Maulana Abul Kalam Azad University of Technology, WB
(Formerly known as West Bengal University of Technology)
Syllabus of B.Sc. in Critical Care Technology
Effective from academic session 2024-25

Semester-III
Course Name: BASICS OF PATHOLOGY, MICROBIOLOGY, PHARMACOLOGY

Mode: Offline

Credits: 5 (3T+2P)

BMICCT 301 & 391

Aim of the course:

The aim is to achieve knowledge of pathology, microbiology, pharmacology and its features as a whole.

Course Objective:

1. Students will grasp the fundamental concepts underlying the development and progression of diseases.
2. Students will learn to recognize and describe common pathological changes at the cellular, tissue, and organ levels.
3. They will gain an understanding of the vast diversity of microorganisms, including bacteria, viruses, fungi, and parasites.
4. They will also learn about the structure, metabolism, and physiology of microorganisms and their role in health and disease.
5. To comprehend the basic concepts of clinical pharmacology.
6. To know how to use drug-specific and patient-specific pharmacokinetic parameters.

Sr no.	**Graduate attributes**	**Mapped Modules**
CO 1	Introduction & History of pathology	MODULE I
CO 2	Hemo dynamics and tissue repair	MODULE II
CO 3	Bacteriology and Mycology	MODULE III
CO 4	General safety measures used in microbiology laboratory	MODULE IV
CO 5	Introduction to clinical pharmacology	MODULE V
CO 6	Essentials of Pharmacology	MODULE VI

Learning objectives:

1. To define and differentiate between the various types of cellular adaptations, including hypertrophy, hyperplasia, atrophy, metaplasia, and dysplasia.

2. To explain the mechanisms of cell injury and death, including apoptosis, necrosis, and autophagy.
3. To identify and classify microorganisms based on their morphological, biochemical, and genetic characteristics.
4. To describe the structure and function of prokaryotic and eukaryotic cells, including bacterial and fungal cell structures.
5. To define pharmacokinetics and pharmacodynamics and explain how these principles influence drug action.
6. To identify the major drug classes and their mechanisms of action, including receptor-mediated effects, enzyme inhibition, and ion channel modulation.

Module Number	Content	Total Hours	% of questions	Bloom Level (applicable)	Remarks, if any
THEORY					
M I	Introduction & History of pathology	7	20		NA
M II	Hemo dynamics and tissue repair	7	20		NA
M III	Bacteriology and Mycology	8	20		NA
M IV	General safety measures used in microbiology laboratory	8	20		NA
M V	Introduction to clinical pharmacology	8	10		NA
M VI	Essentials of Pharmacology	7	10		NA
Total Theory		45	100		
PRACTICAL		30			
TOTAL		75			

Detailed syllabus:

MODULE I: INTRODUCTION & HISTORY OF PATHOLOGY [7L]

a. Basic definitions and familiarization with the common terms used in pathology, Causes and mechanisms of cell injury, reversible and irreversible injury, Introduction of hyperplasia, hypoplasia, hypertrophy, atrophy, metaplasia, necrosis and apoptosis.
b. General features of acute and chronic inflammation: Vascular changes, cellular events, Cells and mediators of inflammation, Phagocytosis and its mechanism.

MODULE II: HEMODYNAMICS AND TISSUE REPAIR [7L]

a. Overview, Basic concept of septic shock
b. Tissue Renewal and Repair, healing and fibrosis, cirrhosis, introduction of oedema, hyperemia, congestion, hemorrhage, haemostasias, thrombosis, embolism, infarction, shock and hypertension

MODULE III: BACTERIOLOGY AND MYCOLOGY [8L]

a. History of Microbiology and Classification: History of microbiology, Discovery of microorganisms. General characteristics and classification of bacteria.
b. Introduction of Mycology: Definition, general properties and classification Cutaneous mycoses, Systemic mycoses, Opportunistic mycoses. Culture and laboratory test for fungus.
c. Microbial Nutrition, Growth and control of Microorganisms by physical and chemical methods : culture media- synthetic and complex, types of media; isolation of pure cultures, growth curves, generation time;

