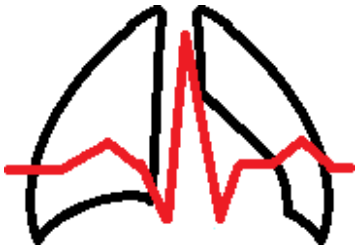
CRITICAL CARE MEDICINE

Residency Training Program
Leading to the degree of

Doctor of Medicine in Critical Care Medicine (MD-CCM)

SHAHEED ZULFIQAR ALI BHUTTO MEDICAL UNIVERSITY
ISLAMABAD



CURRICULUM

Doctor of Medicine in Critical Care Medicine (MD-CCM)

CURRICULUM DEVELOPMENT COMMITTEE

This Curriculum is developed by the following committee

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GENERAL INFORMATION AND PROGRAM GOALS:

The six (06) year MD Critical Care Medicine program trains residents to acquire competency in critical care medicine to work proficiently in intensive care units, including effectively managing and leading patient care as well organizing and supervising an intensive care unit.

The programs major goals include access and application of knowledge to clinical practice, and to safely and effectively appropriate critical care medicine procedures. By the end of the training period post graduate scholars will be able to design and implement effective management plans, organize diagnostic testing, and to conduct research in their field. The MD CCM program values effective communication, application of ethical principles, and working in collaboration with team members by showing professionalism and leadership.

COURSE DESCRIPTION:

A total of one hundred ninety two (192) credit hours of instruction and supervised activities are distributed over six years academic period. This comprises approximately 2592 contact hours of instruction and approximately 10008 scheduled hours including formal didactic, clinical, research and laboratory experience.

The modular based syllabus is to facilitate each resident in covering the CoBaTrICE based syllabus in an organized and regular manner. Each module will be covered in six months and assessment will be held on a six monthly basis on each module and corresponding domain in order to prepare the resident for daily challenges faced in managing a critically ill patient.

Year I MD Critical Care Medicine
TOTAL CREDIT HOURS: 32

MODULE 1 : General Concepts	
TOTAL CREDIT HOURS 14	
Basic Concepts	
1.1	Historical perspective
1.2	Minimal requirements of an ICU
1.3	Organisation of care in the ICU
1.4	Triage, admission / discharge criteria
1.5	ICU scoring systems
1.6	Patient Safety
1.7	Learning resources
1.8	Communicating with families
Basic Medical Sciences	
See Basic Medical Sciences section in the Content of Learning Section	

MODULE 2 : Respiration	
TOTAL CREDIT HOURS 14	
2.1	Ventilation, perfusion and gas exchange in the critically ill
2.2	Airway management
2.3	Acute asthma and COPD in the ICU
2.4	Acute Respiratory Distress Syndrome
2.5	Extrapulmonary causes of respiratory failure
2.6	Acute respiratory failure in pregnancy
2.7	Venous thromboembolisim : Pulmonary embolism & Deep Venous thrombosis
2.8	Aspiration & Drowning
2.9	Mechanical Ventilation : Invasive, Non Invasive ventilation & Weaning
2.10	Pleural diseases in the critically ill patient
2.11	Acute Infectious Pneumonias
2.12	Gas Embolism Syndrome
2.13	Acute Inhalation Injury

Specialty Journal:
TOTAL CREDIT HOURS 4
Intensive Care Medicine
Journal Of Critical Care
American Journal Of Critical Care
Annals Of Intensive Care

Year II MD Critical Care Medicine
TOTAL CREDIT HOURS: 32

MODULE 3 : Circulation	
TOTAL CREDIT HOURS 14	
3.1	Oxygen transport and delivery, regulation of blood pressure and blood volume
3.2	Hypotension and hemodynamic instability
3.3	Evaluation and Management of hypertension in ICU
3.4	Management of advanced heart failure
3.5	Valvular heart disease in ICU
3.6	Unstable angina / NSTEMI
3.7	ST- segment elevation MI & complications
3.8	Ventricular Tachycardias
3.9	Supraventricular Tachyarrhythmias
3.10	Bradyarrhythmias
3.11	ACLS & Cardiac Arrest
3.12	Hemodynamic monitoring
3.13	Infectious Endocarditis

MODULE 4 : Renal & Endocrine Disturbances	
TOTAL CREDIT HOURS 14	
4.1	Metabolic Acidosis & Alkalosis
4.2	Disorders of Sodium & Potassium
4.3	Acute Kidney Injury in the ICU
4.4	Renal replacement therapy in ICU
4.5	Disorders of calcium, phosphate and magnesium
4.6	Thyroid storm & myxedema coma
4.7	Addisons disease & syndrome
4.8	Management of hyperglycemia in ICU
4.9	Diabetic Ketoacidosis & Hyperglycemic Hyperosmolar State
4.10	Sick euthyroid syndrome

