CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT, ODISHA

SCHOOL OF PARAMEDICS AND ALLIED HEALTH SCIENCES

BACHELOR OF SCIENCE IN CLINICAL MICROBIOLOGY

2024

SYLLABUS

Preface: Clinical Microbiologist plays a crucial role in diagnosing and preventing diseases through laboratory-based testing. The program complements medical science by analyzing clinical samples, such as body fluids, tissues, and blood, to identify the presence of pathogens. The field also includes activities such as microorganism screening, sterilization of laboratory environments and equipment, and conducting antibiotic sensitivity tests. Clinical Microbiologists are essential members of the healthcare team, providing vital support through their expertise in laboratory procedures, which ensures accurate diagnoses and the efficient operation of microbiological laboratories.

With the right knowledge and experience, a Clinical Microbiologist holding a +2 Science qualification with a focus on biology can pursue supervisory or management roles in laboratories and healthcare settings. They have the opportunity to work as Laboratory Managers, Consultants, Supervisors, Healthcare Administrators, Hospital Outreach Coordinators, or Laboratory Information System Analysts/Consultants. Additionally, there are career paths in educational consulting, laboratory coordination, and roles in molecular diagnostics, molecular biotechnology firms, *in vitro* fertilization labs, and research institutions. These diverse opportunities allow Clinical Microbiologists to expand their expertise and contribute to various sectors of healthcare and scientific research.

Programme: B. Sc. in Clinical Microbiology

Duration: Three years (Six semesters) full-time programme with 6 months internship in the last semester.

Eligibility: +2 Science with Physics, Chemistry & Biology or equivalent degree.

Examination: Examination rules will be as per guideline of CUTM Examination hand book.

Mini Project: As part of the course requirements, candidates are expected to undertake a mini project, as outlined in the course structure. Upon completion of the mini project, students must submit a dissertation detailing their work. The internal evaluation will include a presentation and viva-voce, which will be conducted by the respective School.

Internship: Candidates are required to complete a six-month internship at a hospital, diagnostic center, or government or private organization that is equipped with modern microbiology laboratory facilities, or at a fully equipped pathology laboratory that meets the University's established guidelines.

The dissertation is mandatory for all students. Students will conduct their dissertation work either individually or in groups of up to three. The dissertation/ internship report should follow a research thesis format, as prescribed by the University.

Degree: The Bachelor of Science (B. Sc.) in Clinical Microbiology degree will be awarded to candidates who have completed the prescribed course of study over a minimum of three academic years, passed all required examinations as outlined in the relevant curriculum, and successfully completed a mandatory six-month internship during the final semester.

Upon successful completion of the three-year program, with a minimum of 140 course credits, the candidate will be awarded the degree of **"Bachelor of Science in Clinical Microbiology (B.Sc. CMB)"** by Centurion University of Technology and Management.

PROGRAMME OUTCOMES (POs)

PO	Outcomes
PO1	Possess a strong foundation of knowledge in the core concepts, theories, and principles of allied health.
PO2	Demonstrate competence in performing a range of clinical procedures and techniques.
PO3	Collaborate with professionals from different healthcare disciplines, demonstrating teamwork.
PO4	Exhibit professionalism, integrity, and ethical conduct in their interactions with patients, colleagues.
PO5	Apply critical thinking skills to analyze complex healthcare scenarios and solve problems.
PO6	Demonstrate leadership qualities and possess basic knowledge of healthcare management principles.
PO7	Provide compassionate and comprehensive patient care.
PO8	Embrace a commitment to lifelong learning and professional development.
PO9	Demonstrate effective verbal and written communication skills.
PO10	Promote health and wellness by educating individuals and communities about healthy lifestyles, disease prevention strategies, and the importance of early

	intervention.
PO11	Respect and appreciate the cultural diversity of patients and communities.
PO12	Understand the importance of research in advancing allied health practice.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSOs	Outcomes
PSO1	To acquire knowledge in the understanding of diagnostic methods used in clinical microbiology.
PSO2	To develop expertise in performing and interpreting advanced techniques used for identification and characterization of microorganisms.
PSO3	To gain research skills and knowledge in epidemiology, allowing to contribute through research projects and investigations

PROGRAMME STRUCTURE

B Sc Clinical Microbiology

CHOICE BASED CREDIT SYSTEM(CBCS) STRUCTURE

Category	Minimum Credits to be completed	Minimum Credits to be completed
School (Core)	**16**	**140**
Discipline (Core)	**76**	
Skill Basket#	**12**	
Value Added**	**6**	
AECC	**6**	
Summer Internship##	**4**	

Project	**10**	
Internship	**10**	

#Skill course is to be registered by the student during 1st, 2nd and 3rd semester.
**Value added course to be registered by the student atleast one time in each year
##Summer Internship is to be undertaken during summer vacation post 2nd semester and 4th semester

BASKET -I
School Core Courses (B.Sc. CMB)

Sl. no.	CODE	SUBJECT	SUBJECT TYPE (T + P + Pj)	CREDITS
1	CUTM4284	Human Anatomy and Physiology	3+1+0	4
2	CUTM4285	Cell Biology	2+0+1	3
3	CUTM4286	Biochemistry	2+1+0	3
4	CUTM1721	Research Methodology	2+0+1	3
5	CUTM4327	Clinical Pathology	2+1+0	3
			Total Credit	**16**

BASKET-II
DISCIPLINE CORE COURSES

Sl.No.	CODE	SUBJECT	SUBJECT TYPE (T+P+Pj)	CREDITS
1	CUTM4287	Haematology	3+1+0	4
2	CUTM4288	Analytical Biochemistry	3+1+0	4
3	CUTM1737	Molecular Biology	3+0+1	4
4	CUTM4289	Cytological Techniques	2+1+0	3
5	CUTM1742	Basic Computer and Information Science	0+2+0	2
6	CUTM1734	Medical Law and Ethics	2+0+1	3
7	CUTM4290	Microbiology	2+1+0	3
8	CUTM4291	Systemic Bacteriology	2+1+0	3
9	CUTM4293	Systemic Virology &	3+1+0	4

		Mycology		
10	CUTM4297	Public Health Microbiology	3+2+0	5
11	CUTM1746	Epidemiology	2+0+1	3
12	CUTM1739	Pharmaceutical Microbiology	3+1+0	4
13	CUTM1741	Industrial Microbiology	3+0+1	4
14	CUTM4294	Diagnostic Bacteriology	2+2+0	4
15	CUTM4295	Immunology	3+1+0	**4**
16	CUTM4296	Diagnostic Virology & Mycology	3+2+0	5
17	CUTM1744	Diagnostic Parasitology	3+1+0	4
18	CUTM4298	Healthcare Associated Infections	3+1+0	4
19	CUTM1730	Medical Instrumentation And Technique	2+2+0	4
20	CUTM4292	Vitamins and Hormones	2+2+0	4
21	CUTM1754	Mini Project	0+0+2	2
			Total Credit	**77**

NOTE: Along with the School core and Disciple core subjects, the students need to opt for AECC Courses, Skill/ Domain/ Elective courses and value- added courses from the University Basket, as per the requirement by the University.

BASKET I

SCHOOL CORE COURSES

HUMAN ANATOMY AND PHYSIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Human Anatomy and Physiology	CUTM4284	Theory+ Practice	3-1-0	**4**

Course Objective:

- To gain comprehensive knowledge of the basic structure of the human body, including cells, tissues, organs, and systems.
- To understand how various systems of the body function and interact to maintain homeostasis and support life.
- To acquire detailed knowledge of specific systems such as the musculoskeletal, nervous, cardiovascular, respiratory, digestive, endocrine, urinary, and reproductive systems.
- To develop skills in identifying anatomical structures and understanding physiological processes through laboratory exercises, dissections, and clinical correlations.

Course Outcome:

After completion of the course, the students will be able to,

Cos	Statements	COs With POs and PSOs Mapping
CO1	Understand the major anatomical terminologies.	PO1, PO7, PO12
CO2	Know the basic concept of human anatomy and physiology.	PO1, PO3, PSO1
CO3	Identify locations of major organs of each system.	PO1, PO10, PO11
CO4	Analyse interrelationships at molecular, cellular and tissue level.	PO2, PO5, PO13, PSO2
CO5	Apply the knowledge for understanding the functions of different organs in human body.	PO1, PO4, PO8, PSO3

Course Outline:

Module-I

Scope of Anatomy and physiology. Terms and terminology used in Anatomy. Structure of cell, function of its components with special reference to mitochondria and microsomes. Elementary tissues: Anatomy of epithelial tissue, muscular tissue, connective tissue and nervous tissue.

Practice: Identification of different organs and systems from charts.

Module-II

Skeletal System: Skeleton system with classification, types of bone, features of long bone, ossification, blood supply, Joints – classification with examples, structure of typical synovial joints, Joint disorders.

Practice: Demonstration of individual bone from skeleton.

Module-III

Cardiovascular System: Composition and functions of blood. Blood groups – ABO system and Rh factor and coagulation of blood. Brief information regarding disorders of blood. lymph – origin, circulation, functions of lymph and lymph nodes. Structure and functions of various parts of the heart. Blood pressure and its recording. Brief information about cardiovascular disorders. Respiratory system: Introduction and functional anatomy of respiratory tract, physiology of respiration.

Practice: Demonstration of the morphology of different blood cells. Measurement of Blood pressure, impulses, Heart beats, respiration rate etc.

Module-IV

Urinary System: Various parts of the urinary system and their functions, structure and functions of the kidney. Physiology of urine formation. Patho-physiology of renal diseases and edema. Digestive System: Anatomy of digestive system and their functions. Structure and functions of liver, physiology of digestion and absorption.

Practice: Demonstration of various parts of the urinary system and digestive system.

Module-V

Endocrine System: Endocrine glands and Hormones. Reproductive system. Structure and function of sense organs.

Practice: Demonstration of various parts of the endocrine and reproductive systems.

Suggested Readings:

1. Text book Anatomy & Physiology for nurses by Evelyn Pearce, Publisher Faber &Faber.
2. Text book Anatomy and Physiology for nurses by Sears, Publisher Edward Arnold.
3. Anatomy & Physiology- by Ross and Wilson, Publisher Elsevier.
4. Anatomy& Physiology: Understanding the human body by Clark, Publisher Jones & Bartlett.
5. Anatomy and Physiology for nurses by Pearson, Publisher Marieb&Hoehn.

6. Anatomy and Physiology by N Murgesh, Publisher Satya.

CELL BIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Cell Biology	CUTM4285	Theory+ Project	2-0-1	**3**

Course Objective:

- Determine the parts of the cell membrane and the cell wall
- Distinguish the types and mechanism of mutation
- Compare and contrast the events of cell cycle and its regulation
- Understand the dynamic character of cellular organelles

Course Outcome:

After completion of the course the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Describe the fundamental principles of cellular biology.	PO1, PSO1, PSO2
CO2	Understand the cells growth, division and death.	PO1, PO2, PO5, PSO1, PSO3
CO3	Utilize the skill in mechanism of cell signaling and how it regulates cellular functions.	PO5, PO6, PSO2
CO4	Relate the knowledge with how cellular dysregulation can lead to diseasecondition.	PO4, PO10, PO12, PSO1, PSO3
CO5	Identify cellular dysregulation.	PO5, PO12, PSO3

Course Outline:

Module –I Fundamentals of Cell Structure and Function:

Overview of Cells: History and Cell Theory: Key historical developments and basic principles. Structure and Function of Cell and its Organelles: Biological Membranes: Structure and function. Nucleus: Nuclear envelope, nucleolus. Mitochondria: Structure, function, and marker enzymes. Chloroplasts: Structure and function. Lysosomes, Glyoxysomes, and Peroxisomes: Structure, function,

and marker enzymes.

Endoplasmic Reticulum: Rough and smooth ER, functions. Ribosomes: Structure and function. Golgi Complex: Structural organization, function, and marker enzymes.Cell Types:Prokaryotes vs. Eukaryotes: Key differences and characteristics.From Single Cell to Multicellular Organisms: Overview of cellular evolution. Different Molecules of the Cell: Water, Salt, and Mineral Ions: Importance and roles.

Project topics:

1. Comparative Study of Organelles: Structure and Function in Prokaryotic and Eukaryotic Cells
2. The Role of Mitochondria and Chloroplasts in Cellular Metabolism
3. Cell Membranes: Structure, Function, and Transport Mechanisms
4. The Role of the Endoplasmic Reticulum and Golgi Complex in Protein Synthesis and Modification

Module II: Cell Cycle and Cellular Communication

Cell Cycle and Its Regulation: Phases of the Cell Cycle: G0/G1, S, G2, and M phases.Cell Division: Mitosis, meiosis, and cytokinesis. Regulation of the Cell Cycle: Key regulatory mechanisms. Cellular Communication and Mobility:

Cell Adhesion: Roles of different adhesion molecules. Gap Junctions: Function and importance. Extracellular Matrix (ECM): Structure and function.

Cell-Cell Interaction and Cell-ECM Interaction: Mechanisms and significance.

The Cytoskeleton: Components and functions. Microtubule-Based Movement and Microfilament-Based Movement: Mechanisms and roles.

Project Topics:

1. Regulation of the Cell Cycle: Key Checkpoints and Their Role in Cell Division
2. The Role of the Cytoskeleton in Cell Movement and Division
3. Extracellular Matrix (ECM) and Cell Adhesion: Mechanisms of Cell Communication
4. Mechanisms of Gap Junction Communication in Multicellular Organisms

Module III: Cell Signaling

Cell Signaling: Hormones and Their Receptors: Types and functions. Cell Surface Receptors: Overview and types. Signaling Through G-Protein Coupled Receptors (GPCR): Mechanisms and pathways. Tyrosine Kinase Receptors: Structure and function. Signal Transduction Pathways: Key pathways and their roles. Second Messengers: Types and functions. Regulation of Signaling Pathways: Mechanisms and importance. Bacterial and Plant Two-Component Systems: Overview and examples. Bacterial Chemotaxis: Mechanisms and significance.

