DM (CRITICAL CARE MEDICINE)

[Syllabus Approved by Board of Studies, Medical & Health Sciences]

Programme Code	:	HLTH10A04
Programme Details	:	DM CRITICAL CARE MEDICINE
Programme Learning Outcomes (PLOs/PSOs)	:	ANNEXED IN THE BELOW FORMAT
Eligibility Criteria	:	**AS PER NMC NORMS**
Duration of the Course	:	3 YEARS
Programme Structure (Credit-Based)	:	NA
Detailed Course Syllabus	:	ANNEXED IN THE BELOW FORMAT
Teaching–Learning Methodologies	:	3 YEARS RESIDENCY PROGRAM
Examination & Evaluation System	:	ANNUAL APPRAISALS FOLLOWED BY FINAL YEAR EXAMINATION AS PER NMC NORMS
Internship / Project / Dissertation Guidelines	:	1 YEAR MANDATORY BOND
Program In Charge	:	HEAD, DEPT OF CRITICAL CARE MEDICINE, Dr. Sheila Myatra,sheila.myatra@tmc.gov.in Academic Coordinator: Dr. Sudivya Sharma, sudivya.sharma@tmc.gov.in
Annexure (Books / Journals etc)	:	*ANNEXURED*

D.M. (CRITICAL CARE MEDICINE)

Program Code: HLTH10A04

Program Outcome:

- To train the DM candidates in basics of clinical critical care.
- To understand underlying principles of critical illness in various patient categories, the pathophysiologic basis of mechanisms of disease, the pharmacologic principles guiding various therapies, appropriate monitoring, organ support therapies and end of life support when required.
- To provide holistic management for critically ill patients, including diagnosis, planning treatment, anticipate likelihood of development of organ failure and be a part of the multidisciplinary team delivering treatment in the role of team leader.
- To build clinical skills, obtain technical expertise in various procedures to be performed for providing organ support therapies.
- To create an understanding regarding basic principles of clinical research, and translating application to bedside management of the critically ill patients.
- To provide national and international platform for presentations of research data in the field of critical care.
- The training should produce consultants to practice all over the country, and teachers to propagate training to future generations of trainees in the field of critical care medicine.

Program Specific Outcome

- The candidate should complete the training programme as per prespecified norms.
- All the necessary training and mandatory theory are specified in the syllabus of the DM Critical Care Medicine Course.
- The student is expected to participate in the regular appraisal examinations and academic programmes conducted in the institute.
- The purpose would be to acquire an understanding of the subject of Critical Care Medicine
- The candidate’s progress through the 3 years will also be assessed with feedback from all stake holders, including the candidate and work-based assessment.

DETAILED SYLLABUS

The candidate must gain experience in the diagnosis and treatment of adult patients with acute, serious, and life-threatening medical and surgical diseases.

The present document defines the core curriculum of cognitive knowledge and procedural skills that a specialist in Critical Care Medicine is expected to be equipped with to effectively approach the complex problems encountered in the critically ill patient.

The content of this three-year training in critical care medicine deals with the learning objectives of the course focusing on acquisition of skills, knowledge, behaviour and attitude pertaining to following core domains. The list enclosed here is not comprehensive and can be modified time to time

▪ GENERAL CURRICULUM

1. Diagnosis: Assessment, Investigation, Monitoring and Data Interpretation
2. Practical Procedures
3. Comfort, Pain-Relief and Recovery
4. Basics of Pediatric Critical Care
5. Physics & Clinical Measurement
6. Research Methods
7. Applied Anatomy
8. Applied Physiology & Biochemistry
9. Applied Pharmacology

▪ ADVANCED CURRICULUM

1. Resuscitation and Initial Management of the Acutely Ill Patients
2. Disease Management
3. Therapeutic Interventions/Organ System Support in Single or multiple organ failure
4. Inter and Intra hospital Transport of critically ill

5. Peri-operative Care

▪ PROFESSIONAL QUALITIES CURRICULUM

1. Patient Safety and Health Systems Management
2. Professionalism and Ethics
3. End of Life Care

▪ ELIGIBILITY AND ADMISSION

The person applying for the DM course must be a postgraduate possessing MD/MS in Anaesthesiology, Internal Medicine, Respiratory Medicine, Pediatric and Emergency Medicine from a university recognized by the Medical Council of India. Admission would be made through a national competitive entrance examination.

