**Skill Based**	**0**	**0**	**4**	**2**
7	**BVM223**	Routine Laboratory Technology-II Practical	**Skill Based**	**0**	**0**	**4**	**2**
8	**BVM224**	Biochemistry - II Practical	**Skill Based**	**0**	**0**	**4**	**2**
9	**BVM225**	Project Work -II	**Research Skill**	**0**	**0**	**8**	**4**
TOTAL				**12**	**0**	**24**	**24**

Semester -III							
Sr. No.	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	**BVM301**	Hematology & Blood Banking -I	**Core**	**3**	**0**	**0**	**3**
2	**BVM302**	Medical Microbiology	**Core**	**3**	**0**	**0**	**3**
3	**BVM303**	Pathology	**Core**	**3**	**0**	**0**	**3**
4	**BVM304**	Advanced Laboratory Science Techniques &Testing Process	**Core**	**3**	**0**	**0**	**3**
5	**BVM321**	Hematology & Blood Banking -I Practical	**Skill Based**	**0**	**0**	**4**	**2**
6	**BVM322**	Medical Microbiology Practical	**Skill Based**	**0**	**0**	**4**	**2**
7	**BVM323**	Pathology Practical	**Skill Based**	**0**	**0**	**4**	**2**
8	**BVM324**	Advanced Laboratory Science Techniques &Testing Process Practical	**Skill Based**	**0**	**0**	**4**	**2**
9	**BVM325**	Project Work -III	**Research Skill**	**0**	**0**	**8**	**4**
TOTAL				**12**	**0**	**24**	**24**

Semester -IV							
Sr. No.	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	**BVM401**	Parasitology	**Core**	**3**	**0**	**0**	**3**
2	**BVM402**	Histopathology and cytology-I	**Core**	**3**	**0**	**0**	**3**
3	**BVM403**	Virology	**Core**	**3**	**0**	**0**	**3**
4	**BVM404**	Microbiology	**Core**	**3**	**0**	**0**	**3**
5	**BVM421**	Parasitology Practical	**Skill Based**	**0**	**0**	**4**	**2**
6	**BVM422**	Histopathology and cytology-I Practical	**Skill Based**	**0**	**0**	**4**	**2**
7	**BVM423**	Virology Practical	**Skill Based**	**0**	**0**	**4**	**2**
8	**BVM424**	Microbiology Practical	**Skill Based**	**0**	**0**	**4**	**2**
9	**BVM425**	Project Work -IV	**Research Skill**	**0**	**0**	**6**	**3**
TOTAL				**12**	**0**	**22**	**23**

Semester -V							
Sr. No.	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	**BVM501**	Clinical Hematology	**Core**	**3**	**0**	**0**	**3**
2	**BVM502**	Histopathology and cytology-II	**Core**	**3**	**0**	**0**	**3**
3	**BVM503**	Clinical Biochemistry	**Core**	**3**	**0**	**0**	**3**
4	**BVM504**	Biochemical Techniques	**Core**	**3**	**0**	**0**	**3**
5	**BVM521**	Clinical Hematology Practical	**Skill Based**	**0**	**0**	**4**	**2**
6	**BVM522**	Histopathology and cytology-II Practical	**Skill Based**	**0**	**0**	**4**	**2**
7	**BVM523**	Clinical Biochemistry Practical	**Skill Based**	**0**	**0**	**4**	**2**
8	**BVM524**	Biochemical Techniques Practical	**Skill Based**	**0**	**0**	**4**	**2**
9	**BVM525**	Project Work -V	**Research Skill**	**0**	**0**	**8**	**4**
TOTAL				**12**	**0**	**24**	**24**

Semester -VI							
Sr. No.	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	**BVM601**	Diagnostic Molecular Biology	**Core**	**3**	**0**	**0**	**4**
2	**BVM602**	Enzymology & Bioenergetics	**Core**	**3**	**0**	**0**	**4**
3	**BVM603**	Clinical Laboratory Operations & Management	**Core**	**3**	**0**	**0**	**4**
4	**BVM604**	Quality Management Practical	**Skill Based**	**0**	**0**	**4**	**2**
5	**BVM621**	Diagnostic Molecular Biology Practical	**Skill Based**	**0**	**0**	**4**	**2**
6	**BVM622**	Enzymology & Bioenergetics Practical	**Skill Based**	**0**	**0**	**4**	**2**
7	**BVM623**	Clinical Laboratory Operations & Management	**Skill Based**	**0**	**0**	**4**	**2**
8	**BVM624**	Project Work -VI	**Research Skill**	**0**	**0**	**8**	**4**
TOTAL				**9**	**0**	**24**	**24**

Evaluation Criteria for Theory Courses

A. Continuous Assessment: [25 Marks]

CA1- Surprise Test (Two best out of three) (10 Marks)

CA2- Assignment(s) (10 Marks)

CA3- Term paper/ Quiz/Presentation (05 Marks)

B. Attendance (05 Marks)

C. Mid Semester Test: (30 Marks)

D. End-Semester Exam: (40 Marks)

Semester I

Course Title: Anatomy -I	L	T	P	Cr.
Course Code: BVM101	3	0	0	3

Total Hours: 45

Learning Outcomes:

1. Students will be able to accurately use and interpret anatomical terminology, including directional terms, body planes, and regions.
2. Students will be able to identify and locate major human anatomical structures, including organs, muscles, and systems, using models, diagrams, and cadaveric specimens.
3. Students will demonstrate an understanding of the relationship between the structure and function of the human body, explaining how anatomical features contribute to physiological processes.
4. Students will apply their knowledge of anatomy to real-world scenarios, such as clinical situations or health-related issues, recognizing the relevance of anatomical understanding in various fields, including medicine and fitness.

Course Contents

UNIT -I **7 Hours**

Anatomical Terminology, Bones: Anatomy & Function, Joints: Function & types, Body Parts and Areas, Terms of Location and Position, Body Cavities and Their Membranes, Dorsal cavity, Ventral cavity, Planes and Sections

UNIT -II **15 Hours**

Cardiovascular System, Heart anatomy, Blood vessels: Arteries, veins, and capillaries, Blood composition and functions, Circulation and cardiac cycle, Respiratory tract anatomy: Nasal cavity, pharynx, larynx, trachea, bronchi, and lungs, Digestive System, Alimentary canal: Mouth, pharynx, esophagus, stomach, small and large intestine, Accessory digestive organs: Liver, pancreas, and gallbladder

UNIT -III **15 Hours**

Urinary System: Kidney structure and function, Urinary tract: Ureters, urinary bladder, and urethra, Urine formation, Male reproductive system: Testes, ducts, accessory glands, and penis, Female reproductive system: Ovaries, uterus, uterine tubes, and vagina, Menstrual cycle and Fertilization

UNIT -IV **8 Hours**

Endocrine System: Endocrine glands and hormones, Regulation of hormone secretion, Major endocrine organs: Pituitary, thyroid, parathyroid, adrenal, pancreas, Olfactory system, taste apparatus, Skin - Features of skin, hair, sebaceous glands, sweat glands, nails.

Course Title: Physiology-I	L	T	P	Cr.
Course Code: BVM102	3	0	0	3

Total Hours: 45

Learning Outcomes:

1. Students will demonstrate a comprehensive understanding of fundamental physiological concepts, including homeostasis, cell physiology, and organ system functions.
2. Students will be able to apply physiological principles to real-world situations, such as exercise physiology, nutrition, and health conditions, to illustrate their relevance to everyday life.
3. Students will analyze how various organ systems interact to maintain overall body function, including the cardiovascular, respiratory, and nervous systems.
4. Students will develop critical thinking skills to interpret experimental data, evaluate physiological processes, and solve problems related to human health and disease.

Course Contents

UNIT -I **15 Hours**

Composition of body, Homeostasis, Organization of the human body at the tissue level – Function of Epithelial, Connective, Muscular & Nervous tissues**,** Blood – hemostasis, coagulation of blood, blood transfusion**,** Lymphatic system – Function of lymph vessels, lymphatic tissue & organs, lymphatics, spleen, thymus.

UNIT -II **10 Hours**

Muscle Anatomy and Function, Bone Anatomy and Physiology, Joints and Movement, Tendon, ligament and cartilage, Common Musculoskeletal Disorders.

UNIT -III **8 Hours**

Respiratory system – Physiology of respiration, Gas exchange in lungs, transport of gases between lungs & tissues, regulation of respiration

UNIT -IV **12 Hours**

General Arrangement of the Cardiovascular System, Heart Structure and Function, Cardiac Cycle and Heart Sounds, Heart Rate and Blood Pressure, Mechanism of Circulation, Hypertension and Shock.

Course Title: Routine Laboratory Technology-I	L	T	P	Cr.
Course Code: BVM103	3	0	0	3

Total Hours: 45

Learning Outcomes:

1. Demonstrate competence in performing basic laboratory techniques and procedures, including sample collection, preparation, and analysis, while adhering to safety protocols.
2. Understand the operation and maintenance of common laboratory equipment, ensuring accurate and reliable results in various diagnostic tests.
3. Apply principles of quality assurance and control in laboratory practices, including the implementation of standard operating procedures (SOPs) and troubleshooting techniques.
4. Analyze and interpret laboratory results accurately, effectively communicating findings and implications to support clinical decision-making.

Course Contents

UNIT -I **12 Hours**

Demonstration of safety rules in a microbiology laboratory**,** Preparation of cleaning agents and techniques of cleaning glassware**,** Principle and care of centrifuge, colorimeter, oven, incubator, microscope, chamber, Autoclave etc.

UNIT -II **15 Hours**

Laboratory Organization & Safety measures, composition and functions of blood, ABO blood typing test and Rh grouping, Hematological Diseases: Anemia and various types of anemias, Thalassemia, Polycythemia, Leukemia, hemolytic disease of newborn, parasitic infections of blood.

UNIT -III **8 Hours**

Study of various types of sterilization-Dry heat and Moist heat sterilization, autoclave, chemical disinfection.

UNIT -IV **10 Hours**

Introduction of Microbiology, Morphology and classification of bacteria, staining Reactions, culture media used in Microbiology, antibiotic susceptibility test.

Course Title: Biochemistry-I	L	T	P	Cr.
Course Code: BVM104	3	0	0	3

Total Hours: 45

Learning Outcomes:

1. Understand the basic principles of biochemistry, including the structure and function of biomolecules such as proteins, carbohydrates, lipids, and nucleic acids.
2. Explain key metabolic pathways and their regulation, including glycolysis, the citric acid cycle, and oxidative phosphorylation, and their roles in cellular energy production.
3. Analyze enzyme structure and function, and apply concepts of enzyme kinetics and regulation to understand biochemical reactions.
4. Develop practical skills in biochemical techniques, including chromatography, electrophoresis, and spectrophotometry, to analyze and characterize biomolecules.