Project topics:

1. Signaling Pathways: The Role of G-Protein Coupled Receptors in Cell Communication
2. Tyrosine Kinase Receptors in Cellular Signal Transduction
3. The Role of Second Messengers in Regulating Cellular Responses

Module IV: Programmed Cell Death (Apoptosis)

Programmed Cell Death (Apoptosis): Intrinsic Pathway: Mechanisms and key components. Extrinsic Pathway: Mechanisms and key components. Caspase Enzymes: Roles and functions. Regulation of Apoptosis: Importance in health and disease.

Project topics:

1. Mechanisms of Apoptosis: Intrinsic vs. Extrinsic Pathways
2. The Role of Caspase Enzymes in Programmed Cell Death
3. Apoptosis and Disease: The Connection Between Programmed Cell Death and Cancer
4. Regulation of Apoptosis in Development and Immune System Function

Module V: Cancer Biology

Cancer Biology: Development and Causes of Cancer: Overview and basic concepts.Tumor Viruses: Types and mechanisms. Oncogenes: Functions and roles in cancer.Tumor Suppressor Genes: Functions and roles in cancer.

Project topics:

1. The Role of Oncogenes in Cancer Development: Mechanisms and Pathways
2. Tumor Suppressor Genes: Their Functions and Implications in Cancer
3. The Impact of Tumor Viruses on Cellular Transformation and Cancer Development
4. The Relationship Between Apoptosis Dysregulation and Cancer Progression

Suggested Readings:

1. The Cell a Molecular Approach (4th Edition) by Cooper & Hausman **https://www.thebiomics.com/books/cell-biology/cell-molecular-approach-cooper-and- hausmn-4th-ed.html**
2. Molecular Biology by Friefelder David, Publisher Narosawww.alibris.com/Molecular- Biology-David.
3. Introduction to Cell biology by John K Young, World Scientific publishing company

   www.overdrive.com/.../introduction-to-cell-biology
4. Introduction to biology,3rd tropic edition by D G Maackean www.amazon.com/Introduction-Biology-D-G-Mackean/.

BIOCHEMISTRY

Subject Name	Code	Type of course	T-P-Pj	Credit

Biochemistry	CUTM4286	Theory+ Practice	2-1-0	**3**

Course Objective:

- To explore the processes and pathways involved in the metabolism of carbohydrates and their significance in energy production.
- To comprehend the structure, function, and importance of amino acids and proteins in biological systems.
- To analyze the function and mechanisms of enzymes in facilitating and regulating metabolic reactions.
- To understand the roles of carbohydrates, proteins, and lipids in maintaining metabolic balance and overall physiological functions.

Course Outcome:

After completion of the course, the students will be able to:

COs	**Statements**	**COs with POs and PSOs Mapping**
CO1	List out the biochemical pathways leading to metabolism in the human body.	PO1, PO5 PSO1
CO2	Understand the significance of biomolecules in metabolic activities.	PO1, PO5, PSO1
CO3	To implement the knowledge of transformation of energy by the cells.	PO1, PO2, PO5, PSO1
CO4	Detects abnormal range of these molecules from patient samples.	PO5, PO5, PO7, PSO2
CO5	Evaluate the biochemical analysis of the patient samples.	PO1, PO2, PO4, PO5, PO7, PO9, PSO1, PSO2, POS3

Course Outline

Module- I

Structure of enzyme: Apoenzyme and cofactors, prosthetic group-TPP, coenzyme NAD, metal cofactors, Classification of enzymes.

Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis.

Enzyme inhibition, enzyme kinetics.

Diagnostic value of serum enzymes: Creatinine kinase, Alkaline phosphatase, Acid phosphatase, LDH, SGOT, SGPT, Amylase, Lipase, Carbonic anhydrase etc.

Practice: Study of effect of temperature on enzyme activity

Study of effect of pH on enzyme activity

Module- II

Carbohydrates: Biomedical importance & properties of Carbohydrates, Classification, **Families of monosaccharides:** aldoses and ketoses, trioses, tetroses, pentoses, and hexoses. Stereo isomerism of monosaccharides, epimers, Haworth projection formulae for glucose; chair and boat forms of glucose.

Practice: Estimation of Glucose in urine

Module- III

Metabolism: Glycogenesis & glycogenolysis, Glycolysis, citric acid cycle & its significance, Components of respiratory chain, energy relationships during cell respiration, types of respiration. HMP shunt & Gluconeogenesis, regulation of blood glucose level.

Practice: Estimation of Glucose in blood

Module- IV

Amino acids: Classification, essential & non-essential amino acids. Chemistry of Proteins & their related metabolism, Classification, biomedical importance.

Metabolism: Ammonia formation & transport, Transamination, Decarboxylation, Urea cycle, metabolic disorders in urea cycle, catabolism of amino acids.

Practice: Estimation of Protein in urine Estimation of Protein in blood

Module- V

Chemistry of Lipids & their related metabolism: Classification, biomedical importance, essentialfatty acids. Brief out line of metabolism: Beta oxidation of fatty acids, fatty liver, Ketogenesis, Cholesterol & it's clinical significance, Lipoproteins in the blood composition & their functions in brief, Atherosclerosis.

Diabetes mellitus: its types, features, gestation diabetes mellitus, glucose tolerance test, glycosuria,Hypoglycemia & its causes.

Practice: Estimation of Bile pigment in urine Estimation of Bile salts in urine

Suggested Readings:

1. Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil(2018) Harper's Illustrated Biochemistry. Mc Graw Hill.
(e-Book link: https://www.pdfdrive.com/harpers-illustrated-biochemistry- d176838999.html)
2. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.
e-Book link: https://www.pdfdrive.com/lehninger-principles-of-biochemistry-5th-edition-d164892141.html)
3. Donald Voet, Judith G. Voet (2011) Biochemistry 4th Edition. Wiley Publishers.
(e-Book link: https://www.pdfdrive.com/biochemistry-4th-edition-e165192126.html)
4. Jeremy M. Berg, John L. Tymoczko, LubertStryer. Biochemistry 7th Edition. W.H. Freemanand Company, New York.
(e-Book link: https://www.pdfdrive.com/biochemistry-seventh-edition- e167675390.html)

Simulation links for labs:

1. Lecture (e-source link: https://app.lecturio.com/#/course/s/8014)
2. Labs for Life (e-source link: http://labsforlife.in/InstructionalVideo.aspx**)**

RESEARCH METHODOLOGY

Subject Name	Code	Type	T + P + Pj	Credits
Research Methodology	CUTM1721	Theory+ Project	2+0+1	3

Course Objective:

- To gain a solid understanding of the fundamental concepts, types, and importance of research in scientific inquiry and academic fields.
- To learn how to formulate research problems, hypotheses, and objectives, as well as how to design and structure research projects.

- To understand and apply various methods of data collection, including surveys, experiments, interviews, and observation, while ensuring accuracy and reliability.
- To become proficient in using statistical tools and techniques for analyzing and interpreting data.

Course Outcome:

After completion of the course, the students will be able to,

COs	Statements	COs With POs and PSOs Mapping
CO1	Identify the key components of research, including its definition, scope, limitations, types, and objectives	PO1, PO6, PO12, PSO3
CO2	Understand the steps involved in developing a health research proposal.	PO2, PO3, PO4, PO9, PSO3
CO3	Implement the methods of data collection.	PO1, PO2, PO10, PO11, PSO2
CO4	Interpret the concepts of sampling designs, the theory of estimation and hypothesis testing, and the significance tests based on t, F, Z, and Chi-Square tests	PO2, PO5, PO13, PSO2, PSO3
CO5	Evaluate the importance of tabulation, coding, editing, interpretation, and report writing in the research process.	PO7, PO9, PO12, PSO3

Course Outline:

Module- I

Introduction to Research**:** Definition, scope, limitations, and types of research. Objectives of Research**:** Types and importance. Research Process**:** Basic steps involved in the health research proposal development process. Literature Review**:** Importance, sources, strategies for accessing information, library and computer search techniques.

Project Topics:

1. Impact of Digital Library Systems on Literature Review Effectiveness in Health Research
2. Evaluating the Scope and Limitations of Research in Rural Healthcare Development
3. Comparative Study of Traditional vs. Modern Research Methods in Public Health

Module- II

Research Title and Objectives**:** Criteria for selecting a research title. Formulation of Research Objectives**:** Types and qualities of research objectives. Research Designs**:** Different types of research designs and their

applicability to various research contexts.

Project Topics:

1. Exploring Factors Influencing Research Title Selection in Epidemiological Studies
2. Formulating Research Objectives for Preventing Lifestyle Diseases Among Urban Youth
3. Analyzing the Applicability of Experimental vs. Observational Research Designs in Community Health Projects

Module- III

Data Collection Methods**:** Secondary and primary data collection techniques. Scaling Techniques**:** Concept, types, rating scales, ranking scales, scale construction techniques, and multi-dimensional scaling. Sampling Designs**:** Concepts, types, techniques, and sample size determination.

Project Topics:

1. Effectiveness of Primary Data Collection Techniques in Monitoring Pandemic Outbreaks
2. Assessing Multi-Dimensional Scaling in Consumer Preferences for Health Products
3. Sampling Techniques in Determining Prevalence Rates of Non-Communicable Diseases

Module- IV

Research Hypothesis**:** Definition, qualities, importance, and types of hypotheses. Theory of Estimation**:** Testing of hypothesis, small and large sample tests. Statistical Tests**:** Tests of significance based on t, F, Z, and Chi-Square tests.

Project Topics:

1. Hypothesis Testing for the Impact of Yoga on Mental Health in Adolescents
2. Statistical Analysis of Health Outcomes in Smokers vs. Non-Smokers Using Chi-Square Tests
3. Small and Large Sample Testing to Study Vaccination Rates in Urban vs. Rural Areas

Module- V

Designing Questionnaire & Interviewing**:** Techniques for effective data collection. Tabulation, Coding, Editing**:** Organizing and processing research data. Interpretation and Report Writing**:** How to analyze results and prepare research reports.

Project Topics:

1. Designing Questionnaires to Assess Public Awareness of Reproductive Health
2. Developing an Interview Framework to Study Health-Seeking Behavior in Low-Income Communities
3. Tabulation and Statistical Interpretation of Survey Data on Patient Satisfaction in Hospitals

Suggested Readings:

1. Research Methodology by C.R. Kothari (3rd Ed)
2. Research Methodology In the Medical & Biological Sciences by Petter Laake et al.
3. Essentials of Research Design and Methodology by Geoffrey Marczyk et al.
4. WHO, Health Research Methodology: A guide for training in research Methods, 2nd Edition, WHO- WIPRO
5. A Student's Guide to Methodology by Clough P and Nutbrown C. Sage Publication.
6. National Ethical Guidelines for Health Research in Nepal, Available at Nepal Health

Research Council.

7. Field Trials of Health Interventions in Developing Countries by Smith PG, Morrow.

CLINICAL PATHOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Clinical pathology	CUTM4327	Theory+ Practice	2-1-0	**3**

Course Objective:

- To develop a comprehensive understanding of the pathophysiological mechanisms underlying common diseases and disorders affecting different body systems.
- To acquire knowledge of various laboratory techniques and diagnostic tests used in clinical pathology, including hematological, biochemical, microbiological, and histopathological tests.
- To understand the principles of specimen collection, handling, processing, and the importance of quality control in clinical pathology.
- To apply theoretical knowledge to the identification of pathological changes in tissues and organs through microscopic and other diagnostic techniques.

Course Outcome:

After completion of the course, the students will be able to,

COs	Statements	Cos with POs and PSOs Mapping
CO1	Execute the technique of collection of pathological specimens.	PO1, PO2, PO7, PO9, PO10,PSO1
CO2	Understand preservation and processing of pathological samples.	PO1, PO2, PO7, PO9, PO10, PSO1, PSO2
CO3	Identify the causative agents of infectious diseases.	PO1, PO2: PO5, PO12, PSO1, PSO2, PSO3
CO4	Interpret Gram staining and ZN staining results to diagnose respiratory infections, differentiate between amoebic and bacillary dysentery, and assess the	PO1, PO2: PO5, PO12, PSO1, PSO2, PSO3

	presence of pathogens in various body fluids.	
CO5	Evaluate human abnormalities through clinical investigations.	PO1, PO2: PO5, PO12, PSO1, PSO2, PSO3

Course Outline:

Module-I

Physical & Chemical Examination of Urine: Sugar, ketone bodies, diabetes, nephritis, UTI, etc. Microscopical Examination of Urine: Including operation of the urine analyzer. Special Tests: Pregnancy test, multistix reagent strip, jaundice, albumin, phosphate, BJP, bile salt and pigment.
Lab & Practice: Benedict test, Rothera's test, Fouchet's test, urine analyzer operation, and other urine tests.

Module-II

Respiratory Tract Infection: Gram staining, ZN staining, and DOT centers. Sputum Analysis: For diagnosis of Mycobacterium tuberculosis. Clinical Significance & Report Writing: Sputum and respiratory infections.
Throat Swab Analysis: Bacteriological examination and clinical significance.
Lab & Practice: Gram staining, ZN staining, sputum analysis. Throat swab examination.