MODULE IV: GENERAL SAFETY MEASURES USED IN MICROBIOLOGY LABORATORY [8L]

a. Sterilization and disinfection: Various physical methods of sterilization – heat, UV radiation, ionizing radiation, filtration. Antiseptics &Disinfectants: Definition, types and properties, mode of action and use, Occurrence of lab infections, route of infections in laboratory, Antibiotics

MODULE V: INTRODUCTION TO CLINICAL PHARMACOLOGY [8L]

a. Drugs – routes of administration, pharmacokinetics, pharmacodynamics; Drugs acting on autonomic nervous system – inotropes; NSAIDS; Hormones – thyroid, insulin, calcium metabolism; Sedatives; Drugs used in psychiatric diseases.

MODULE VI: ESSENTIALS OF PHARMACOLOGY [8L]

a. Anti-hypertensive drugs; Anti anginal Drugs; Antiarrhythmic drugs; Diuretics; Drugs affecting bleeding and coagulation; Drugs for peptic ulcer, constipation, and diarrhoea; Antimicrobial drugs – antibiotics, antivirals, antifungals, anti TB drugs; Vaccines.

PRACTICALS [30P]

1. Staining techniques: Gram Stain, Acid-fast, Albert Stain

2. Preparation of culture media and isolation of bacteria on Nutrient Agar, Blood agar and MacConkey Agar

3. Study of culture characteristics

4. Swab collection techniques

5. Collection of body fluids, physical, chemical and microbial processing

6. Collection, preservation and examination of stool

7. Analysis and examination of Semen- physical examination, sperm motility, microbiological study of sperms, fructose determination of semen.

Suggested Readings:

1. Textbook of Pathology - 8th Edition + Pathology by Harsh Mohan
2. Essentials of Medical Microbiology by SastryApurba and BhatSandhya.
3. Text and Practical Microbiology for MLT Paperback by C.P.Bavja and V.Baveja
4. Mnemonics on Pathology and Microbiology (English, Paperback, Sharma Krishna N.)
5. Essentials of Medical Pharmacology 7th Edition, by Kd (Author), M.D. Tripathi (Author)

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Effective from academic session 2024-25

Course Name: FUNDAMENTALS OF BIO-PHYSICS

Mode: Offline

Credits: 5

BMICCT 302

Aim of the course:

The aim is to achieve knowledge of fundamentals of bio-physics and its features as a whole.

Course Objective:

1. To understand the principles of biophysics and their application to biological systems.
2. To analyze the physical properties of biomolecules and their role in cellular processes.
3. To explain the principles of membrane biophysics and their significance in cell physiology.
4. To apply biophysical concepts to elucidate the mechanisms of biological phenomena such as signal transduction and molecular transport.

Sr no.	Graduate attributes	Mapped Modules
CO 1	BIOMEDICAL SIGNALS & ELECTRODES	MODULE I
CO 2	ASSISTIVE DEVICES CARDIAC SYSTEM AND MONITORS	MODULE II
CO 3	RADIOLOGICAL, SURGICAL SCOPY AND DIATHERMY EQUIPMENTS	MODULE III
CO 4	ULTRASONIC AND NEONATAL INSTRUMENTS	MODULE IV
CO 5	BIOTELEMETRY, TELEMEDICINE AND SAFETY MEASUREMENTS	MODULE V

Learning objectives:

1. To explain the principles of biophysics and their application in understanding biological systems and processes.

2. To analyze the relationship between physical forces, such as electromagnetism and thermodynamics, and biological phenomena.
3. To demonstrate proficiency in mathematical modeling and computational techniques used to describe biological systems at the molecular and cellular levels.
4. To evaluate experimental techniques in biophysics and their role in elucidating the structure and function of biomolecules and cellular processes.