▪ CLINICAL TRAINING PROGRAMME

In order to foster the growth of Critical Care Medicine, wherever stand-alone department of Critical Care Medicine do not exist, for the first ten years MCI should accept departments of Anaesthesiology, Internal Medicine, Respiratory Medicine and Emergency Medicine as parent departments recognized to start DM in Critical Care Medicine.

The department should have been running general purpose adult intensive care (minimum 08 beds) for medical and surgical patients for at least two years before applying for DM in CCM. It should not be mandatory for the parent department (responsible for DM in CCM) to have (or manage) super-specialty postoperative intensive care for liver transplant, cardiac surgery or neurosurgery. However the students would be rotated through these intra-departmental ICUs if they exist in the institution.

The training programme for DM in Critical Care Medicine should be of 3 years (36 months) duration. The resident doctors would be spending their time in the following clinical disciplines :

a) Twenty-four months in core discipline i.e. Intensive Care Units of the Department of Critical Care Medicine

b) Maximum of 12 months of need-based rotation in other disciplines like Microbiology, radiology, transfusion medicine, Nuclear medicine, Medical Oncology, Anaesthesiology, etc. to cover up any deficiency in the required case-mix for the purpose of DM in CCM.

Our Trainees will rotate in other hospitals for training to fulfil the deficiency in case-mix within our hospital such as Cardiology, Neurology, poisoning, tropical diseases, trauma, extracorporeal support, etc.

- **EDUCATIONAL PROGRAMME**

- **Weekly Teaching Schedule**

Days	**Tue**	**Wed**	**Thu**	**Fri**
9-10 am OR 3.00-5.00 pm	Case Presentation	Masterclass/ Lecture	Hospital Academic Meeting Mortality and Morbidity Journal Club/Seminar	Research Project discussion

DM Dissertation: 1 Dissertation to be Undertaken

Trainees should have a poster or oral paper presentation or a research paper as first author.

- **EVALUATION AND MODE OF EXAMINATION**

Examination will be held at the end of having completed three years of supervised training. Four papers each of 3 hours duration and 100 mark each. (total 400 marks) would be given . They would include either 10 short questions or 2 long and 6 short questions. In addition, a candidate

will have to appear in practical and clinical examination of 400 marks, candidate will have to pass both in theory and practical examination as given below for the DM degree.

- **Theory Examination**

Paper I (100 marks): Basic and applied Critical Care

Paper II (100 marks): Paper on Clinical Critical Care- Etiology, diagnosis and treatment of acute life threatening medical and surgical diseases

Paper III (100 marks) : Paper on Clinical Critical Care – Procedures, interventions, professionalism, ethics and research methods

Paper IV (100 marks): Recent Advances in Critical Care

- **Practical and Clinical examination**

One long cases	(100 marks)
Two short cases	(50 marks each)
Skills (ICU procedures)	(25 x 4 marks)
Viva Voce	(100 marks)

▪ LIST OF COURSE CONTENTS

• Resuscitation and Initial Management of the Acutely Ill Patients

1. Adopts a structured and timely approach to the recognition, assessment and stabilization of the acutely ill patient with disordered physiology
2. Manages cardiopulmonary resuscitation
3. Manages the patient post-resuscitation
4. Triages and prioritises patients appropriately, including timely admission to ICU
5. Assesses and provides initial management of the trauma patient
6. Assesses and provides initial management of the patient with burns
7. Describes the management of mass casualties

- **Diagnosis: Assessment, Investigation, Monitoring and Data Interpretation**

1. Obtains a history and performs an accurate clinical examination
2. Undertakes timely and appropriate investigations
3. Describes indications for echocardiography (transthoracic/transoesophageal)
4. Performs electrocardiography (ECG/EKG) and interprets the results
5. Obtains appropriate microbiological samples and interprets results
6. Obtains and interprets and results from blood gas samples
7. Interprets chest x-rays
8. Liaises with radiologists to organize and interpret clinical imaging
9. Monitors and responds to trends in physiological variables
10. Integrates clinical findings with laboratory investigations to form a differential diagnosis