Module-III

Physical, Chemical, and Microscopical Examination of Stool: Including differences between amoebic and bacillary dysentery. Clinical Significance of Stool Examination: For parasitic and bacterial infections.
Lab & Practice: Stool analysis, occult test, protozoa and helminth identification.

Module-IV

Pleural, Pericardial, and Synovial Fluids: Composition, collection, and routine laboratory investigation. Cerebrospinal Fluid (CSF): Related to meningitis, brain tumors, and other disorders.
Lab & Practice: Collection and examination of pleural, pericardial, synovial fluids, and CSF.

Module-V

Semen Examination: Composition, and analysis for male infertility disorders.
Lab & Practice: Semen analysis, chemical and microscopical examination.

Suggested Readings:

1. Textbook of Clinical laboratory methods and diagnosis by Gradwohls, Publisher Mosby
2. Medical laboratory technology Vol.1 by K. L. Mukherjee, 2007, Publisher Tata McGrawHill Textbook of medical laboratory technology by Praful B Godkar, Publisher Bhalan
3. Medical laboratory science theory and practice by J Ochei and Kolhatkar, 2002, Tata McGraw- Hill, Publisher TBS

BASKET II

DISCIPLINE CORE COURSES

HAEMATOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Hematology	CUTM4287	Theory+practical	3-1-0	**4**

Course Objective:

- To gain advanced knowledge of common hematologic diseases and their impact on blood cells and other blood components.
- To develop the ability to investigate hemorrhagic disorders and identify laboratory abnormalities such as anemia, polycythemia, leukopenia, leukocytosis, thrombocytopenia, thrombocytosis, and elevated ESR.
- To evaluate normal and abnormal cell morphology and associate these findings with specific diseases for clinical relevance.
- To acquire expertise in clinically relevant hematological analyses for a deeper understanding of blood components and their diagnostic significance.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Understand and identify various laboratory	PO1, PO2, PO5, PO7,

	findings and associate them with clinical conditions.	PSO1
CO2	Demonstrate good skills in the relevant haematology methodology.	PO2, PO4, PO9, PSO1
CO3	Analyse various components of blood, their functions and roles in various diseases.	PO1, PO5, PO12, PSO1, PSO2
CO4	Evaluate blood elements and report results within the stated limits of accuracy.	PO2, PO5, PO7, PO12, PSO1, PSO2
CO5	Evaluate blood elements and report results within the stated limits of accuracy.	PO4, PO6, PO9, PSO1, PSO2

Course Outline

Module- I

Scope & importance of Hematology, important equipment and chemicals, various test performed in Hematology laboratory, Focusing different blood cells through microscope.

Practice*:* Demonstration of instruments used in hematology- Microscope, Blood Cell counter, Sahali's Apparatus.

Module- II

Identify and/or confirm the composition & function of various red blood cell inclusions.Function of normal cellular components. Formation of blood, Synthesis of blood in Bone marrow- Erythropoiesis, leucopoiesis, thrombopoiesis. Anticoagulants: definition, Uses, Different types of Anticoagulants., mode of action, their merits and demerits. Morphology of normal blood cells, abnormal morphology & diseases.

Practice*:* Demonstration of different blood cell, their synthesis from slide presentation or chart.

Demonstration the normal and abnormal morphology of different blood cells.

Module- III

Hematological Disorders

Classification of Anemia: Morphological & etiological. Iron Deficiency Anemia: Distribution of body Iron, Iron Absorption, causes of iron deficiency, lab findings. Megaloblastic Anemia: Causes, Lab findings. Hemolytic Anemia: Definition, causes, classification & lab findings.

Bone Marrow: Cell composition of normal adult Bone marrow, Aspiration, Indication, Preparation & Staining, Special Stain for Bone Marrow -Periodic Acid Schiff, Sudan Black **Leukemia:** Classification, Blood Picture, Differentiation of Blast Cells.

Practice: Collection of blood by different methods

Different normal and abnormal morphology of RBCs, WBCs, Platelet.

Module- IV

Collection of blood, Methods & Preparation of Stains and Smears

Practice:

Cleaning and drying of glass and plastic ware, Collection of venous and capillary blood, cleaning ofglass-syringes and its sterilization. Preparation of buffers, Preparation of the stains and other reagents,

Preparation of peripheral blood film (PBF), To stain a peripheral blood Film by Leishman- stain,Haemoglobin estimation (Sahali's method and cyanmethaemoglobin method).

Module- V

Routine Hematological Tests:

Complete blood cell count, ESR, Differential Leukocyte count, Total leukocyte count, Bleeding timeand Clotting time, Blood Grouping and Rh Typing.

Practice:

Complete Blood Counts, Determination of Haemoglobin, TRBC Count by Haemocytometers, TLC by Haemocytometer, Differential Leukocyte count, Determination of Platelet Count. Determination of ESR by wintrobes, Determination of ESR by Westergeren's method, Determination of PCV by Wintrobes, Erythrocyte Indices- MCV, MCH, MCHC. Reticulocyte Count, Absolute Eosinophil Count,Bleeding time and Clotting time, Blood Grouping and Rh Typing.

Suggested Readings:

1. Textbook of Medical Laboratory Technology P.B Gotkar Mumbai, Bhalani Publishing House
2. Text book of Medical Laboratory Technology by Paraful B. Godkar, Publisher Bhalani
3. Text book of Medical Laboratory Technology (2nd edition) by V.H Talib, Publisher CBS
4. Atlas of hematology (5th edition) by G.A. McDonald, Publisher Churchill Livingstone
5. Medical Laboratory Technology By K.L Mukherjee, Publisher McGraw Hill education

pvt. limited

6. Text book of Medical Laboratory Technology (6th edition) by Ramnik Sood, Jaypee Publication.
7. Ebook link-https://www.pdfdrive.com/hematology-basic-principles-and-practicee176384006.html
8. Ebook link-https://www.pdfdrive.com/hematology-basic-principles-and-practice-expert- consult- online-and-print-expert-consult-title-online-print-5th-edition-e186195241.html
9. Ebook link https://books.google.co.in/books?id=6sfacydDNsUC&printsec=frontcover&dq=hematology&hl=en&sa=X&ved=2ahUKEwja9ve3I7qAhUwzTgGHSMUDekQ6wEwAHoECAQQAQ#v=onepage&q=hematology&f=false
10. Ebooklink- https://books.google.co.in/books?id=QQcYAAAAYAAJ&printsec=frontcover&dq=hematology&hl=en&sa=X&ved=2ahUKEwja9-ve3I7qAhUwzTgGHSMUDekQ6wEwAnoECAIQAQ#v=onepage&q=hematology&f=f alse

ANALYTICAL BIOCHEMISTRY

Subject Name	Code	Type of course	T-P-Pj	Credit
Analytical Biochemistry	CUTM4288	Theory+ Practice	3-1-0	**4**

Course Objective:

- To understand the principles and functioning of biochemical analyzing instruments, both automated and semi-automated, used in clinical laboratories.
- To learn the procedures for the proper care, maintenance, and handling of laboratory equipment and chemicals to ensure optimal performance and safety.

- To familiarize with the normal reference ranges of key biochemical components in the human body, such as proteins, electrolytes, and hormones.
- To explore clinically relevant biochemical analysis techniques for a deeper understanding of the roles and clinical significance of biochemical components in health and disease.

Course Outcome:

After completion of the course, the students will be able to:

Cos	Statements	COs with POs and PSOs Mapping
CO1	Understand various tests carried out for biochemical analysis & Hormone investigations.	PO1, PO10, PSO1
CO2	Know the application and handling of equipment's in biochemical laboratory.	PO2, PO4, PSO2
CO3	Perform analysis using semi-automated and fully automated biochemistry analyser.	PO2, PO5, PSO2
CO4	Perform major biochemical investigations.	PO2, PO9, PSO1
CO5	Operate biochemical analysers.	PO2, PO3, PSO2, PSO3

Course Outline

Module I: Chromatography Techniques

Chromatography Techniques: Paper Chromatography, Thin Layer Chromatography (TLC), Column Chromatography, Ion Exchange Chromatography, Affinity Chromatography, Gel Filtration Chromatography, Gas Chromatography (GC)

High-Performance Liquid Chromatography (HPLC), Fast Protein Liquid Chromatography (FPLC)

Practice:

Handling of Equipment and Chemicals: Techniques for working with biochemical laboratory equipment and chemicals.

Module II: Electrophoresis Techniques

Electrophoresis Techniques: Moving Boundary Electrophoresis, Zone Electrophoresis (Paper and Gel), Immunoelectrophoresis, Isoelectric Focusing, 2-D Electrophoresis, Principle and Instrumentation: X-ray Diffraction (XRD) Nuclear Magnetic Resonance (NMR) Electron Spin Resonance (ESR)

Practice:

Estimate Erythrocyte Sedimentation Rate (ESR): Techniques for measuring the rate of erythrocyte sedimentation.

Module III: Automated and Semi-Automated Analyzers

Biochemistry Analyzers: Fully Automated Biochemistry Analyzer, Semi-Automated Biochemistry Analyzer, Coagulometer, Methods of Estimation and Assessment: Glucose Tolerance Test, Clearance Test for Renal Function, Gastric Analysis, Liver Function Test (LFT), Kidney Function Test (KFT), Lipid Profile, Qualitative Tests: Urobilinogens, Renal Calculi, Barbiturates, T3, T4, and TSH, 17-Ketosteroids

Principles and Procedures for Estimation: Acid Phosphatase, Alkaline Phosphatase, Lactate Dehydrogenase (LDH), Aspartate Transaminase (AST), Alanine Transaminase (ALT), Creatine Phosphokinase (CPK)

Practice:

Glucose Tolerance Test, Clearance Test, Gastric Juice Collection and Analysis

Kidney Function Test (KFT), Liver Function Test (LFT), Lipid Profile Tests for Renal Calculi and Hormones

Module IV: Advanced Instrumentation and Techniques

Principles and Applications of Advanced Techniques: X-ray Diffraction (XRD)

Nuclear Magnetic Resonance (NMR), Electron Spin Resonance (ESR)

Practice:

Estimate Erythrocyte Sedimentation Rate (ESR)

Module V: Clinical Chemistry and Diagnostic Tests

Clinical Chemistry Procedures:

Principles and Procedures of Automated and Semi-Automated Analyzers

Methods for Estimation of Various Biochemical Parameters: Glucose, Renal Function, Gastric Analysis, Liver Function, Lipid Profile, Hormones, and Enzymes

Clinical Significance of Enzyme Tests: Acid Phosphatase, Alkaline Phosphatase, LDH, AST, ALT, CPK

Practice:

Comprehensive Diagnostic Tests: Including glucose tolerance test, clearance test, gastric analysis, kidney and liver function tests, lipid profile, renal calculi analysis, and hormone tests.

Suggested readings:

1. Handbook of Christen Medical Association, India (CMAI) Medical Laboratory Technology-Robert H.Carman. 2nd Edn. CMAI, New Delhi.
2. Text book of Medical Laboratory Technology, P.B. Godkar 2nd Edn. Bhalani Publication.
3. Handbook of Biochemistry by M. A. Siddique 8th Edn. Vijay Bhagat Scientific Book
4. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2008). **Lehninger Principles of Biochemistry** (5th ed.). W.H. Freeman and Company.
5. Voet, D., & Voet, J. G. (2011). **Biochemistry** (4th ed.). John Wiley & Sons.
6. Berg, J. M., Tymoczko, J. L., Gatto, G. J., & Stryer, L. (2019). **Biochemistry** (8th ed.). W.H. Freeman and Company.
7. Roy, A. K. (Year). **Biochemistry of Metabolic Processes**. Kalyani Publishers.
8. Ebook link- https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_ science_st udents/medicalbiochemistry.pdf
9. Ebook link- https://books.google.co.in/books?id=Je_pJfb2r0cC&printsec=frontcover&source=g bs_ge_sum mary_r&cad=0#v=onepage&q&f=false
10. Ebook link- https://books.google.co.in/books?id=csPcDAAAQBAJ&printsec=frontcover&source=gbs_ge_s ummary_r&cad=0#v=onepage&q&f=false
11. Ebook link- https://books.google.co.in/books?id=2FkXAwAAQBAJ&printsec=frontcover&sourc e=gbs_ge_ summary_r&cad=0#v=onepage&q&f=false

MOLECULAR BIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Molecular Biology	CUTM1737	Theory + Project	3-0-1	**4**

Course Objective:

- To comprehend the molecular biology of cells, including their evolution, types, and structural organization of organelles
- To explore molecular mechanisms of cellular processes.
- To examine the molecular nature of genetic materials, including DNA and RNA structures, their replication, transcription, and translation processes.
- Understand the causes and mechanisms of human cancer, the role of tumor suppressor genes and oncogenes, and insights from genome research.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Conceptually understand the central dogma of life.	PO1, PO5, PO12, PSO1, PSO3
CO2	Apply basic techniques of Molecular Biology in disease diagnosis.	PO2, PO5, PO7, PO12 PSO1, PSO2
CO3	Analyse molecular nature of human genome leading to oncogene formation.	PO1, PO5, PO12, PSO1, PSO2
CO4	Justify the concept of regulation of gene expression and metabolism.	PO1, PO5, PO10, PO12, PSO1, PSO3
CO5	Evaluate and compare molecular diagnostic techniques in relation to specific diseases.	PO2, PO5, PO6, PO12, PSO1, PSO2, PSO3

Course outline

Module I

Introduction: a. Introduction to molecular biology, b. Molecular biology of cell. Evolution and Molecular structure of cell and its organelles.