Course Contents

UNIT -I **15 Hours**

Elementary Knowledge of Inorganic Chemistry Structure of atom, atomic weight, molecular and Equivalent weight, Acids, bases, and salts. pH indicators (pH meter, pH paper, universal indicator). Molar solutions, normal solutions, buffer solutions, Elementary Knowledge of Organic Chemistry Organic compounds, Aliphatic, aromatic, alcohol, ethers, phenols, acids, etc.

UNIT -II **15 Hours**

Body water compartments, Donnan membrane equilibrium, Osmolality, Electrolyte concentration of body fluid compartments, Regulation of sodium and water balance, Renin-angiotensin system, Clinical applications of Sodium, Potassium, Chloride, Hypernatremia, Hyponatremia, Hypokalemia, Hyperkalemia, Hyperchloremia, Hypochloremia.

UNIT -III **7 Hours**

Biochemical Test Profile - II (Quantitative determination of CSP) Chlorides, Glucose, Proteins, Sterilization Techniques: Definition & Methods, principles, bacteriological filtration, irradiation, tantalization.

UNIT -IV **8 Hours**

Principles, instrumentation, working, uses, care, Maintenance: balances, - centrifuges, pH meter, colorimeter, Spectrophotometer, fluorimeter, flame photometer, ion selective electrodes, Urinometer, chromatograph, electrophoresis, densitometer.

Course Title: Anatomy-I Practical	L	T	P	Cr.
Course Code: BVM121	0	0	4	2

Total Hours: 30

Learning Outcomes:

1. Demonstrate proficiency in dissection techniques and procedures for identifying and labeling major anatomical structures in specimens, adhering to safety and ethical guidelines.
2. Develop a strong understanding of the three-dimensional organization of human anatomy through hands-on exploration and examination of anatomical models and specimens.
3. Use appropriate anatomical terminology to accurately identify and describe the locations and relationships of structures within the human body.
4. Relate anatomical structures to their physiological functions, enhancing the understanding of how anatomical features contribute to overall body mechanics and systems.

Course Contents

List of Practical's / Experiments:

1. Identification and study of human skeletal system including bones of the axial and appendicular skeleton.
2. Dissection and identification of major muscles and nerves in the human body.
3. Examination and study of the heart, blood vessels, and respiratory organs through models and dissections.
4. Dissection and study of the digestive tract and urogenital organs.

Course Title: Physiology -I Practical	L	T	P	Cr.
Course Code: BVM122	0	0	4	2

Total Hours: 45

Learning Outcomes:

1. Demonstrate proficiency in basic physiological experimental techniques, including data collection and analysis related to human body functions, such as cardiovascular, respiratory, and neuromuscular physiology.
2. Understand and operate physiological equipment (e.g., sphygmomanometer, spirometer, electromyography) to measure and interpret physiological parameters accurately.
3. Analyze and interpret experimental data, drawing meaningful conclusions about physiological processes and their relevance to health and disease.
4. Communicate findings effectively through structured lab reports, utilizing appropriate scientific terminology and demonstrating clarity in the presentation of data and results.

Course Contents

List of Practical's / Experiments:

1. Perform CBC and interpret results for RBC, WBC, hemoglobin, and platelets.
2. Conduct and analyze the different types of white blood cells in a blood smear.
3. Assess urine for color, clarity, and chemical constituents using reagent strips.
4. Identify and count cells, casts, and crystals in urine sediment.
5. Measure and record blood pressure using a sphygmomanometer and interpret results.
6. Determine and analyze pulse rate at various anatomical sites.
7. Measure lung volumes and capacities using a spirometer and interpret the data.
8. Assess peak expiratory flow rate to evaluate respiratory function

Course Title: Routine Laboratory Technology-I (Practical)	L	T	P	Cr.
Course Code: BVM123	0	0	4	2

Total Hours: 30

Learning Outcomes:

1. Demonstrate the ability to perform basic laboratory techniques and procedures accurately, including sample collection, preparation, and analysis.
2. Develop competence in using common laboratory equipment and instruments, ensuring proper calibration, maintenance, and troubleshooting.
3. Understand and apply laboratory safety protocols and guidelines, including the proper handling of chemicals and biological materials to minimize risks.
4. Analyze and interpret laboratory results, presenting findings clearly and accurately, while understanding the significance of data in a clinical context.

Course Contents

List of Practical's / Experiments:

1. Use and maintenance of instruments such as centrifuges, spectrophotometers, and pH meters.
2. Performing calibration of instruments to ensure accuracy and reliability of measurements.
3. Making standard solutions, reagents, and media with precise concentrations.
4. Proper storage methods and handling techniques to maintain reagent stability and prevent contamination.
5. Techniques for collecting and labeling biological samples such as blood, urine, and tissue samples.
6. Preparing and processing samples for various laboratory tests and analyses, including centrifugation and staining procedures. Staining techniques: Gram, Albert's, Ziehl – Neelson's
7. Aseptic techniques: Sterilization by autoclave and hot air oven.

8. Microscopy: Handling and use of compound microscope
9. Preparation and sterilization of various culture media (Nutrient agar, Nutrient Broth, Blood agar, Chocolate agar, MacConkey agar), Antimicrobial susceptibility testing by Stokes disc diffusion method.

Course Title: Biochemistry-I (Practical)	L	T	P	Cr.
Course Code: BVM124	0	0	4	2

Total Hours: 45

Learning Outcomes:

1. Gain hands-on experience with fundamental biochemical techniques, such as spectrophotometry, chromatography, and electrophoresis, to analyze biomolecules.
2. Develop skills in isolating, purifying, and quantifying macromolecules (proteins, carbohydrates, lipids, and nucleic acids) using appropriate laboratory methods.
3. Learn to interpret and analyze experimental data, including understanding biochemical pathways and the implications of results in a biological context.
4. Enhance critical thinking skills by troubleshooting experimental procedures and designing experiments to investigate biochemical questions effectively.

Course Contents

List of Practical's / Experiments:

1. Performing Benedict's test and Fehling's test for reducing sugars.
2. Tests for Polysaccharides: Conducting iodine test for starch and the Barfoed's test for monosaccharides.
3. Identifying proteins by detecting peptide bonds using Biuret reagent.
4. Ninhydrin Test: Testing for free amino acids using Ninhydrin reagent.
5. Sudan III Test: Determining the presence of lipids by staining with Sudan III dye.
6. Saponification Test: Measuring the hydrolysis of fats to identify lipid presence.
7. Sudan III Test: Determining the presence of lipids by staining with Sudan III dye.
8. Saponification Test: Measuring the hydrolysis of fats to identify lipid presence.

Course Title: Project Work- I	L	T	P	Cr.
Course Code: BVM125	0	0	6	3

Total Hours: 45

Learning Outcomes:

1. Demonstrate the ability to conduct independent research by formulating a clear research question, conducting literature reviews, and utilizing appropriate methodologies.
2. Gain experience in planning, organizing, and managing a project from inception to completion, including setting timelines, milestones, and deliverables.
3. Enhance skills in critically analyzing data and synthesizing information from various sources to draw meaningful conclusions and insights related to the project topic.
4. Improve written and oral communication skills by presenting project findings clearly and effectively to diverse audiences, including preparing reports, presentations, and possibly defending the project.

Course Contents

List of Project's / Experiments:

1. **Objective:** To understand and perform blood typing and cross-matching procedures.

   Description: Students can conduct experiments to determine blood groups using different blood typing methods and perform cross-matching to ensure compatibility for transfusions. The project can include case studies or simulations of transfusion reactions.
2. **Objective:** To identify and analyze common pathogens responsible for UTIs.

   Description: Students can collect and analyze urine samples for the presence of bacteria, perform urine culture tests, and identify the bacterial species. They can also evaluate antibiotic susceptibility through sensitivity tests.
3. **Objective:** To study hemoglobin variants and their clinical significance.

Description: Students can perform hemoglobin electrophoresis to separate and identify different types of hemoglobin in blood samples. The project can include a discussion on hemoglobinopathies like sickle cell anemia and thalassemia.

4. **Objective:** To study hemoglobin variants and their clinical significance.

   Description: Students can perform hemoglobin electrophoresis to separate and identify different types of hemoglobin in blood samples. The project can include a discussion on hemoglobinopathies like sickle cell anemia and thalassemia.

Semester II

Course Title: Biochemistry-II	L	T	P	Cr.
Course Code: BVM201	3	0	0	3

Total Hours: 45

Learning Outcomes:

1. Understand and analyze complex metabolic pathways, including carbohydrate, lipid, and protein metabolism, and their regulation in different physiological contexts.
2. Develop a thorough understanding of enzyme kinetics, including factors affecting enzyme activity and mechanisms of enzyme action, through both theoretical knowledge and practical applications.
3. Gain proficiency in advanced biochemical techniques such as mass spectrometry, NMR spectroscopy, and molecular cloning, applying these methods to real-world biochemical problems.
4. Explore the interdisciplinary nature of biochemistry by connecting biochemical principles to fields like genetics, pharmacology, and biotechnology, demonstrating the relevance of biochemistry in various scientific contexts.

Course Contents

UNIT -I **15 Hours**

Respiratory system: Names of organs of organs of Respiratory system. Location and features, blood supply and nerve supply of Nose, Pharynx, larynx, Trachea to bronchial tree, Lungs with broncho-pulmonary segments and surface anatomy, Bronchial circulation, Upper respiratory anatomy: Nose, Pharynx, Lower respiratory anatomy: Larynx, Trachea to bronchial tree, Lungs with Respiratory unit, Muscles of respiration: - Intercostals, Diaphragm. Paranasal sinuses

UNIT -II **12 Hours**

Digestive system: Names of organs of digestion, Location and features, blood supply and nerve supply of mouth, pharynx, esophagus, stomach, small and large intestine, bowel, and anus, Primary digestive organs: mouth, pharynx, esophagus, stomach, small and large intestine, bowel, and anus, Secondary digestive organs: Salivary glands, pancreas, liver, and gall bladder.

UNIT -III **10 Hours**

Names of organs of urinary system. Location and features, Blood supply and nerve supply of Kidney, Ureter, Urinary bladder, Urethra (male and female). Microscopic structure of kidney, Structure of nephron.

UNIT -IV **8 Hours**

CNS&PNS, Autonomic Nervous System- Sympathetic and parasympathetic, Brain - Sub-divisions, location external features and internal structure of medulla oblongata, pons, mid-brain, cerebellum, and cerebrum.

Course Title: Physiology- II	L	T	P	Cr.
Course Code: BVM202	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Gain a comprehensive understanding of the physiological processes of various systems, including the cardiovascular, respiratory, endocrine, and gastrointestinal systems, and their interconnections.
2. Analyze the mechanisms of homeostasis and how the body regulates internal conditions in response to external changes, focusing on feedback loops and regulatory pathways.
3. Develop practical skills in conducting and interpreting physiological measurements, such as blood pressure, respiratory rate, and muscle activity, using appropriate tools and techniques.
4. Apply physiological principles to clinical scenarios, understanding how physiological dysfunctions contribute to disease states and informing approaches to diagnosis and treatment.