- **Disease Management**

Acute disease

1. Manages the care of the critically ill patient with specific acute medical conditions

Chronic Disease

2. Identifies the implications of chronic and co morbid disease in the acutely ill patient

Organ System Failure

3. Recognises and manages the patient with circulatory failure
4. Recognises and manages the patient with, or at risk of, acute renal failure
5. Recognises and manages the patient with, or at risk of, acute liver failure
6. Recognises and manages the patient with neurological impairment
7. Recognises and manages the patient with acute gastrointestinal failure
8. Recognises and manages the patient with acute lung injury syndromes (ALI/ARDS)
9. Recognises and manages the septic patient
10. Recognises and manages the patient following intoxication with drugs or

environmental toxins

11. Recognises life-threatening maternal peri-partum complications and manages care under supervision

- **Therapeutic Interventions/Organ System Support in Single or Multiple Organ Failure**

1. Prescribes drugs and therapies safely
2. Manages antimicrobial drug therapy
3. Administers blood and blood products safely
4. Uses fluids and vasoactive/inotropic drugs to support eh circulation
5. Describes the use of mechanical assist devices to support the circulation
6. Initiates, manages and weans patients from invasive and non-invasive ventilatory support
7. Initiates, manages and weans patients from renal replacement therapy
8. Recognises and manages electrolyte, glucose and acid-base disturbances
9. Co-ordinates and provides nutritional assessment and support

- **Practical Procedures**

Respiratory System

1. Administers oxygen using a variety of administration devices
2. Performs fibreoptic laryngoscopy under supervision
3. Performs emergency airway management
4. Performs difficult and failed airway management according to local protocols
5. Performs endotracheal suction
6. Performs fibreoptic bronchoscopy and BAL in the intubated patient under supervision
7. Performs percutaneous tracheostomy under supervision
8. Performs thoracocentesis via a chest drain

Cardiovascular system

1. Performs peripheral venous catheterization
2. Performs arterial catheterization
3. Describes a method for surgical isolation of vein/artery
4. Describes ultrasound techniques for vascular localization

5. Performs ventral venous catheterization
6. Performs defibrillation and cardioversion
7. Performs cardiac pacing (transvenous or transthoracic)
8. Describes how to perform pericardiocentesis
9. Demonstrates a method for measuring cardiac output and derived haemodynamic variable

Central Nervous System

1. Performs lumbar puncture (intradural/spinal) under supervision
2. Manages the administration of analgesia via an epidural catheter

Gastrointestinal System

1. Performs nasogastric tube placement
2. Performs abdominal paracentesis
3. Describes sengs taken tube (or equivalent) placement
4. Describes indications for, and safe conduct of gastroscopy

Genitourinary System

1. Performs urinary catheterization

• Peri-operative Care

1. Manages the pre and post-operative care of the high risk surgical patient
2. Manages the care of the patient following cardiac surgery under supervision
3. Manages the care of the patient following craniotomy under supervision
4. Manages the care of the patient following solid organ transplantation under supervision
5. Manages the pre and post-operative care of the trauma patient under supervision

• Comfort, Pain-Relief and Recovery

1. Identifies and attempts to minimize the physical and psychosocial consequences of critical illness for patients and families

2. Manages the assessment, prevention and treatment of pain and delirium
3. Manages the administration of analgesia via an epidural catheter
4. Manages sedation and neuromuscular blockade

5. Communicates the continuing care requirements of patients at ICU discharge to health care professionals, patients and relatives

6. Manages the safe and timely discharge of patients from the ICU

- **End of Life Care**

1. Manages the process of withholding or withdrawing treatment with multidisciplinary team
2. Discusses end of life care with patients and their families/surrogates
3. Manages palliative care of the critically ill patient
4. Performs brain-stem death testing
5. Manages the physiological support of the organ donor

- **Paediatric Care**

1. Describes the recognition of the acutely ill child and initial management of paediatric emergencies
2. Describes national legislation and guidelines relating to child protection and their relevance to critical care

- **Transport**

1. Undertakes transport of the mechanically ventilated critically ill patient outside the ICU
2. Describes the special considerations required during patient transport by air.

- **Patient Safety and Health Systems Management**

1. Leads a daily multidisciplinary ward round
2. Complies with local infection control measures
3. Identifies environmental hazards and promotes safety for patients & staff
4. Identifies and minimizes risk of critical incidents and adverse events, including complications of critical illness
5. Organises a case conference
6. Critically appraises and applies guidelines, protocols and care bundles
7. Describes commonly used scoring systems for assessment of severity of illness, case mix and workload

8. Demonstrates an understanding of the managerial & administrative responsibilities of the ICM specialist

- **Professionalism**

Communication skills

1. Communicates effectively with patients and relatives
2. Communicates effectively with members of the health care team
3. Maintains accurate and legible records/documentation
4. Provides explanations and teaches multidisciplinary members of critical care team