Module Number	**Content**	**Total Hours**	**% of questions**	**Bloom Level (applicable)**	**Remarks, if any**
THEORY					
M I	BIOMEDICAL SIGNALS & ELECTRODES	9	20		NA
M II	ASSISTIVE DEVICES CARDIAC SYSTEM AND MONITORS	9	20		NA
M III	RADIOLOGICAL, SURGICAL SCOPY AND DIATHERMY EQUIPMENTS	9	20		NA
M IV	ULTRASONIC AND NEONATAL INSTRUMENTS	9	20		NA
M V	BIOTELEMETRY, TELEMEDICINE AND SAFETY MEASUREMENTS	9	20		NA
Total Theory		45	100		
TUTORIAL		30			
TOTAL		75			

Detailed syllabus:

MODULE I: BIOMEDICAL SIGNALS & ELECTRODES [9L]

Sources of biomedical signals, Basic medical instrumentation system, Origin of bioelectric signals - ECG, EEG, EMG. Electrodes for ECG, EEG, EMG, Medical surface electrodes and problems, Microelectrodes. Electrocardiograph-block diagram, ECG leads, Faults and troubleshooting, Phonocardiograph-origin of heart sounds, microphones and amplifiers for PCG, Operating Rooms

MODULE II: ASSISTIVE DEVICES CARDIAC SYSTEM AND MONITORS [9L]

Cardiac Pacemekers, Heart lung machine. Different types of Oxygenators, Pumps, and Monitoring Process. Hemodialyser- Principle of Hemodialysis, Membranes, Dialyasate, Different types of heamodialysers, Wearable Artificial Kidney, Implantable Type. Defibrillators, Implantable defibrillators, Functional electrical stimulator (FES)

MODULE III: RADIOLOGICAL, SURGICAL SCOPY AND DIATHERMY EQUIPMENTS [9L]

Digital radiography, Digital Fluroscopy, Mammography, Angiography, Bone densitometry, Endoscopy, Laparoscopy Bronchoscopy, Gastroscopy, Physiological effects of HF radiation, Depth of Penetration, Short wave, Ultrasonic and microwave diathermy, Surgical diathermy,

MODULE IV: ULTRASONIC AND NEONATAL INSTRUMENTS [9L]

Basic principles of Echo technique, display techniques A, B, M modes, Echo cardiograms, Echoencephalogram, Ultrasonic applied as diagnostic tool in ophthalmology, obstetrics and gynecology. Infusion Pumps. Baby incubator, Phototherapy, Radiant warmer - Working principle, block diagram, description, and function of basic blocks,

MODULE V: BIOTELEMETRY, TELEMEDICINE AND SAFETY MEASUREMENTS [9L]

Elements of Biotelemetry system, Design of a biotelemetry system, Implantable Units-Problems, Application of Telemetry in Patient Care. Fundamentals of Telemedicine, Block diagram of Telemedicine, Scope & Benefits and Limitation of Telemedicine. Applications – Teleradiography, Telecardiology, Telesurgery. Electric shock hazards – Gross shock, Effects on human body, Micro and macro electric shock, Leakage current and types, Testing of Biomedical Equipments.

Suggested Readings:

1. Joseph J Carr and John M Brown – Introduction to Biomedical equipment Technology - Pearson Education 4th edition New Delhi 2001.

2. Albert M Cook and Webster J G – Therapeutic medical devices Prentice Hall Nee York 1982

3. Webster J.G Medical Instrumentation application and design – John Wiley and sons New York 3rd edition 1999

4. Jacobson B and Webster J G Medical and Clinical Engineering – Prentice Hall of India New Delhi 1999

5. Leslie Cromwell , Fred J.Weibell and Erich A.Pfeiffer - Biomedical Instrumentation Prentice Hall New Delhi 2000

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Semester-IV

Course Name: ICU THERAPY

Mode: Offline

Credits: 4

BMICCT 401

Aim of the course:

The aim is to achieve knowledge of ICU therapy and its features as a whole.