Course Contents

UNIT -I **10 Hours**

Parts of respiratory system, mechanism of respiration, Pulmonary function, pulmonary circulation, lungs volume, And gas transport between lungs and tissues, Respiratory adjustments in health and diseases.

UNIT -II **15 Hours**

Organs of GIT and their structure & function, Secretion, digestion, absorption, and assimilation, Gastrointestinal hormones, physiology of digestion of carbohydrates, Proteins & lipids, Structure & function of liver, spleen, Gall bladder & pancreas, Jaundice, Cirrhosis & Pancreatitis

UNIT -III **15 Hours**

Urinary System: Kidney structure and function, Urinary tract: Ureters, urinary bladder, and urethra, Urine formation and excretion Fluid and electrolyte balance, Reproductive System: Male reproductive system: Testes, ducts, accessory glands, and penis, Female reproductive system: Ovaries, uterus, uterine tubes, and vagina, Menstrual cycle and hormonal regulation and Fertilization.

UNIT -IV **5 Hours**

Central nervous system (CNS): Brain and spinal cord, Peripheral nervous system (PNS): Cranial and spinal nerves, Autonomic nervous system (ANS): Sympathetic and parasympathetic divisions

Course Title: Routine Laboratory Techniques-II	L	T	P	Cr.
Course Code: BVM203	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate proficiency in advanced laboratory techniques, including microbiological assays, biochemical tests, and molecular biology methods, for accurate sample analysis.
2. Understand and apply principles of quality control and assurance in laboratory settings, ensuring the reliability and validity of test results through proper protocols and documentation.
3. Develop skills in analyzing and interpreting laboratory data, including recognizing patterns, identifying anomalies, and understanding the clinical significance of results.
4. Comprehend ethical considerations and regulatory requirements in laboratory practice, including proper handling of samples, patient confidentiality, and adherence to safety protocols.

Course Contents

UNIT -I **15 Hours**

Routine Hematological Tests: Determination of hemoglobin concentration, determination of hematocrit, calculations of red blood cell indices - MCV, MCH, and MCHC, Automated systems in hematology, study of blood smear.**,** Reticulocyte count, Erythrocyte sedimentation rate (ESR) Eosinophil count, platelet count

UNIT -II **5 Hours**

Routine examination of urine, rapid chemical tests of Urine, Clinical significance, specimen collection, laboratory investigation

UNIT -III **10 Hours**

Stool Examination: Gross examination, physical examination of stool, determination of pH, chemical examination of feces, microscopic examination of stool specimen, Clinical significance, specimen collection, laboratory investigation

UNIT -IV **15 Hours**

Semen Examination: Semen analysis, routine examination of semen, quantitative determination of semen fructose, interpretative semen analysis, examination for the presence of sperms, Sputum Examination: Indication, collection, container, transport, preservation for different types of sputum analysis. Physical examination and its significance, chemical examination, and its significance. Microscopic examination and its significance.

Course Title: Biochemistry-II	L	T	P	Cr.
Course Code: BVM204	3	0	0	3

Total Hours:

Learning Outcomes:

1. Understand and analyze the interconnectedness of metabolic pathways, focusing on the regulation and energy transfer within carbohydrate, lipid, and protein metabolism.
2. Develop a deep understanding of enzyme kinetics, mechanisms, and the regulatory factors influencing enzyme activity, including allosteric regulation and feedback inhibition.
3. Gain hands-on experience with advanced biochemical techniques, such as chromatography, electrophoresis, and spectrophotometry, for the separation and analysis of biomolecules.
4. Explore the clinical applications of biochemical knowledge, including the role of biomolecules in disease processes, diagnostics, and therapeutic approaches in health care.

Course Contents

UNIT -I **8 Hours**

Eukaryotic Cell, its Structure and function, Cell organelle's structure and functions, biological membrane and transport. Passive and Active Transport

UNIT -II **10 Hours**

Classification, glycolysis and its energetic, TCA cycle and its energetic, fate of private, Regulation of blood glucose by Insulin and Glucagon. Normal Blood Glucose levels.

UNIT -III **12 Hours**

Classification and importance of lipids, Types of Fatty acids, Triacylglycerols, Importance of TAG, Phospholipids classification and function, Prostaglandins and steroids, Digestion and Transportation of Lipids.

UNIT -IV **15 Hours**

Classification of amino acids, Importance of amino acids, Classification of Proteins, structure and functions of proteins. Classification of enzymes, Properties of Enzyme, Factors affecting Enzyme action, Diagnostic Significance of Enzymes.

Course Title: Anatomy- II (Practical)	L	T	P	Cr.
Course Code: BVM221	0	0	4	2

Total Hours: 30

Learning Outcomes:

1. Develop hands-on experience in anatomical dissection techniques, enabling students to accurately identify and describe the structures of various body systems, such as the muscular, nervous, and circulatory systems.
2. Three-Dimensional Spatial Understanding: Enhance the ability to visualize and understand the three-dimensional relationships of anatomical structures within the body, using models, cadavers, or virtual tools.
3. Relate anatomical structures to their functions, demonstrating an understanding of how anatomy supports physiological processes and clinical applications.
4. Understand and apply laboratory safety protocols and ethical considerations in anatomical studies, including the respectful treatment of human remains and adherence to guidelines.

Course Contents

List of Practical's / Experiments:

1. **Identification and dissection of major muscle groups:** Dissect and identify muscles of the upper and lower limbs, and trunk, including their origins, insertions, and actions.
2. **Muscle histology:** Examine muscle tissue under the microscope to differentiate between skeletal, cardiac, and smooth muscle tissues.
3. **Dissection of the central nervous system:** Dissect and study the anatomy of the brain and spinal cord, including major brain structures and pathways.
4. **Peripheral nervous system examination:** Identify and trace the major peripheral nerves and their distributions in the limbs and trunk.

5. **Dissection and identification of digestive organs:** Dissect and identify the major components of the digestive system, including the stomach, intestines, liver, and pancreas.
6. **Histological examination of digestive tissues:** Examine tissue samples from various digestive organs to understand the structure and function of different layers.
7. **Dissection of the respiratory system:** Dissect and study the anatomy of the respiratory organs, including the lungs, trachea, and bronchi.
8. **Histological examination of respiratory tissues:** Analyze the histological features of the respiratory tract and identify different tissue types, including the mucosa, submucosa, and adventitia.

Course Title: Physiology -II (Practical)	L	T	P	Cr.
Course Code: BVM222	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate the ability to perform key physiological experiments, including measurements of vital signs, muscle function, and respiratory parameters, using appropriate instruments and methodologies.
2. Develop skills in collecting, analyzing, and interpreting physiological data, recognizing trends and variations, and understanding their implications for health and disease.
3. Apply theoretical concepts learned in lectures to practical scenarios, effectively linking physiological principles to real-world biological functions and clinical situations.
4. Enhance teamwork and communication abilities by collaborating effectively in lab settings, presenting findings clearly, and discussing results with peers and instructors.

Course Contents

List of Practical's / Experiments:

1. **Reflex Testing:** Evaluation of simple reflexes such as the patellar reflex. **Muscle Strength Testing:** Assessing muscle strength using manual muscle testing techniques.
2. **Blood Glucose Measurement:** Monitoring fasting blood glucose levels and understanding glucose metabolism.
   Thyroid Function Tests: Performing tests to evaluate thyroid hormone levels using reagent kits.
3. **Acid-Base Balance Testing:** Measuring stomach acid levels and assessing gastric pH.
   Digestive Enzyme Activity: Evaluating enzyme activity using substrates and analyzing digestion efficiency.

4. **Creatinine Clearance Test:** Assessing kidney function by measuring creatinine levels in blood and urine.
5. **Urine Osmolality Test:** Evaluating the concentration of solutes in urine to assess renal concentrating ability.

Course Title: Routine Laboratory Techniques-II (Practical)	L	T	P	Cr.
Course Code: BVM223	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate proficiency in advanced laboratory techniques, such as microbiological culturing, biochemical assays, and haematological analyses, ensuring accurate and reliable results.
2. Gain hands-on experience with specialized laboratory instruments, including centrifuges, spectrophotometers, and analyzers, learning proper operation, calibration, and maintenance.
3. Understand and implement quality control measures and standard operating procedures (SOPs) to ensure the integrity and reproducibility of laboratory results.
4. Develop critical thinking skills to troubleshoot experimental procedures and resolve technical issues, fostering a proactive approach to laboratory challenges.

Course Contents

List of Practical's / Experiments:

1. Blood sample collection, preparation, and staining techniques.
2. Complete blood count (CBC) procedures and analysis.
3. Preparation and analysis of blood glucose, urea, and creatinine.
4. Enzyme assays and their clinical significance.
5. Handling and use of compound microscope.
6. Sterilization methods and preparation of culture media
7. Isolation and identification of microorganisms from clinical samples.
8. Immunological and Serological Technique for antigen-antibody reactions. Procedures for conducting ELISA and immunoassays.

Course Title: Biochemistry -II (Practical)	L	T	P	Cr.
Course Code: BVM224	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate proficiency in advanced biochemical techniques, such as chromatography, electrophoresis, and spectrophotometry, for the separation and analysis of biomolecules.
2. Develop skills in performing quantitative assays to measure enzyme activity, substrate concentrations, and metabolic products, ensuring accuracy and reliability in data collection.
3. Analyze and interpret experimental results, understanding their significance in the context of metabolic pathways and biochemical processes.
4. Design and conduct experiments with a strong emphasis on safety protocols and ethical considerations in biochemical research, including proper handling of reagents and biological samples.

Course Contents

List of Practical's / Experiments:

1. Determination of enzyme activity and specific activity
2. Effect of temperature and pH on enzyme activity
3. Analysis of carbohydrate metabolism pathways
4. Study of lipid metabolism and its regulation
5. Isolation and quantification of proteins
6. Electrophoretic techniques for protein analysis
7. Extraction and purification of DNA and RNA
8. Gel electrophoresis for nucleic acid analysis

Course Title: Project Work- II	L	T	P	Cr.
Course Code: BVM225	0	0	8	4

Total Hours: 60

Learning Outcomes:

1. Demonstrate the ability to apply appropriate research methodologies to investigate a specific problem or question, effectively utilizing literature reviews, data collection, and analysis techniques.
2. Develop skills in planning, executing, and managing a research project, including setting objectives, timelines, and milestones to ensure successful completion.
3. Enhance critical thinking abilities by evaluating data, interpreting findings, and formulating conclusions, while also addressing potential challenges encountered during the research process.
4. Improve written and oral communication skills by presenting project results clearly and professionally, including the preparation of comprehensive reports and presentations for diverse audiences.