Professional relationships with patients and relatives

1. Involves patients (or their surrogates if applicable) in decisions about care and treatment
2. Demonstrates respect of cultural and religious beliefs and an awareness of their impact on decision making
3. Respects privacy, dignity, confidentiality and legal constraints on the use of patient data

Professional relationships with members of the health care team

1. Collaborates and consults; promotes team working
2. Ensures continuity of care through effective hand-over of clinical information
3. Supports clinical staff outside the ICU to enable the delivery of effective care
4. Appropriately supervises and delegates to others, the delivery of patient care

Self Governance

1. Takes responsibility for safe patient care
2. Formulates clinical decisions with respect for ethical and legal principles
3. Seeks learning opportunities and integrates new knowledge into clinical practice
4. Participates in multidisciplinary teaching
5. Participates in research or audit under supervision
6. Participates in the team approach with respect for team members

- **Physics & Clinical Measurement**

Mathematical Concepts

1. Relationships and graphs
2. Concepts of exponential functions and logarithms: wash-in and washout

3. Basic measurement concepts: linearity, drift, hysteresis, signal: noise ratio, static and dynamic response
4. SI units: fundamental and derived units
5. Other systems of units where relevant to ICM (e.g. mmHg, bar, atmospheres)
6. Simple mechanics: Mass, Force, Work and Power

Gases & Vapours

1. Absolute and relative pressure.
2. The gas laws; triple point; critical temperature and pressure
3. Density and viscosity of gases.
4. Laminar and turbulent flow; Poiseuille's equation, the Bernoulli principle
5. Vapour pressure: saturated vapour pressure
6. Measurement of volume and flow in gases and liquids.
   The pneumotachograph and other respirometers.
7. Principles of surface tension

Electricity & Magnetism

1. Basic concepts of electricity and magnetism.
2. Capacitance, inductance and impedance
3. Amplifiers: bandwidth, filters
4. Amplification of biological potentials: ECG, EMG, EEG.
5. Sources of electrical interference
6. Processing, storage and display of physiological measurements Bridge circuits

Electrical Safety

13.21 Principles of cardiac pacemakers and defibrillators

13.22 Electrical hazards: causes and prevention.

13.23 Electrocution, fires and explosions.

13.24 Diathermy and its safe use

13.25 Basic principles and safety of lasers

13.26 Basic principles of ultrasound and the Doppler effect

Pressure & Flow Monitoring

1. Principles of pressure transducers
2. Resonance and damping, frequency response
3. Measurement and units of pressure.
4. Direct and indirect methods of blood pressure measurement; arterial curve analysis
5. Principles of pulmonary artery and wedge pressure measurement
6. Cardiac output: Fick principle, thermodilution

Clinical Measurement

Measurement of gas and vapour concentrations, (oxygen, carbon dioxide, nitrous oxide, and volatile anaesthetic agents) using infrared, paramagnetic, fuel cell, oxygen electrode and mass spectrometry methods

a. 1Measurement of H+, pH, pCO2 , pO2
    i. Measurement CO2 production/ oxygen consumption/ respiratory quotient
    ii. Colligative properties: osmometry
    iii. Simple tests of pulmonary function e.g. peak flow measurement, spirometry.
    iv. Capnography
    v. Pulse oximetry
    vi. Measurement of neuromuscular blockade
    vii. Measurement of pain

Research Methods

Data Collection

1. Simple aspects of study design (research question, selection of the method of investigation, population, intervention, outcome measures)
2. Power analysis
3. Defining the outcome measures and the uncertainty of measuring them
4. The basic concept of meta-analysis and evidence based medicine

5. Descriptive Statistics

1. Types of data and their representation
2. The normal distribution as an example of parametric distribution
3. Indices of central tendency and variability

Deductive & Inferential Statistics :

1. Simple probability theory and the relation to confidence intervals
2. The null hypothesis.
3. Choice of simple statistical tests for different data types
4. Type I and type II errors
5. Inappropriate use of statistics

Applied Anatomy

Respiratory System

1. Mouth, nose, pharynx, larynx, trachea, main bronchi, segmental bronchi, structure of bronchial tree and differences in the children's airway
2. Airway and respiratory tract, blood supply, innervation and lymphatic drainage