Specialty Journal:
TOTAL CREDIT HOURS 4
Intensive Care Medicine
Journal Of Critical Care
American Journal Of Critical Care
Annals Of Intensive Care

Year III MD Critical Care Medicine
TOTAL CREDIT HOURS: 32

MODULE 5 : Neurology	
TOTAL CREDIT HOURS 14	
5.1	Evaluation of a patient with altered consciousness in ICU
5.2	Metabolic Encephalopathy
5.3	Cerebrovascular disease
5.4	Status epilepticus
5.5	Gullian-Barre syndrome & Myasthenia Gravis
5.6	Subarachnoid Hemorrhage
5.7	Critical illness myopathy & neuropathy
5.8	Generalized anoxia of the CNS
5.9	Miscellaneous Neurologic problems in ICU
5.10	Neuroimaging in critically ill patients
5.11	CNS infections including cerebral malaria

MODULE 6 : Gastroenterology & Nutrition	
TOTAL CREDIT HOURS 14	
6.1	Upper & Lower GI bleeding
6.2	Gastrointestinal motility in the critically ill
6.3	Stress ulcer syndrome
6.4	Fulminant colitis & toxic megacolon
6.5	Evaluation & Management of Liver failure
6.6	Diarrhea
6.7	Acute Pancreatitis
6.8	Severe and complicated biliary tract disease
6.9	Nutritional therapy in the critically ill
6.10	Parenteral & enteral nutrition in the ICU

Specialty Journal:
TOTAL CREDIT HOURS 4
Intensive Care Medicine
Journal Of Critical Care
American Journal Of Critical Care
Annals Of Intensive Care

Mid Term Assessment (MTA) Examination
By University

Year IV MD Critical Care Medicine
TOTAL CREDIT HOURS: 32

MODULE 7 : Infectious Diseases & Hematologic diseases	
TOTAL CREDIT HOURS 14	
7.1	Fever in an ICU patient
7.2	Use of antimicrobials for treatment of infectious diseases in ICU
7.3	Tetanus
7.4	Botulism
7.7	Tuberculosis
7.6	Severe sepsis
7.7	HIV in an ICU setting
7.8	Viral Hemorrhagic Fevers and emerging viral infections
7.9	Infections associated with vascular catheters & UTI's
7.10	Disorders of hemostasis in the critically ill patient
7.11	Thombocytopenia in ICU
7.12	Transfusion therapy :Blood components and complications of transfusions
7.13	Anemia in critical care setting
7.14	COVID 19 Management
7.15	Antithrombotic pharmacotherapy
7.16	Critical care of patients with hematologic malignancies

MODULE 8 : Toxicology	
TOTAL CREDIT HOURS 14	
8.1	General principles – Toxidromes
8.2	Acetaminophen Poisoining
8.3	Organophosphate Poisoning
8.4	Alcohol & glycols Poisoining
8.5	Opioid Poisoning
8.6	Antiarrhythmic, anti-epileptic, anti-psychotic Poisoining
8.7	Salicylate & NSAID's Poisoining
8.8	Corrosive Poisoining
8.9	Beta- blocker & Calcium channel blockers Poisoining
8.10	Cocaine Poisoning
8.11	Sedative-Hypnotic Poisoining
8.12	Heavy Metal Poisoining
8.13	Envenomations
8.14	Carbon monoxide poisoning & cyanide poisoning

Specialty Journal:
TOTAL CREDIT HOURS 4
Intensive Care Medicine
Journal Of Critical Care
American Journal Of Critical Care

Year V MD Critical Care Medicine
TOTAL CREDIT HOURS: 32

MODULE 9 : Surgical Problems in ICU & Trauma	
TOTAL CREDIT HOURS 14	
9.1	Management of Post operative Cardiac Surgical Patient
9.2	Management of Post operative Neurosurgical Patient
9.3	Esophageal perforation & acute mediastinitis
9.4	Acute Mesenteric Ischemia
9.5	Acute Limb Ischemia
9.6	Intra-abdominal sepsis
9.7	Abdominal compartment syndrome
9.8	Traumatic Brain Injury
9.9	Spinal cord Trauma
9.10	Thoracic & Cardiac Trauma
9.11	Management of critically ill abdominal trauma patient
9.12	Resuscitation from shock following trauma
9.13	Fat embolism & orthopedic injury
9.14	Pressure sores
9.15	Trauma Systems

MODULE 10 : Miscellaneous	
TOTAL CREDIT HOURS 14	
10.1	Rheumatologic diseases in the ICU
10.2	Vasculitis in the ICU
10.3	Anaphylaxis
10.4	Delirium, Agitation, Depression in the ICU
10.5	End of Life care
10.6	Hypo & Hyperthermia in ICU
10.7	Burn Management
10.8	Heat stroke
10.10	Critical care problems in renal transplant patients
10.10	Critical care of liver transplant patients
10.11	Immunosuppression in solid transplant recipients
10.12	Disaster management
10.13	Biological & chemical warfare

