**CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT,**

**ODISHA**

**SCHOOL OF PARAMEDICS & ALLIED HEALTH SCIENCES**


Centurion
UNIVERSITY

*Shaping Lives...*
*Empowering Communities...*

# MASTER OF SCIENCE IN MEDICAL LABORATORY TECHNOLOGY

**2021**

**SYLLABUS**

# Master of Science in Medical Laboratory Technology

**Programme structure**

| BASKET 1 | BASKET 2 | BASKET 3 | BASKET 4 | |
|---|---|---|---|---|
| **School Core Courses** | **Discipline Core Courses** | **Ability Enhancement Compulsory Course (AECC)** To be selected from University Basket | **Skill Courses** (To be selected from University Basket) | |
| SC-1<br>SC-2<br>SC-3<br>SC-4<br>SC-5<br>SC-6<br>SC-7<br>SC-8 | DC-1<br>DC-2<br>DC-3<br>DC-4<br>DC-5<br>DC-6<br>DC-7<br>DC-8<br>DC-9<br>DC-10 | AECC-I<br>AECC-II | SFS-1<br>SFS-2<br>SFS-3 | **TOTAL CREDITS** |
| **28 Credits** | **50 Credits** | **6 Credits** | **12 Credits** | **96 Credits (Minimum Credits required)** |

**BASKET I**

**School Core Courses**

| Sl. No. | CODE | SUBJECT | SUBJECT TYPE (T+P+Pj) | CREDITS |
|---|---|---|---|---|
| SC-1 | CUTM1708 | Human Anatomy and Physiology | 2+1+0 | 3 |
| SC-2 | CUTM1709 | Analytical Techniques | 3+1+0 | 4 |
| SC-3 | CUTM1710 | Biological Chemistry | 2+1+0 | 3 |
| SC-4 | CUTM1712 | Clinical Hematology | 3+1+0 | 4 |
| SC-5 | CUTM1715 | Clinical Pathology | 3+1+0 | 4 |
| SC-6 | CUTM1714 | Cell and Molecular Biology | 2+0+1 | 3 |
| SC-7 | CUTM1718 | Clinical Biochemistry | 2+1+0 | 3 |
| SC-8 | CUTM1720 | Histology | 3+1+0 | 4 |

**BASKET II**
**Discipline Core Courses**

| Sl. No. | CODE | SUBJECT | SUBJECT TYPE (T+P+Pj) | |
|---|---|---|---|---|
| DC-1 | CUTM1723 | Medical Laboratory Technology | 3+2+0 | 5 |
| DC-2 | CUTM1725 | Blood Banking | 3+0+1 | 4 |
| DC-3 | CUTM1726 | Health Programme in India | 2+0+1 | 3 |
| DC-4 | CUTM1724 | Medical Microbiology | 3+1+0 | 4 |
| DC-5 | CUTM1728 | Immunology & Parasitology | 3+2+0 | 5 |
| DC-6 | CUTM1727 | Advanced Hematology | 3+1+0 | 4 |
| DC-7 | CUTM1721 | Research Methodology | 2+0+1 | 3 |
| DC-8 | CUTM1754 | Mini Project | 0+0+2 | 2 |
| DC-9 | CUTM1755 | Internship | | 12 |
| DC-10 | CUTM1756 | Project | | 12 |

**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**

**SC1- CUTM1708- Human Anatomy and Physiology**

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| Human Anatomy and Physiology | CUTM1708 | Theory+ Practice | 2-1-0 | Fundamental Science |

**Objective**

- To identify different types of cells and describe their functions.
- To identify the organelles of a typical cell and describe their functions.
- To identify the major components of the integumentary system and describe their functions.
- To identify the major structures of the skin and describe their functions
- To identify the major components of the skeletal system and describe their functions.
- To identify the major components of the circulatory, endocrine, nervous system etc and describe their functions.

**Course outcome**

- Use anatomical terminology to identify and describe locations of major organs of each system covered.
- Explain interrelationships among molecular, cellular, tissue, and organ functions in each system.
- Describe the interdependency and interactions of the systems.
- Explain contributions of organs and systems to the maintenance of homeostasis.
- Identify causes and effects of homeostatic imbalances.
- Describe modern technology and tools used to study anatomy and physiology.

**Course Outline**

**Module-I (10 Hours)**

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.

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.

Identification of different organs and system from chart.

**Module-II (13 Hours)**

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 the morphology of different blood cells

Measurement of Blood pressure, impulses, Heart beats, respiration rate etc.

**Module-III (15 Hours)**

Urinary System: Various parts of urinary system and their functions, structure and functions of 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.

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

**Practice:** Demonstration of various parts of body, tissues of body, parts of digestive system, parts of respiratory system, parts of excretory system. Identification of different organs and system from chart

***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 EdwardArnold.
3. Anatomy & Physiology- by Ross and Wilson, PublisherElsevier.
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, PublisherSatya

## SC2- CUTM1709- Analytical Techniques

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Analytical Techniques** | CUTM1709 | Theory+ Practice | 3-1-0 | Fundamental Science |

**Objective**

- To learn the principle, instrumentation & application of Microscopy
- Principle, instrumentation & application of Centrifugation
- Chromatographic techniques
- Electrophoretic techniques
- Principle of Spectroscopy

**Course outcome**

- After completion of the course the student will be efficient in handling the microscopy equipment's.
- They will also be able to have idea about handling instruments like centrifuge, spectrophotometer, chromatography, flow cytometer, Automated and semi-automated Biochemistry analyzer.
- They will gain knowledge on the principle behind and the application of NMR, X-ray diffraction, ESR.
- The conceptual understanding of the subject provides opportunities for skill enhancement and scopes for higher education.

**Course Outline**

**Module–I**

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

Bacterial Colony Counter (Principle and working).

**Microtomy**: Sectioning, Staining. Application.

**Cytometry**: Types, Flow cytometry and its applications.

**Practice:** Demonstration of different Microscopes with their operation.
Preparing specimens for observing under microscopes.
Demonstration of Microtome.