Module II

Types of cells. Including different kinds of Prokaryotic and eukaryotic cells, Cell growth, Cell adhesion, cell junctions and extracellular matrix organelles, Cell cycle, Cell membrane and its structure (fluid-mosaic model). Factors influencing on membrane fluidity, asymmetry of membrane and membrane transport (active and passive)

Project Topic: Causes, types and molecular mechanism of human cancer.

Module III

Molecular Nature of the Genetic Material in Prokaryotic and Eukaryotic Cells: Molecular biology of Genes, DNA: Molecular structure, types: Primary, secondary and tertiary, Double helix, types, RNA: Molecular structure, types. Evolution of DNA and RNA, Gene and genetic codes.

Project Topic: Tumor suppressor gene and oncogene.

Module IV

General Concept on: a. Regulation of the Gene Expression b. Regulating the Metabolism: The Lac-Operon system, Catabolic repression, Trp Operon system: regulating the biosynthesis of the tryptophan, Gene expression in Eukaryotic cells, Plasmids: types, maintenance and functions.

Project Topic: Human Genome Project.

Module V

DNA Replication and Gene Expression: DNA Replication: Semi conservative Nature of DNA Replication, DNA Replication in prokaryotic Cells, DNA Replication in Eukaryotic cell, Enzymes involved in DNA Replication: DNA polymerases, Proofreading, post- replication Modification of DNA. Transferring information from DNA to RNA, Synthesis of RNA (Transcription), RNA polymerase, Initiation and Termination of Transcription, Post and co- transcription modification of the RNA. Protein Biosynthesis**:** Translation of the genetic code, Translation of m RNA, Role of r-RNA in protein synthesis, Forming the polypeptides- elongation, Termination of the protein biosynthesis.

Project Topic: Molecular basis, types, causes and a case study of the effects of DNA mutation.

Suggested Readings:

1. Molecular Biology of the gene (7th Ed) by James D. Watson.

E-booklink-https://www.pdfdrive.com/molecular-biology-of-the-gene-e158278674.html

2. Genes XII by Lewin's.

   E-book link- https://www.pdfdrive.com/lewins-genes-xii-e168024578.html

3. Molecular cell biology (5th Ed) by Lodish H.

4. E-book link - https://www.pdfdrive.com/molecular-cell-biology-lodish-5th-ed- e15674865.html

CYTOLOGICAL TECHNIQUES

Subject Name	Code	Type of course	T-P-Pj	Credit
Cytological Techniques	CUTM4289	Theory+ Practice	2-1-0	**3**

Course Objective:

- To understand the structure, function, and organization of cells, along with the techniques for preparing and analyzing cytological samples in medical and research applications.
- To learn to use various microscopy methods, including light, fluorescence, confocal, and electron microscopy, for identifying and analyzing cellular components.
- To acquire skills in applying diverse staining techniques to enhance visualization and analysis of cellular structures and functions.
- To develop the ability to critically evaluate cytological data for applications in research, diagnostics, and advancements in areas like cancer research, genetics, and infectious diseases.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Understand the significance of Cell Anatomy and Cytological Sampling	PO1, PO5, PSO1
CO2	Analyze cytogenetic and molecular methods, such as karyotyping, FISH, and PCR, to investigate genetic	PO5, PO6, PO12, PSO2

	disorders, chromosomal abnormalities, and cellular anomalies.	
CO3	Perform staining techniques to distinguish between microorganisms.	PO2, PO3, PSO1
CO4	Evaluate the use of common and specialized staining techniques, such as H&E, PAS, and fluorescent stain. Apply the concept of pathogenicity in disease diagnosis.	PO5, PO7, PO10, PSO1, PSO2
CO5	Apply the ability to utilize various microscopy techniques.	PO2, PO5, PO9, PSO2

Course Outline:

Module I: Fundamentals of Cytology and Sample Preparation

Introduction to Cytology: Definition, scope, and importance in medicine and research.
Cell Structure and Function: Overview of cell organelles and differences between prokaryotic and eukaryotic cells.
Sample Collection and Preparation: Techniques for cell/tissue sampling, fixation, embedding, and sectioning.

Practice:

1. Preparation of fixatives: Demonstrate the preparation of fixatives
- 95% ethyl Alcohol
- 50 % ethyl alcohol
  Carnoy's fixative (P5)
2. Demonstrate cytological specimen preservation

Module II: Staining Techniques

Staining Principles: Importance in contrast enhancement and cellular component identification.
Common Stains: Hematoxylin and Eosin (H&E), PAS, Giemsa, Wright's stain.
Fluorescent Staining: Basics of fluorescent dyes in cytology.

Practice:

1. PAP staining: Prepare smear and perform PAP staining
2. Explain Diff-quick staining.

Module III: Microscopy Techniques

Light Microscopy: Brightfield and phase contrast microscopy. Advanced Microscopy: Fluorescence, confocal, transmission electron (TEM), and scanning electron microscopy (SEM).

Practice:

1. Demonstrate quality control in cytology laboratory (P5)

Module IV: Cytogenetic and Molecular Techniques

Karyotyping: Chromosome preparation and analysis. FISH: Principles and applications for genetic mapping and diagnosis. Molecular Cytology: PCR and in situ hybridization for detecting nucleic acid sequences.

Practice:

1. Perform karyotyping (P4)
2. Perform methylene blue staining for buccal smear

Module V: Modern Cytological Techniques and Clinical Applications
Cell Sorting: Flow cytometry and laser capture microdissection. Advanced Techniques: Cytogenomics, advanced imaging. Clinical Applications: Diagnostic cytology in disease detection, especially cancer.

Practice:

1. Demonstrate receiving, handling and labelling of cytological specimen
2. Explain fine needle aspiration cytology
3. Demonstration of the specimen processing in cytology
   - Gynaecological
   - Urine
   - Body fluids
   - CSF
   - Sputum

Suggested Readings:

1. Catherine M Keebler, Theresa M – Manual of Cytotechnolgy, 7th edition.
2. Edmund S. Cibas, Barbara S. Ducatman- Cytology- Diagnostic Principles and Clinical Correlations, 4th edition
3. Leopold G. Koss, Myron R. Melamed- Koss' Diagnostic Cytology and Its Histopathologic Bases.
4. John D. Bancroft- Bancroft's Theory and Practice of histological Techniques

BASIC COMPUTER AND INFORMATION SCIENCE

Subject Name	Code	Type of course	T-P-Pj	Credit
Basic Computer and Information Science	CUTM1742	Practice	0-2-0	**2**

Course Objective:

- To gain knowledge about the roles and operations of various computer hardware components.
- To identify the key considerations for individuals and organizations when selecting and acquiring computer hardware based on specific needs and budgets.
- To learn methods for maintaining computer equipment and resolving common hardware issues to ensure optimal functionality and longevity.
- To understand how hardware and software collaborate to perform computing tasks, alongside

the principles of software development, categorization, and upgrading.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Understand the fundamental hardware components.	PO1, PO5, PSO3
CO2	Apply the concept in preparing documents.	PO8, PO9, PSO1,PSO3
CO3	Organize data's available digitally.	PO5, PO9, PSO3
CO4	Create presentations, formatting and enhancing texts	PO5, PO9, PSO3
CO5	Utilize the concepts and software skills in data handling.	PO5, PO8, PSO1, PSO2

Course Outline:

Module- I

Introduction to Computers: Basic Concepts, Introduction to Computers, Characteristics of Computers,Block Diagram of a Computer

Generations of Computers, Input and Output Devices, Types of Input Devices, Types of Output Devices, Processor and Memory, The Central Processing Unit (CPU)

Main Memory (RAM), Storage Devices, Types of Storage Devices, Functions and Uses

Module II: Introduction to MS-Word: Basics of MS-Word, Introduction to MS-Word, Components of the Word Window, Document Management, Creating, Opening, and Inserting Files, Editing a Document File, Page Setting and Formatting the Text, Saving the Document, Spell Checking, Printing the Document, Advanced Features, Creating and Editing Tables, Mail Merge

Module III:

Introduction to Excel: Basics of Excel, Introduction to Excel, About the Worksheet, Workbook Management, Entering Information, Saving Workbooks, Formatting the Worksheet, Printing the Worksheet, Data Visualization, Creating Graphs

Module IV:

Introduction to PowerPoint and MS-DOS: Basics of PowerPoint, Introduction to

PowerPoint, Creating and Manipulating Presentations, Views in PowerPoint, Formatting and Enhancing Text, Adding Slides with Graphs, Introduction to MS-DOS, History of MS-DOS, Features of MS-DOS, MS-DOS Commands (Internal and External)

Module V:

Introduction to Windows: Computer Networks, and the Internet, Introduction to Windows, History of Windows, Features of Windows, Desktop, Taskbar, Icons on the Desktop, Operations with Folders, Creating Shortcuts, Operations with Windows (Opening, Closing, Moving, Resizing, Minimizing, and Maximizing), Computer Networks, Introduction to Computer Networks, Types of Networks (LAN, MAN, WAN, Internet, Intranet), Network Topologies (Star, Ring, Bus, Mesh, Tree, Hybrid), Internet and Its Applications, Definition and Brief History of the Internet

Basic Services (E-Mail, File Transfer Protocol, Telnet, World Wide Web (WWW))

Web Browsers, Use of the Internet

Suggested readings:

1. Objective Computer Awareness
2. Computer Networking (Global Edition)

MEDICAL LAW AND ETHICS

Subject Name	Code	Type of course	T-P-Pj	Credit
Medical Law and Ethics	CUTM1734	Theory+ Project	2-0-1	**3**

Course Objective:

- To provide students with a foundational understanding of ethics, with a particular focus on medical ethics, and to explore key ethical principles such as autonomy, which significantly influence medical law.
- To examine the general principles of medical law that govern the legal relationship between medical practitioners and their patients, ensuring that students grasp the legal dynamics in healthcare settings.
- To analyze the legal implications of providing medical advice, diagnosis, and treatment, enabling students to understand the legal responsibilities and potential liabilities in medical practice.
- To investigate selected medico-legal issues over the course of human life, including reproductive

technologies, fetal rights, research on human subjects, organ donation, rights of the dying, and the legal definition of death.

Course Outcomes:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Understand the Legal Framework Governing Medical Practice.	PO4, PO5, PSO1
CO2	Recognize Professional Responsibilities and Legal Obligations of Medical Practitioners.	PO4, PO9, PSO1
CO3	Analyze different types of medical negligence.	PO4, PO5, PSO3
CO4	Evaluate Legal Processes in Medical Malpractice Litigation.	PO4, PO5, PO9, PSO3
CO5	Assess the Medico legal risks in Healthcare Practice	PO4, PO5, PO10, PSO1

Course Outline:

Module-I

1. The Indian medical council act, 2. Medical council of India (functions), 3. Functions of state medical councils, 4. The declaration of Geneva, 5. Association of Healthcare Providers (AHPI) India

Module-II

1. Duties of medical practioners 2. Regarding Red Cross emblem 3. Professional secrecy

4. Privileged communication.

Module-III

1. Professional negligence 2. Medical mal occurrence 3. Contributory negligence 4. Criminal negligence 4. Corporate negligence 5. Ethical negligence 6. Precautions against negligence 7. difference between professional negligence and infamous conduct.

Module-IV

1. Malpractice litigation involving various specialties 2. Prevention of medical negligence 3. supremecourt of India guidelines on medical negligence 3. The therapeutic misadventure 4. Vicarious liability

Module-V

1. Products liability 2. Medical indemnity insurance 3. Medical records 4. Consent in medical practice, 4. Euthenesia 5. Deaths due to medical care 6. Malingering

Suggested Readings:

1. Medical Law and Ethics by Shaun D Pattinson, 5 th edition, 2017.
2. Medical Law and Ethics in India" by KK Singh, 1st Edition (2018).
3. Medical Ethics Manual for Students" by Dr. Vijayaprasad Gopichandran and Dr. S.S. Lal, 1st Edition (2016).

Suggested Project Works:

1. Legal Responsibilities of Medical Professionals in Clinical Practice
2. Informed Consent: Legal and Ethical Implications in Treatment Process
3. Confidentiality and Data Protection in Hospitals: Legal Perspectives
4. The Role of Professional Codes of Conduct in Clinical Practice
5. Ethics: Balancing Patient Autonomy and Beneficence
6. Duty of Care and Negligence in Hospitals: Understanding Legal Accountability
7. Legal and Ethical Implications of Tele-Medicine Practice
8. The Impact of Medical Malpractice Laws on Clinical Practice
9. Regulatory Frameworks for Medical Practice in India
10. The Importance of Ethical Documentation in Clinical Practice
11. Patient Rights and Responsibilities: A Legal Perspective

MICROBIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Microbiology	CUTM4290	Theory+ Practice	2-1-0	**3**

Course Objective:

- To learn about various types of culture media, their preparation, and applications in microbiology
- To acquire knowledge of microbial techniques for the isolation and identification of pure cultures of bacteria, fungi, and viruses.