Specialty Journal:
TOTAL CREDIT HOURS 4
Intensive Care Medicine
Journal Of Critical Care
American Journal Of Critical Care
Annals Of Intensive Care

Year VI MD Critical Care Medicine
TOTAL CREDIT HOURS: 32

MODULE 11 : Pregnancy	
TOTAL CREDIT HOURS 14	
11.1	Post partum hemorrhage
11.2	Septic abortion
11.3	Eclampsia & HELLP syndrome
11.4	Chronic diseases, acute hepatic & renal failure in Pregnancy
11.5	Cerebral vein Thrombosis in post partum patients
11.6	Amniotic fluid embolism
11.7	Management of obstetrical patients in a post operative setting

MODULE 12 : Radiology in Critically Ill Patients	
TOTAL CREDIT HOURS 14	
12.1	Chest Ultrasound in Critically Ill Patient
12.2	Echocardiography in Critically Ill Patient
12.3	FAST SCAN
12.4	Fluid Responsiveness via Ultrasonography
12.5	Ultrasound Guided Placement of Catheters
12.6	CT Scan interpretation Chest/Abdomen/Brain
12.7	Neuroradiological Evaluation interpretation in Critically Ill Patients

Specialty Journal:
TOTAL CREDIT HOURS 4
Intensive Care Medicine
Journal Of Critical Care
American Journal Of Critical Care
Annals Of Intensive Care

EXIT/FINAL EXAMINATION
By University

SKILLS

The residents are expected to acquire all the essentials skills necessary for practicing critical care medicine. These skills have been subdivided into the level of competency expected of the residents based on the year of their residency.

Year I MD Critical Care Medicine

Skill	Competency (Observation / Under Supervision / Independent)	Minimum number required
Peripheral Venous Cannullation	Under supervision / Independent	20
Nasogastric / Orogastric tube insertion	Under supervision / Independent	10/10 = 20
Urinary catheterization	Under supervision / Independent[1]	10/10 = 20
Endotracheal Intubation	Observation / Under supervision / Independent	15/15/15 = 45
Thoracocentesis	Observation / Under supervision / Independent	5/5/5 = 15
Paracentesis	Observation / Under supervision / Independent	5/5/5 = 15
Pericardiocentesis	Observation / Under supervision	2/2 = 4
Central Venous Cannullation	Observation / Under supervision	15/5 = 20
Arterial Cannullation	Observation / Under supervision	15/5 = 20
Tube Thoracostomy	Observation / Under supervision	14/1 = 15
Joint aspiration	Observation	1
Bronchoscopy	Observation	2
Tracheostomy	Observation	2
Suprapubic Catheterization	Observation / Under Supervision	2/2
Imaging Modalities		
USG Chest	Observation	20
Echocardiography	Observation	20
Abdominal USG / FAST scan	Observation	20

Observation : Residents are expected to ONLY observe the procedure and not actively participate
Under Supervision : Residents will perform the procedure but ONLY under direct supervision
Independent : Residents will perform the procedure without supervision, this will occur only after they have performed the said procedure under supervision

1. Residents are expected to be well versed in method of catheterization in both males and females

Year II MD Critical Care Medicine

Skill	Competency (Observation / Under Supervision / Independent)	Minimum number required
Peripheral Venous Cannullation	Independent	20
Nasogastric / Orogastric tube insertion	Independent	20
Urinary catheterization	Independent[1]	20
Endotracheal Intubation	Under supervision / Independent	20/20 = 40
Thoracocentesis	Under supervision / Independent	10/10 = 20
Paracentesis	Under supervision / Independent	10/10 = 20
Pericardiocentesis	Observation / Under supervision	2/2 = 4
Central Venous Cannullation	Observation / Under supervision	15/10 = 25
Arterial Cannullation	Observation / Under supervision	15/10 = 25
Tube Thoracostomy	Observation / Under supervision	10/5 = 15
Joint aspiration	Observation / Under supervision	1/1 = 2
Bronchoscopy	Observation	5
Tracheostomy	Observation	5
Suprapubic Catheterization	Observation / Under Supervision	2/2
Imaging Modalities		
USG Chest	Observation / Under Supervision	20/5 = 25
Echocardiography	Observation / Under Supervision	20/5 = 25
Abdominal USG / FAST scan	Observation / Under Supervision	20/ 5 = 25

Observation : Residents are expected to ONLY observe the procedure and not actively participate
Under Supervision : Residents will perform the procedure but ONLY under direct supervision
Independent : Residents will perform the procedure without supervision, this will occur only after they have performed the said procedure under supervision