Course Objective:

1. Discuss in detail the concept of Mechanical Ventilation

2. Demonstrate in detail the design features of ventilators, their types, how they work and the various modes of ventilation

3. Demonstrate in detail the care of patient on ventilator and weaning from ventilator.

4. Discuss in detail the Basic and Advanced Life Support.

5. Discuss in detail the care of unconscious patient.

Sr no.	Graduate attributes	Mapped Modules
CO 1	MECHANICAL VENTILATION	MODULE I
CO 2	AIRWAY ASSISTANCE	MODULE II
CO 3	CARDIOVASCULAR SYSTEM	MODULE III
CO 4	LIFE SUPPORT	MODULE IV
CO 5	CENTRAL NERVOUS SYSTEM	MODULE V
CO 6	INFECTION CONTROL	MODULE VI

Learning objectives:

1. Ability to comprehend concept of Mechanical Ventilation
2. Ability to comprehend features of ventilators, their types, how they work and the various modes of ventilation
3. Ability to comprehend care of patient on ventilator and weaning from ventilator

4. Ability to comprehend Basic and Advanced Life Support
5. Ability to comprehend care of unconscious patient

Module Number	Content	Total Hours	% of questions	Bloom Level (applicable)	Remarks, if any
THEORY					
M I	MECHANICAL VENTILATION	7	20		NA
M II	AIRWAY ASSISTANCE	7	20		NA
M III	CARDIOVASCULAR SYSTEM	8	20		NA
M IV	LIFE SUPPORT	8	20		NA
M V	CENTRAL NERVOUS SYSTEM	8	10		NA
M VI	INFECTION CONTROL	7	10		NA
Total Theory		45	100		
TUTORIAL		30			
TOTAL		75			

Detailed syllabus:

MODULE I: MECHANICAL VENTILATION [7L]

Mechanics of ventilation, Mechanics of exhalation, Work of breathing, Distribution of ventilation, Efficiency and effectiveness of ventilation, Mechanical Ventilators, Types of ventilators, Modes of Mechanical Ventilation, Oxygenation, Ventilation, Timing – Inspiratory of gas / Expiratory, inspiratory hold, PEEP, POP – OFF, FiO2, Humidification, Non-Invasive Ventilation, Humidifier types, Trouble shooting and alarms, Weaning and Extubation, Nebulization and MDI, Inhaled drug therapy, Suctioning and chest physiotherapy, Incentive Spirometry, Inspiratory resistance exercises, Care of Patient on Ventilator, Care of the chest tube, Extubation failure

MODULE II: AIRWAY ASSISTANCE [7L]

Tracheal intubation (oral, nasal), Cricothyrotomy, Open/percutaneous tracheostomy, Fiberoptic bronchoscopy: FOB Intubation, Therapeutic BAL; Decanulation of tracheostomy

MODULE III: CARDIOVASCULAR SYSTEM [8L]

Fluid resuscitation and inotropes, Basic of IABP /ECMO, Pericardiocentesis

MODULE IV: LIFE SUPPORT [8L]

Basic life support - AED, Mask ventilation, Chest compression, advanced cardiac life support - Drugs, defibrillation, Trauma life support: A –Airway and cervical spine stabilization; B – Breathing; C –Circulation and hemorrhage control; D –Disability; E –Exposure; Manual in line stabilization, Basic care of surgical wounds and fractures, Burns Assessment: History and physical assessment, Assessment of burns and fluid and electrolyte loss, Etiology classification, Pathophysiology, clinicalmanifestations, Diagnosis, treatment modalities.

MODULE V: CENTRAL NERVOUS SYSTEM [8L]

Care of Unconscious Patient, Comfort - Skin integrity assessment and care, Physiotherapy – chest & limbs, Nutritional needs & supply; Pain Control, Care of epidural, Patient controlled analgesia.

MODULE VI: INFECTION CONTROL [8L]

Hand hygiene, Universal precautions

Suggested Readings:

1. Egan’s Fundamentals of Respiratory Care – Robert L. Wikins, James K Stoller,

2. The ICU Book – Paul L Marino (Lippincott, Williams & Wilkins)

3. Practical Methods for Respiratory Care – Raymond Sibberson (Mosby)

4. Respiratory Physiology – The Essentials l John B West (Williams & Wilkins)

5. Ventilation / Blood Flow & Gas Exchange – John B West (Blackwell Scientific Publications)

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Course Name: CSSD PROCEDURE

Mode: Offline

Credits: 4

BMICCT 402

Aim of the course:

The aim is to achieve knowledge of CSSD procedure and its features as a whole.