- To gain expertise in performing aseptic techniques to handle microbial cultures safely and effectively during routine laboratory tasks.
- To implement appropriate sterilization methods and culture-handling procedures.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Understand the significance of microbial cell organelles.	PO1, PO5, PSO1
CO2	Apply the concept of pathogenicity in disease diagnosis.	PO5, PO7, PO10, PSO1, PSO2
CO3	Perform staining techniques to distinguish between microorganisms.	PO2, PO3, PSO1, PSO2
CO4	Justify the use of different culture media for the growth of variouspathogenic microbiota.	PO5, PO6, PSO1, PSO2
CO5	Apply the concept of pathogenicity in disease diagnosis	PO5, PO7, PO10, PSO1, PSO2

Course Outline:

Module –I: Introduction to Microbiology and Bacterial Anatomy

Microbiology: Definition, history, and host-microbe relationship

Safety measures in a microbiology laboratory

Bacterial anatomy: Bacterial cell structure including spores, flagella, pili, and capsules

Sporulation

Practice:

Handling of the microscope

Module-II: Growth and Nutrition of Microbes

General nutritional requirements of bacteria

Bacterial growth curve

Practice:

Inoculation techniques for bacteria on culture media

Module-III: Sterilization Techniques and Equipment

Sterilization: Definition, sterilization by dry heat, moist heat (at, above and below 100°C)

Use of Autoclave and Hot air oven

Radiation, Filtration, preventive measures, controls, and sterilization indicators

Practice:

Preparation and use of sterilization equipment

Module-IV: Staining Techniques

Simple staining: Methylene blue

Gram staining

Practice:

Demonstration of Gram stain and special stains (spore, capsule)

Module-V: Culture Media and Antibiotic Susceptibility Testing

Types of culture media: Liquid, solid, routine laboratory media (basal, enriched, selective)

Preparation of culture media for microbial growth

Practice:

Preparation of different types of culture media

Suggested Reading:

1. Medical Laboratory Technology by Kanai Lal Mukherjee; Tata McGraw Hill, New Delhi
2. Microbiology by Prescott
3. An Introduction to Medical Laboratory Technology by FJ Baker; Butterworth – Heinemann;Oxford
4. Practical Book of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi
5. Medical Laboratory Manual for Tropical Countries Vol. I and II by Monica Cheesbrough;Cambridge University Press; UK
6. Textbook of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House,Mumbai

7. Text book of Medical Microbiology by Gruckshiank

SYSTEMIC BACTERIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Systemic Bacteriology	CUTM4291	Theory+ Practice	2-1-0	**3**

Course Objective:

- To provide an in-depth understanding of various bacterial pathogens, their classification, and their role in human diseases.
- To equip students with advanced skills in identifying bacterial pathogens through both traditional and modern diagnostic methods.
- To apply theoretical knowledge in clinical scenarios, including the interpretation of diagnostic results and the management of bacterial infections.
- To learn opportunities in the basic principles of medical microbiology and infectious disease.

Course Outcome:

After completion of the course, the students will be able to,

Cos	Statements	COs With POs and PSOs Mapping
CO1	Identify various types of bacteria from different groups based on their morphological characteristics.	PO1, PO11, PSO1
CO2	Understand the cultural characteristics, biochemical reactions, pathogenesis of diseases caused by specific bacteria	PO1, PO5, PSO1, PSO2
CO3	Explain the significance of culture techniques, media preparation, and identification methods in distinguishing different bacterial species	PO1, PO2, PO10, PO11, PSO1, PSO2
CO4	Apply their understanding to perform culture techniques and other diagnostic methods	PO1, PO10, PO11, PSO2

CO5	Evaluate the appropriateness of preventive and control measures, and synthesize their knowledge to perform accurate identification of bacterial species.	PO1, PO5, PO8, PO11, PSO2, PSO3

Course Outline:

Module –I

Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & laboratory diagnosis, Prevention and Control: Aerobic Cocci : Micrococcus, Staphylococcus, Streptococcus and Anaerobic Cocci.

Practice: Culture techniques, culture media, identification of *Staphylococcus* species

Module –II

Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & laboratory diagnosis, Prevention and Control: Aerobic Gram-negative bacteria: Neisseria spp., Anaerobic Gram-negative bacteria.

Practice: Preparation of media for biochemical identification and uses.

Module –III

Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & laboratory diagnosis, Prevention and Control: Aerobic non-spore forming gram positive bacilli: Bacillus anthracis, Corynebacterium diphtheriae, Actinomyces spp., Nocardia spp. Tubercle bacilli and Hansen's bacilli. Anaerobic Gram-Positive Bacilli: *Bifidobacterium* spp, *Actinomyces* spp., *Clostridium* spp.

Practice: Identification of *Mycobacterium.*

Media preparation for anaerobic bacteria, identification of common anaerobes.

Module –IV

Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & laboratory diagnosis, Prevention and Control: Aerobic Gram-Negative Bacilli (*Enterobacteriaceae* family): *Citrobacter, Edwardsiella, Enterobacter, Escherichia coli, Klebsiella, Morganella, Proteus, Porvidencia, Salmonella, Serratia, Shigella, Yersinia*

Practice: Culture methods and identification of *Escherichia coli, Klebsiella, Proteus* species

Module –V

Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & laboratory diagnosis, Prevention and Control: Aerobic and Miscellaneous Gram-Negative Bacilli: *Vibrio, Pseudomonas, Brucella, Bordetella, Haemophilus,* and *Mycoplasma* specimens.

Practice: Antibiotic sensitivity testing.

Suggested Readings:

1. Textbook of Microbiology- Ananthanarayan & Paniker (10th Ed)
2. Microbiology (7th Ed)- by Prescott
3. Medical Microbiology- by David Greenwood et al (Elseviere)
4. Essential Medical Microbiology- by Rajesh Bhatia (4th Ed)
5. Medical Microbiology- by Kayser et al
6. The short text book of medical microbiology- by Satis Gupte (10th Ed)

SYSTEMIC VIROLOGY & MYCOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Systemic Virology & Mycology	CUTM4293	Theory+ Practice	3-1-0	**4**

Course Objective:

- To learn opportunities in the basic principles of medical microbiology and infectious disease.
- To study mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body's normal microflora.
- To understand the importance of pathogenic Virus and fungus in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract, skin and soft tissue.
- To use insights from microbiology to develop strategies for preventing and managing infections effectively in clinical and public health settings.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Understand the classification, morphology and pathogenicity of virus and fungi.	PO1, PO5, PSO1, PSO2

CO2	Know the serological techniques and their utilization.	PO1, PO2, PO5, PSO1
CO3	Perform laboratory investigations for the diagnosis of diseases caused by virus and fungi.	PO2, PO5, PO7, PSO1, PSO2
CO4	Analyse different culture techniques used to propagate human virus.	PO5, PO6, PSO2
CO5	Evaluate the severity of viral and fungal infection based on diagnostic results.	PO5, PO7, PO10, PSO1, PSO2

Course Outline:

Module-I

Structure, cultivation and properties of Viruses. Classification of Medically Important Viruses. Geneticmaterial, Organ system involved, Transmission.

Practice:

1. Demonstration of virus isolation techniques.

Module- II

Replication of Viruses, Virus Host Interaction, Bacteriophage. Epidemiology, Pathogenesis, Treatment, Prevention and Control of Viral Diseases (DNA Viruses) *Adenoviridae, Poxviridae, Herpes viridaes,* Epidemiology, Pathogenesis, Treatment, Prevention & Control of Viral Diseases

Practice:

2. Demonstration of cell and tissue culture techniques used for virus isolation

Module- III

Morphology, Epidemiology, Pathogenesis, Treatment, laboratory diagnosis, Prevention and Control of Viral Diseases (RNA Viruses) *Orthomyxoviridae, Paramyxoviridae, Picornaviridae, Corona viridae, Rhabdoviridae, Retrovirida.*

Practice:

3. Demonstration of virus isolation techniques.
4. Demonstration of cell and tissue culture techniques used for virus isolation

5. Serological techniques used in diagnostic virology

Module-IV

Mycology, Classification, Scope and medical importance of fungi. General Structure of Fungus and Yeast. Laboratory Methods of Fungal Isolation and Identification. Superficial and Cutaneous Mycoses.Subcutaneous Mycoses. Systemic Mycosis caused by Endemic Dimorphic Fungal Pathogens, Opportunistic Mycoses.

Practice:

6. Organization of laboratory – Mycology
7. Preparation of different media, chemical and stain for fungus study
8. Microscopic examination of saprophytic molds / Collection of agar plates for exposure

Module-V

Pathogenic Group of Fungi: Opportunistic pathogens, True pathogens: *Blastomyces dermatitidis, Cooccidioidesimmitis, Paracocidioidesbrasiliensis, Histoplasma capsulatum.* A. Dermatophytes:*Mycrosporum* (Hair, skin), *Tricophyton* (Skin, hair, nail), *Epidermophyton* (Skin, nail), *Aspergillus spp.* Dermatomycosis (*Candida albicans, Cryptococcus neofornans*).

Practice:

1. Slide culture technique for Superficial infections
2. Culture and identification of yeasts
3. Processing of specimens in Mycology lab

Suggested Reading:

1. Textbook of Microbiology- Ananthanarayan & Paniker (10th Ed)
2. Medical Microbiology-by Fritz H. Kayser et al
3. Fundamental medical mycology / Errol Reiss, H. Jean Shadomy, and G. Marshall Lyon III
4. Essential Medical Microbiology- by Rajesh Bhatia (4th Ed)
5. Clinical Microbiology Procedures Handbook- by Amy L. Leber (4th Ed)
6. The short text book of medical microbiology- by Satis Gupte (10th Ed)

PUBLIC HEALTH MICROBIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Public Health Microbiology	CUTM4297	Theory+ Practice	3-2-0	**5**

Course Objective:

- To study the Occurrence and Role of Microorganisms in Public Health.
- To learn Methods for Microbial Detection and Characterization.
- To explore the fundamental principles of environmental microbiology and their application to real-world environmental challenges.
- To apply Microbiological Knowledge to Address Pollution and Infections.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Understand the diversity among the microorganisms.	PO1, PO11, PSO1
CO2	Demonstrate different preventive measures for microbial infection.	PO5, PO7, PO10, PSO3
CO3	Analyse the importance of microorganisms in the field of biomedical science.	PO1, PO5, PO12, PSO1, PSO3
CO4	Evaluate the factors that influence the effectiveness of antimicrobial agents.	PO2, PO5, PO8, PSO2
CO5	Analyze different environmental factors affecting microbial diseases.	PO5, PO6, PO10, PSO3

Course Outline:

Module- I

Introduction to Public Health**:** Definition, scope, concept and importance of public health microbiology, Roles of microbiologist in public health.

Practice: Isolation and identification of microorganism from different food products: meat, cannedjuice, milk, cheese and ice cream.

Module- II

Concept of health and disease, Indicators of health, Microbial association of water, air and soil, Basic concept on pollution (air, water, noise, radiation and waste pollution) and public health hazard in the community.

Practice: Isolation and Identification of microorganisms (hospital acquired infection)

Module- III

Air Borne Infections:

Introduction**:** Air and its composition, Microbial air pollution, Sources of air pollution & control**,** Indicator of air pollution – WHO guide line (microbial pollution). Air borne diseases: Transmission of pathogens, Respiratory infection (Viral, bacterial, fungal), Sources of infection, characters of organisms and controls of: Bacterial pneumonia, Diphtheria, Tuberculosis, Influenza, Measles. Method of measuring microorganisms in air.

Practice: Selection, collection, perseveration and transportation of samples from the community to the laboratory.

Module- IV

Water Borne Infections: Introduction: Definition of wholesome and safe water, Nature, cycle, sources, importance and quality (WHO guideline) of water. Water pollution and sanitation, Microorganisms in water: Transmission of pathogens,

Practice: Isolation and Identification of microorganisms from air.

Module- V

Water borne diseases (Viral, bacterial, protozoal), Sources of infection, characters of organisms and control of: Hepatitis, Cholera, Typhoid, Amoebiasis, Giardiasis, Poliomyelitis. Water Pollution Control. Method of Measuring Microorganisms in Water. Water Treatment, Control of Water Borne Diseases.

Practice: Isolation and Identification of microorganisms from water and evaluation of water quality.

Suggested Readings:

1. A Textbook of Microbiology, by Ghimire P. & Parajuli K. Vidhyarthi Pustak Bhandar Publication, Kathmandu.
2. Text Book of Social and Preventive Medicine by Park JE and Park K.
3. Evidence Based Public Health by Brownson, RC., Baker, EA., Leet. TL., Follespie. KN,Oxford University Press.
4. The Quest for Health, Educational Enterprises, Kathmandu, by Dixit H.
5. Epidemiology for Public Health Practice, by Friis, RH., and Sellers,TA, 2nd Edition, Gaithersburg, MD: Aspen Publication.
6. Modern Food Microbiology, by Jay, J, H 3rd Edition CBS Publication and Distributors Delhi 1987.
7. Introduction to Soil Microbiology, Martin Alecender, *by* Academic press,1961**.**

EPIDEMIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Epidemiology	CUTM1746	Theory+Project	2-0-1	**3**

Course Objective:

- Understand the basic epidemiological methods and study designs.
- Understand and discuss population-based perspective to examine disease and health – related events.
  - Discuss the ethical issues in epidemiological research.
  - Explain the importance of epidemiology for informing scientific, ethical, economic and political discussion of health issues.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Know the basic principles, methods and study designs in epidemiology.	PO1, PO5, PO12, PSO1, PSO3
CO2	Demonstrate the role of various determinants in	PO5, PO7, PO10, PSO3

	health-related events.	
CO3	Illustrate the key features and application of descriptive and analytical epidemiology.	PO1, PO5, PO10, PSO3
CO4	Review various studies and interpret the data.	PO1, PO5, PO12, PSO3
CO5	Develop Public health policies.	PO6, PO10, PO11, PO12, PSO3

Course Outline

Module-I

Introduction to Principles of Epidemiology: History, Definition, and scope of epidemiology, Achievements in epidemiology, Terms & Terminologies used in epidemiology.

Project Topic: Prevalence of Diabetes and its Associated Rish Factors with Sex and Age Group of 35-45 Years and Treatment or Prevention.

Module-II

Measuring Health and Disease: Definitions of health and disease, Measures of disease frequency Use of available information, Comparing disease occurrence.