1. Residents are expected to be well versed in method of catheterization in both males and females

Year III MD Critical Care Medicine

Skill	Competency (Observation / Under Supervision / Independent)	Minimum number required
Peripheral Venous Cannullation	Independent	20
Nasogastric / Orogastric tube insertion	Independent	20
Urinary catheterization	Independent[1]	20
Endotracheal Intubation	Independent	25
Thoracocentesis	Independent	20
Paracentesis	Independent	20
Pericardiocentesis	Observation / Under supervision	2/2 = 4
Central Venous Cannullation	Under supervision / Independent	15/10 = 25
Arterial Cannullation	Under supervision / Independent	15/10 = 25
Tube Thoracostomy	Under supervision / Independent	10/5 = 15
Joint aspiration	Observation / Under supervision	1/1 = 2
Bronchoscopy	Observation / Under supervision	5/2 = 7
Tracheostomy	Observation / Under supervision	5/2 = 7
Suprapubic Catheterization	Observation / Under Supervision	2/2
Imaging Modalities		
USG Chest	Observation / Under Supervision	20/5 = 25
Echocardiography	Observation / Under Supervision	20/5 = 25
Abdominal USG / FAST scan	Observation / Under Supervision	20/ 5 = 25

Observation : Residents are expected to ONLY observe the procedure and not actively participate
Under Supervision : Residents will perform the procedure but ONLY under direct supervision
Independent : Residents will perform the procedure without supervision, this will occur only after they have performed the said procedure under supervision

1. Residents are expected to be well versed in method of catheterization in both males and females

Year IV MD Critical Care Medicine

Skill	Competency (Observation / Under Supervision / Independent)	Minimum number required
Peripheral Venous Cannullation	Independent	20
Nasogastric / Orogastric tube insertion	Independent	20
Urinary catheterization	Independent[1]	20
Endotracheal Intubation	Independent	25
Thoracocentesis	Independent	20
Paracentesis	Independent	20
Pericardiocentesis	Under supervision / Independent	2/2 = 4
Central Venous Cannullation	Independent	25
Arterial Cannullation	Independent	25
Tube Thoracostomy	Independent	15
Joint aspiration	Independent	2
Bronchoscopy	Observation / Under supervision	5/5 = 10
Tracheostomy	Observation / Under supervision	5/5 = 10
Suprapubic Catheterization	Observation / Under Supervision	2/2
Imaging Modalities		
USG Chest	Under supervision / Independent	20/5 = 25
Echocardiography	Under supervision / Independent	20/5 = 25
Abdominal USG / FAST scan	Under supervision / Independent	20/ 5 = 25

Observation : Residents are expected to ONLY observe the procedure and not actively participate
Under Supervision : Residents will perform the procedure but ONLY under direct supervision
Independent : Residents will perform the procedure without supervision, this will occur only after they have performed the said procedure under supervision

1. Residents are expected to be well versed in method of catheterization in both males and females

Year V MD Critical Care Medicine

Skill	Competency (Observation / Under Supervision / Independent)	Minimum number required
Peripheral Venous Cannullation	Independent	20
Nasogastric / Orogastric tube insertion	Independent	20
Urinary catheterization	Independent[1]	20
Endotracheal Intubation	Independent	25
Thoracocentesis	Independent	20
Paracentesis	Independent	20
Pericardiocentesis	Independent	2/2 = 4
Central Venous Cannullation	Independent	25
Arterial Cannullation	Independent	25
Tube Thoracostomy	Independent	15
Joint aspiration	Independent	2
Bronchoscopy	Under supervision / Independent	5/5 = 10
Tracheostomy	Under supervision / Independent	5/5 = 10
Suprapubic Catheterization	Under supervision / Independent	2/2
Pulmonary Artery Catheterization	Observation	1
Imaging Modalities		
USG Chest	Under supervision / Independent	20/5 = 25
Echocardiography	Under supervision / Independent	20/5 = 25
Abdominal USG / FAST scan	Under supervision / Independent	20/ 5 = 25

Observation : Residents are expected to ONLY observe the procedure and not actively participate
Under Supervision : Residents will perform the procedure but ONLY under direct supervision
Independent : Residents will perform the procedure without supervision, this will occur only after they have performed the said procedure under supervision