Course Contents

List of Project's / Experiments:

1. **Project:** "Comparative Study of Automated vs. Manual Hematology Analysis Techniques"

   Objectives: To compare the accuracy, efficiency, and reliability of automated hematology analyzers with traditional manual methods,
2. **Project:** "Assessment of Blood Glucose Levels in Diabetic and Non-Diabetic Patients"

   Objectives: To evaluate the variations in blood glucose levels among diabetic and non-diabetic individuals using various biochemical techniques.
3. **Project:** "Antibiotic Sensitivity Testing of Common Pathogens"

Objectives: To identify the antibiotic resistance patterns of common bacterial pathogens isolated from clinical samples

4. **Project**: "Histopathological Examination of Tissue Samples from Cancer Patients"

   Objectives: To study the histopathological changes in tissue samples from patients with different types of cancer and to correlate the findings with clinical outcomes.

Semester III

Course Title: Hematology & Blood Banking -I	L	T	P	Cr.
Course Code: BVM301	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate a comprehensive understanding of the composition and function of blood components, including red blood cells, white blood cells, platelets, and plasma, and their roles in physiological processes.
2. Gain practical skills in performing fundamental hematological techniques, such as complete blood counts (CBC), blood smears, and coagulation tests, ensuring accuracy in laboratory procedures.
3. Develop proficiency in blood typing methods and cross-matching techniques, understanding their importance in transfusion medicine and the prevention of transfusion reactions.
4. Analyze hematological data and laboratory results, recognizing their clinical significance in diagnosing and monitoring blood disorders, as well as the implications for patient management.

Course Contents

UNIT -I **8 Hours**

Introduction to blood, its composition, function and normal cellular components, Formation of cellular components of blood: Erythropoiesis, Leucopoiesis, Thrombopoiesis, Blood banking concepts and types, Application of Blood banking.

UNIT -II **10 Hours**

Hemostasis, Mechanism of blood coagulation, Fibrinolysis, Laboratory Investigation & Bleeding Disorders: Laboratory preparation for coagulation tests, Routine coagulation tests, Prothrombin time, plasma recalcification time, Partial thromboplastin time Laboratory diagnosis of bleeding disorders.

UNIT -III **15 Hours**

Principles of immunohematology, Human blood group system, ABO blood group systems, Clinical significance of blood transfusion, Blood collection, preservation of blood in blood bank, anticoagulants used in blood banking, Preparation of donor, criteria of an ideal blood donor, history of donor, Transportation of blood after collection, Comb's test - preparation of antisera, principle, types and importance of Comb's test.

UNIT -IV **12 Hours**

Specimen collection for blood bank, General laboratory reagents in blood bank. Preparation of laboratory regents in blood bank, reporting of hemagglutination reaction, Transfusion reactions, Screening of blood for- AIDS, Hepatitis, Syphilis, ABO blood grouping Rh blood typing Anti human globulin (AHG) or cross matching, Transfusion reactions &Hemolytic Disease of a newborn: Blood transfusion process, Transfusion reaction, Hemolytic disease of the newborn

Course Title: Medical Microbiology	L	T	P	Cr.
Course Code: BVM302	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate the ability to identify and classify various pathogenic microorganisms, including bacteria, viruses, fungi, and parasites, using laboratory techniques and diagnostic methods.
2. Gain a comprehensive understanding of the mechanisms of microbial pathogenesis, including how pathogens invade host tissues, evade the immune system, and cause disease.
3. Develop knowledge of antimicrobial agents, including their mechanisms of action, resistance patterns, and appropriate clinical use in treating infectious diseases.
4. Apply microbiological principles to clinical scenarios, interpreting laboratory results, and understanding their implications for diagnosis, treatment, and infection control in healthcare settings.

Course Contents

UNIT -I **15 Hours**

History and importance of medical microbiology, Classification of microorganisms: bacteria, viruses, fungi, and parasites, Laboratory safety and aseptic techniques

UNIT -II **10 Hours**

Structure and function of bacterial cells, Bacterial growth and reproduction, Basics of bacterial genetics.

UNIT -III **10 Hours**

Major bacterial pathogens and associated diseases, Overview of viral pathogens and infections, Common fungal and parasitic infections

UNIT -IV **10 Hours**

Techniques for microbial identification, Principles of antimicrobial therapy, Infection control and prevention strategies.

Course Title: Pathology	L	T	P	Cr.
Course Code: BVM303	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate a comprehensive understanding of the mechanisms of disease, including cellular injury, inflammation, and the processes underlying various pathological conditions.
2. Develop proficiency in histopathological techniques, including tissue processing, staining, and microscopic examination, to identify and analyze pathological changes in tissues.
3. Apply pathological concepts to clinical cases, interpreting laboratory results and understanding the relationship between pathological findings and disease presentation and progression.
4. Gain awareness of current research trends in pathology and the ethical considerations involved in pathological research and practice, including patient confidentiality and informed consent.

Course Contents

UNIT -I **7 Hours**

Fundamentals of Pathology: Definition, scope, and branches, Cell Injury and Adaptation: Mechanisms, necrosis, and apoptosis, Inflammation and Repair: Acute and chronic processes, wound healing

UNIT -II **8Hours**

Blood Disorders: Anemia, leukemias, and lymphomas, Hemostasis and Coagulation: Mechanisms, clotting, and bleeding disorders, Bone Marrow Pathology: Normal structure, function, and pathological changes

UNIT -III **15 Hours**

Cardiovascular Pathology: Diseases of the heart and blood vessels, Respiratory Pathology: Major respiratory diseases, infections, Gastrointestinal Pathology: Diseases of the gastrointestinal tract, inflammatory and neoplastic conditions

UNIT -IV **15 Hours**

Diagnostic Techniques: Laboratory methods, histopathology, and cytology, Clinical Correlation: Laboratory findings, clinical presentations, case studies, Autopsy Pathology: Procedure, cause of death determination, ethical considerations

Course Title: Advanced Laboratory Science Techniques &Testing Process	L	T	P	Cr.
Course Code: BVM304	3	0	0	3

Total Hours:45

Learning Outcomes:

1. **Demonstrate advanced skills in laboratory techniques, such as molecular diagnostics, high-throughput screening, and automated testing methods, ensuring accuracy and reliability in results.**
2. **Understand and apply quality assurance and control measures in laboratory practices, including the implementation of standard operating procedures (SOPs) to maintain laboratory integrity.**
3. **Develop the ability to critically analyze and interpret complex laboratory data, recognizing trends, and understanding the clinical significance of test results in diagnostic decision-making.**
4. **Gain knowledge of ethical considerations and regulatory requirements in laboratory science, including patient safety, confidentiality, and compliance with local and international standards.**

Course Contents

UNIT -I **13 Hours**

Electron Microscopy: Principles and applications of SEM and TEM, Confocal and Fluorescence Microscopy: Techniques and uses in research, Imaging Data Analysis: Software and methodologies for image analysis.

UNIT -II **12Hours**

Polymerase Chain Reaction (PCR): Types, applications, and troubleshooting, Next-Generation Sequencing (NGS): Principles and workflows in genomics, CRISPR-Cas9 Technology: Genome editing principles and techniques.

UNIT -I **10 Hours**

Mass Spectrometry: Principles and applications in analysis, Chromatography: Techniques and applications in biomolecular separation, Spectroscopy: Applications in structural analysis.

UNIT -I **10 Hours**

Flow Cytometry: Principles and applications in cell sorting, Immunoassays: Types and applications in diagnostics, Quality Control and Assurance: Standards and practices in laboratory testing.

Course Title: Hematology & Blood Banking-I (Practical)	L	T	P	Cr.
Course Code: BVM321	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate proficiency in essential hematological techniques, including performing complete blood counts (CBC), blood smears, and reticulocyte counts, ensuring accurate sample analysis.
2. Develop skills in the preparation and analysis of blood components, such as red blood cells, white blood cells, and platelets, understanding their functions and clinical relevance.
3. Gain hands-on experience in blood typing methods (ABO and Rh) and crossmatching procedures to ensure compatibility in blood transfusions.
4. Analyze and interpret laboratory results in the context of clinical conditions, recognizing normal and abnormal findings to support diagnosis and treatment decisions.

Course Contents

List of Practical's / Experiments:

1. Microscopy and staining techniques for blood smears
2. Performing and interpreting complete blood count (CBC)
3. Examination of red blood cell (RBC) morphology
4. White blood cell (WBC) differentiation and pathology
5. Testing for clotting time and bleeding time
6. Performing prothrombin time (PT) and activated partial thromboplastin time (APTT)
7. Blood typing (ABO and Rh) and crossmatching
8. Preparation and storage of blood components

Course Title: Medical Microbiology (Practical)	L	T	P	Cr.
Course Code: BVM322	0	0	4	2

Total Hours: 30

Learning Outcomes:

1. Demonstrate proficiency in sterile techniques for culturing and isolating pathogenic microorganisms from clinical specimens, using appropriate media and incubation conditions.
2. Develop skills in identifying microbial pathogens through various methods, including Gram staining, biochemical testing, and molecular techniques, to accurately classify and differentiate organisms.
3. Gain hands-on experience in performing antibiotic susceptibility tests, such as the disk diffusion method, to determine the effectiveness of antimicrobial agents against specific pathogens.
4. Understand and apply infection control measures in the laboratory setting, including proper handling of specimens, waste disposal, and safety protocols to prevent contamination and ensure laboratory safety.

Course Contents

List of Practical's / Experiments:

1. Demonstration of safety rules (universal precautions) in a microbiology laboratory
2. Handling and use of compound microscope
3. Sterilization by autoclave and hot air oven
4. Identify bacterial species through biochemical tests and identification systems.
5. Staining techniques: Gram, Albert's, Ziehl – Neelson's
6. Preparation and sterilization of various culture media (Nutrient agar, Nutrient)
7. Broth, Blood agar, Chocolate agar, Mac-Conkey agar, Lowenstein-Jensen Media Aerobic and anaerobic culture methods
8. Biochemical tests with positive and negative control bacteria:
9. Catalase, Coagulase, Indole, Methyl Red (MR), Voges-Proskauer (VP), Urease, Citrate, Oxidase, TSIA,

10. Measure microbial growth using techniques like turbidimetry and viable cell counts.
11. Test antimicrobial susceptibility using disk diffusion and broth dilution methods.
12. Apply molecular diagnostic methods such as PCR for pathogen detection.
13. Analyze clinical samples, including urine, blood, and sputum, for diagnostic evaluation.

Course Title: Pathology (Practical)	L	T	P	Cr.
Course Code: BVM323	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate proficiency in tissue processing techniques, including fixation, embedding, and sectioning, as well as the application of various staining methods to visualize pathological changes in tissues.
2. Develop skills in the microscopic examination of stained tissue sections to identify and describe histopathological features indicative of disease processes.
3. Analyze and correlate pathological findings with clinical presentations and laboratory results, enhancing the understanding of disease mechanisms and implications for patient care.
4. Understand and apply safety protocols and ethical considerations in the pathology laboratory, including the proper handling of specimens and adherence to regulations regarding patient confidentiality.