Project Topic: Epidemiology of typhoid

Epidemiology of chickenpox

Module-III

Concept of Epidemiological Study: Basic concepts of epidemiology Descriptive / Analytical, Applied/Experimental, Field Epidemiology. Concept of Prevention and Control of Diseases: Causation in epidemiology: The concept of cause, Establishing the cause of a disease Epidemiological markers, Phenotypic and genetic markers including molecular epidemiology. Disease surveillance: Clinical, Laboratory.

Project Topic: Epidemiology of influenza virus

Module-IV

Communicable disease epidemiology, Clinical epidemiology, Environmental & occupational epidemiology, Nutritional epidemiology, Reproductive epidemiology, Social epidemiology, Food epidemiology.

Project Topic: Epidemiology of bronchitis

Module-V

Epidemiology, Health services and health Policy: Health care planning, Monitoring & evaluation, The planning cycle, Epidemiology, public policy and health policy, Healthy public policy in practice.

Project Topic: Epidemiological aspect of Hypertension

Epidemiology of hyperthyroidism

Suggested Readings:

1. Basic Epidemiology. By Beaglehole R., Bonita R., Kjellstrom , World Health Organization,Geneva,**https://books.google.com/books/about/Basic_Epidemiology.html?id=AAZGobMNTXgC**
2. Field Epidemiology, By B Gregg, 2nd Edition, Oxford University Press, 2002 **academic.oup.com/aje/article/156/8/783/78217**
3. Gordis L. E*pidemiology*, 2nd Edition, WB Saunders Company Aharcourt Health Sciences Company, Philadelphia. www.bookdepository.com/Epidemiology-Leon- Gordis/..
4. Epidemiology in Medicine, by LipppincottEilliams and Wilkins, and Walters Kluwer Company wkauthorservices.editage.com/.../medicine.html
5. Epidemiology, Principle and Method, McMahon B, Trichopoulos D, by 2nd Edition, Boston, Little, Brown.

PHARMACEUTICAL MICROBIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Pharmaceutical Microbiology	CUTM1739	Theory+ Practice	3-1-0	**4**

Course Objective:

- To Understand the types and synthesis of antimicrobial agents.
- To know the process of Manufacturing of antibiotics.
- To understand the mechanism of action of antibiotics.
- To study how microorganisms are known to develop resistance to antibiotics.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Acquire knowledge about the discovery of antimicrobial agents.	PO1, PO5, PO12, PSO1, PSO3
CO2	Comprehend the mode of action of various antimicrobial drugs.	PO1, PO5, PSO2
CO3	Understand different mechanism of action of antibiotics.	PO1, PO5, PO10, PSO1
CO4	Illustrate the effectiveness of antiviral, antifungal and antiprotozoal drugs.	PO1, PO2, PO5, PSO2, PSO3
CO5	Categorise structural and functional groups of antimicrobial agents.	PO1, PO5, PO6, PSO1

Course Outline

Module I: Basics of Pharmaceutical Microbiology

Chemical Disinfectants and Antiseptics: Definitions, types, and applications.

Antibiotics: Definitions, types (static and cidal activities), and their mechanisms of action. Synthetic Antimicrobial Agents: Overview of synthetic drugs used to combat infections. Antifungal Drugs: Types and mechanisms of action. Antiviral Drugs: Types and mechanisms of action.

Practice:

Sterilization Methods: Techniques used in microbiology labs.

Isolation of Human Pathogens: Methods to isolate pathogens under sterile conditions.

Module II: Manufacture and Assessment of Antibiotics

Production of Antibiotics: Penicillin: Production processes and key steps.

Streptomycin: Production processes and key steps.

Assessment of New Antibiotics:

Parameters for Determination: In vitro and in vivo assessments.

Pharmacokinetics and Pharmacodynamics: Overview and significance.

Antibiotic Assay:

Microbiological Methods: Disc diffusion technique and dilution technique.

Practice:

Test for Bacteriostatic and Bactericidal Activity: Disc test and dilution test.

Module III: Mechanisms of Action of Antibiotics

Cell Wall Synthesis Inhibitors: Mechanisms and examples.

Inhibitors of Protein Biosynthesis: Mechanisms and examples.

Inhibitors of Tetrahydrofolate Synthesis: Mechanisms and examples.

Disorganization of the Cytoplasmic Membrane: Mechanisms and examples.

Practice:

Screening of Herbal Plants for Antibiotic Activity: Methods and procedures.

Module IV: Bacterial Resistance to Antibiotics

Biochemical Mechanisms of Resistance: How bacteria resist antibiotics biochemically.

Genetic Basis of Antibiotic Resistance: Genetic factors contributing to resistance.

Problems in Antibiotic Therapy Due to Resistance: Implications and challenges in treatment.

Practice:

Sterility Testing of Pharmaceuticals: Techniques and importance.

Bacteriological Analysis of Water: Methods for analyzing microbial contamination in water.

Module V: Microbial Spoilage and Preservation of Pharmaceutical Products

Microbial Spoilage: Types and effects on pharmaceutical products.

Preservation Techniques: Methods used to prevent spoilage and ensure product safety.

Suggested Readings:

1. W B Hugo and A D Russel, Pharmaceutical Microbiology, 2nd Edition (e-Book link: https://www.pdfdrive.com/hugo-and-russells-pharmaceutical- microbiology-e34745384.html)
2. T H Sandal Pharmaceutical Microbiology: Essentials for quality assurance and qualitycontrol. Woodhead Publishing Series. (e-Book link: https://www.pdfdrive.com/pharmaceutical-microbiology-essentials-for-quality-assurance-and-quality-control-e157918748.html)
3. Willey MJ, Sherwood LM & Woolverton C J. (2013). Prescott, Harley and Klein'sMicrobiology. 7thEd., McGraw Hill. (e-Book link: https://www.pdfdrive.com/prescott-harley-and-kleins-microbiology-7th-ed- e188166539.html)

Online tutorial links:

1. Lecturiolink
   (https://app.lecturio.com/#/course/s/6956)

INDUSTRIAL MICROBIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Industrial Microbiology	CUTM1741	Theory+Project	3-0-1	**4**

Course Objective:

- To provide an in-depth understanding of the history, scope, and foundational concepts of industrial microbiology
- To familiarize students with the principles of primary and secondary fermentation processes
- To explore biological waste treatment methods, including anaerobic fermentation.
- To educate students on the microbiology of industrial and domestic sewage.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Learn about the concept of fermentation.	PO1, PO5, PO12, PSO2
CO2	Understand the methods of industrial sewage and its treatment.	PO5, PO10, PO12, PSO1, PSO3
CO3	Apply appropriate techniques for processing of different products using microbes.	PO2, PO5, PO6, PSO2, PSO3
CO4	Identify microbes in food products.	PO2, PO5, PO10, PSO1, PSO2
CO5	Demonstrate the techniques applicable in fermentation process.	PO2, PO5, PO9, PSO2

Course Outline:

Module – I

Introduction to Industrial Microbiology: Introduction, History, Definition and scope. Industrial Equipment and Uses

Project Topic: Fermenter Designing

Module – II

Fermentation Process: Primary and secondary screening, Detection and assay of fermentation products- Physical and chemical assays, Biological assay Stock culture, Fermentation media, Inoculums preparation, Increasing products.

Project Topic: 1**.** Design a protocol for the treatment of community sewage in your locality.

Module III

Typical Fermentation Process: Antibiotic drug fermentation - Penicillin, Streptomycin, Bacterial insecticide, other antibiotics. Acetone, Lactic acid, Brewing.

Project Topic: Detail fermentation process of wine and ginger beer production.

Module – IV

Biological Waste Treatment / Bioremediation**:** Anaerobic fermentation. Production of**:** Vitamin, Vaccines, Milk & Milk Products, Baker's yeast, Food and feed yeasts, Mushrooms, Vinegar (Acetic acid) Enzymes**:** Amylase, Pectinases, Invertase Other enzymes.

Project Topic: Detail fermentation process of a food product and the advantages of fermented food.

Module V

Industrial sewage and its treatment: Introduction, Industrial pollution, Types of sewage. Microbiology of Domestic sewage and industrial sewage. Methods for the treatment of industrial effluent and sewage-Primary treatment, secondary treatment and tertiary treatment.

Project Topic: Impacts of industrial pollution on Society and Environment and its prevention and control.

Suggested Readings:

1. Industrial Microbiology (2nd Ed.) by A. H. Patel.
2. Modern industrial Microbiology and Biotechnology.

   (E-book link- https://www.pdfdrive.com/modern-industrial-microbiology-and- biotechnology-

e33452862.html)

3. L. E. Casida, JR., *Industrial Microbiology*, 1991, Wiley Eastern Limited, New Delhi,

DIAGNOSTIC BACTERIOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Diagnostic Bacteriology	CUTM4294	Theory+ Practice	2-2-0	**4**

Course Objective:

- To impart knowledge on the scope, importance, and factors influencing aerobic cultures.
- To provide comprehensive training in the laboratory diagnosis of bacterial infections, including enteric, respiratory, urinary, oral, and systemic infections.
- To equip students with hands-on experience in advanced diagnostic methods for various infections.
- To deepen understanding of the microbiology of specific infections, such as peptic ulcers, venereal diseases, and eye infections, while mastering the preparation and interpretation of laboratory diagnostic results.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Gain knowledge about bacterial pathogens.	PO1, PO5, PSO1
CO2	Understand infectious disease cycle.	PO1, PO10, PSO3
CO3	Demonstrate biochemical tests for the identification of bacterial pathogens.	PO2, PO5, PO9, PSO2
CO4	Differentiate pathogenic bacteria based on their growth in selective media.	PO2, PO5, PSO1, PSO2
CO5	Diagnose causative agents by bacteriological techniques.	PO2, PO5, PO7, PSO1

Course Outline:

Module -I

Aerobic Culture: Scope and importance of aerobic culture, Factors affecting aerobic culture, Various media and techniques of aerobic culture.

Practice:

1. Anaerobic Culture
2. Preparation and use of different stains in bacteriology laboratory Grams stain, ZN stain, Albertstain, Spore stain, Capsule stain, Flagella stain,
3. Motility test.

Module -II

Laboratory Diagnosis of Enteric Infections: (Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods) Enteric fever / Typhoid fever, Bacterial endocarditis, Bacteraemia, Septicemia, Pyrexia of unknown origin (PUO).

Practice:

1. Isolation & identification of different groups of bacteria in laboratory
2. Antibiotic susceptibility test

Module -III

Laboratory Diagnosis of Respiratory Tract Infection (RTI): (Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods) Lower RTI, Upper RTI.

Practice:

1. Laboratory Diagnosis of Throat Swab
2. Laboratory Diagnosis of Nasopharyngeal swabs

Module -IV

Laboratory Diagnosis of Urinary Tract Infection: (Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods).

Practice:

1. Laboratory Diagnosis of Pus
2. Laboratory Diagnosis of GI Tract

Module V:

Laboratory Diagnosis of Oral, Throat and Stomach Infection**:** (Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods) Gingivitis and anaerobic infection of oral cavity. Peptic ulcer (with emphasis in mechanism of peptic ulcer caused by *Helicobacter pylori),* Laboratory Diagnosis of Eye Infection: (Terminology, mechanism of infection, etiology, conventional and rapid diagnostic methods) Corneal ulcer, Conjunctivitis.

Practice:

1. Laboratory Diagnosis of Mycobacterium Infection
2. Laboratory Diagnosis of Venereal Diseases

Suggested Readings:

1. Textbook of Microbiology- Ananthanarayan & Paniker (10th Ed)
2. Medical Microbiology-by Fritz H. Kayser et al
3. Bailey and Scott's Diagnostic Microbiology(12th) Ed
4. Essential Medical Microbiology- by Rajesh Bhatia (4th Ed)
5. Clinical Microbiology Procedures Handbook- by Amy L. Leber (4th Ed)
6. The short text book of medical microbiology- by Satis Gupte (10th Ed)

IMMUNOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Immunology	CUTM4295	Theory + Practice	3-1-0	**4**

Course Objective:

- Understanding the concept of Innate & adaptive immune system; complement system; Hypersensitivity.
- To study the types and biological classes of antigens, antigen-antibody interactions, and the structure and function of different immunoglobulin classes.
- Clinically relevant serological analysis for deeper understanding of antigen- antibody

interaction.

- To understand the mechanisms of complement activation, its biosynthesis, quantification, and the implications of complement deficiencies.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Understand the concept of Innate & adaptive immunity.	PO1, PO5, PO12, PSO1
CO2	Apply application of immunology in disease diagnosis.	PO1, PO5, PO10, PSO1, PSO2
CO3	Analyse clinically relevant serological samples for Ag- Ab interaction.	PO1, PO2, PO11, PSO2
CO4	Justify and interpret diagnostic results of patient sample.	PO2, PO5, PO11, PSO2, PSO3
CO5	Interpret types of Hypersensitivity reactions.	PO1, PO5, PO8, PSO1, PSO3

Course Outline

Module-I

Immunity: Classification, Measurement of immunity, Local immunity, Herd immunity.

Module-II

Antigens: Types of antigen, Epitope. Biological Classes of antigens, Superantigens.

Immunoglobulins: Antibody structure, Immunoglobin classes.

Practice: Collection of blood sample by vein puncture

Separation and preservation of serum

Module-III

Complement System: Principal pathways of Complement activation, Quantitation of Complement (C)and its Components. Biosynthesis of complement, Complement Deficiencies.

Practice: Performing Serological tests: Widal test, VDRL test, ASO test, C-Reactive Protein

test, Rheumatoid factor (RF) test

Module-IV

Antigen-Antibody Reactions, Antigen-Antibody measurement, Parameters of serological tests. Serological Reactions.