1. Residents are expected to be well versed in method of catheterization in both males and females

Year VI MD Critical Care Medicine

Skill	Competency (Observation / Under Supervision / Independent)	Minimum number required
Peripheral Venous Cannullation	Independent	20
Nasogastric / Orogastric tube insertion	Independent	20
Urinary catheterization	Independent[1]	20
Endotracheal Intubation	Independent	25
Thoracocentesis	Independent	20
Paracentesis	Independent	20
Pericardiocentesis	Independent	2/2 = 4
Central Venous Cannullation	Independent	25
Arterial Cannullation	Independent	25
Tube Thoracostomy	Independent	15
Joint aspiration	Independent	2
Bronchoscopy	Independent	10
Tracheostomy	Independent	10
Suprapubic Catheterization	Independent	4
Pulmonary Artery Catheterization	Observation	1
Imaging Modalities		
USG Chest	Independent	25
Echocardiography	Independent	25
Abdominal USG / FAST scan	Independent	25

Observation : Residents are expected to ONLY observe the procedure and not actively participate
Under Supervision : Residents will perform the procedure but ONLY under direct supervision
Independent : Residents will perform the procedure without supervision, this will occur only after they have performed the said procedure under supervision

1. Residents are expected to be well versed in method of catheterization in both males and females

Requirements of MD Degree for Graduate students Enrolled in the Program

- Fulfillment of University requirements for postgraduate study.
- Six (06) years of consecutive full time advanced study and clinical training.
- Complete and approved master's thesis based on original research during the course of study in an area related to specialty, suitable for publication in a reputable medical journal.
- Must complete all didactic & clinical work in the required curriculum and satisfactorily pass all the University examinations.
- A minimum of 60% must be earned in all work/examinations attempted in the master's program. A grade below this will require re-examination.
- A complete road map for postgraduate MS/MD/MDS can be seen on the university website at
- http://www.szabmu.edu.pk/content/downloads/road-map-forpostgraduate-residents.pdf

INTRODUCTION

INTRODUCTION

The residency program in Critical Care Medicine is a six-year course covering all aspects of Critical Care Medicine, and leading to the degree of Masters of Medicine in Critical Care Medicine

This curriculum has been developed on the basis of COBATRICE model which is indicative of the competencies required at the varying levels of training within the specialty together with the knowledge, skills and attitudes achieved by the trainee in acquiring those competencies.

The training has been based on the current thinking and the requirements for greater protection of the public interest by providing clear information as to the level of training achieved.

- Improved access to specialty training than general practitioners.
- Greater flexibility of training through the availability of multiple instructors.
- Producing a competent workforce with the appropriate skills and knowledge necessary to meet the varying levels of treatment complexity, as well as considering the relative need and demand of potential patients.
- Acquire the experience to carry out research projects, critically evaluate scientific publications and communicate clinical and research papers in journals and conferences.

RATIONALE

RATIONALE

Need of program

This training program is structured keeping in view the need of the society. Following needs are identified through formal and informal discussion with the stakeholders.

- Deficiency of the quality health care providers to public especially in remote areas in the field of Critical Care Medicine.
- Dearth deficiency of competent faculty in the field.
- Deficiency of critical care consultants and intensive care units for pandemic response
- Deficiency of state of the art critical care medicine training center in a government setup.

Purpose of training

The purpose of this curriculum is to guide the training of an individual to the core level of competence required for specialist and consultant. This training will produce consultant who are specialists in their field.

Context of Training

To provide an organized educational program with guidance and supervision, a structured training program will be followed so that each trainee is exposed to different aspects of the subject and acquires special knowledge and skill as expected in this program. The training will provide a basis for the candidate to develop into a lifelong learner who is capable of self-reflection and self-directed learning. It will provide a basis for further ongoing development in the field.

Duration of training

The program leading to MD in Critical Care Medicine will be of 06 years full time.

AIMS & OBJECTIVES

Aims of Training

The aim of six years MD program in Critical Care Medicine is to train residents to acquire the competency of a specialist in the field so that they can become good teachers, researchers and clinicians in their specialty after completion of their training. The candidate should acquire and become proficient in the skills required for Critical Care Medicine with an emphasis on multidisciplinary treatment planning, disease prevention, diagnosis and provision of advanced Critical Care Medicine techniques for those clinical cases meriting specialist care. The candidate should demonstrate attitudes necessary for the achievement of high standards of practice both in relation to the health needs of the population and to his/her own personal development.

Learning Objectives

On completion of training, the trainee will be able to achieve following aptitudes.