3. Pleura, mediastinum and its contents
4. Lungs, lobes, microstructure of lungs
5. Diaphragm, other muscles of respiration, innervation
6. The thoracic inlet and 1st rib
7. Interpretation of a chest x-ray

Cardiovascular System

1. Heart, chambers, conducting system, blood and nerve supply
2. Congenital deviations from normal anatomy
3. Pericardium
4. Great vessels, main peripheral arteries and veins
5. Foetal and materno-foetal circulation

Nervous System

1. Brain and its subdivisions
2. Spinal cord, structure of spinal cord, major ascending and descending pathways
3. Spinal meninges, subarachnoid and extradural space, contents of extradural space.
4. Cerebral blood supply
5. CSF and its circulation
6. Spinal nerves, dermatomes
7. Brachial plexus, nerves of arm
8. Intercostal nerves
9. Nerves of abdominal wall
10. Nerves of leg and foot
11. Autonomic nervous system
12. Sympathetic innervation, sympathetic chain, ganglia and plexuses
13. Parasympathetic innervation.
14. Stellate ganglion
15. Cranial nerves: base of skull: trigeminal ganglion

16. Innervation of the larynx
17. Eye and orbit

Vertebral Column

1. Cervical, thoracic, and lumbar vertebrae
2. Interpretation of cervical spinal imaging in trauma
3. Sacrum, sacral hiatus
4. Ligaments of vertebral column
5. Surface anatomy of vertebral spaces, length of cord in child and adult

Surface Anatomy

1. Structures in antecubital fossa
2. Structures in axilla: identifying the brachial plexus
3. Large veins and anterior triangle of neck
4. Large veins of leg and femoral triangle
5. Arteries of arm and leg
6. Landmarks for tracheostomy, cricothyrotomy
7. Abdominal wall (including the inguinal region): landmarks for suprapubic urinary
    a. and peritoneal lavage catheters
8. Landmarks for intrapleural drains and emergency pleurocentesis
9. Landmarks for pericardiocentesis

Abdomen

1. Gross anatomy of intra-abdominal organs
2. Blood supply to abdominal organs and lower body

Physiology & Biochemistry

General

1. Organisation of the human body and homeostasis
2. Variations with age
3. Function of cells; genes and their expression
4. Mechanisms of cellular and humoral defence
5. Cell membrane characteristics; receptors
6. Protective mechanisms of the body
7. Genetics & disease processes

Biochemistry

1. Acid base balance and buffers Ions e.g. Na^{+} , K^{+}, Ca^{++} , Cl^{-}, $HCO^{3-,}$ Mg^{++}, PO^{4-} Cellular and intermediary metabolism; variations between organs
2. Enzymes

Body Fluids

1. Capillary dynamics and interstitial fluid
2. Oncotic pressure
3. Osmolarity: osmolality, partition of fluids across membranes
4. Lymphatic system
5. Special fluids: cerebrospinal, pleural, pericardial and peritoneal fluids

Haematology & Immunology

1. Red blood cells: haemoglobin and its variants
2. Blood groups
3. Haemostasis and coagulation; pathological variations
4. White blood cells
5. Inflammation and its disorders
6. Immunity and allergy

Muscle

1. Action potential generation and its transmission
2. Neuromuscular junction and transmission
3. Muscle types
4. Skeletal muscle contraction
5. Motor unit
6. 16.26 Muscle wasting
7. 16.27 Smooth muscle contraction: sphincters

Heart & Circulation:

i. Cardiac muscle contraction
ii. The cardiac cycle: pressure and volume relationships
iii. Rhythmicity of the heart
iv. Regulation of cardiac function; general and cellular
v. Control of cardiac output (including the Starling relationship)
vi. Fluid challenge and heart failure
vii. Electrocardiogram and arrhythmias
viii. Neurological and humoral control of systemic blood pressures, blood volume and blood flow (at rest and during physiological disturbances e.g. exercise, haemorrhage and Valsalva manoeuvre)
ix. Peripheral circulation: capillaries, vascular endothelium and arteriolar smooth muscle Autoregulation and the effects of sepsis and the inflammatory response on the peripheral vasculature
x. Characteristics of special circulations including: pulmonary, coronary, cerebral,
xi. renal, portal and foetal

Renal Tract

1. Blood flow, glomerular filtration and plasma clearance
2. Tubular function and urine formation
3. Endocrine functions of kidney
4. Assessment of renal function
5. Regulation of fluid and electrolyte balance
6. Regulation of acid-base balance
7. Micturition
8. Pathophysiology of acute renal failure

