Second Semester Syllabus
Masters in Critical Care Science & Technology (CCST)

Semester II

II Semester = 26 weeks × 6 days × 5 hours = 780 hours [18 lecture hour = 1 credit (36 hours = 1 credit in practical)]

Course	Course Code	Credit
Basic ICU Monitoring	CC201	2+1
Advanced ICU Monitoring	CC202	2+1
ICU Therapy	CC203	2+1
Biomedical Engineering	CC204	2+1
Biostatistics	CC205	2
Equipment Maintenance	CC206	2
ICU Administration, Ethics, Logistics and Communication	CC207	2
Values & Indian Heritage	CC208	2
Total		20

8 THEORETICAL COURSES (6 courses X 2 credits and 2 courses X 1 credit) & 5 PRACTICAL COURSES (4 courses 1 credit each and 1 course of 2 credits)
Total **14 credit + 6 credit**, 252 + 216 = 468 hours

CC201 Basic ICU Monitoring Credit: 2+1 (Theory + Practical) CCST

Unit 1 General Monitoring

Temperature monitoring, Principles of temperature monitoring Hypothermia and hyperthermia; Pulse; Positioning of patient; Monitoring for pressure sores

Unit 2 Respiratory System

Airway monitoring Securing, ET tube, Cuff pressure; Monitoring Gas Exchhange; Oxygenation ABG; Pulse Oximetry; Oxygen delivery and consumption; Ventilation ABG, Capnography; Calculations-Oxygen consumption, Alveolar gas equations Dead space; Monitoring muscle strength, work of breathing; PFT - Recognize the methods & significance of measuring the following lung volume and flow in the ICU: Tidal, volume Vital capacity Peak flow rate, Negative inspiratory pressure

Unit 3 Cardiovascular System

ECG; NIBP; Invasive arterial blood pressure; CVP monitoring; Zeroing, calibration, trouble shooting of pressure transducers.

Unit 4 Nervous System

Neurological history and examination, pupils, Muscle strength; Glasgow Coma Scale; ICP Monitoring

Unit 5 Abdomen/Renal

Intra-abdominal pressure monitoring; Monitoring renal function: 1. Clinical – Urine output, 2. Laboratory- Creatinine, creatinine clearance

Practical

Clinical evaluation, case study/case book, assignments, Oral Presentation, Troubleshooting

Recommended books:

1. Egan's Fundamentals of Respiratory Care – Robert L. Wikins, James K Stoller, Craig L Scalan (Mosby)
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)
6. Techniques in Bedside haemodynamic Monitoring – Elaine Kiess Daily & Johnspeer Schroeder (Mosby)
7. All you really need to know to interpret arterial blood gases – Lawrence Martin (Lea & Febiger)
8. Mechanical Ventilation – Susan P Pilbeam & J M Cairo (Elsevier)

CC202 ICU Monitoring (Advanced) Credit: 2 + 1 (Theory + Practical) CCST

Unit 1 Respiratory System

Monitoring lung and chest wall mechanics, Compliance, Resistance, Pressures, Auto, PEEP, Volumes; Monitoring muscle strength, work of breathing, Maximum inspiratory and expiratory pressures; Monitoring patient ventilator system, Graphics monitoring; Bedside PFT

Unit 2 Cardiovascular System

Assessment of Preload responsiveness static and dynamic parameters; Basic Echocardiography in ICU; Defibrillator and Cardioversion; PICCO; Monitoring tissue perfusion; Pulmonary artery catheters; Temporary Pacemakers

Unit 3 Central Nervous System

Monitoring brain stem function; Sedation and analgesia scoring

Unit 4 Nutritional Monitoring

Functional nutritional assessment (history and physical examination), Metabolic assessment; Estimating nutritional requirements

Unit 5 Care & maintenance if ICU equipment & Troubleshooting (Includes quality checks and calibrations of all the equipment)

Mechanical Ventilators & Non-invasive ventilators; Pumps: Infusion, syringe; Monitors: Stand-alone & multi-parameter, Cardiac Output monitors; ECG machine; ABG machine; Defibrillator; Ultrasound machine Section 8: Bronchoscope

Practical:

Log book and project completion for internal assessment Should know the workings of all ICU equipment; Should know care and maintenance of all ICU equipment Should be able to monitor ventilator parameters; Should be able to assess fluid responsiveness in a patient