Course Contents

List of Practical's / Experiments:

1. **Microscopy Techniques**: Mastery of light microscopy for examining tissue samples and staining methods.
2. **Specimen Handling and Preparation:** Procedures for collecting, fixing, and embedding tissue samples for histological analysis.
3. **Blood Smear Preparation:** Techniques for preparing and staining blood smears and identifying blood cell types.
4. **Hematology Tests:** Performing and interpreting common hematological tests such as CBC and blood coagulation assays
5. **Routine Histopathology Staining:** Application and interpretation of standard histopathology stains to assess tissue structure and pathology.

6. **Identification of Pathological Changes:** Recognition and documentation of common pathological changes in tissues, including inflammation and tumors.
7. **Cytopathology Techniques:** Techniques for preparing and interpreting cytological samples from body fluids and tissues.
8. **Special Staining and Immunohistochemistry:** Application of special stains and immunohistochemical methods to identify specific cellular markers and pathogens.

Course Title: Advanced Laboratory Science Techniques &Testing Process (Practical)	L	T	P	Cr.
Course Code: BVM324	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate proficiency in advanced laboratory techniques, such as PCR, ELISA, and mass spectrometry, effectively applying these methods for accurate and reliable testing.
2. Develop skills in implementing quality control measures and standard operating procedures (SOPs) to ensure the reliability and validity of laboratory results throughout the testing process.
3. Analyze and interpret complex laboratory data, utilizing statistical tools and software to draw meaningful conclusions and support clinical decision-making.
4. Understand and adhere to relevant regulatory standards and ethical considerations in laboratory practices, ensuring safety, confidentiality, and compliance with local and international guidelines.

Course Contents

List of Practical's / Experiments:

1. **Spectroscopy and Chromatography:** Practical use of spectrophotometers, HPLC, and GC, including sample preparation and data analysis.
2. **Microscopy Techniques:** Application of advanced microscopy techniques like fluorescence and confocal microscopy for sample examination
3. **PCR and Gel Electrophoresis:** Conducting PCR reactions and gel electrophoresis, including analysis and interpretation of results.

4. **DNA Sequencing and Analysis:** Performing DNA sequencing and using bioinformatics tools for sequence data analysis.

5. **Clinical Chemistry Tests:** Executing tests for blood glucose, cholesterol levels, and enzyme activities, and interpreting results.

6. **Microbiological Testing:** Culturing and identifying microbial pathogens and conducting Gram staining and antimicrobial susceptibility testing.

7. **Quality Control Procedures:** Implementing quality control measures, including equipment calibration and test result validation.

8. **Laboratory Safety and Compliance:** Ensuring adherence to safety protocols, maintaining laboratory records, and complying with regulatory standards.

Course Title: Project Work- III	L	T	P	Cr.
Course Code: BVM325	0	0	8	4

Total Hours: 60

Learning Outcomes:

1. Demonstrate the ability to conduct independent research, including the formulation of a research question, development of a methodology, and execution of experiments or studies relevant to the chosen topic.
2. Develop skills in critically analyzing data and synthesizing information from multiple sources, allowing for informed conclusions and insights regarding the project subject.
3. Enhance written and oral communication skills by preparing and presenting comprehensive reports and presentations that clearly convey project objectives, methods, results, and implications.
4. Gain experience in project management, including time management, teamwork, and collaboration, effectively coordinating with peers and stakeholders throughout the project lifecycle.

Course Contents

List of Project's / Experiments:

1. Basics of laboratory practices, roles, and responsibilities, including safety, quality control, and equipment handling.
2. Biochemical tests for disease diagnosis, along with the use of laboratory instruments and data interpretation.
3. Techniques for analyzing blood cells, diagnosing disorders, and preparing blood smears.
4. Blood collection, processing, storage, typing, crossmatching, and transfusion practices.
5. Isolation and identification of microorganisms, along with antibiotic susceptibility testing and microbial culture.

6. Functions of the immune system, immunological assays, and diagnostic tests for autoimmune diseases and infections.
7. Disease diagnosis through histopathology, including techniques for tissue processing and staining.
8. Molecular diagnostics, automation in laboratories, and emerging technologies in laboratory medicine

Semester IV

Course Title: Parasitology	L	T	P	Cr.
Course Code: BVM401	3	0	0	3

Total Hours:

Learning Outcomes:

1. Demonstrate the ability to identify and classify various parasites, including protozoa, helminths, and ectoparasites, using appropriate laboratory techniques and diagnostic tools.
2. Explain the life cycles of significant parasitic organisms and their modes of transmission, including host interactions and environmental factors that influence the spread of parasitic diseases.
3. Analyze clinical cases to correlate parasitological findings with patient symptoms and laboratory results, enhancing the understanding of the implications for diagnosis and treatment of parasitic infections.
4. Discuss preventive measures and control strategies for parasitic infections, including public health interventions, hygiene practices, and the role of vector control in reducing transmission.

Course Contents

UNIT -I **Hours**

Overview of parasitology and its relevance to human health, Classification of parasites: protozoa, helminths, and ectoparasites, Host-parasite interactions and their effects, Laboratory techniques for the identification and study of parasites.

UNIT -II **Hours**

Characteristics and classification of protozoa, Major intestinal protozoan infections and their impact, Blood and tissue protozoan infections and their clinical significance, Diagnostic methods for detecting protozoan parasites, Treatment and prevention strategies for protozoan infections

UNIT -III **Hours**

Key nematode infections, their lifecycle, and clinical manifestations, Important cestode infections, their lifecycle, and health effects, Trematode infections, including their lifecycle and diseases caused by trematode, Diagnostic approaches and treatment options for helminthic infections.

UNIT -IV **Hours**

Classification and characteristics of ectoparasites (e.g., fleas, ticks, lice), Transmission mechanisms and control measures for ectoparasites, public health impact of major parasitic diseases, Case studies of parasitic infections and their management, Diagnostic techniques and therapeutic options for ectoparasitic diseases.

Course Title: Histopathology & Cytology -I	L	T	P	Cr.
Course Code: BVM402	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate proficiency in tissue preparation methods, including fixation, embedding, sectioning, and staining of specimens for microscopic examination.
2. Develop skills in the microscopic examination of histological and cytological specimens, accurately identifying normal and abnormal cellular structures and patterns indicative of disease.
3. Explain the diagnostic criteria for various histopathological and cytological conditions, correlating laboratory findings with clinical presentations to support accurate diagnoses.
4. Understand and apply quality control measures and standard laboratory practices to ensure the reliability and accuracy of histopathological and cytological analyses.

Course Contents

UNIT -I **13 Hours**

Introduction to histopathology and its significance in diagnosing diseases, Basic histological techniques including tissue processing, embedding, sectioning, and staining, Principles of microscopy and application of histological stains, microscopic anatomy of tissues and organs

UNIT -II **15 Hours**

Tissue changes associated with various disease processes, Characteristics and classification of benign and malignant tumors, Histopathological features of inflammatory and infectious diseases, Diagnostic techniques including special stains and immunohistochemistry.

UNIT -III **10 Hours**

Overview of cytology and its diagnostic role, Techniques for specimen collection, preparation, and staining, Examination of cellular morphology under a microscope, Normal and pathological cellular patterns.

UNIT -IV **12 Hours**

Cytopathological patterns associated with diseases, Procedures and techniques for cytological evaluation, Use of cytology in cancer detection and management, Quality control and accuracy in cytological diagnostics.

Course Title: Virology	L	T	P	Cr.
Course Code: BVM403	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate the ability to classify and identify various viruses based on their structure, genetic material, replication methods, and pathogenesis using laboratory techniques.
2. Explain the mechanisms by which viruses infect host cells, replicate, and cause disease, including the immune response and the factors that influence viral pathogenicity.
3. Develop proficiency in laboratory techniques for diagnosing viral infections, such as PCR, serology, and viral culture, and understand their applications and limitations.
4. Discuss strategies for the prevention and control of viral infections, including vaccination, antiviral therapies, and public health measures to reduce transmission.

Course Contents

UNIT -I **12 Hours**

History and scope of virology, detailing its development and importance in medicine, Virus classification and structure, including types of viruses and their components, Viral replication processes, including entry, genome replication, and assembly, Techniques in virology, such as virus detection, isolation, and culture methods.

UNIT -II **10 Hours**

Mechanisms of viral infection and disease, including how viruses invade host cells, Host immune response to viral infections and strategies used by viruses to evade immunity, Overview of viral diseases and syndromes, with examples of significant

viral infections, Case studies on viral outbreaks, including their impact and public health responses.

UNIT -III **13 Hours**

Diagnostic techniques for detecting viruses, including PCR, ELISA, and virus culture methods, Virus identification methods used to determine specific viruses in clinical samples, Measurement of viral load to quantify the amount of virus in patient specimens, Quality control practices in virology to ensure the accuracy and reliability of diagnostic tests.

UNIT -IV **15 Hours**

Antiviral agents, including their mechanisms of action and applications in treating viral infections, Vaccination strategies, focusing on vaccine development and examples of effective vaccines, Mechanisms of viral resistance to antiviral drugs and approaches to overcoming resistance, public health measures for preventing and controlling viral infections, including policy and practice.

Course Title: Microbiology	L	T	P	Cr.
Course Code: BVM404	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate the ability to identify and classify various microorganisms, including bacteria, fungi, viruses, and protozoa, using laboratory techniques such as culturing, staining, and molecular methods.
2. Explain the metabolic pathways and physiological processes of microorganisms, including their growth requirements, reproduction, and the factors influencing microbial growth and survival.
3. Analyze the mechanisms of microbial pathogenesis, including how microorganisms interact with hosts and evade immune responses, and understand the resulting clinical implications.
4. Develop skills in applying microbiological techniques to health-related issues, such as infection control, antibiotic susceptibility testing, and food safety, as well as industrial applications like fermentation and bioprocessing.

Course Contents

UNIT -I **13Hours**

Discovery of Microorganisms, Contribution of Antonie Van Leeuwenhoek, Louis Pasteur, Bordet, Paul Ehrlich, Alexander Flemming, Elie Metchnikoff, Needham, Tyndall Janssen, Joseph Lister, Karl Landsteiner etc., Scope & relevance and safety measures of Medical Microbiology, Role of medical in microbiology in identification and management of various infectious diseases

UNIT -II **10 Hours**

Centrifuge machine, Distillation plant, Hotplate, Magnetic Stirrer, Water Bath, Automatic dispenser and diluters, Deionizer, Microbiological Instruments: pH -

meter, Autoclave, Incubator, Hot air oven, Laminar Air flow, Colony counter, Muffle furnace, Refrigerator, Inoculator, McIntosh and Fildes anaerobic jar.