Respiration

1. Gaseous exchange: O2 and CO2 transport, hypoxia and hyper- and hypocapnia,
    i. hyper-and hypobaric pressures
2. Functions of haemoglobin in oxygen carriage and acid-base equilibrium
3. Pulmonary ventilation: volumes, flows, dead space.
4. Effect of IPPV and PEEP on lungs and circulation

Mechanics of ventilation: ventilation/perfusion abnormalities

Control of breathing, acute and chronic ventilatory failure, effect of oxygen therapy

Non-respiratory functions of the lungs

5. Cardio-respiratory interactions in health & disease

Nervous System

1. Functions of nerve cells: action potentials, conduction, synaptic mechanisms and
    i. transmitters
2. The brain: functional divisions
3. Intracranial pressure: cerebrospinal fluid, blood flow
4. Maintenance of posture
5. Autonomic nervous system: functions
6. Neurological reflexes Motor function: spinal and peripheral
7. Senses: receptors, nociception, special senses

8. Pain: afferent nociceptive pathways, dorsal horn, peripheral and central mechanisms, neuromodulatory systems, supraspinal mechanisms, visceral pain, neuropathic pain, influence of therapy on nociceptive mechanisms
9. Spinal cord: anatomy and blood supply, effects of spinal cord section

Liver

1. .Functional anatomy and blood supply
2. Metabolic functions
3. Tests of function

Gastrointestinal

1. Gastric function; secretions, nausea and vomiting
2. Gut motility, sphincters and reflex control
3. Digestive functions and enzymes
4. Nutrition: calories, nutritional fuels and sources, trace elements, growth factors

Metabolism and Nutrition

1. Nutrients: carbohydrates, fats, proteins, vitamins, minerals and trace elements
2. Metabolic pathways, energy production and enzymes; metabolic rate
3. Hormonal control of metabolism: regulation of plasma glucose, response to trauma
4. Physiological alterations in starvation, obesity, exercise and the stress response
5. Body temperature and its regulation

Endocrinology

1. Mechanisms of hormonal control: feedback mechanisms, effect on membrane and
    a. intracellular receptors
2. Central neuro-endocrine interactions
3. Adrenocortical hormones
4. Adrenal medulla: adrenaline (epinephrine) and noradrenaline (norepinephrine)
5. Pancreas: insulin, glucagons and exocrine function
6. Thyroid and parathyroid hormones and calcium homeostasis

Pregnancy

1. Physiological changes associated with a normal pregnancy and delivery
2. Materno-foetal, foetal and neonatal circulation
3. Functions of the placenta: placental transfer
4. Foetus: changes at birth

- ## Pharmacology

Principles of Pharmacology

1. Dynamics of drug-receptor interaction
2. Agonists, antagonists, partial agonists, inverse agonists
3. Efficacy and potency
4. Tolerance
5. Receptor function and regulation
6. Metabolic pathways; enzymes; drug: enzyme interactions; Michaelis-Menten
    a. equation
7. Enzyme inducers and inhibitors.
8. Mechanisms of drug action Ion channels: types: relation to receptors.
9. Gating mechanisms.
10. Signal transduction: cell membrane/receptors/ion channels to intracellular
    a. molecular targets, second messengers
11. Action of gases and vapours
12. Osmotic effects
13. pH effects
14. Adsorption and chelation
15. Mechanisms of drug interactions:
16. Inhibition and promotion of drug uptake.
17. Competitive protein binding.

18. Receptor inter-actions.
19. Effects of metabolites and other degradation products.

Pharmacokinetics & Pharmacodynamics

1. Drug uptake from: gastrointestinal tract, lungs, nasal, transdermal, subcutaneous,
    i. IM, IV, epidural and intrathecal routes
2. Bioavailability
3. Factors determining the distribution of drugs: perfusion, molecular size, solubility,
    a. protein binding.
    b. The influence of drug formulation on disposition
4. Distribution of drugs to organs and tissues:
    a. Body compartments Influence of specialised membranes: tissue binding and solubility
5. Materno-foetal distribution
6. Distribution in CSF and extradural space
7. Modes of drug elimination
8. Direct excretion
9. Metabolism in organs of excretion: phase I & II mechanisms
10. Renal excretion and urinary pH
11. Non-organ breakdown of drugs
12. Pharmacokinetic analysis:
13. Concept of a pharmacokinetic compartment
14. Apparent volume of distribution
15. Orders of kinetics
16. Clearance concepts applied to whole body and individual organs
17. Simple 1 and 2 compartmental models
18. Concepts of wash-in and washout curves
19. Physiological models based on perfusion and partition coefficients
20. Effect of organ blood flow: Fick principle