**Module-II**

**Centrifugation**: Principle;Preparative, Analytical, Density gradient centrifugation.
**Chromatography**: Principles and Applications:Paper, Thin layer, Column, Ion exchange, Affinity chromatography, Gelfiltration, Gas Chromatography, HPLC, FPLC.
**Electrophoresis**:Immunoelectrophoresis, Isoelectric focusing, 2-Dgel electrophoresis.

**Practice:** Demonstration of Centrifuge
Demonstration of Chromatography techniques
Demonstration of Electrophoresis

**Module-III**

**Colorimeter**: Principle and Instrumentation; **Spectrophotometry**: Ultraviolet, Mass spectrophotometry; Flame photometry;

Principle, Instrumentation, Specimen preparation and Application of: X-ray diffraction, NMR, EPR.

Principle and Application of: Fully Automated Biochemistry Analyser, Semi- automated Biochemistry Analyser, Coagulometer.

**Practice:** Demonstration of Semi automated Analyzer
Demonstration of Fully automated Analyzer

***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's Microbiology. 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**)**

## SC3- CUTM1710- Biological Chemistry

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Biological Chemistry** | CUTM1710 | Theory+ Practice+ Project | 2-1-0 | General chemistry & Biology |

**Objective**

- Work to promote good health by teaching the public and other health professionals about diet and nutrition.
- To demonstrate clinical disorders, the biochemical consequences of particular disease process and the response to therapy.
- To describe the various intracellular controls that govern the rate at which the metabolic pathway functions.
- To explain the ways in which hormones work in human body and alter cellular activity by binding to intracellular receptors.

**Course outcome**

- Students will be able to demonstrate an understanding of fundamental biochemical principles, such as the structure/function of metabolic pathways, and the regulation of biological/biochemical processes.
- Able to apply and effectively communicate scientific reasoning and data analysis in both written and oral forums.
- Demonstrate a thorough knowledge of the intersection between the disciplines of Biology and Chemistry.
- Appreciate the way in which practitioners in the disciplines of Biology and Chemistry intersect and bring their expertise to bear in solving complex problems involving living systems.

**Course Outline**

**Module I**

**Chemical aspects of Food, Nutrition and Vitamins:** Energy yielding nutrients and Calorific value of carbohydrates, fats and proteins. Basal metabolic rate (BMR) and Body Mass Index (BMI). The Food Pyramid**.** History, Chemistry, Absorption, transport, and storage of Vitamins, Metabolic functions and Biochemical manifestations of Water soluble Vitamins-B-Complex Vitamins : Vitamin –B1,Vitamin –B2,Vitamin-B3,Vitamin –B6, Biotin, Panthothenic acid, Folic acid, Vitamin-B12.Coenzymes of B-Complex Vitamins. Fat soluble Vitamins: Vitamin -A, Vitamin - D, Vitamin-E, Vitamin- K.

**Practice:** Calculation of BMR and BMI.

**Module II**

**Cellular Respiration:** Aerobic and anaerobic respiration; Energy yield and regulation. Oxidation of fatty acid, Transamination and Deamination reaction, Urea formation and transport, Ketogenesis.

**Practice: Solutions:** Definition, use, classification, preparation and storage. Stock and working solutions. Molar and Normal solutions of compounds and acids. (NaCl, NaOH, HCl, $H_2SO_4$)

**Module III**

**Biochemical aspects of Hormone:** Hormone receptors and intracellular messengers, Adenylate cyclase, protein kinase and phosphodiesterase. Role of Insulin, glucagon's, epinephrine and their mechanism of action.

**Practice:** Diabetes and other disorder identification.

***Suggested Readings:***


1. Lehninger Principles of Biochemistry (https://www.pdfdrive.com/lehninger-principles-of-biochemistry-5th-edition-e164892141.html)
2. Fundamentals of Biochemistry: Life at the Molecular Level (https://www.pdfdrive.com/fundamentals-of-biochemistry-life-at-the-molecular-level-e186753533.html)


## SC4- CUTM1712 - Clinical Hematology

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| Clinical Hematology | CUTM1712 | Theory+Practice | 3-1-0 | Basic Medical science |

**Objective**

- The Clinical Hematology course will cover the diagnosis and management of blood cell disorders, anatomy and physiology of hematopoiesis, routine specialized hematology tests, analysis, classification, and monitoring of blood cell abnormalities.
- Clinically relevant hematological analysis for deeper understanding evaluate normal and abnormal cell morphology with associated diseases and other blood components.
- Be able to handle an investigation of hematological disorder and laboratory abnormalities such as anaemia, polycythemia, leukopenia, leukocytosis, thrombocytopenia, thrombocytosis, elevated ESR etc within hematology.

**Course outcome**

- Differentiate various hematological procedures and the use of basic equipmentessential to working in a Hematology Laboratory.
- Discuss differences between Quality control, Quality Assurance, and ContinuingQuality Improvement principles as used in the Hematology Laboratory.
- Categorize various hematology analyses, operational principles of various hematology instruments, and troubleshooting of various instruments.
- Explain the principles and theories utilized in a variety of problem-solving situations.
- Define testing suitability standards for Hematology specimens.
- To be able to carry out blood sampling & Evaluate specimen acceptability.

**Course Outline**

**Module-I (16 Hrs)**

Scope & importance of Haematology, important equipment and chemicals, various test performed in Haematology laboratory. Identify and/or confirm the composition of various red blood cell inclusions. Function of normal cellular components, Formation of blood, Erythropoiesis, thrombopoiesis. Anticoagulants, definition, Uses, Different types, mode of action, their merits and demerits. Morphology of normal blood cells, abnormal morphology & diseases, Hematological Disorder

**Practice:** Demonstration of instruments used in hematology- Microscope, Blood Cell counter. Demonstration of different blood cell, their synthesis from slide presentation or chart. Demonstration the normal and abnormal morphology of different blood cells.