Practice: Performing Precipitation in agarose gel

Performing Ouchterlony Double diffusion test Demonstration of SDS-PAGE

Module-V

Immune Response: Types of Immune response, Humoral immunity, Cell-mediated Immune Responses, Cytokines, Immunological tolerance.

Hypersensitivity Reactions: Classification of hypersensitivity reactions, Type I Hypersensitivity (IgE Dependent). Type II Hypersensitivity: Cytolytic and Cytotoxic. Type III Hypersensitivity-Immune Complex-mediated, Type IV Hypersensitivity-Delayed Hypersensitivity.

Practice: Demonstration of ELISA

Demonstration of Western blotting

Suggested Readings:

1. Kuby's Immunology (7th Ed) - by J. Owen, J. Punt, S. Strandford. Macmillan HigherEducation, England.

(e-book link: https://www.pdfdrive.com/kuby-immunology-7th-edition-2013- e44842271.html)

2. Roitt's Essential Immunology (13th Ed)- by Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt.Wiley Blackwell. (e-book link:http://dl.mehrsys.ir/pdf-books/Roitt_s%20Essential%20Immunology%20Thirteenth%20Edition(www.myuptodat e.com).pdf)
3. Prescott, Harley, and Klein's Microbiology (Seventh Edition)- by Joanne M. Willey, Linda M.Sherwood, Christopher J. Woolverton. McGrawHill.
4. Microbiology An Introduction (10th Edition)- by Gerard J. Tortora, Berdell R. Funke, Christine, L. Case. Pearson.
5. Text book of Microbiology (7th Edition)- by Ananthanereyan & Paniker, Publisher Universitiespress.

(e-book link: https://www.pdfdrive.com/textbook-of-microbiology-e177143667.html)

6. Practical Immunology (4th Edition)- by Frank C. Hay, Olwyn M.R. Westwood. BlackwellScience.

(e-Book link: https://www.pdfdrive.com/practical-immunology-d34330313.html)

Online Tutorial links:

1. Fundamentals of Immunology: Innate Immunity and B-Cell Function (Coursera link: https://www.coursera.org/learn/immunologyfundamentalsimmunitybcells)
2. Fundamentals of Immunology: T Cells and Signaling

(Courseware link: https://www.coursera.org/learn/immunologyfundamentalstcellssignaling)

DIAGNOSTIC VIROLOGY & MYCOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Diagnostic virology & Mycology	CUTM4296	Theory +Practice	3-2-0	**5**

Course Objective:

- To Understand laboratory diagnosis of virus by both conventional and molecular approach.
- To confirm the suspicion of fungal disease.
- To identify the etiologic agent by isolating the causative fungal pathogen.
- To produce a cadre of specialized medical virologists who would help establish clinical diagnostic services in various hospitals/centers.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Know basics of viral and fungal pathogens, their pathogenesis and diagnosis.	PO1, PO5, PO12, PSO1
CO2	Implement laboratory diagnostic methods for detection of virus and fungi.	PO2, PO5, PSO1, PSO2

CO3	Analyze the role of virulence factors in viral and fungal diseases.	PO5, PO10, PSO1, PSO3
CO4	Categorize diseases based on the severity level.	PO5, PO6, PSO1
CO5	Identify rapid indication of fungal or viral infections, ensuring timely initiation of appropriate antifungal or antiviral therapy.	PO7, PO9, PO10, PSO2

Course Outline

Module I:

Laboratory Organization and Specimen Management. Virology Laboratory Guidelines: Establishing a virology laboratory as per WHO standards, including space, electricity, water, and sterility. Specimen Management: Selection, collection, transportation, and storage of specimens in virology and mycology. Biosafety and Waste Management: Use of personal protective equipment (PPE), handling of lab waste, minimizing hazards.

Quality Systems: Documentation and Standard Operating Procedures (SOP).

Practice:

Preparation of stock solutions and antibiotics for antifungal sensitivity tests.

Module II:

Clinical Virology and Fungal Infections:

Viral Infections: Skin (pediatric exanthems), respiratory (pharyngitis, pneumonia), CNS (encephalitis, meningitis), gastroenteritis, hepatitis (HAV, HBV, HCV), immunocompromised conditions, congenital infections (HCMV, rubella, VZV), sexually transmitted infections, oncogenic viruses (HIV/AIDS). Fungal Diseases: Overview of mycoses (superficial, subcutaneous, cutaneous, systemic), with examples like histoplasmosis, blastomycosis, and trichophytosis.

Practice:

Case studies on viral infections (MERS, SARS).

Antifungal sensitivity tests.

Module III:

Pathogenesis and Laboratory Diagnosis of Infections:

Viruses: Common pathogens and conditions caused by Aspergillus spp., Candida albicans, Cryptococcus neoformans, and others.

Fungi: Pathogens like Histoplasma capsulatum, Fusarium spp., Sporothrix spp., and more.

Laboratory Diagnosis: Smear preparation, KOH preparation, and staining techniques for fungal and viral infections.

Practice:

Dilution technique

Determination of minimal inhibitory concentration (MIC) for fungi.

Smear preparation techniques for microscopy.

Module IV:

Virological and Mycological Isolation Techniques: Virus Isolation Techniques:

Cell (tissue) culture, embryonated hen's egg inoculation, and animal inoculation methods. Direct examination techniques: Electron microscopy (TEM, SEM), staining, and identification of viral inclusion bodies. Fungal Isolation and Identification: Selection of specimens (skin, hair, nails, biopsy, sputum, etc.), media preparation, and identification methods.

Practice:

Preparation of different media and chemicals for fungi study.

Isolation and identification of medically important fungi.

Module V:

Advanced Molecular and Diagnostic Techniques: Molecular Techniques:

Virology: PCR, real-time PCR, nucleic acid amplification for virus detection.

Mycology: Molecular identification techniques for fungal pathogens.

Serological and Indirect Assays: Immunofluorescence, ELISA, hemagglutination inhibition (HAI), and complement fixation tests (CFT).

Antiviral and Antifungal Drugs: Laboratory approaches for sensitivity testing.

Practice:

Hands-on demonstrations of molecular techniques for viral and fungal identification.

Comparative studies of molecular and serological methods for virus detection (e.g., coronavirus).

Suggested Readings:

1. Bailey & Scott's Diagnostic Microbiology.
(e-book-https://www.pdfdrive.com/bailey-scotts-diagnostic-microbiologye187863782.html)

2. Basic virology by Edward K. Wagner.
(e-book -https://www.pdfdrive.com/basic-virology-e18900518.html)
3. Essential in clinical microbiology by C A Kauffman and J D Sobel, 2nd Ed.
(Ebook-link-https://www.pdfdrive.com/essentials-of-clinical-mycology-second-edition-e39564930.html)
4. Textbook of Microbiology- Ananthanarayan & Paniker (10th Ed)
5. Medical Microbiology-by Fritz H. Kayser et al
6. Fundamental medical mycology / Errol Reiss, H. Jean Shadomy, and G. Marshall Lyon III
7. Essential Medical Microbiology- by Rajesh Bhatia (4th Ed)
8. Clinical Microbiology Procedures Handbook- by Amy L. Leber (4th Ed)
9. The short text book of medical microbiology- by Satis Gupte (10th Ed)

DIAGNOSTIC PARASITOLOGY

Subject Name	Code	Type of course	T-P-Pj	Credit
Diagnostic Parasitology	CUTM1744	Theory+ Practice	3-1-0	**4**

Course Objective:

- To explain the mechanisms of pathogenesis from a gross, microscopic and molecular perspective.
- To develop the ability to recognize the diagnostic stages of infections under the microscope and apply this knowledge in managing infected patients effectively.
- To study the biology of parasites, their relationships with hosts, and their impact on the ecology and evolution of free-living species.
- To analyze the role of parasites in global public health, emphasizing their influence on disease dynamics, transmission, and prevention strategies.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Understand basic structure and characteristics of	PO1, PO5, PSO1

	different parasites.	
CO2	Identify pathogenic parasites during disease diagnosis and treatment.	PO2, PO7, PSO10, PSO1, PSO2
CO3	Describe and contrast unicellular parasites and parasitic worms.	PO1, PO5, PSO1
CO4	Execute investigations relating to pathogenic parasite.	PO2, PO5, PO12, PSO2, PSO3
CO5	Categorise medically important parasites.	PO5, PO9, PO11, PSO1, PSO2

Course Outline:

Module I:

Laboratory Organization and Safety: Laboratory Organization in Parasitology**,** Selection and Collection of Samples**,** Preservation and Transportation of Samples**,** Safety Measures in the Parasitology Lab**,** General Safety Protocols**,** specific Precautions for Handling Parasites

Practice: Safety measures in the Parasitology lab

Laboratory organization practices

Module II: Basics of Parasitology and Diagnostic Techniques: Laboratory Diagnosis of Intestinal and Vaginal Parasites**,** Terminology, Mechanism of Infection**,** Etiology**,** Conventional and Rapid Diagnostic Methods**.** Protozoa: *Entamoeba histolytica*, *Giardia lamblia*, *Trichomonas* spp, *Cryptosporidium*, *Cyclospora cayetanensis*, *Isospora* Helminthes: *Ascaris lumbricoides*, Hookworm (*Ancylostoma* and *Necator*), *Enterobius vermicularis*, *Trichuris trichiura*, *Strongyloides* spp., *Taenia* spp., *Echinococcus* spp., *Hymenolepis nana***.** Tissue and Blood Parasites: *Plasmodium* spp., *Leishmania* spp. (Kalaazar), *Wuchereria* spp., *Brugia*, *Loa loa*, *Onchocerca*, *Dracunculus*, *Paragonimus westermani/hendersoni*

Practice: Examination of stool for parasite identification

Examination of clinical samples for parasite identification

Module III: Diagnostic Techniques for Parasites

Direct Methods Microscopy, Direct Smears and Stains. Indirect Methods, Serological Tests Immunoassays

Practice: Demonstration of direct methods for parasite identification

Module IV:

Advanced Diagnostic Techniques: Rapid Methods for Parasite Identification**,** Rapid Diagnostic Tests (RDTs)**,** Point-of-Care Testing, Molecular Techniques**,** PCR (Polymerase Chain Reaction)**,** Nucleic Acid Hybridization

Practice:

Demonstration of rapid methods for parasite identification

Introduction to molecular techniques in parasitology

Module V:

Culture and Staining Techniques: Parasite Culture Techniques**,** In vitro Cultures, Maintenance and Identification**,** Stains Used in Diagnostic Parasitology**,** Common Stains (e.g., Giemsa, Wright's, Trichrome)**,** Special Stains for Specific Parasites

Practice: Demonstration of different stains used in diagnostic parasitology**,** Culture techniques and maintenance for parasitic samples

Suggested Readings:

1. Textbook of medical Parasitology.

   (e-book link- https://www.pdfdrive.com/textbook-of-medical-parasitology-textbook-of-medical-parasitology-e128716897.html)
2. Parasitology book by K.D. Chatterjee.

   (e-booklink-https://sites.google.com/site/bkthrtrpazg/atahrgiwu. https://www.goodreads.com/book/show/24366965-parasitology-protozoology-and-helminthology-with-two-hundred-fourteen.)
3. Stool Examination https://www.youtube.com/watch?v=_ePqcdDKCe0 https://www.youtube.com/watch?v= MRzUXg8kFiY https://www.youtube.com/watch?v=-iI2PxmHxuo
4. Malaria thick smear preparation. https://www.youtube.com/watch?v=WPP7AjmStBg Malaria thin smear preparation. https://www.youtube.com/watch?v=acoALifVvb8

HEALTHCARE ASSOCIATED INFECTIONS

Subject Name	Code	Type	T + P + Pj	Credits
Healthcare Associated Infections	CUTM4298	Theory+ Practice	3-1-0	4

Course Objective:

- To comprehend the structural organization of a hospital infection control program.
- To identify the major types of healthcare-associated infections, such as CAUTI, CLABSI, SSI, and VAP
- To gain knowledge of surveillance techniques for healthcare-associated infections, particularly device-associated infections, and calculate infection rates.
- To equip students with the ability to manage infection outbreaks and understand infection control measures during pandemics.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Define key terms related to HAIs and describe the structure and responsibilities of infection control programs	PO1, PO6, PO8, PSO1
CO2	Demonstrate proper hand hygiene techniques, including the steps of hand washing, PPE donning and doffing, and spillage management.	PO1, PO5, PO10, PO11, PSO2
CO3	Analyze the transmission routes of MDROs.	PO1, PO2, PO5, PO8, PSO1, PSO2
CO4	Assess different transmission methods and recommend appropriate infection control strategies in healthcare settings	PO1, PO5, PO6, PO8, PSO1
CO5	Evaluate the effectiveness of infection control practices during outbreaks.	PO1, PO5, PO8, PO9, PO11, PSO3

Course Outlines:

Module–I

Introduction – Definition, Epidemiological chain of HAI, Structural organization of HIC program Composition, functions & responsibilities of HICC & ICT, Major healthcare associated infection types CAUTI, CLABSI, SSI, VAP Definition, organisms implicated, microbiological diagnosis & care bundles.
Practice: Air sampler for OT, Settle plate for OT

Module-II

Surveillance of HAI – Device associate infection calculation of rate Hand hygiene surveillance, Needle stick injury, & body fluid exposure surveillance. Standard precautions – hand hygiene Indications of hand hygiene & hand hygiene methods& hand hygiene audit. Standard precautions – PPE various equipment types donning doffing of
PPE kit.