1. Access and apply relevant knowledge to clinical practice:

- Apply scientific knowledge in practice
- Appropriate to patient need and context
- Critically evaluate new technology

2. Safely and effectively performs appropriate critical care medicine procedures:

- Consistently demonstrate critical care medicine skills
- Demonstrate procedural knowledge and technical skill at a level appropriate to the level of training
- Demonstrate manual dexterity required to carry out procedures
- Adapt their skills in the context of each patient and procedure

- Maintain and acquire new skills
- Approach and carries out procedures with due attention to safety of patient, self and others
- Critically analyze their own clinical performance for continuous improvement

3. Design and implement effective management plans:

- Recognize the clinical features, accurately diagnose and manage critical care medicine related problems
- Formulate a well-reasoned provisional diagnosis and management plan based on a thorough history and examination
- Formulate a differential diagnosis based on investigative findings
- Manage patients in ways that demonstrate sensitivity to their physical, social, cultural and psychological needs
- Recognize disorders of the human body and differentiate those amenable to surgical treatment
- Effectively manage the care of patients with trauma including multiple system trauma
- Effectively recognize and manage complications
- Accurately identify the benefits, risks and mechanisms of action of current and evolving treatment modalities
- Indicate alternatives in the process of interpreting investigations and in decision-making
- Manage complexity and uncertainty
- Consider all issues relevant to the patient

- Identify risk

- Assess and implement a risk management plan

- Critically evaluate and integrate new technologies and techniques.

4. Organize diagnostic testing, imaging and consultation as needed:

- Select medically appropriate investigative tools and monitoring techniques in a cost-effective and useful manner

- Appraise and interpret appropriate diagnostic imaging and investigations according to patients' needs

- Critically evaluates the advantages and disadvantages of different
- investigative modalities

5. Communicate effectively:

- Communicate appropriate information to patients (and their family) about procedures, potentialities and risks associated with different critical care medicine techniques in ways that encourage their participation in informed decision making

- Communicate with the patient (and their family) the treatment options including benefits and risks of each

- Communicate with and co-ordinate health management teams to achieve an optimal surgical environment

- Initiate the resolution of misunderstandings or disputes

- Modify communication to accommodate cultural and linguistic sensitivities of the patient

6. Recognize the value of knowledge and research and its application to clinical practice:

- Assume responsibility for self-directed learning
- Critically appraise new trends in Critical Care Medicine
- Facilitate the learning of others.

7. Appreciate ethical issues associated with Critical Care Medicine:

- Consistently apply ethical principles
- Identify ethical expectations that impact on medico-legal issues
- Recognize the current legal aspects of informed consent and confidentiality
- Be accountable for the management of their patients.

8. Professionalism by:

- Employing a critically reflective approach to Critical Care Medicine
- Adhering with current regulations concerning workplace harassment
- Regularly carrying out self and peer reviewed audit
- Acknowledging and have insight into their own limitations
- Acknowledging and learning from mistakes.

9. Work in collaboration with members of an interdisciplinary team where appropriate:

- Collaborate with other professionals in the selection and use of various types of treatments assessing and weighing the indications and contraindications associated with each type
- Develop a care plan for a patient in collaboration with members of an interdisciplinary team

- Employ a consultative approach with colleagues and other professionals
- Recognize the need to refer patients to other professionals.

10 . Management and Leadership

- Effective use of resources to balance patient care and system resources
- Identify and differentiate between system resources and patient needs
- Prioritize needs and demands dealing with limited system resources.
- Manage and lead clinical teams
- Recognize the importance of different types of expertise which contribute to the effective functioning of clinical team.
- Maintain clinically relevant and accurate contemporaneous records

11.**Health advocacy**:

- Promote health maintenance of patients
- Advocate for appropriate health resource allocation
- Promote health maintenance of colleagues and self scholar and teacher

ENTRY CRITERIA

Eligibility to apply for MD Critical Care Medicine

For admission in MD Crtical Care Medicine course, the candidate shall be required to have:

- MBBS degree
- Completed one year House Job in Anaesthesia/Medicine/Surgery
- Post house job one year experience in Critical Care Medicine / Medicine & Allied / Anaesthesia in the given order of preference
- Registration with PMDC
- Passed Entry Test conducted by the University & aptitude interview by the Institute concerned
- Having up to the mark credentials as per SZABMU rules (no. of attempts in each professional, any gold medals or distinctions, relevant work experience, Rural/ Army services, research experience in a recognized institution, any research article published in a National or International Journal) may also be considered on case to case basis.

Required Documents

Attested photo copies of the following documents must be attached with application form:

- Computerized National Identity Card (CNIC)
- Domicile certificate
- Matric/O Level, FSc/A Level, Certificates or equivalent
- MBBS degree with detail marks certificates of all professional
- MBBS Attempts certificates of all professional
- NEB pass certificate (for foreign graduates)
- House Job certificates
- PMDC valid permanent registration certificate
- MD Part-I passing certificate
- Experience Certificates (if any)
- Migration Certificate (To be produced at the time of admission)

Admission Procedure

- Details of admission procedure is available on university website at http://www.szabmu.edu.pk/admission/postgraduate-admission

CONTENT OF LEARNING

CONTENT OF LEARNING:

The content of learning will include all the modules and skills mentioned as above plus the following domains as per the COBATRICE syllabus.