**Module-II (18 Hrs)**

Collection and preservation of blood: different methods of collection (venous and capillary blood), preservation, changes in stored blood normal and absolutely values in hematology, Preparation of peripheral blood film (PBF), To stain a peripheral blood Film by Leishman stain, Malaria thick smear preparation, Different types of stains, Romanwsky stains: principle of staining, Hemoglobin estimation (oxy Hb and cyanmethaemoglobinmethod), Complete Blood Cell Count: Total RBC count, Total WBC count, Platelet count, DLC value, HB, MCH, MCV, MCHC, Determination of ESR by wintrobes, Determination of ESR by Westergren's method, Determination of PCV by Wintrobes, Reticulocyte Count, Absolute Eosinophil Count, Morphology of Red Blood Cells.

**Practice:** Different methods of collection (venous and capillary blood), Preparation of DLC, TLC, TRBC etc. Estimation of ESR, Complete blood cell count, Blood grouping, Hb and values of MCH, MCV, MCHC, PCV, Staining & Smear preparation.

**Module-III (14 Hrs)**

Hematological Disorders

1. Classification of Anemia: Morphological &etiological.
2. Iron Deficiency Anemia: Distribution of body Iron, IronAbsorption, causes of iron deficiency, labfindingsc. Megaloblastic Anemia: Causes, Labfindings.
3. Hemolytic Anemia: Definition, causes, classification & labfindings.
4. Laboratory diagnosis of Hemophilia and von-will brand disease.
5. Laboratory diagnosis of Idiopathic thrombocytopenic purpura (ITP),
6. Platelet function tests and their interpretation.

**Practice:** Observation about different normal and abnormal morphology of RBCs, WBCs, Platelet, Bleeding Time & Clotting Time, PT & APTT.

**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 Mukharjee, Publisher McGraw Hill education pvtlimited
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-practice-e176384006.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=2ahUKEwja9-ve3I7qAhUwzTgGHSMUDekQ6wEwAHoECAQQAQ#v=onepage&q=hematology&f=false
10. Ebook link-https://books.google.co.in/books?id=QQcYAAAAYAAJ&printsec=frontcover&dq=hematology&hl=en&sa=X&ved=2ahUKEwja9-ve3I7qAhUwzTgGHSMUDekQ6wEwAnoECAIQAQ#v=onepage&q=hematology&f=false


## SC5-CUTM1715 -Clinical Pathology

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Clinical pathology** | CUTM1715 | Theory+ Practice | 3-1-0 | Fundamental Science |

**Objective**

- Analyze body fluid for diagnosis of disease
- Analyze waste product for diagnosis of disease
- Understanding DOT Policy
- Understand Physiological disorder and infectious disease
- Analysis of pregnancy

**Course outcome**

- Able to collect pathological specimen
- Able to detect diabetes, ketosis, nephritis, jaundice and other physiological disorder

- Able to detect infectious disease (UTI, Hematuria, Filaria, Dysentery, Ulcer, TB, etc.)
- Preservation and processing of pathological sample.
- Identification of Parasites
- Analysis of Infertility disorder

**Course Outline**

**Module-I (16 Hrs)**

Introduction of clinical pathology, Composition, collection and preservation of urine, Physical examination of Urine, Chemical Examination of Urine - Sugar and Ketone bodies, Diabetes and Ketosis, Nephritis and UTI, Albumin, Phosphate, BJP, Bile Salt and Bile pigment, Chemical Examination of Urine - Multistix reagent strip, Jaundice, Microscopical Examination of Urine, Operation of Urine Analyzer, Pregnancy test, Report writing and report analysis of Urine

**Practice:** Operation of Urine analyzer, Benedict Test, Heat and Acid Test, Rothera's Test, Benzidine Test, Fouchet's Test

**Lab:-**

Urine Analysis: Collection and Physical Examination, Specific Gravity, Benedict's Qualitative test, Acetone Rothera's Test, Protein and BJP Test, Hay's Test and Fouchet's test, Benzidine test, Microscopical Examination, Pregnancy Test, Auto-mentation by Urine analyzer

**Module-II (14 Hrs)**

Respiratory Tract Infection: Gram Staining and ZN Staining, Basic of DOT Centre, Report writing and report analysis of sputum, Sputum for the diagnosis of Mycobacterium tuberculosis, Clinical significance and Report writing of Stool, Difference between Amoebic, Dysentery and Bacillary Dysentery, Microscopical Examination of Stool, Physical and Chemical examination of Stool, Composition, collection and preservation of stool

**Practice:** Microscopic finding of stool, Morphology of stool parasite

**Lab:-**

Stool Analysis: Collection and physical examination, Chemical Examination, Occult test and reducing sugar, Microscopical Examination: Protozoa, Microscopical Examination: Helminthes

Sputum Analysis: Collection and physical examination, Tuberculosis (ZN Stain), Respiratory infection (Gram Stain)

**Module-III (15 Hrs)**

Routine laboratory investigation of Pleural Fluid, Routine laboratory investigation of Pericardial Fluid, Routine laboratory investigation of Synovial Fluid, Synovial fluid: Collection and preservation, Examination of CSF related to Meningitis, Brain Tumour and other disorder, CSF: Composition, Collection, Preservation and physical examination, Report analysis and report writing of Semen, Semen examination for male infertility disorder, Semen: Composition, function, collection and physical examination

**Practice:** Gram stain, ZN Stain, General consideration on specimen collection

**Lab:-**

Semen Analysis: Collection and physical examination, Chemical Examination, Microscopical examination

CSF Analysis: Collection and Routine Examination

Synovial Fluid: Collection and Routine examination

Pleural Fluid: Collection and routine examination

Pericardial Fluid: Collection and routine examination

Bacteriological Examination of throat swab

***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
3. Textbook of medical laboratory technology by Praful B Godkar, Publisher Bhalan
4. Medical laboratory science theory and practice by J Ochei and Kolhatkar, 2002, Tata McGraw-Hill, Publisher TBS


## SC6- CUTM1714 - Cell and Molecular Biology

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Cell and Molecular Biology** | CUTM1714 | Theory+ Project | 2-0-1 | Fundamental Science |

**Objective**

- Understanding the central dogma of life
- To understand the concept of gene regulation and its impact
- The use of several molecular diagnostic techniques for disease interpretation

**Course outcome**

- After completion of the course the student will be gain knowledge of thesignificance of genes and proteins.
- They will understand the mechanism of gene expression and protein synthesis,
- The significance of gene expression regulation will become clear.
- The students will understand the use of several molecular techniques in disease diagnosis.