Practice: Hand hygiene movements & steps, Donning &doffing of PPE kit & gloves

Module-III

Transmission based precautions Definition –Contact precautions, droplet precautions, airborne precautions, Agents, infection control measures. Infection control in special situations: Infection control in laboratory, OT, sterilization, disinfection, asepsis, cleaning & decontamination
CSSD: Objectives of CSSD Types of sterilizers & uses Sterilization control – Chemical & biological
Practice: Spillage management, Disinfection

Module-IV

Definition MDRO, MRSA, ESBL, Transmission & infection control measures for MDRO Identification of MRSA, VRE, ESBL Screening of health care workers for MDRO. Antimicrobial stewardship program.
Practice: MRSA detection, ESBL detection

Module-V

Needle stick injury (NSI), Prevention of needle stick injury, Post exposure Prophylaxis, Out break management, Identification & management, Infection control practices in pandemic situation, Waste management
Practice: Reporting of needle stick injury, Biomedical waste & visit to plant

Suggested Readings:

1. Shastri, Apurba S., & R., Deepashree. **Essentials of Hospital Infection Control.** Jaypee Brothers Medical Publishers, 2020.
2. Patawardhan, Nita. **Hospital Associated Infections: Epidemiology, Prevention & Control**. Jaypee Brothers Medical Publishers, 2010.

MEDICAL INSTRUMENTATION AND TECHNIQUES

Subject Name	Code	Type of course	T-P-Pj	Credit

Basic Medical Instrumentation and Techniques	CUTM1730	Theory+Practice	2-2-0	**4**

Course Objective:

- To study the principles, instrumentation, specimen preparation, and applications of advanced microscopic techniques
- To learn the principles, working mechanisms, and applications of key laboratory instruments.
- To understand the principles of microtomy, including tissue sectioning and staining techniques, and gain insights into the operation of fully and semi-automated biochemistry analyzers.
- To acquire knowledge of the principles, working mechanisms, and uses of clinical and sterilization instruments.

Course Outcome:

After completion of the course, the students will be able to:

COs	**Statements**	**COs with POs and PSOs Mapping**
CO1	To deliberate the basic principles of medical instruments.	PO1, PO5, PO12, PSO1, PSO2
CO2	To be able to explain the technical functioning of biomedical instruments.	PO2, PO4, PO5, PSO2
CO3	To demonstrate the applications of biomedical instruments.	PO5, PO7, PO12, PSO1, PSO2
CO4	To relate the use of these instruments with diagnostic service.	PO2, PO4, PO10, PSO2, PSO3
CO5	Interpret and diagnose diseases result.	PO1, PO5, PO7, PSO1, PSO3

COURSE OUTLINE

Module-I

Microscopic techniques: Principle, Instrumentation, Specimen preparation and Application: Phase– contrast microscopy, fluorescene microscopy, polarization microscopy, electron microscopy (Scanning and Transmission);

Module-II

Bacterial Colony Counter (Principle and working). Laminar Air Flow (Principle and

working technique).

Practice: Demonstration of different Microscopes with their operation and maintain technique.

Module- III

Colorimeter: Principle and Instrumentation; **Spectrophotometry**: Ultraviolet, Mass spectrophotometry; Flame photometry. **Centrifugation**: Principle; Preparative, Analytical, Density gradient centrifugation. **Cytometry**: Types, Flow cytometry and its applications.

Practice*:* Operation, Demonstration and Quality control of Centrifuge, UV-Vis spectrometer, Colorimeter.

Module- IV

Microtomy: Sectioning, Staining. Application, Principle and Application of: Fully Automated Biochemistry Analyser, Semi- automated Biochemistry Analyser,

Module-V

Coagulometer. Principle, working and uses of: Incubator, Hot air oven, Autoclave.

Practice: Demonstration *of* Auto/ Semi auto Analyzer; Working procedure of microtome, Incubator, Hot air oven, autoclave and others

Suggested Readings:

1. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.

(e-Book link: https://www.pdfdrive.com/principles-and-techniques-of- biochemistry-and-molecular-biology-e174866056.html)

2. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H.Freeman and Company.(e-Book link: https://www.pdfdrive.com/lehninger-principles-of-biochemistry-5th-edition- d164892141.html)
3. Willey MJ, Sherwood LM & Woolverton C J. (2013). Prescott, Harley and Klein'sMicrobiology. 7thEd., McGraw Hill.

(e-Book link: https://www.pdfdrive.com/prescott-harley-and-kleins-microbiology- 7th-ed-

e188166539.html)

4. Labs for Life

(e-source link: http://labsforlife.in/InstructionalVideo.aspx **)**

(e-Booklink-

https://books.google.co.in/books?id=z9SzvsSCHv4C&printsec=frontcover&dq=instrumentation&hl=en&sa=X&ved=2ahUKEwjipqrO347qAhUjwzgGHRomCNUQ6wEwAHoECAIQAQ#v=onepage&q=instrumen tation&f=f alse)

VITAMINS AND HORMONES

Subject Name	Code	Type	T + P + Pj	Credits
Vitamins and Minerals	CUTM4292	Theory+ Practice	2-2-0	4

Course Objective:

- To provide students with a comprehensive understanding of the daily nutrition requirements for vitamins and minerals and their role in maintaining overall health.
- To enable students to identify and evaluate various food sources rich in essential vitamins and minerals, promoting informed dietary choices.
- To explore the physiological and health impacts of vitamin and mineral deficiencies and excesses, including the identification of associated health conditions.
- To equip students with the skills to analyze dietary patterns and develop practical strategies for optimizing vitamin and mineral intake in diverse populations.

Course Outcome:

After completion of the course, the students will be able to:

COs	Statements	COs with POs and PSOs Mapping
CO1	Identify and list the essential vitamins and minerals, along with their food sources and functions in the human body.	PO1, PO10, PSO1
CO2	Demonstrate the biochemical roles of key vitamins and minerals, including their impact on	PO1, PO5, PO7, PSO1

	health and metabolism.	
CO3	Analyze dietary intake and create a balanced meal plan that meets recommended daily allowances of vitamins and minerals for specific populations.	PO5, PO9, PO10, PSO3
CO4	Evaluate the effects of vitamin and mineral deficiencies and excesses on health, including common disorders associated with imbalances	PO1, PO5, PO7, PO12 PSO1, PSO3
CO5	Design an educational program to promote awareness of the importance of vitamins and minerals in diet, targeting specific demographic groups such as children, athletes, or the elderly.	PO6, PO9, PO10, PSO3

Course Outlines:

Module 1: Vitamin Classification

Overview and Classification of Vitamins: Study of fat-soluble and water-soluble vitamins, their differences, and general roles.

Practical: Vitamin Solubility Test

Module 2: Fat-Soluble Vitamins

Chemistry, Properties, and Deficiency of Fat-Soluble Vitamins: Exploration of vitamins A, D, E, and K—chemical structures, functions, and the effects of deficiencies.

Practical: Vitamin A Detection Test,

Perform a color reaction using iodine to detect vitamin A in food samples.

Module 3: Water-Soluble Vitamins

Chemistry, Coenzyme Functions, and Deficiency of Water-Soluble Vitamins: Focus on the B-complex and vitamin C, their roles as coenzymes, and deficiency-related diseases.

Practical: Vitamin C Titration

Measure the vitamin C content in fruit juices using an iodine titration method.

Vitamin B Detection with pH Indicator

Use a pH indicator to detect B vitamins, noting color changes that indicate their presence.

Module 4: Hormone Basics

Classification, Action Mechanism, and Secretion Regulation of Hormones: Study of hormone types, how they act on target cells, and how their release is controlled.

Practical:

Blood Glucose Measurement

Measure blood glucose levels before and after eating, illustrating insulin secretion and regulation by the pancreas.

Module 5: Specific Hormones and Functions

Chemistry, Metabolism, and Disorders of Key Hormones: Detailed study of hormones from the hypothalamus, pituitary, thyroid, parathyroid, pancreas, adrenal glands, and gonads, including their functions and related disorders.

Practical:

Thyroid Function Test

Cortisol Measurement Test

Suggested Readings:

1. Vitamins and Hormones" (Series) - edited by Gerald Litwack
2. "The Vitamins: Fundamental Aspects in Nutrition and Health" by Gerald F. Combs Jr.
3. "Principles of Hormone/Behavior Relations" by Donald W. Pfaff
4. "Vitamins: Their Role in the Human Body" by G. F. M. Ball
5. "Hormones" by Anthony W. Norman and Helen L. Henry
6. "Handbook of Vitamins" by Janos Zempleni, John W. Suttie, Jesse F. Gregory III, and Patrick J. Stover

MINI PROJECT

Subject Name	Code	Type	T + P + Pj	Credits
Mini Project	CUTM1754	Project	0-0-2	2

Course Objective:

- To contribute to the advancement of knowledge in the field of microbiology by conducting original research or exploring innovative approaches
- To apply theoretical knowledge gained during the academic coursework to real-world optometry scenarios.
- To develop skills in data collection techniques, data analysis, and interpretation,

which are essential for evidence-based practice i.

- To develop effective communication skills through oral presentations, written reports, and patient record

Course Outcome:

After completion of the course, the students will be able to,

COs	Statements	COs with POs and PSOs Mapping
CO1	Identify health gaps specific to a community.	PO5, PO10, PO11, PSO3
CO2	Demonstrate critical thinking in solving health related issues.	PO5, PO7, PO12, PSO3
CO3	Evaluate case studies.	PO5, PO8, PO12, PSO3
CO4	Design and address a research problem.	PO6, PO8, PO12, PSO3
CO5	Understand the steps involved in data collection and questionnaire design	PO9, PO10, PO12, PSO3

Course Outline:

- The student is supposed to carry out project work in assistance with a mentor. The project should be relevant to the syllabus and should be qualitatively initiated towards fetching a research publication/ case study/ clinical study/ community service/ survey on successful completion within the stipulated time.
- Outcome: Research paper publication/ new idea generation/ case study/ clinical study/ community service/ survey.

PROJECT

Subject Name	Code	Type	T + P + Pj	Credits
Mini Project	CUTM4339	Project	0-0-10	10

Course Objective:

- To contribute to the advancement of knowledge in the field of microbiology

by conducting original research or exploring innovative approaches

- To apply theoretical knowledge gained during the academic coursework to real-world optometry scenarios.
- To develop skills in data collection techniques, data analysis, and interpretation, which are essential for evidence-based practice i.
- To present findings and results in a clear, concise, and professional manner.

Course Outcome:

After completion of the course, the students will be able to,

COs	Statements	COs with POs and PSOs Mapping
CO1	Select relevant scientific literature.	PO1, PO8, PO12, PSO3
CO2	Execute appropriate data collection techniques and tools.	PO9, PO10, PO12, PSO3
CO3	Analyse data with appropriate statistical techniques.	PO5, PO9, PO12, PSO3
CO4	Design a research proposal.	PO6, PO8, PO12, PSO3
CO5	Integrate theoretical concepts and practical skills gained from their coursework to design and execute a research project	PO1, PO2, PO5, PO12, PSO1, PSO3

Course Outline:

1. Antibacterial activity of sweet orange (citrus sinesis) on Staphylococcus aureus and Escherchia coli isolated from wound infected.
2. The incidence of Salmonella and Escherchia coli in livestock (Poultry) feeds
3. Microbial evaluation of milk from a dairy farm.
4. Gastroenteritis in primary school children (6-12yr) of specific locality.
5. Comparative analysis of microbial load of the main water production and water available to CUTM campus

INTERNSHIP

Subject Name	Code	Type	T + P + Pj	Credits
Internship	CUTM4340	Project	0-0-10	10

Course Objective:

- To gain hands-on clinical experience in conducting comprehensive diagnosis of the specimen.
- To become familiar with advanced instrumentation and technology used in the field of diagnosis
- To operate specialized diagnostic tools, imaging devices, and diagnostic instruments, enhancing their skills in evaluating health and providing accurate diagnosis.
- To develop effective patient interaction and communication skills

Course Outcome:

After completion of the course, the students will be able to,

COs	Statements	COs with POs and PSOs Mapping
CO1	Select relevant scientific literature.	PO1, PO8, PO12, PSO3
CO2	Execute appropriate data collection techniques and tools.	PO9, PO10, PO12, PSO3
CO3	Analyse data with appropriate statistical techniques.	PO5, PO9, PO12, PSO3
CO4	Design a research proposal.	PO6, PO8, PO12, PSO3
CO5	Integrate theoretical concepts and practical skills gained from their coursework to design and execute a research project	PO1, PO2, PO5, PO12, PSO1, PSO3

Course Outline:

Internship Thesis Guideline:

This Guideline is designed to provide students the knowledge and practice of public health research

activity, to enable them to carry out researches and solve research related problems and to help them in writing thesis and defend their work. Upon successful completion of the course, the students shall be able to:

1. Search relevant scientific literature
2. Develop a research proposal
3. Employ appropriate data collection techniques and tools
4. Manage collected data
5. Analyze data with appropriate statistical techniques
6. Write thesis
7. Defend the findings Proposal

Development:

At the ending of second year (4th Semester), students individually consultation with designated faculties and extensive literature survey will develop research proposal during the initial 6 months period.

Data Collection/ Thesis Writing:

Students will carry out data collection, data management, data analysis, and thesis writing during the remaining period (Six Semester).

The Dissertation should have following format:

1. Title
2. Introduction
3. Materials and Methods
4. Results
5. Discussion
6. Conclusion
7. Recommendation
8. References
9. Appendix
10. Internship
11. Case record
12. Lab management and ethics
13. Evaluation – Guide (internal)
    a) Industries guide(external)
    b) University-project report/ Viva