UNIT -III **15 Hours**

Definition, mode of action and uses, various physical methods of sterilization - heat, UV radiation, Ionizing radiation, character affecting sterilization, Autoclave control and sterilization indicators, Chemical disinfectants - phenol and its compounds, alcohol, halogen, Heavy metals and quaternary ammonium compounds, aldehyde, Gaseous compounds. Use and abuse of disinfectants. Disinfectants, Antiseptics, chemotherapeutic agents, chemotherapeutic index, development of chemotherapy, Antibiotics and effect of antibiotics on protein and nucleic acid synthesis and cytoplasmic membrane, Future development of chemo - therapy.

UNIT -I **7 Hours**

Basic rules for specimen, collection, and handling, Transportation of specimen and safety regulations, SEM, TEM, Phase Contrast Microscope

Course Title: Parasitology (Practical)	L	T	P	Cr.
Course Code: BVM421	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate proficiency in practical techniques for identifying and classifying various parasites using microscopy, staining methods, and other laboratory diagnostic tools.
2. Illustrate the life cycles of significant parasitic organisms through practical exercises, enhancing the understanding of their development stages and transmission routes.
3. Gain hands-on experience in the collection, processing, and analysis of clinical samples (e.g., stool, blood) for the detection of parasitic infections.
4. Develop the ability to analyze and interpret laboratory results in the context of clinical cases, understanding the implications of findings for diagnosis and treatment of parasitic diseases.

Course Contents

List of Practical's / Experiments:

1. Microscopic examination techniques for parasites
2. Identification of common parasitic forms in clinical samples
3. Collection and preservation of parasitic specimens
4. Safety procedures and protocols in parasitology
5. Microscopic examination and classification of protozoa
6. Preparation of protozoan specimens for observation
7. Application of staining techniques for protozoa
8. Analysis of protozoan infections through case studies
9. Identification of helminth eggs, larvae, and adults
10. Preparation and mounting of helminth specimens
11. Use of staining techniques to visualize helminths
12. Application of diagnostic techniques for helminth infections
13. Identification of arthropod parasites and vectors
14. Collection and preservation of arthropod specimens
15. Techniques for vector control and management
16. Case studies of vector-borne diseases and their control

Course Title: Histopathology and Cytology -I (Practical)	L	T	P	Cr.
Course Code: BVM422	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate proficiency in tissue processing techniques, including fixation, embedding, sectioning, and staining of specimens, to prepare them for microscopic examination.
2. Develop skills in the microscopic examination of histological and cytological specimens, accurately identifying normal and pathological cellular structures and patterns.
3. Explain and apply diagnostic criteria for various histopathological and cytological conditions, correlating laboratory findings with clinical scenarios to support accurate diagnosis.
4. Understand and implement safety protocols and quality control measures in the laboratory, ensuring reliable and accurate results in histopathological and cytological analyses.

Course Contents

List of Practical's / Experiments:

1. Tissue processing methods including fixation, dehydration, embedding, and sectioning
2. Staining techniques, specifically routine stains like Hematoxylin and Eosin (H&E)
3. Operation and handling of light microscopes for tissue examination
4. Preparation and labeling of histological slides
5. Identification and analysis of different tissue types under the microscope
6. Recognition of common pathological features such as inflammation and necrosis

7. Application of special stains for identifying specific tissue components
8. Interpretation and documentation of histopathological findings
9. Techniques for preparing cytology smears from body fluids and specimens
10. Application of cytological stains like Papanicolaou (Pap) stain and Giemsa stain
11. Examination of cytology smears under the microscope
12. Identification and interpretation of cellular changes indicative of disease
13. Analysis of case studies with histopathological and cytological findings
14. Accurate documentation and reporting of laboratory results
15. Implementation of quality control measures in histopathology and cytology
16. Adherence to ethical practices and laboratory standards.

Course Title: Virology (Practical)	L	T	P	Cr.
Course Code: BVM423	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate proficiency in techniques for isolating and culturing viruses from clinical samples using appropriate cell lines and culture conditions.
2. Develop skills in performing diagnostic assays for viral infections, including serological tests (e.g., ELISA) and molecular techniques (e.g., PCR), to detect and identify viral pathogens.
3. Analyze and interpret laboratory results related to viral infections, understanding their clinical significance and implications for patient management.
4. Understand and apply laboratory safety and biosecurity protocols when working with viruses, including the proper handling of infectious materials and adherence to biosafety guidelines.

Course Contents

List of Practical's / Experiments:

1. **Preparation and Sterilization:** Methods for sterilizing equipment and preparing viral culture media.
2. **Virus Cultivation:** Techniques for growing viruses in cell cultures and maintaining cell lines.
3. **Microscopy in Virology:** Use of light and electron microscopy for observing viruses and staining techniques.
4. **Plaque Assay:** Procedures for performing plaque assays to quantify viral infectivity and interpreting results.
5. **Hemagglutination Assay:** Detecting viral hemagglutination activity and analyzing patterns.

6. **Immunofluorescence Assay:** Detecting viral antigens using immunofluorescence and visualizing with fluorescent microscopy.
7. **Polymerase Chain Reaction (PCR):** Amplifying viral DNA/RNA and analyzing PCR products through gel electrophoresis.
8. **Nucleic Acid Extraction:** Isolating viral nucleic acids from samples and assessing quality and quantity.
9. **Sequencing Techniques:** Introduction to viral sequencing and data analysis for virus identification.
10. **Infection Models:** Establishing animal or tissue models for studying viral infections and observing disease progression.
11. **Antiviral Susceptibility Testing:** Evaluating the effectiveness of antiviral agents and interpreting results.
12. **Viral Epidemiology:** Studying viral spread and transmission and applying data to control measures and public health responses.

Course Title: Microbiology (Practical)	L	T	P	Cr.
Course Code: BVM424	0	0	4	2

Total Hours: 30

Learning Outcomes:

1. Demonstrate proficiency in various microbial culture techniques, including aseptic techniques, streak plating, and liquid media preparation, to isolate and grow different microorganisms.
2. Develop skills in the microscopic examination of bacterial, fungal, and protozoan samples, utilizing staining techniques such as Gram staining and acid-fast staining to identify and differentiate organisms.
3. Gain hands-on experience in performing antimicrobial susceptibility testing, such as the disk diffusion method, to evaluate the effectiveness of antibiotics against specific microbial strains.
4. Analyze and interpret microbiological data from laboratory results, preparing clear reports that summarize findings and their clinical implications for infection control and treatment strategies.

Course Contents

List of Practical's / Experiments:

1. Microscopy techniques, including use of light and electron microscopes
2. Aseptic techniques for maintaining sterility
3. Culture media preparation and sterilization
4. Inoculation methods for transferring microorganisms
5. Isolation techniques for obtaining pure bacterial cultures
6. Observation and recording of colony morphology
7. Measurement of bacterial growth using various methods
8. Gram staining for bacterial classification
9. Performing biochemical tests for bacterial identification

10. Antibiotic susceptibility testing to assess resistance
11. Identification techniques for fungi and parasites
12. Introduction to molecular techniques such as PCR
13. Detection and identification of pathogens in clinical samples
14. Environmental sampling and microbial contamination analysis
15. Quality control practices in microbiological testing
16. Interpretation and reporting of laboratory results

Course Title: Project Work- IV	L	T	P	Cr.
Course Code: BVM425	0	0	6	3

Total Hours: 45

Learning Outcomes:

1. Demonstrate the ability to apply advanced research methodologies to design and conduct a comprehensive project, including data collection, analysis, and interpretation.
2. Enhance critical thinking skills by addressing challenges encountered during the project, employing innovative solutions and adapting research strategies as needed.
3. Improve written and oral communication skills by effectively presenting project findings through comprehensive reports, presentations, and discussions, tailored to various audiences.
4. Understand and adhere to ethical standards and professional practices in research, including proper citation of sources, maintaining data integrity, and considering the implications of the research on society.

Course Contents

List of Project's / Experiments:

1. Overview of the role and responsibilities of medical laboratory technologists, including their significance in disease diagnosis and management.
2. Laboratory safety protocols, quality control measures, and basic techniques for sample collection, preparation, and handling.
3. Techniques for biochemical analysis of blood and urine, including common tests and their clinical significance.
4. Methods for blood cell morphology, counting, classification, and understanding of blood disorders.
5. Identification techniques for pathogenic microorganisms, including culture, staining, and sensitivity testing.

6. Basic principles of tissue processing, staining, and identifying pathological changes, with an emphasis on infection control practices.

7. Molecular diagnostics techniques such as DNA/RNA extraction, PCR, and their application in disease diagnosis.

8. Use of automated analyzers and laboratory information systems, including laboratory management principles and ethical considerations.

Semester V

Course Title: Clinical Haematology	L	T	P	Cr.
Course Code: BVM501	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate a comprehensive understanding of various hematological disorders, including anemias, leukemias, and clotting disorders, and their pathophysiology.
2. Develop skills in performing key laboratory techniques, such as complete blood counts (CBC), peripheral blood smears, and coagulation tests, ensuring accurate and reliable results.
3. Analyze and interpret hematological data in the context of clinical scenarios, correlating laboratory findings with patient symptoms and medical history to support diagnosis and treatment.
4. Understand and apply quality control measures and safety protocols in the clinical laboratory setting, ensuring the integrity of test results and adherence to regulatory standards.

Course Contents

UNIT -I **12 Hours**

Introduction to hematology, including blood components and their functions, Hematopoiesis and the role of bone marrow, Overview of blood disorders and diagnostic tests, Laboratory techniques for blood sample analysis.

UNIT -II **13 Hours**

Types and causes of anemia, including diagnostic criteria and treatment, Polycythemia and its diagnostic and management strategies, Hemoglobinopathies, focusing on sickle cell disease and thalassemia, Laboratory tests for diagnosing red blood cell disorders.

UNIT -III **7 Hours**

Causes and implications of leukopenia and leukocytosis, Classification and management of leukemias, Types of lymphomas and diagnostic techniques, Immune system disorders affecting white blood cells.

UNIT -IV **13 Hours**

Thrombocytopenia and thrombocytosis: causes, diagnosis, and management, Coagulation disorders such as hemophilia and von Willebrand disease, Understanding and managing disseminated intravascular coagulation (DIC), Coagulation profiles and interpretation of laboratory results.

Course Title: Histopathology and Cytology- II	L	T	P	Cr.
Course Code: BVM502	3	0	0	3

Total Hours:

Learning Outcomes:

1. Demonstrate proficiency in advanced histopathological techniques, including immunohistochemistry and in situ hybridization, for the detection and characterization of specific antigens in tissue samples.
2. Develop skills in the collection, preparation, and microscopic evaluation of cytological specimens, accurately identifying and differentiating benign and malignant cells.
3. Analyze and integrate histopathological and cytological findings with clinical data and imaging studies, enhancing the understanding of disease diagnosis and patient management.
4. Understand and implement quality assurance protocols and best practices in histopathology and cytology laboratories, ensuring reliable results and adherence to safety standards.