21. Pharmacokinetic variation: influence of body size, sex, age, disease, pregnancy,
22. Anaesthesia, trauma, surgery, smoking, alcohol and other drugs
23. Effects of acute organ failure (liver, kidney) on drug elimination Influence of renal replacement therapies on clearance of commonly used drugs
24. Pharmacodynamics: concentration-effect relationships: hysteresis
25. Pharmacogenetics: familial variation in drug response
26. Adverse reactions to drugs: hypersensitivity, allergy, anaphylaxis, anaphylactoid reactions

Systemic Pharmacology

1. Hypnotics, sedatives and intravenous anaesthetic agents
2. Simple analgesics
3. Opioids and other analgesics; Opioid antagonists
4. Non-steroidal anti-inflammatory drugs
5. Neuromuscular blocking agents (depolarising & non-depolarising) and anti cholinesterases
6. Drugs acting on the autonomic nervous system (including inotropes, vasodilators, vasoconstrictors, antiarrhythmics, diuretics)
7. Drugs acting on the respiratory system (including respiratory stimulants and
    a. bronchodilators)
8. Antihypertensives
9. Anticonvulsants
10. Anti-diabetic agents
11. Diuretics
12. Antibiotics
13. Corticosteroids and other hormone preparations
14. Antacids. Drugs influencing gastric secretion and motility
15. Antiemetic agents
16. Local anaesthetic agents
17. Immunosuppressants

18. Principles of therapy based on modulation of inflammatory mediators indications,
    a. actions and limitations
19. Plasma volume expanders
20. Antihistamines
21. Antidepressants
22. Anticoagulants
23. Vitamins A-E, folate, B12

▪ Assessment

Assessment would be comprised of (A) formative assessment during residency programme and (B) summative assessment at the completion of training.

(A) Formative Assessment during Residency Programme

Integrated and coherent formative assessment of competence of the students during the residency programme shall be comprised of various suitable methods complemented by the provision of frequent and constructive feedback. Yearly appraisals will be conducted both in theory and practical assessment

Feedback

1. Feedback should be given to the trainees on regular basis.
2. The feedback should be about the overall integrated, coherent and longitudinal assessment of the trainee.
3. The feedback should be in the form of constructive suggestions for improvement in their performance.

Assessment shall be carried by supervising teachers with focus on

1 Acquisition and application of knowledge and skills
2 Clinical reasoning and judgment in uncertain situations
3 Problem solving skills - Situation/Problem Based Learning
4 Skill development for diagnostic and therapeutic procedures

5 All above through departmental and extra department rotation

Formative assessment by suitable assessment method(s) should cover all competencies mentioned in the curriculum and include the following

(a) Cognitive Domain

Competence

1. Resuscitation and Initial Management of the Acutely Ill Patients
2. Diagnosis : Assessment, Investigation, Monitoring and Data Interpretation
3. Disease Management
4. Therapeutic interventions/organ system support in single or multiple organ failure
5. Peri-operative care
6. Pediatric Care
7. Transportation
8. Research Methods
9. Physics & Clinical Measurement Mathematical Concepts
10. Applied Anatomy
11. Physiology & Biochemistry
12. Pharmacology

(b) Psychomotor Domain

Competence

1. Practical procedures

(c) Affective Domain

Competence

1. Pain Relief, Comfort and Recovery
2. Patient safety and health systems management
3. End of life care
4. Ethics, Attitudes and Professionalism
   a. Integrity, Empathy & Patient Advocacy
   b. Self-Motivation & Time Management
   c. Appearance and Personal Hygiene
   d. Self-Confidence & Respect
   e. Communications

f. Teamwork and Diplomacy

g. Careful Delivery of Service

(B) Summative Assessment at the Completion of Training

At the completion of training, summative assessment of competence of the students should be conducted by the examiners by methods as suggested below :

	Competency	**Evaluator (s)**
1.	Patient Care	Examiner (s)
2.	Medical Knowledge	Examiner (s)

Composition of Theory Assessment: Short answer questions

Composition of Practical Assessment: Long and short cases, Clinical skill stations, Viva Voce.