Recommended books:

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)
6. Techniques in Bedside haemodynamic Monitoring – Elaine Kiess Daily & Johnspeer Schroeder (Mosby)
7. All you really need to know to interpret arterial blood gases – Lawrence Martin (Lea & Febiger)
8. Text book of Advanced Cardiac Life Support. American Heart Association
9. Mechanical Ventilation – Susan P Pilbeam & J M Cairo (Elsevier)
10. 10. Critical Care Secrets: Parsons, Wiener – Kronish, Jaypee Brothers

CC203 ICU Therapy Credit: 2 + 1 (Theory + Practical) CCST

Unit 1 Mechanical ventilation/ventilator dependence/difficult weaning

Basic Concepts; Mechanics of ventilation Mechanics of exhalation Work of breathing; Distribution of ventilation; Efficiency and effectiveness of ventilation; Indications Mechanical Ventilators; How ventilators work; Operator interface; Types of ventilators; Modes of Mechanical Ventilation; Basic and newer modes Ventilator initiation; Initial ventilator settings Adjusting ventilatory settings Oxygenation; Ventilation Timing – Inspiratory of gas / Expiratory,

inspiratory hold Flow; Tidal volume; Pressure- Peak/Plateau PEEP; POP – OFF; Pressure support; Proximal airway (VS) distal; FiO_2; Humidification; Humidifier types Advantages & disadvantages; Non-Invasive Ventilation; Types of NIV (CPAP, BIPAP); Goals of & indications of NIV; Patient selection and exclusion criteria for NIV Equipment used in the application of NIV Instituting and managing
NIV Complications of NIV; Time & cost associated with NIV; Trouble shooting and alarms; Weaning and Extubation; Reasons for ventilator dependence; Patient evaluation; Preparing the Patient; Methods:
Newer techniques for facilitating ventilator discontinuance; Selecting an approach; Monitoring the patient during weaning; Chronically ventilator dependent patients & difficulty in weaning; Terminal weaning Extubation; Indications; Procedure; Post extubation care; Nebulization and MDI; Inhaled drug therapy; Nebulization; Advantages & disadvantages; MDI with spacer Characteristics of therapeutic aerosols; Hazards of aerosols therapy; Aerosol drug delivery system; Assessment based bronchodilator therapy protocols; Special considerations; Controlling environmental and contamination; Suctioning and chest physiotherapy; Incentive Spirometry; Inspiratory resistance exercises; Care of Patient on Ventilator; Ensuring proper placement Cuff pressure; Tracheo bronchial hygiene & suctioning Humidification, chest physiotherapy Ventilator settings; Monitoring ventilatory parameters; Care of the chest tube Drainage systems of pleural with fluid; Extubation failure

Unit 2 Airway Assistance

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

Unit 3 Cardiovascular System

Fluid resuscitation and ionotropes; Basic of IABP /ECMO; Pericardiocentesis

Unit 4 Life Support

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, clinical manifestations, Diagnosis, treatment modalities

Unit 5 Renal/Abdomen

Basics of Renal Replacement Therapy, modes of dialysis; Intra-abdominal pressure, abdominal compartment syndrome

Unit 6 Central Nervous System

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

Unit 7 Infection Control

Hand hygiene, Universal precautions

Practical:

Clinical rotations in selected Medical and Surgical areas; Patient assignments for patient centered comprehensive care; Case presentations; Drug study discussion

Recommended Books:

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)
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8. Text book of Advanced Cardiac Life Support. American Heart Association
9. Mechanical Ventilation – Susan P Pilbeam & J M Cairo (Elsevier)
10. Critical Care Secrets: Parsons, Wiener – Kronish, Jaypee Brothers
11. Washington Manual of Critical Care
12. Smeltzer – Brunner & Suddharth Textbook of Medical Surgical Nursing, 2010,LWW 13. Black – Medical Surgical Nursing, 2009, Elsevier
14. Nettina – Lippincott manual of Nursing Practice, 2013. LWW
15. Lewis – medical Surgical Nursing, 2008, Elsevier
16. Davidson's Principles &Practice of Medicine, 2010, Elsevier
17. Bailey & Love Short Practice of Surgery, 2013, Hodder Arnold