The development of the syllabus for the MD Critical Care Medicine program has been based on the CoBaTrICE syllabus developed under the auspices of the European Society of Intensive Care Medicine. It is central to the development of the MD Critical Care Medicine Curriculum that it should be a valid and accepted qualification for the professional practice of Intensive Care Medicine throughout Pakistan.

This syllabus is the aggregate of all the knowledge, skills, behavior and attitudes required for each of the required MD CCM competencies. It is divided into 13 sections: 12 domains plus Basic Sciences. This format inevitably results in some repetition with the same topic appearing in more than one domain and linked to multiple competencies. Similarly there is some cross-over between the knowledge and Basic Sciences, and knowledge and skills lists.

This syllabus can be used by trainees and trainers to aid reflective learning, formal teaching and to guide some aspects of assessment. The syllabus is presented in tables to allow trainees to track the progression of their learning. It is not intended that these tables be used as checklists for the assessment of competence. No trainee can be expected to have a comprehensive knowledge of every single aspect of the syllabus.

Assessment Tools Key

Each competence is mapped to the relevant assessment tools as follows:

Assessment Tools	
Code	**Full name**
D	Direct Observation of procedural Skills [DOPS]
I	ICM Mini- Clinical Evaluation Exercise [ICM-CEX]
C	Case Based Discussion [CBD]
M	Multisource Feedback [MSF]
T	Acute Care Assessment Tool [ACAT]
S	Simulation
E	Examination

Good Medical Practice

Each competence is also mapped to the four domains of Good Medical Practice:

Domains of Good Medical Practice	
Domain	**Descriptor**
1	Knowledge, skills and performance
2	Safety and quality
3	Communication, partnership and teamwork
4	Maintaining trust

Listed below are the competencies for the *MD Critical Care Medicine*, compiled for ease of reference.

Assessment of Domains - I

Assessment on each of the competencies in these domains will be split over the course of the six years and will be done using the assessment tools assigned previously in the curriculum. In addition the guidelines of good medical practice will also be kept in mind while assessing the residents. Trainers and trainees should both be involved in the judgement of competence. Residents should assess and monitor their own progress during the training program and when they believe they are competent, they shall be evaluated by the assigned trainer using the tools described in this curriculum.

Domain Details

Domain 1: Resuscitation and management of the acutely ill patient
1.1 Adopts a structured and timely approach to the recognition, assessment and stabilisation of the acutely ill patient with disordered physiology
1.2 Manages cardiopulmonary resuscitation - ALS recommended
1.3 Manages the patient post resuscitation
1.4 Triages and prioritises patients appropriately, including timely admission to ICU
1.5 Assesses and provides initial management of the trauma patient
1.6 Assesses and provides initial management of the patient with burns
1.7 Describes the management of mass casualties
Domain 2: Diagnosis, Assessment, Investigation, Monitoring and Data Interpretation
2.1 Obtains a history and performs an accurate clinical examination
2.2 Undertakes timely and appropriate investigations
2.3 Performs electrocardiography (ECG / EKG) and interprets the results
2.4 Obtains appropriate microbiological samples and interprets results
2.5 Obtains and interprets the results from blood gas samples
2.6 Interprets imaging studies
2.7 Monitors and responds to trends in physiological variables
2.8 Integrates clinical findings with laboratory investigations to form a differential diagnosis
Domain 3: Disease Management
Acute Disease
3.1 Manages the care of the critically ill patient with specific acute medical conditions
Chronic Disease
3.2 Identifies the implications of chronic and co-morbid disease in the acutely ill patient
Organ System Failure
3.3 Recognises and manages the patient with circulatory failure
3.4 Recognises and manages the patient with, or at risk of, acute renal failure
3.5 Recognises and manages the patient with, or at risk of, acute liver failure
3.6 Recognises and manages the patient with neurological impairment
3.7 Recognises and manages the patient with acute gastrointestinal failure
3.8 Recognises and manages the patient with severe acute respiratory failure/acute lung injury syndromes (ALI/ARDS)
3.9 Recognises and manages the septic patient
3.10 Recognises and manages the patient following intoxication with drugs or environmental toxins
3.11 Recognises life-threatening maternal peripartum complications and manages care
Domain 4: Therapeutic interventions / Organ support in single or multiple organ failure
4. 1 Prescribes drugs and therapies safely
4.2 Manages antimicrobial drug therapy
4.3 Administers blood and blood products safely
4.4 Uses fluids and vasoactive / inotropic drugs to support the circulation
4.5 Describes the use of mechanical assist devices to support the circulation
4.6 Initiates, manages, and weans patients from invasive and non-invasive ventilatory support
4.7 Initiates, manages and weans patients from renal replacement therapy