**Course Outline**

**Module-I**

**DNA structure**. Salient features of double helix, Types of DNA. DNA topology - linking number, topoisomerases. Bidirectional and unidirectional replication, semi- conservative, semi- discontinuous replication.

**Mechanism of DNA replication**. Enzymes and proteins involved in DNA replication.

**Module-II**

**RNA Structure**. **Transcription**: Promoter, Polymerase and the transcription unit. **Transcription in Eukaryotes**: RNA polymerases, general Transcription factors. Split genes, concept of introns and exons, RNA splicing, spliceosome machinery, concept of alternative splicing, Polyadenylation and capping, Processing of rRNA, RNA interference: si RNA, miRNA and its significance.

**Translational machinery**: Charging of tRNA, aminoacyl tRNA synthetases. Mechanisms of initiation, elongation and termination of polypeptides in both prokaryotes and eukaryotes.

Malignant transformation of cells and role of oncogenes, Tumor virus, Proto- oncogenes, Tumor suppressor genes; Apoptosis, cell regeneration.

**Module- III**

**Molecular diagnostics**: Recombinant DNA Technology and its applications, Polymerase chain reaction andits application in diagnosis of pathogens, Site directed mutagenesis, DNA finger printing, DNase Foot Printing, antisense RNA technology, inherited genetic disorders in man and gene therapy.

**Suggested Readings:**


1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 7th edition, Cold Spring Harbour Lab. Press, Pearson Publication. (e-Book link: https://www.pdfdrive.com/molecular-biology-of-the-gene-e158278674.html )
2. Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter (2015) Molecular Biology of the cell, 6th edition, Taylor and Francis Group. (e-Book link: https://www.pdfdrive.com/molecular-biology-of-the-cell-d184612905.html )
3. Principles and Practice of Medicine- by Davidson, S. S., J. MacLeod and C.R.W. Edwards,1991 Publisher Churchill Livingstone. (e-Book link: https://www.pdfdrive.com/davidsons-principles-and-practice-of-medicine-d186204495.html)
4. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.(e-Book link: https://www.pdfdrive.com/search?q=Sambrook+J+and+Russell+DW.+%282001%29.+Molecular+Cloning%3A+A+Laboratory+Manual.+4th+Edition&pagecount=&pubyear=&searchin=&more=true)
5. Geoffrey M. Cooper, Robert E. Hausman (2007). The Cell, A molecular approach. 4th ASM Press, Washington, D.C.(e-Book link: https://www.pdfdrive.com/the-cell-a-molecular-approach-e186369576.html
6. B. Primrose and R.M. Twyman (2006) Principles of Gene Manipulation and Genomics 7thEdition. Blackwell Publishing.(e-Book link: https://www.pdfdrive.com/principles-of-gene-manipulation-and-genomics-e25845509.html )


Online Tutorial links:

1. DNA Decoded (coursera link: https://www.coursera.org/learn/dna-decoded)
2. DNA Replication (Lecturio link: https://app.lecturio.com/#/course/s/8020 )
3. Transcription (Lecturio link: https://app.lecturio.com/#/lecture/s/5990/35832)

## SC7- CUTM1718 – Clinical Biochemistry

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Clinical Biochemistry** | CUTM1718 | Theory+Practice | 2-1-0 | Basic Medical science |

**Objective**

- Understanding the concept of Biochemical analyzing instruments, chemicals and normal ranges of biochemical components in our body.
- Clinically relevant biochemical analysis for deeper understanding of all biochemical components i.e., Proteins, Electrolytes, Hormones etc

**Course outcome**

- To learn about tests carried out for biochemical investigations.
- Understanding of principle of biochemical Clinical biochemistry tests.
- To learn normal ranges and abnormal ranges of biochemical components and hormones.
- To study about diseases related to biochemical and hormone imbalance in human body.

**Course Outline**

**Module-I (10 Hrs)**

LFT, KFT, Lipid profile, Estimation of Glucose, Hormone test: T3, T4, TSH, Prolactin, 17 Kitosteroids

**Practice:** Demonstration the centrifuge machine, Demonstration of Colorimeter, Method of estimation and assessment for: a. Glucose tolerance test , Detection of sugar in Urine, Estimation of Protein in urine, Estimation of Liver function test, Kidney function test, Lipid profile, Thyroid

**Module-II (10 Hrs)**

Metabolic disorders and Diagnostic enzymology: Disorders of metabolism: carbohydrate, Lipids, Amino acids and Nucleic acids. Diagnostic enzymes: Role of Enzymes in Clinical Practice: Marker enzymes in myocardium, liver and pancreas. Tumor markers, Radio isotope techniques

**Module-III (14 Hrs)**

Organ function tests: Liver function tests, Bile pigment metabolism, tests for liver function. Jaundice and its type, Functions of Kidney, Urine formation and renal function tests disease of kidney , Renal Calculi : Theory of formation and analysis , Gastric Analysis , Composition of gastric juice, concepts of free and bound acid, Fractional Test Meal

**Practice:** Operation procedure of Centrifuge machine, colorimeter etc. Estimation of Liver function test, Kidney function test, Estimation of bile pigment, bile salt, bilirubin etc.

***Suggested Readings***

1. Text book of Medical Laboratory Technology by P. B. Godker, PublisherBhalani.
2. Text book of Medical Biochemistry by Chaterjee & Shinde, PublisherJPB
3. Medical Laboratory Technology by Mukherjee
4. Principal of Biochemistry by Lehninger, Publisher Kalyani
5. Practical Clinical Biochemistry by Harold Varley, Publisher CBS.
6. Ebook link- https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/medicalbiochemistry.pdf
7. Ebook link- https://books.google.co.in/books?id=Je_pJfb2r0cC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
8. Ebook link- https://books.google.co.in/books?id=csPcDAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
9. Ebook link- https://books.google.co.in/books?id=2FkXAwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

## SC-8- CUTM1720- Histology

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Histology** | CUTM1720 | Theory+Practice | 3-1-0 | Basic Medical Science |

**Objective**

- Understanding the concept of histotechnology;Basic concepts about routine methods of examination of tissues Collection.
- perform routine laboratory procedures encompassing all major areas of the histology laboratory.
- accurately and proficiently embed tissue and understand the principles of microtomy.
- Clinically relevant onchological analysis for deeper understanding of abnormal cell growth at anywhere in human body.
- The conceptual understanding of the subject provides opportunitiesfor employability and scopes for higher education.