Course Objective:

1. Determination of activities related to CSSD and its core activities
2. Comprehend decontamination and infection control practices
3. Determine steam sterilization techniques and monitoring techniques
4. Determine procedures for pathology

Sr no.	Graduate attributes	Mapped Modules
CO 1	ROLE OF CSSD	MODULE I
CO 2	DECONTAMINATION	MODULE II
CO 3	STERILIZATION	MODULE III
CO 4	PATHOLOGY & ADVANCED LAB INVESTIGATION	MODULE IV

Learning objectives:

1. Understand the principles of CSSD (Central Sterile Services Department) procedures for effective sterilization and maintenance of medical instruments.
2. Demonstrate proficiency in CSSD protocols for infection control and prevention in healthcare settings.
3. Apply knowledge of CSSD best practices to ensure compliance with regulatory standards and guidelines.
4. Recognize the importance of teamwork and communication within the CSSD team for efficient instrument processing and distribution.

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Module Number	Content	Total Hours	% of questions	Bloom Level (applicable)	Remarks, if any
THEORY					
M I	ROLE OF CSSD	14	30		NA
M II	DECONTAMINATION	12	20		NA
M III	STERILIZATION	14	30		NA
M IV	PATHOLOGY & ADVANCED LAB INVESTIGATION	15	20		NA
Total Theory		45	100		
TUTORIAL		30			
TOTAL		75			

Detailed syllabus:

MODULE I: ROLE OF CSSD **[15 L]**

Planning and layout, Infection Control and hygiene, Water Quality and its impact in CSSD process, Surgical Procedures, Surgical Instruments: Criteria for Purchase and Maintenance, Quality Assurance in CSSD, Equipment's Purchase Criteria, Re-Processing of Devices, Engineering aspect for CSSD

MODULE II: DECONTAMINATION **[12 L]**

Surgical Instruments and Procedures, Recommended Practices, Principles of Disinfection Assembly of Surgical Instruments, Packaging Materials - Types and Selection

MODULE III: STERILIZATION **[14 L]**

Preparation and Supplies for Terminal Sterilization, Endoscopes and its Sterilization, Different Methods of Sterilization High Temperature Sterilization – Dry Heat, Scientific Principles, Sterilizer Operation, Basic Trouble Shooting Methods, Recommended Practices for Flash Sterilization

MODULE IV: PATHOLOGY AND ADVANCED LAB MEDICINE INVESTIGATIONS [15 L]

Pathology and advanced lab medicine investigations, HAVC system and its impact, Microbiology and its implication with respect to CSSD, Call back system in case of detection of failure

Suggested Readings:

1. Sterilization Technology for the health Care Facility from AN ASPEN PUBLICATION.

2. Hand book on Operation Theatre & Asepsis Published by Cochin Ophthalmic Club COC-CME Series 2, 2013

3. Recommended Guidelines for CSSD Ist Edition Published July 2008, Hospital Sterile Service Association (India)

4. The Guide to Good Manufacturing Practices in National Health Services, Sterile Service Department ISSM

5. Introduction to Sterilization and Disinfection by Gardner and Peel

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Effective from academic session 2024-25
Course Name: LABORATORY SCIENCE [HAEMATOLOGY & PARASITOLOGY]

Mode: Offline

Credits: 5 (3T+2P)

BMICCT 403 & 493

Aim of the course:

The aim is to achieve knowledge of laboratory science [haematology & parasitology] and its features as a whole.

Course Objective:

1. Develop proficiency in conducting hematological analyses and interpreting results accurately for diagnostic purposes.
2. Acquire comprehensive knowledge of parasitological techniques and identification methods to detect and manage parasitic infections effectively.
3. Demonstrate competency in performing laboratory procedures following safety protocols and quality assurance standards in hematology and parasitology.
4. Apply critical thinking skills to correlate laboratory findings with clinical presentations and contribute to patient care in hematology and parasitology contexts.