Course Contents

UNIT -I **15 Hours**

Histological staining techniques including immunohistochemistry and special stains, Histopathological techniques for tissue sample processing, embedding, sectioning, and mounting, Histopathology of neoplastic diseases including identification and classification of tumors, Advanced histopathological imaging methods such as digital microscopy.

UNIT -II **8 Hours**

Advanced cytological staining methods including Papanicolaou stain and immunocytochemistry, Preparation and analysis of cytological smears from body fluids and tissues, Cytopathology of neoplasms including diagnostic criteria for various cancers, Digital imaging and automated analysis in cytopathology.

UNIT -III **13 Hours**

Histopathological diagnosis of common diseases such as infections and autoimmune disorders, Evaluation of tissue samples from specific organs to understand pathological changes, Case studies to correlate histopathological findings with clinical presentations, Quality control measures and troubleshooting in histopathology.

UNIT -IV **9 Hours**

Cytological diagnosis of common diseases from cytological specimens, Exploration of emerging techniques and technologies in cytology, Application of cytological findings in clinical decision-making and patient management, Ethical and legal considerations in the practice of cytology, including patient consent and confidentiality.

Course Title: Clinical Biochemistry	L	T	P	Cr.
Course Code: BVM503	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate a comprehensive understanding of key biochemical pathways and their roles in metabolism, including carbohydrate, lipid, and protein metabolism, and how these pathways relate to disease states.
2. Develop skills in performing and interpreting various laboratory tests used in clinical biochemistry, such as enzyme assays, hormone levels, and metabolic panels, ensuring accurate diagnosis and monitoring.
3. Analyze and correlate biochemical test results with clinical conditions, understanding the implications of these findings for diagnosis, treatment, and disease management.
4. Understand and apply quality control measures and safety protocols in the clinical biochemistry laboratory, ensuring the integrity of test results and compliance with regulatory standards.

Course Contents

UNIT -I **8 Hours**

Overview of clinical biochemistry and its role in healthcare, Techniques for sample collection and handling, Introduction to biochemical analyzers and laboratory techniques, Quality control procedures in clinical testing.

UNIT -II **9 Hours**

Pathways of carbohydrate metabolism and their regulation, Clinical tests for blood glucose and related parameters, Diabetes Mellitus: Types, pathophysiology, and diagnostic criteria, Management and monitoring of hypoglycemia and hyperglycemia

UNIT -III **14 Hours**

Overview of lipid metabolism and its physiological roles, Measurement and clinical significance of serum lipid levels, Causes and management of dyslipidemia, Relationship between lipid levels and cardiovascular disease.

UNIT -IV **14 Hours**

Fundamentals of protein metabolism and its physiological importance, Clinical evaluation of serum proteins and proteinuria, Assessment of renal function through biochemical tests, Disorders related to protein metabolism and renal function.

Course Title: Clinical Biochemistry	L	T	P	Cr.
Course Code: BVM504	3	0	0	3

Total Hours:45

Learning Outcomes:

1. Demonstrate a thorough understanding of the biochemical principles underlying human physiology, including metabolic pathways, enzymatic reactions, and the role of biomolecules in health and disease.
2. Develop proficiency in various laboratory techniques used in clinical biochemistry, such as spectrophotometry, chromatography, and immunoassays, to analyze biological samples accurately.
3. Analyze and interpret clinical biochemistry test results, correlating them with patient conditions and clinical history to inform diagnosis and treatment plans.
4. Understand and implement quality assurance practices and safety protocols in the clinical biochemistry laboratory, ensuring accurate results and adherence to regulatory standards.

Course Contents

UNIT -I **8 Hours**

Beer-Lambert's Law, Light absorption and its transmittance, Applications of following spectroscopic techniques in elucidating structure of Bimolecular- Visible, U.V, Infra-red and fluorescence spectroscopy, ORD, C.D. and N.M.R.

UNIT -II **15 Hours**

Electrophoretic Techniques: Principles and applications of the following electrophoresis, techniques, SDS-PAGE: Discontinuous electrophoresis, is electrophoresis, is electric focusing and immunoelectrophoresis.

Centrifugation Techniques: Various centrifugation techniques and their applications in Biochemistry, Preparative and analytical ultra- centrifugation procedures, Application of partial specific volume, Diffusion coefficient and viscosity measurements in the study of macromolecules of biochemical importance.

UNIT -III **12Hours**

General principles of chromatography and the application of following chromatographic procedures in isolation and purification of biomolecules: Absorption, Partition, paper and thin layer chromatography, Gas liquid chromatography. High performance liquid chromatography (HPLC), Ion exchange and Exclusion chromatography. Affinity chromatography.

UNIT -IV **10Hours**

Nature of isotopes and radioisotopes. Radioactive decay. Properties of radioactive emissions. Units of radioactivity. Techniques used to measure radioactivity, GM counter and liquid scintillation counting and gamma counter. Labeling of Biochemical compounds and autoradiography.

Course Title: Clinical Hematology (Practical)	L	T	P	Cr.
Course Code: BVM521	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate practical skills in performing essential hematological procedures, such as complete blood counts (CBC), differential counts, and reticulocyte analysis, ensuring accuracy and reliability in results.
2. Develop the ability to prepare and examine peripheral blood smears and bone marrow samples, accurately identifying normal and abnormal cellular components to assist in diagnosis.
3. Analyze and interpret hematological data in the context of clinical scenarios, understanding the significance of findings related
4. Understand and apply quality control measures and laboratory safety protocols in clinical hematology, ensuring the integrity of test results and compliance with regulatory standards.

Course Contents

List of Practical's / Experiments:

1. Microscopic examination of blood smears to identify blood cells
2. Hemoglobin estimation using methods such as cyanmethemoglobin
3. Hematocrit measurement and analysis of packed cell volume
4. Performing complete blood count (CBC) and interpreting results
5. Identification and classification of different types of anemia
6. Screening for hemoglobinopathies and interpreting hemoglobin electrophoresis
7. Performing reticulocyte counts and understanding their clinical significance

8. Bone marrow aspiration and analysis of marrow findings
9. Counting and differentiating white blood cells and identifying abnormalities
10. Morphological examination of leukocytes and correlating with clinical conditions
11. Bone marrow examination for detecting leukemias and interpreting findings
12. Assessment of lymphoid tissues and identifying lymphoproliferative disorders
13. Counting and examining platelets, identifying disorders like thrombocytopenia
14. Performing coagulation tests
15. Assessing hemostasis through bleeding and clotting time tests
16. Analyzing case studies and troubleshooting common testing issues

Course Title: Histopathology and Cytology-II (Practical)	L	T	P	Cr.
Course Code: BVM522	0	0	4	2

Total Hours:30

Learning Outcomes:

1. Demonstrate proficiency in advanced techniques for tissue processing, including embedding, sectioning, and staining methods (such as immunohistochemistry) to prepare specimens for microscopic analysis.
2. Develop skills in the collection, preparation, and microscopic examination of cytological specimens, accurately identifying and distinguishing between benign and malignant cellular changes.
3. Analyze and interpret histopathological and cytological findings in conjunction with clinical data, enhancing diagnostic accuracy and understanding disease implications.
4. Understand and implement quality control measures and safety protocols in the histopathology and cytology laboratory, ensuring the reliability of results and compliance with health regulations.

Course Contents

List of Practical's / Experiments:

1. **Processing and Embedding:** Techniques for processing tissue samples, including fixation, dehydration, and embedding in paraffin.

2. **Microtomy:** Operation of microtomes for sectioning embedded tissues, with emphasis on achieving uniform thickness.

3. **Staining Techniques:** Application of advanced staining methods such as special stains (e.g., PAS, Gomori's methenamine silver) for tissue differentiation.

4. **Histological Slide Preparation:** Mounting, labeling, and observing stained tissue slides using light microscopy.

5. **Immunohistochemical Staining:** Techniques for detecting specific antigens in tissue sections using antibody-based methods.

6. **In Situ Hybridization:** Application of in situ hybridization for detecting nucleic acids within tissue sections.

7. **Electron Microscopy Preparation:** Preparation of samples for electron microscopy, including fixation, embedding, and sectioning.

8. **Histochemical Methods:** Techniques for visualizing specific chemical components in tissue using histochemical stains.

9. **Cytological Smears Preparation:** Techniques for preparing and staining smears from various bodily fluids and exfoliated cells.

10. **Pap Smear Analysis:** Evaluation of Pap smears for the detection of abnormal cells and potential malignancies.

11. **Fluorescence Microscopy:** Use of fluorescence microscopy for analyzing cellular components and identifying specific cell markers.

12. **Cell Culture Techniques:** Methods for isolating and growing cell cultures for cytological examination.

13. **Case Study Analysis:** Review and analysis of histopathological and cytological case studies to understand diagnostic processes and clinical correlations.

14. **Quality Control in Histopathology:** Implementation of quality control measures in histopathological and cytological laboratory practices.

15. **Diagnostic Reporting:** Preparation and interpretation of histopathological and cytological reports based on practical findings.

16. **Troubleshooting Techniques:** Identification and resolution of common issues encountered in histopathological and cytological procedures.

Course Title: Clinical Biochemistry (Practical)	L	T	P	Cr.
Course Code: BVM523	0	0	4	2

Total Hours:30

Learning Outcomes:

Course Contents

List of Practical's / Experiments:

1. Spectrophotometry for biochemical analysis and result interpretation
2. Chromatography techniques including paper, thin-layer, and HPLC for compound separation
3. Electrophoresis methods for protein and nucleic acid separation and analysis
4. Enzyme assays for measuring activity and kinetics in clinical diagnostics
5. Blood glucose analysis for diagnosing diabetes mellitus and hypoglycemia
6. Lipid profile testing to assess cholesterol, triglycerides, and lipoproteins for cardiovascular health

7. Electrolyte analysis including sodium, potassium, and calcium for fluid balance and kidney function
8. Liver function tests evaluate liver enzymes, bilirubin, and proteins for liver diseases.
9. Protein quantification methods for diagnosing proteinopathies and kidney diseases
10. Enzyme profiling is used to assess enzyme levels and isoenzymes for clinical diagnosis.
11. Urinalysis for detecting proteins, glucose, and other substances in urine for renal and systemic diseases
12. Hemoglobin electrophoresis for identifying hemoglobin variants and diagnosing hemoglobinopathies
13. Quality control procedures for ensuring accuracy and reliability of biochemical tests.
14. Statistical analysis for interpreting data and validating experimental results.
15. Case studies and troubleshooting for understanding practical applications and resolving issues.
16. Laboratory documentation and reporting for accurate recording and presentation of results.