**Course outcome**

- In this section students will be made aware of terminology used in histotechnology, various instruments and their maintenance and also learn theprocessing of various samples for histopathological investigations.
- Reception and labeling of histological specimens.
- Use of antiseptics, disinfectants and insecticides in a tissue processinglaboratory.
- The students will learn about various staining procedures for demonstrationof different substances & various cytological investigations.
- The students will learn about special staining procedures & handling & testingof various cytological specimens.

**Module- I ( 8 Hrs)**

Histotechnology, Care & Maintenance of histotechnology equipements and their parts and Safety measures of laboratory equipment used in histotechnology. Basic concepts about routine methods of examination of tissues, Collection and transportation of specimens for histological examination, fixation: Process, Various types of fixatives used in a routine histopathology laboratory- Simple fixatives, Compound fixatives, Special fixatives for demonstration of various tissue elements.

**Practice:** Care & maintenance of Histology equipments, Collection & transportation of specimens, Fixation

**Module- II (8 Hrs)**

Decalcification Criteria of a good decalcification agent, Technique of decalcification Followed with selection of tissue fixation, decalcification neutralization of acid and thorough washing. Various types of decalcifying fluids, Processing of various tissues for histological examination, Embedding, Schedule for manual or automatic Tissue processing, Components & principles of various types of a tissue processors.

**Practice:** Method of Decalcification, Embedding, manual or automatic tissue processings schedule.

**Module- III (10 Hrs)**

Periodic Acid Schiff Staining, Impregnation and Mountains, Commonly used mountains in histotechnology lab. General Staining Procedures( routine H&E stain, PAP stain and other special stain)

for Paraffin Infiltrated and Embedded tissue, To perform & practice the manual & automated Haematoxylin and Eosin staining technique, To perform & practice the Mallory's Phosphotungstic Acid Haematoxylin (PTAH). Introduction of FNAC and its staining tech, museum technique, post mertum technique.

**Practice:** Procedure for manual Staining and Automatic Staining Technique, FNAC technique, Museum technique (Hospital Visit), Post mertum technique(Hospital Visit).

**Module- IV (8 Hrs)**

Demonstration of instruments used for dissection Use of antiseptics, disinfectants and insecticides in a tissue processing laboratory Reception and labeling of histological specimens Preparation of various fixatives -Helly's fluid, Zenker's fluid, Bouin's fluid, Corney's fluid, 10% Neutral formalin, Formal saline, Formal acetic acid, Pereyn's fluid, prepare 70% alcohol from absolute alcohol. To perform embedding and casting of block.

**Practice:** Use of antiseptics, disinfectants and insecticides in tissue processing laboratory, Preparation of various Fixatives, Labeling of Histological specimens, Embedding and Casting of block

**Module- V (8 Hrs)**

Tissue Processor, Microtomy, Honing and Stropping technique, Use of tissue floating bath, Use of incubator

**Practice**: Processing of tissue by manual and automated processor method To demonstrate various part and types of microtome. To learn sharpening of microtome knife (Honing and stropping technique) To perform section cutting, learn mounting of stained smears. To practice attachment of tissue sections to glass slides To learn using tissue floatation bath drying of sections in incubator ($37^0$ C)

***Suggested Readings:***


1. Color text book of histology by Gartner &Hiatt, publisherElsevier
2. Netter's essential histology by William Ovalle, publisherElsevier
3. Histology E-book by Barry Mitchell, publisherElsevier
4. Textbook of Histology (color atlas) by Krishna Garg, Indira Bahl, Mohini kaul, publisherCBS
5. Textbook of Histology and a Practical Guide by JP Gunasegaran, PublisherElsevier
6. Textbook of Medical Laboratory Technology by Praful B Godkar, Publisher Bhalami

7. Ebook link- https://books.google.co.in/books?id=qWScAQAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
8. Ebook link- https://books.google.co.in/books?id=MrpEDwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
9. Ebook link- https://books.google.co.in/books?id=CERPDwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

**BASKET II**
**Discipline Core Courses**

**DC-1- CUTM1723- Medical Laboratory Technology**

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Medical Laboratory Technology** | CUTM1723 | Theory+ Practice | 3-2-0 | Fundamental Science |

**Objective**

- Understanding the concept of Medical Laboratory Science
- Diagnosis of Disease
- Understanding Rules and Regulations for clinical laboratory
- Automentation technique in diagnostic division

**Course outcome**

- Perform routine clinical laboratory process
- Understand the clinical laboratory policy
- Quality management in diagnostic division
- Laboratory management information
- Patient safety and lab safety
- Team leader in diagnostic division

**Course Outline**

**Module-I (13 Hrs)**

Basic laboratory principle, Code of conduct of medical laboratory, Organization of clinical laboratory, Functional components of clinical lab, Role of medical laboratory technician, Communication between physician and lab technician.

**Practice:** Observation of Lab Equipments

**Module-II (14 Hrs)**

PPE in labs, Standardized clinical lab setup, Various types of laboratories, Lab safety, First-Aid in clinical laboratory, Different types of laboratory records, Responsibilities of lab workers, General consideration on specimen collection, Transportation and preservation of lab samples, Automentation in clinical laboratory

**Practice:** PPE Equipments, Lab record maintenance, Specimen collection, transportation, preservation, Lab setup process.