CC204 Biomedical Engineering Credit: 2 + 1 (Theory + Practical) CCST

Unit 1 Fundamentals of Electricity and Electronics

Resistance; Capacitance; Inductance and transformers; parameters of electricity – voltage, current, power; Difference between AC and DC current, phase, neutral, earth, color coding; Ohm's law, Kirchhoff's law-electrical circuits; Classification of medical equipment: According to type of protection: B, C, and F etc.; According to mode of protection: Class I-III

Unit 2 Introduction to PCB

Soldering and Desoldering Techniques ,SMD Testing of PCB and Replacement of defective components

Unit 3 Switches, Relays and Displays

Switch Types, Construction Specifications – voltage rating, contact current rating and application. Relays-Construction, working and Application of General Purpose relay. Difference between switch & relay. Display –Types (LED/LCD/& segment)

Unit 4 Sensors and Instruments

Introduction to Sensors- Construction, operation and Types used in Medical Equipment. Temperature, Pressure, Gas and Flow sensors Troubleshooting of Sensors

Practicals:

Identification of different types of batteries Demo and Practice on Charging the Device Battery and Replacement of battery Demo and Practice on Soldering and Desoldering techniques; Practice on Testing of PCB and Replacement of defective Components. Practice on Operation of different types of Switches. Identification of Rating of Relays-Voltage and Current Demo and Practice on Operation of Relay Identification of Types of Display Identification of different types of Sensors in Medical field. Demo and Practice on operation of sensor. Reading and understanding the messages or Alarms of sensors of the equipment displayed on the screen for different OEM's. Practice Troubleshooting of Sensors.

CM 205 Biostatistics Credit: 2 (Theory) CCST

Unit 1 Fundamentals of Biostatistics

Fundamentals of biostatistics: Introduction, types of data, tabular and graphical presentation of data. Measures of location, dispersion and correlation: Measures of central tendency. Mean, mode, median, GM, HM, quartiles Measures of dispersion—ra nge, standard deviation, variance, coefficient of variation.

Unit 2 Probability

Probability and statistical inference: Concept and probability distribution. Normal distribution—density curves, applications and statistical tables. Concept of significance tests, parametric and nonparametric tests, standard error and confidence intervals.
Inferential statistics: Probability and distributions – Poisson, Binomial a nd Normal distribution – Chi- square test – Hypothesis test - Student's t-tes t – Correlation and Regression – ANOVA.

Recommended Books:

1. Basic and Clinical Biostatistics. Beth Dawson, Robert G. Trapp, Robert Trapp. Latest edition / Pub. Date: March 2004.
2. Discovering Statistics Using SPSS. Andy Field. Latest edition / Pub. Date: April 2005. Publisher: SAGE Publications.

3. Arora PN & Malhon PK (1996). Biostatistics Imalaya Publishing House, Mumbai.
4. Sokal & Rohif (1973). Introduction to Biostatistics, Toppan Co. Japan.
5. Stanton A & Clantz, Primer of Biostatistics — T he McGraw Hill Inc., New York.

CM 206 Equipment Maintenance Credit: 1+1 (Theory + Practical) CCST

Unit 1 CPAP,BIPAP and Nebulizer - Operation, Maintenance and calibration

Introduction to Respiratory Devices in Brief; Oxygen Concentrator-VentilatorBiPaP, CPap, Pulse Oximeter, Nebuliser; Medical Terminology and Basics Sleep Apnea and Types (OSA and CSA), NIV and IV (Non Invasive & Invasive Ventilation) CPaP and BiPaP Parts and Accessories Functional difference between CPAP and BiPAP; Types of Sensors used in the CPAP and BiPAP machine -- Operation and Working of a CPAP and BiPAP machine – Initial Setting features and Procedures for set up of Machine of CPAP & BiPAP - IPAP and EPAP as per OEM Standards; Different Modes of Settings and Initial Calibration modes; Study of nebulizer and its clinical usage against the respiratory diseases; Parts and Accessories of Nebulizer; Operation Settings of the device as per the OEM and Clinical standards.