Course Title: Biochemical Techniques (Practical)	L	T	P	Cr.
Course Code: BVM524	0	0	4	2

Total Hours:

Learning Outcomes:

Course Contents

List of Practical's / Experiments:

1. Preparation of standard solutions, buffers, and reagents.
2. Use of spectrophotometers to measure absorbance and concentration.
3. Calibration and use of pH meters.
4. Operation of centrifuges for separating cellular components.
5. Determination of protein concentration using assays like Bradford or Lowry.
6. Separation of proteins using SDS-PAGE.
7. Detection of proteins through Western Blotting.
8. Measurement of enzyme activity using various substrate assays.
9. Isolation of DNA from biological samples.
10. Amplification of DNA sequences using PCR.
11. Separation of DNA fragments using agarose gel electrophoresis.
12. Measurement of nucleic acid concentration using spectrophotometry.
13. Separation and analysis of metabolites using HPLC.
14. Identification and quantification of metabolites using mass spectrometry.
15. Detection of proteins or metabolites using ELISA.
16. Analysis of metabolite mixtures using advanced analytical techniques.

Course Title: Project Work- V	L	T	P	Cr.
Course Code: BVM525	0	0	8	4

Total Hours:60

Learning Outcomes:

Course Contents

List of Project's / Experiments:

1. Design a rapid diagnostic test for detecting a specific infectious disease and validate its accuracy and reliability.
2. Analyze the resistance patterns of bacterial isolates from clinical samples to various antibiotics and propose strategies for managing resistance.
3. Investigate the use of specific biomarkers in the early diagnosis of cancer and evaluate their effectiveness and sensitivity.
4. Develop and implement a quality control program to ensure accuracy and reliability in laboratory test results and assess its impact on overall lab performance.

Semester VI

Course Title: Diagnostic Molecular Biology	L	T	P	Cr.
Course Code: BVM601	4	0	0	4

Total Hours:60

Learning Outcomes:

Course Contents

UNIT -I **15 Hours**

Overview of molecular biology principles including DNA, RNA, and protein synthesis, Structure and function of nucleic acids, chromosomes, and genes, Introduction to essential techniques like PCR, gel electrophoresis, and sequencing, Basic laboratory skills, equipment handling, and safety protocols.

UNIT -II **15 Hours**

Principles of PCR and its applications in diagnostics, Techniques and applications of qPCR in quantifying nucleic acids, Methods such as Southern, Northern, and Western blotting for detecting specific DNA/RNA/proteins, Principles and applications of DNA microarrays in diagnostics.

UNIT -III **15 Hours**

Basics of CRISPR-Cas9 technology for gene editing and diagnostic applications, Types of genetic mutations and their role in disease development, Genomic sequencing and epigenetic modifications in disease diagnosis, Principles and practice of genetic counseling in diagnosing hereditary conditions, Application of molecular diagnostics in identifying and managing genetic disorders.

UNIT -IV **15 Hours**

BIOINFORMATICS introduction, aims and importance, Prediction and pattern, homologues and analogues sequence, Protein structure, Motif and domain, Chaperon protein and its clinical significance, Biological databases: definition and types, Nucleic acid databases, Protein databases (Primary and Secondary), Sequence alignment: Local and global alignment, Pairwise alignment, DNA sequence analysis: 6 frame translation, UTRs and its identification in FASTA sequence, ORF, Kozak sequence and their identification from FASTA file, EST analysis tools, Primer designing Ethical considerations and regulatory aspects of molecular diagnostics.

Course Title: Enzymology & Bioenergetics	L	T	P	Cr.
Course Code: BVM602	4	0	0	4

Total Hours:60

Learning Outcomes:

Course Contents

UNIT -I **13Hours**

Enzyme structure, function, and classification, Michaelis-Menten kinetics and factors affecting enzyme activity, Types of enzyme inhibition: competitive, non-competitive, and uncompetitive, Mechanisms of enzyme action, including acid-base and covalent catalysis, Applications of enzymes in biotechnology, medicine, and industry.

UNIT -II **15Hours**

Detailed mechanisms of enzyme catalysis and reaction intermediates, Role and types of coenzymes and cofactors in enzyme function, Regulation of enzyme activity through allosteric sites and covalent modifications, Effects of enzyme dynamics on catalytic efficiency, Methods for studying enzyme mechanisms and kinetics.

UNIT -III **15 Hours**

Basic thermodynamic principles relevant to biological systems, including free energy and entropy, Metabolic pathways for energy production: glycolysis, citric acid cycle, and oxidative phosphorylation, ATP synthesis and its role in cellular energy transactions, Bioenergetic principles governing energy efficiency and conservation, Experimental techniques for measuring bioenergetic processes, such as calorimetry.

UNIT -IV **17Hours**

Mechanisms of metabolic regulation, including feedback inhibition and hormonal control, Integration of metabolic pathways for maintaining cellular homeostasis Overview of metabolic disorders related to energy metabolism, such as mitochondrial diseases, Approaches to studying metabolic regulation and enzyme activity in research, Techniques for assessing metabolic integration and pathway interactions.

Course Title: Clinical Laboratory Operations & Management	L	T	P	Cr.
Course Code: BVM603	4	0	0	4

Total Hours:60

Learning Outcomes:

Course Contents

UNIT -I **12Hours**

Overview of clinical laboratory functions and roles, Laboratory organization and workflow management, Quality assurance and control in laboratory settings, Laboratory accreditation and regulatory requirements, Safety protocols and risk management in clinical laboratories

UNIT -II **18Hours**

Implementation and management of laboratory information systems (LIS), Data entry, processing, and reporting in clinical laboratories, Integration of LIS with electronic health records (EHR), Data security and confidentiality in laboratory management, Utilization of data analytics for laboratory performance improvement

UNIT -III **15Hours**

Recruitment, training, and retention of laboratory personnel, Performance evaluation and professional development of staff, Team dynamics and communication in laboratory environments, Conflict resolution and staff motivation techniques, Compliance with labor laws and ethical considerations.

UNIT -IV **15Hours**

Budgeting and financial planning for clinical laboratories, Cost control and resource optimization strategies, Procurement and inventory management of laboratory supplies, financial performance analysis and reporting, Strategies for revenue generation and sustainability

Course Title: Quality Management (Practical)	L	T	P	Cr.
Course Code: BVM621	0	0	4	2

Total Hours:30

Learning Outcomes:

Course Contents

List of Practical's / Experiments:

1. Overview of quality management principles and standards such as ISO 9001
2. Practical exercises in documenting quality processes and procedures
3. Case studies on implementation of quality management systems in various industries
4. Hands-on training in statistical quality control methods and tools
5. Practical application of inspection techniques and sampling methods
6. Real-world exercises in identifying and addressing quality issues in production
7. Practical sessions on designing and conducting internal audits
8. Exercises in developing and implementing corrective and preventive actions (CAPA)
9. Role-playing scenarios to practice quality assurance communication and reporting
10. Workshops on Lean, Six Sigma, and other continuous improvement methodologies
11. Real-world projects on process improvement and waste reduction
12. Case studies on successful continuous improvement initiatives and their outcomes

Course Title: Quality Management (Practical)	L	T	P	Cr.
Course Code: BVM622	0	0	4	2

Total Hours:

Learning Outcomes:

Course Contents

List of Practical's / Experiments:

1. Isolation of DNA from various sources using standard protocols
2. Quantification and purity assessment of nucleic acids using spectrophotometry
3. Preparation and analysis of agarose gel electrophoresis for DNA visualization
4. Setting up and optimizing PCR reactions, including primer design.
5. Analysis of PCR products using gel electrophoresis and interpretation of results.
6. Troubleshooting common PCR issues and understanding the principles of real-time PCR.
7. Cloning of DNA fragments into plasmid vectors and transformation of competent cells.
8. Screening and selection of recombinant clones using antibiotic resistance and blue-white screening.
9. Plasmid isolation and confirmation of recombinant DNA by restriction digestion and gel electrophoresis.
10. Introduction to next-generation sequencing (NGS) technologies and sample preparation.
11. Application of molecular diagnostics in detecting genetic mutations, infectious diseases, and cancer biomarkers.
12. Retrieval of FASTA sequence from NCBI, identification of introns, exons, initiation and termination codon from FASTA file, ORF reading.
13. Use of different databases: PDB, UniProtKB, GenBank (NCBI), Genome data viewer (NCBI), BLAST Primer designing.

Course Title: Enzymology & Bioenergetics (Practical)	L	T	P	Cr.
Course Code: BVM623	0	0	4	2

Total Hours:30

Learning Outcomes:

Course Contents

List of Practical's / Experiments:

1. Enzyme extraction and purification methods
2. Determination of enzyme activity and specific activity
3. Kinetic parameters: Vmax, Km determination using Michaelis-Menten and Lineweaver- Burk plots
4. Types of enzyme inhibitors: competitive, non-competitive, and uncompetitive inhibition assays
5. Effect of pH, temperature, and substrate concentration on enzyme activity
6. Allosteric regulation and feedback inhibition in metabolic pathways
7. Measurement of cellular respiration rates using respirometers
8. Assays for ATP production and consumption
9. Evaluation of mitochondrial function and integrity through specific biochemical tests
10. Use of enzymes in industrial processes and biotechnology
11. Enzyme immobilization techniques and their applications
12. Case studies on enzyme applications in diagnostics and therapeutics

Course Title: Clinical Laboratory Operations & Management (Practical)	L	T	P	Cr.
Course Code: BVM624	0	0	4	2

Total Hours:

Learning Outcomes:

Course Contents

List of Practical's / Experiments:

1. Implementing laboratory safety protocols, including handling of hazardous materials and waste management
2. Quality control procedures for maintaining accuracy and precision in test results
3. Documentation and record-keeping practices for regulatory compliance and audit readiness
4. Calibration, maintenance, and troubleshooting of laboratory instruments and equipment
5. Inventory management, including ordering, stocking, and controlling laboratory supplies
6. Developing standard operating procedures (SOPs) for the use and maintenance of laboratory instruments
7. Techniques for proper collection, labeling, and processing of clinical samples
8. Methods for ensuring sample integrity, including transport and storage conditions
9. Implementing pre-analytical, analytical, and post-analytical procedures to minimize errors
10. Utilizing laboratory information management systems (LIMS) for data entry, analysis, and reporting
11. Ensuring data accuracy and confidentiality in compliance with health regulations
12. Generating and interpreting laboratory reports for effective communication with healthcare providers

Course Title: Project Work- VI	L	T	P	Cr.
Course Code: BVM625	0	0	8	4

Total Hours: 60

Learning Outcomes:

Course Contents

List of Project's / Experiments:

1. Selection of a research topic related to medical laboratory technology
2. Conducting a comprehensive literature review on the chosen topic
3. Formulating research objectives, hypothesis, and methodology
4. Designing experiments or surveys for data collection
5. Implementing ethical considerations and obtaining necessary approvals
6. Collecting data using appropriate laboratory techniques and instruments
7. Analyzing collected data using statistical tools and software
8. Interpreting results in the context of the research objectives and hypothesis
9. Identifying patterns, trends, and significant findings
10. Compiling research findings into a structured project report
11. Preparing visual aids and presentations for effectively communicating results
12. Presenting the project findings to peers, faculty, and external evaluators