**Module-III (18 Hrs)**

Clinical establishment Act, Quality control for clinical lab, NABH, NABL (National accreditation board of laboratory), ISO Certification, Annual maintenance contract, Procurement and supply management, WHO Policy for medical lab, Important instruction to minimize infection in laboratory work, Bio-Medical waste management

**Practice:** Patient care and personal care, Bio-medical waste management.

***Suggested Readings:***


1. Handbook of Medical laboratory technology by V. H. Talib, Publisher CBS Publisher and distributors
2. Medical laboratory technology Vol.1 by K. L. Mukherjee, 2007, Publisher Tata McGrawHill
3. Medical Laboratory by Ramnik Sood
4. Practical Pathology by Harsh Mohan
5. Textbook of medical laboratory technology by Praful B Godkar, Publisher Bhalan
6. Medical laboratory science theory and practice by J Ochei and Kolhatkar, 2002, Tata McGraw- Hill, Publisher TBS

## DC-2- CUTM1725- Blood Banking

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| Blood Banking | CUTM1725 | Theory+ Project | 3-0-1 | Fundamental Science |

**Objective**

- Understanding blood bank method, demonstrate knowledge of testing
- Knowledge of Anticoagulant used in blood bank
- Get knowledge about blood regulation policy
- Understanding solid organ transplantation and it's policy
- Basic of transfusion reaction
- Investigation related to blood bank

**Course outcome**

- Perform phlebotomy and related donor room activity in blood bank
- Manage the blood bank
- Identifies and communicate abnormal test report by alerting supervisory personal
- Organize blood donation blood bank
- Inventory and stock management in blood bank
- Perform and maintain record of QC procedure related reagents, kits and equipments.

**Course Outline**

**Module-I (11 Hrs)**

Basic principle in blood banking, Blood bank organisation, Planning and documentation, NACO Blood bank policy, National blood policy, Equipment used in blood bank. Anticoagulant use in blood bank, Selection of blood donor, Rhesus blood group system, Human blood group system

**Practice:** Documentation, ABO Grouping, RH Typing, Operation of equipment.

**Module-II (14 Hrs)**

Auto-mentation technique used in blood bank, Techniques used for the separation of blood constituent, CBC, Blood preservation, Special investigation for processing of blood under the guide lines of NACO, Routine investigation for processing of blood, Phlebotomy in blood bank, Quality control in blood bank

**Practice:** Phlebotomy in blood bank, Cross matching and compatibility test, Measurement of Blood Pressure, Arrangement of blood bank lab

**Module-III (20 Hrs)**

Blood transfusion alternative, Prevention of diseases transmitted through blood transfusion, Transfusion reaction investigation, Transfusion reaction, Precaution taken for infusion of blood components, Pre-transfusion testing, Transfusion in solid organ transplantation, Exchange blood transfusion, Pre-surgical blood transfusion, Blood and blood components transfusion, Selection of blood components, Aphersis and Hemapheresis

**Practice:** Routine hematological test, HIV, VDRL, Hbs-Ag, Other STD Test.

***Suggested Readings:***


1. Textbook of Clinical laboratory methods and diagnosis by Gradwohls, Publisher Mosby
2. Modern Blood Banking and transfusion Practice by Denise M Harming
3. Standards of blood bank by NACO ( http://naco.gov.in/sites/default/files/Standards%20for%20Blood%20Banks%20and%20Blood%20Transfusion%20Services.pdf )
4. Handbook of blood banking and transfusion medicine (http://www.uomisan.edu.iq/library/admin/book/77040715888.pdf )
5. Medical laboratory technology Vol.1 by K. L. Mukherjee, 2007, Publisher Tata McGrawHill
6. Textbook of medical laboratory technology by Praful B Godkar, Publisher Bhalan
7. Medical laboratory science theory and practice by J Ochei and Kolhatkar, 2002, Tata McGraw- Hill, Publisher TBS


**DC-3- CUTM1726- Health Programme in India**

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| Health Programme in India | CUTM1726 | Theory+ Project | 2-0-1 | Fundamental Science |

**Objective**

- Understanding efficiency of health education and health promotion programmes.
- Reducing exposure to harmful factors in the living, working and educational environment and mitigating their health effects.
- Improving efficiency and effectiveness for Health care industry.
- Improving access to and efficiency of primary health care.
- Understanding about various health programme in India.

**Course outcome**

- Perform as a health care team manager.
- Work as team leader in different types of health programme.
- As a service provider n National Tuberculosis Programme.
- Able to give the service for health awareness Programme.

**Course Outline**

**Module-I (12 Hrs)**

Introduction to Health Programme in India, Voluntary Health Agencies in India, Indian Red Cross Society, Central Social Welfare Brand, Indian Council for Child welfare.

**Module-II (10 Hrs)**

Family Planning Association of India, National programme for control of blindness, National Tuberculosis Programme, National Leprosy Eradication Programme

**Module-III (12 Hrs)**

National Programme for health care of elders, National Programme for prevention and control of cancer, Diabetes, Cardiovascular disease, National Immunization Programme, AYUSH- Objective and Goal.

***Suggested Reading:***

1. Text Book of Social and Preventive Medicine by Park JE and Park K

**DC-4- CUTM1724- Medical Microbiology**

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| Medical Microbiology | CUTM1724 | Theory+ Practice | 3-1-0 | Fundamental Science |

**Objective**

- The content of this course includes many etiological agents responsible for global infectious diseases.
- It covers all biology of bacteria, viruses and other pathogens related with infectious diseases in humans.
- It will also provide opportunities for a student to develop diagnostic skills in microbiology, including the practical application and interpretation of laboratory tests for the diagnosis of infectious diseases.

**Course outcome**

- The course provides the conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause disease in the human body.
- Recall the relationship of this infection to symptoms, relapse and the accompanyingpathology.
- Solve problems in the context of this understanding.
- Explain the methods of microorganism's control, e.g. chemotherapy & vaccines.

**Module I**

**Medical Bacteriology-** Anatomy and structure of prokaryotes (Detail structure of gram positive and gram negative bacteria, Peptidoglycan synthesis etc). Classification of bacteria according both cell wall and shape. Nutritional requirement of bacteria, Biochemical test (IMViC, Catalase, Coagulase etc).

Sterilization technique, different staining procedures (AFB, Flagella and Endospore staining etc), Culture media and its types. Pathogenesis and laboratory diagnosis of medically important gram positive and gram negative bacteria, Clinical significance of human pathogenic bacteria and their identification.