Unit 2 Oxygen Concentrator and Pulse Oximeter -Installation, Operation, Maintenance and calibration

Features, Working Principle of Oxygen Concentrator Need and Use of Oxygen concentrator-Pros and Cons; Parts and Accessories of OC – Electrical, Electronics, Pneumatics; Operation, Installation and Commissioning at Hospitals as per OEM Standards; Functional Testing (Static and Dynamic test) and Safety precautions in OC, Oxygen concentrators Vs Oxygen Cylinders; Measurement of Voltage, current, Pressure and % of Oxygen; Maintenance and Calibration of Equipment as per the OEM Standards; Troubleshooting of Alarms and Faults; Brief of Medical Terminology Brief of oxygen saturation, Principles/ theory of operation of pulse oximetry and use in Emergency intensive care and hospital ward other Clinical applications; Different types of Sensors used in Pulse Oximeters; Construction, Electronic Parts, Types and operation and Study of accuracy level required for clinical applications; Alarms and malfunctioning of device.

Unit 3 Medical Ventilator -Installation, Operation, Maintenance and calibration

Brief of Respiratory System and Medical Terminology used; Knowledge features, Working Principle of Medical ventilator, Parts and accessories of electrical, Electronics and Pneumatics; Need and Use of Medical Ventilator Operation, Installation and set up at Hospitals as per OEM Standards; Measurement Settings and Modes on Graphical Display; Maintenance and Calibration of equipment as per the OEM Standards; Troubleshooting of Alarms and Faults;

Practical:

Operation and Working of a CPAP and BiPAP. Demo and Practice on Connection of Breathing Circuit As per OEM Standards for Clinical Application; Identification of appropriate compressor Settings for clinical usage as per OEM standards; Demo and practice on Interconnections of Parts in function of each device; Identification of Parts and Accessories in

Oxygen concentrator. Demo and Practice on Installation, operation and functionality of Oxygen Concentrators; checking of AIR and OXYGEN points; Demo and Practice on Functional Test and Measurements - Static Test and Dynamic Test; Measurement of Pressure, % Oxygen using Oxygen Analyzer and Gauges; Demo and Practice on Maintenance, Changing and cleaning of filters of oxygen concentrators; Troubleshooting of Alarms, Initial calibration settings of Equipment as per OEM Standards; Identification of Parts of ventilator Demo and Practice on Installation, Commissioning and operation of Medical Ventilator in different Modes and settings features Changing and cleaning of filters of medical compressors, ventilators. Maintaining AIR and OXYGEN pressures in the icu s.

Recommended Books:

1. Mishra, R.C., Sodhi, K., Prakash, K. C., Kapoor, P. M. (2020) ISCCM Manual of RRT and ECMO in ICU: A reference book for practical intensivists. Jaypee Brothers Medical Publishers, New Delhi

CC207 ICU Administration, Ethics, Logistics and Communication Credit: 1+1 (Theory + Practical) CCST

Unit 1 Basic Administration

Economic issues in ICU; Raising Purchase Orders for Equipment; Maintaining Consumable Stock; Equipment Repair

Unit 2 CSSD Procedures

Waste disposal collection of used items from user area, reception protective clothing and disinfection safe guards; Disinfection in ICU – Surfaces; Reusable equipment and accessories; Wrapping & packing; General principles of sterilization Moist heat sterilization, Dry Heat Sterilization, Chemical sterilization, EO gas sterilization, H_2O_2 gas plasma vap sterilization

Unit 3 Medical Ethics

Medical ethics –Definition – Goal – Scope; Code of conduct: Introduction, Basic principles of medical ethics, Confidentiality, Autonomy and Informed consent – Right of patients; Care of the terminally ill – Euthanasia, withdrawal, withholding support; Organ transplantation; Medico legal aspects of medical records; Medico-legal case and type – Records and document related to MLC; Ownership of medical records; Confidentiality Privilege communication Release of medical information; Unauthorized disclosure – retention of medical records – other various aspects.

Unit 4 Communication and Counselling

Basic Principles, Breaking news to kith and kin; What is to be spoken and what to be kept for the seniors to deal with; Role specification; Counselling; Inter-hospital patient transport; patient safety, fire safety, protection against accidents/natural calamity

Unit 5 ICU Management

Basic principles of Management – functions, types, importance etc.; Personnel management – staffing, orientation, disciplining, complaints etc.; Financial management – short and long term

Practical:

Demonstration

Recommended books:

1. Marino, P. L. – The ICU Book, 1998, Williams & Wilkins, Baltimore

2. Boulanger, C. and McWilliams, D.- Passport to Successful ICU Discharge, 2020, Springer, Cham

CC208 Values and Indian Heritage Credit: 2 (Theory) CCST