Sr no.	**Graduate attributes**	**Mapped Modules**
CO 1	Haemoglobin	MODULE I
CO 2	Haematopoiesis Overview	MODULE II
CO 3	ESR	MODULE III
CO 4	Introduction of parasitology	MODULE IV
CO 5	General characters &classification of Viruses Bacteriophages	MODULE V
CO 6	Introduction to oncogenic viruses	MODULE VI

Learning objectives:

1. Master techniques for analyzing blood samples and identifying abnormalities in hematological parameters.

2. Develop skills in detecting and identifying various parasites through microscopic examination of clinical specimens.
3. Understand the principles of hematological and parasitological testing methodologies, including interpretation of results and clinical significance.
4. Apply quality control measures to ensure accuracy and reliability in hematological and parasitological laboratory procedures.

Module Number	**Content**	**Total Hours**	**% of questions**	**Bloom Level (applicable)**	**Remarks, if any**
THEORY					
M I	Haemoglobin	7	20		NA
M II	Haematopoiesis Overview	7	20		NA
M III	ESR	8	20		NA
M IV	Introduction of parasitology	8	20		NA
M V	General characters &classification of Viruses Bacteriophages	8	10		NA
M VI	Introduction to oncogenic viruses	7	10		NA
Total Theory		45	100		
PRACTICAL		30			
TOTAL		75			

Detailed syllabus:

MODULE I: HAEMOGLOBIN **[7L]**

a) Structure, function, types, normal and abnormal haemoglobins. Estimation of haemoglobin by various methods with advantages and disadvantages.

b) Hemocytometry: visual and electronic method, Neubauer counting chamber, RBC count, WBC count, Platelet count, absolute eosinophil count. Principle, procedure, calculation,

significance, precautions involved during counting. Absolute count of various WBCs. Estimation of G-6-PD.

c) Anemia

MODULE II: HAEMATOPOIESIS OVERVIEW [7L]

a) Leukopoiesis, erythropoiesis and thrombopoiesis

b) Overview of haemostasis and coagulation

c) Collection of blood & Anticoagulants. Phlebotomy and after care

MODULE III: ESR [8L]

a) Physiological and pathological changes in values
b) Bone Marrow Aspiration & Bone Marrow Biopsy- Procedure, indications, contraindications, preparation of tray, smear, staining

MODULE IV: INTRODUCTION OF PARASITOLOGY [8L]

Definition-Parasitism, Host, Vectors etc, Classification, Protozoa-general, pathogenic and non pathogenic protozoa, Nemathelminths/Round worms – Nematode, Platyhelminthes–class-Cestode, class-Trematode, Lab diagnosis of medically important parasitic infection (Amoebiasis, Giardiasis, Leishmaniasis, Malaria, filariasis, Round worm, Hookworm, Pinworm infection etc)

MODULE V: GENERAL CHARACTERS & CLASSIFICATION OF VIRUSES BACTERIOPHAGES [8L]

Pox virus Adenovirus Herpes Virus Orthomyxo and Paramyxovirus Hepatitis virus RhabdoVirus ARBO Virus Oncogenic virus Retro Viruses-HIV

MODULE VI: INTRODUCTION TO ONCOGENIC VIRUSES [8L]

DNA and RNA viruses, concepts of oncogenes and protooncogenes, prevention & control of viral diseases, antiviral compounds and their mode of action, interferon and their mode of action, General principles of viral vaccination

PRACTICAL:

1. Blood collection procedure.
2. Determination of haemoglobin by various methods.

3. Blood smear preparation.
4. Total count of WBC.
5. Determination of Total RBC count.
6. Determination of platelet count.
7. ESR estimation
8. Leishman Staining for examination Ova, Parasite, cyst
9. Examination of Pathogenic parasites from clinical specimens specially Stool

Suggested Readings:

1. Technical Communication, M.H. Rizvi, Tata McGraw-Hill
2. Effective Business Communication, Asha Kaul
3. Functional Grammar and Spoken and Written Communication in English, Bikram K. Das, Orient Blackswan
4. Communication Skills, Sanjay Kumar and Pushplata, Oxford Publication