**Practice:** Demonstration of various parts of microscope its functioning. Preparation of media, and cultivation of bacteria. Biochemical tests for identification of bacteria, Preservation of stock cultures of bacteria. Preparation of bacterial smear and staining – Gram's, Acid-fast, Staining of bacterial spores flagella, capsule. Isolation, Characterization and identification of pathogens from various clinical specimens. Study of antibiotic sensitivity of common pathogens.

**Module II**

**Medical Virology -:** Morphology, general properties of viruses, detection of viruses and antigens in clinical specimens, laboratory diagnosis, Serological diagnosis of virus infections. Cultivation of viruses. Viral vaccines, their preparation and their immunization schedules. Viruses of importance to bacteria, bacteriophages, their structure, types, typing and application in bacterial genetics. Detail information about human pathogenic viruses.

**Practice:** Demonstration of various inoculation routes in fertilized hen egg (Egg Inoculation Method)

**Module-III**

**Medical Mycology -:** Morphology, general characteristic, taxonomy, classification of fungi, detection and recovery of fungi from clinical specimens. Dermatophytes and agents of superficial mycoses. Trichophyton. Epidermophyton and Microsporurn. Yeasts of medical importance, Candida, Cryptococcus Detail Information with lab diagnosis of human pathogenic Fungus.

**Practice:** To prepare culture media used routinely in mycology. To perform staining technique for identification f fungi. Isolationand identification of fungus from clinical specimen.

***Suggested Reading:***


1. Medical Laboratory Technology by Kanai Lal Mukherjee, Publish Tata McGrawHill
2. An Introduction to Medical Laboratory Technology by FJ Baker; Butterworth
3. Practical Book of Medical Microbiology by Satish Gupta, Publisher JPBrothers
4. Medical Laboratory Manual for Tropical Countries Vol. I and II by MonicaCheesbrough.
5. Textbook of Medical Laboratory Technology by Praful BGodkar.

6. Biology of Microorganism by Brock 14th Ed.

## DC-5- CUTM1728- Immunology & Parasitology

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Immunology and Parasitology** | CUTM1728 | Theory+ Practice | 3-2-0 | Fundamental Science |

**Objective**

- Understanding the concept of Innate & adaptive immune system; complement system; Hypersensitivity.
- Clinically relevant serological analysis for deeper understanding of antigen-antibody interaction.
- To understand the concept of cells of immune system and organs of immune system.
- To understand the characteristics of parasites and their examination.

**Course outcome**

- The student will learn the application of Immunology in disease diagnosis.
- Complement system followed by the body on encountering an Antigen.
- Immune Response produced on encounter with foreign body.
- The students will learn the role of immunity in fighting disease, along with consequence of undesirable expression of immune system such as, hypersensitivity and auto immune disease.
- They will able to learn the techniques of isolating parasites.
- They will also be able to diagnose the parasites.

**Course Outline**

**Module– I**

**Immunity:** Concept of Innate and Adaptive immunity.

**Immune Cells and Organs:** Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

**Antigens:** Characteristics, Hapten, Epitopes, Adjuvants;

**Antibody:** Structure & its classes. Antigen-Antibody interaction, avidity &affinity.

**Serological Reactions**: Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluoresence, Immunoelectron microscopy.

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

Rheumatoid factor (RF) test

Precipitation in agarose gel

Performing Ouchterlony Double diffusion test

Demonstration of SDS-PAGE

Demonstration of ELISA

Demonstration of Western blotting

**Module – II**

**Complement System:** Role of complement system in immune response, Complement components and Activation pathways.

**Immune Response:** Cell mediated and humoral Immunity.

**Monoclonal antibodies:** Production, characterization and applications.

**Types of Autoimmunity and Hypersensitivity** with examples; Immunodeficiencies, SCID, DiGeorge syndrome, Chediak- Higashi syndrome, Leukocyte adhesion deficiency, CGD

**Practice:** Perform blood grouping, Agglutination, Precipitation, Neutralization, flocculation; Production of monoclonal antibodies

**Module-III**

**Medical parasitology:** Introduction to medical Parasitology, Morphology, General Characteristics, Classification, Laboratorial diagnosis of different human pathogenic parasites. Examination of faeces for ova and cysts, Concentration methods. Blood smear examination for Parasites. Cultivation of Protozoan Parasites.

**Practice:** Concentration techniques for demonstration of Ova

Routine Stool examination for detection of intestinal parasites

Identification of adult worms from models or slide's

Identification of different parasites, their morphology from slide's

***Suggested Readings:***


1. Kuby's Immunology (7th Ed) - by J. Owen, J. Punt, S. Strandford. Macmillan Higher Education, 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.myuptodate.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. Paniker's Text book of Parasitology (8th Edition)- C. K. Jayaram Paniker. The Health Sciences Publisher.
   (e-Book link: https://www.pdfdrive.com/panikers-textbook-of-medical-parasitology-e183895440.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
   (Coursera link: https://www.coursera.org/learn/immunologyfundamentalstcellssignaling )
3. Fundamentals of Immunology: Death by Friendly Fire
   (Coursera link: https://www.coursera.org/learn/immunology-friendlyfire )
4. Viruses & How to Beat Them: Cells, Immunity, Vaccines
   (edX link: https://www.edx.org/course/viruses-how-to-beat-them-cells-immunity-vaccines)
5. The Immune System: New Developments in Research
   (edX link: https://www.edx.org/course/the-immune-system-new-developments-in-research-par)

## DC-6- CUTM1727- Advanced Hematology

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| Advanced Hematology | CUTM1727 | Theory+Practice | 3-1-0 | Fundamental Medical science |

**Objective**

- The overall aims are that the student should obtain advanced knowledge of themost common hematologic diseases & understanding the concept of Blood cells and other blood components.
- Demonstrate an understanding of the components of human blood and characteristics, functions, and abnormalities and disease states of each.
- Demonstrate proficiency in the skills necessary to perform blood cell counts,and evaluation of blood elements within stated limits of accuracy.
- Determine suitability of hematology specimens and dispose of them in the appropriate bio-hazard containers.

**Course outcome**

- Differentiate various hematological procedures and the use of basic equipment essential to working in a Hematology Laboratory.
- Discuss differences between Quality control, Quality Assurance, and Continuing Quality Improvement principles as used in the Hematology Laboratory.
- Categorize various hematology analyses , operational principles of various hematology instruments, and troubleshooting of various instruments.
- Explain the principles and theories utilized in a variety of problem-solving situations.
- Compare and contrast hematology values under normal and abnormal conditions

**Course Outline**

**Module-I (8 Hrs)**

**Quality assurance in hematology:** Internal and external quality control including reference preparation Routine quality assurance**,** Protocol, Statistical analysis i.e. Standard deviation, Co-efficient variation,

accuracy and precision, Safety precautions in hematology**.** Basic concepts of automation in hematology with special reference to: Blood cell counter, Coagulometer.

**Practice:** Collection of blood from different body parts. Data and record Maintain, Handling hematological equipments.

**Module-II (12 Hrs)**

**Bone marrow examination:**

**1.** Composition and functions, Aspiration of bone marrow (Adults and children), Processing of aspirated bone marrow (Preparation & staining of smear)

**2.** Brief knowledge about examination of aspirated bone marrow (differential cell counts and cellular ratios). Special Stain for Bone Marrow -Periodic Acid Schiff, Sudan Black

**3.** Leukemia: Classification, Blood Picture, Differentiation of BlastCells. Laboratory diagnosis of leukaemias, Processing and staining of trephine biopsy specimens.

**Practice:** Method of aspiration bone marrow, method of Processing and staining of trephine biopsy.

**Module-III (10 Hrs)**

**L.E. cell phenomenon**

1. Definition of L.E. cell, Demonstration of L.E. cell by various methods, Clinicals Physiological variations in Hb, PCV, TLC and Platelets. Investigations of a case suffering from bleeding disorders.
2. Quantitative assay of coagulation factors - **a**. Principle **b**. Procedure **c**. Mechanism **d**. Tests
3. Biomedical waste management in hematology laboratory (Other than Radioactive material)

**Practice-:** Demonstration of functional aspect of blood cell counter Study the RBCs abnormal morphological form -**a.** Variation in size, shape and staining Character, **b.** Red cell inclusion, ***c.*** Identify morphologically the- Immature Erythroid series of cells **d.** Immature Myeloid ad other WBCs series of cells

**Module-IV (10 Hrs)**

Demonstration of various parts of centrifuge; its functioning and care, Cleaning and drying of glass and plastic ware, Cleaning of glass, syringes and its sterilization. Preparation of various anticoagulants, Preparation of buffers, Preparation of the stains and other reagents.

**Practice:** Use centrifuge machine to separate serum & plasma from whole blood cells, Sterilization, Buffer & stain preparation.

***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 Mukharjee, Publisher McGraw Hill education pvtlimited
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-practice-e176384006.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=2ahUKEwja9-ve3I7qAhUwzTgGHSMUDekQ6wEwAHoECAQQAQ#v=onepage&q=hematology&f=false
10. Ebook link-https://books.google.co.in/books?id=QQcYAAAAYAAJ&printsec=frontcover&dq=hematology&hl=en&sa=X&ved=2ahUKEwja9-ve3I7qAhUwzTgGHSMUDekQ6wEwAnoECAIQAQ#v=onepage&q=hematology&f=false


## DC-7- CUTM1721- Research Methodology

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| Research Methodology | CUTM1721 | Theory+ Project | 2-0-1 | Fundamental Science |

**Objective**

- To equip students with a basic understanding of the underlying principles of quantitative and qualitative research methods.
- Provide students with in-depth training on the conduct and management of research from inception to completion using a wide range of techniques.

**Course outcome**

- Students can understand the ethical and philosophical issues associated with researchin education
- This study provides knowledge on various modes of presenting and disseminatingresearch findings.
- Enable students to acquire expertise in the use and application of the methods of data collection and analysis.
- Provide learning opportunities to critically evaluate research methodology and findings.
- Enable students to be reflexive about their role and others' roles as researchers.

**Course Outline**

**Module- I (9 Hrs)**

Introduction to Research: Definition, Scope, Limitations, and Types. Objectives of Research. Research Process: Proposal Development: Basic steps involved in the health research proposal development process Literature Review: Importance and Sources, Strategies for gaining access to information, Library search, Computer search.

Research Designs: Research Title and Objectives Criteria for selecting a research title, Formulation of research objectives, Types of research objectives, Qualities of research objective

**Module- II (8 Hrs)**

Data Collection: Secondary Data, Primary Data, and Methods of Collection. Scaling Techniques: Concept, Types, Rating scales & Ranking Scales, Scale Construction Techniques and Multi-Dimensional Scaling. Sampling Designs: Concepts, Types and Techniques and Sample size Decision.

**Module- III (14 Hrs)**

Research Hypothesis**:** Definition, Qualities of research hypothesis Importance and types of research hypothesis. Theory of Estimation and Testing of Hypothesis Small & Large Sample Tests, Tests of Significance based on t, F, Z test and Chi-Square Test. Designing Questionnaire. Interviewing. Tabulation, Coding, Editing. Interpretation and Report Writing.

**Project:** Writing a review on Nosocomial urinary tract infection.

Writing a research article on antibiotic resistance patterns in wound infections.

Writing a review on Virus culture

Literature survey on Covid-19

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


**DC-8- CUTM1754- Mini Project**

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| Mini Project | CUTM1754 | Project | 0-0-2 | Basic Medical science |

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.

**DC-9- CUTM1755 - Internship**

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Internship** | **CUTM1755** | Project | 0-0-12 | Basic Medical science |

**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 inwriting 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 third year (Sixth 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 theremaining 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

**Internship**

1. Case record
2. Lab management and ethics
3. Evaluation -Guide(internal)
    a. -Industries guide(external)
    b. -University-project report/ Viva

**DC-10- CUTM1756 - Project**

| Subject Name | Code | Type of course | T-P-Pj | Prerequisite |
|---|---|---|---|---|
| **Project** | **CUTM1756** | Project | 0-0-12 | Basic Medical science |

**Project work:**

## Suggested Project title

1. Antibacterial activity of sweet orange (citrus sinesis) on Staphylococcus aureus and Escherchiacoli 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 toCUTM campus