4.8 Recognises and manages electrolyte, glucose and acid-base disturbances
4.9 Co-ordinates and provides nutritional assessment and support
Domain 5: Practical procedures
Respiratory System
5.1 Administers oxygen using a variety of administration devices
5.2 Performs emergency airway management
5.3 Performs difficult and failed airway management according to local protocols
5.4 Performs endotracheal suction
5.5 Performs fibreoptic bronchoscopy and BAL in the intubated patient
5.6 Performs percutaneous tracheostomy
5.7 Performs chest drain insertion
Cardiovascular System
5.8 Performs arterial catheterisation
5.9 Performs ultrasound techniques for vascular localisation
5.10 Performs central venous catheterisation
5.11 Performs defibrillation and cardioversion
5.12 Performs transthoracic cardiac pacing, describes transvenous
5.13 Describes how to perform pericardiocentesis
5.14 Demonstrates a method for measuring cardiac output and derived haemodynamic variables
Central Nervous System
5.15 Performs lumbar puncture (intradural / 'spinal') under supervision
5.16 Manages the administration of analgesia via an epidural catheter
Gastrointestinal System
5.17 Performs abdominal paracentesis
5.18 Describes Sengstaken tube (or equivalent) placement
5.19 Performs nasogastric tube placement
Genitourinary System
5.20 Performs urinary catheterisation

Domain 6: Perioperative care
6.1 Manages the pre- and post-operative care of the high risk surgical patient
6.2 Manages the care of the patient following cardiac surgery
6.3 Manages the care of the patient following craniotomy
6.4 Manages the care of the patient following solid organ transplantation
6.5 Manages the pre- and post-operative care of the trauma patient under supervision
Domain 7: Comfort and recovery
7.1 Identifies and attempts to minimise the physical and psychosocial consequences of critical illness for patients and families
7.2 Manages the assessment, prevention and treatment of pain and delirium
7.3 Manages sedation and neuromuscular blockade
7.4 Communicates the continuing care requirements of patients, including rehabilitation, at ICU discharge to health care professionals, patients and relatives
7.5 Manages the safe and timely discharge of patients from the ICU
Domain 8: End of life care
8.1 Manages the process of withholding or withdrawing treatment with the multi-disciplinary team
8.2 Discusses end of life care with patients and their families / surrogates
8.3 Manages palliative care of the critically ill patient
8.4 Performs brain-stem death testing
8.5 Manages the physiological support of the organ donor
8.6 Manages donation following cardiac death

Domain 10: Transport
10.1 Undertakes transport of the mechanically ventilated critically ill patient outside the ICU
Domain 11: Patient safety and health systems management
11.1 Leads a daily multidisciplinary ward round
11.2 Complies with local infection control measures
11.3 Identifies environmental hazards and promotes safety for patients & staff
11.4 Identifies and minimises risk of critical incidents and adverse events, including complications of critical illness
11.5 Organises a case conference
11.6 Critically appraises and applies guidelines, protocols and care bundles
11.7 Describes commonly used scoring systems for assessment of severity of illness, case mix and workload
11.8 Demonstrates an understanding of the managerial & administrative responsibilities of the ICM specialist
Domain 12: Professionalism
Communication
12.1 Communicates effectively with patients and relatives
12.2 Communicates effectively with members of the health care team
12.3 Maintains accurate and legible records / documentation
Professional Relationships with patients and relatives
12.4 Involves patients (or their surrogates if applicable) in decisions about care and treatment
12.5 Demonstrates respect of cultural and religious beliefs and an awareness of their impact on decision making
12.6 Respects privacy, dignity, confidentiality and legal constraints on the use of patient data
Professional Relationships with members of the healthcare team
12.7 Collaborates and consults; promotes team-working
12.8 Ensures continuity of care through effective hand-over of clinical information
12.9 Supports clinical staff outside the ICU to enable the delivery of effective care
12.10 Appropriately supervises, and delegates to others, the delivery of patient care
Self Governance
12.11 Takes responsibility for safe patient care
12.12 Formulates clinical decisions with respect for ethical and legal principles
12.13 Seeks learning opportunities and integrates new knowledge into clinical practice
12.14 Participates in multidisciplinary teaching
12.15 Participates in research or audit under supervision

Assessment of Domains - II

Assessment will be primarily undertaken by the supervisors, head of departments / professors of the current unit in which the resident is undergoing training. Input will be taken from the immediate registrars, senior registrars of the critical care medicine program along with a comprehensive peer review while making a final assessment on each domain.

Satisfactory completion of all competencies within each single domain should be confirmed by supervisors. These supervisors are not reassessing the individual competencies but are simply stating that, to the best of their knowledge, the individual competencies within a domain were obtained and documented appropriately.

Year I MD Critical Care Medicine

Basic Sciences:

Student is expected to acquire comprehensive knowledge of Anatomy, Physiology, Pathology (Microbiology), Biochemistry, Pharmacology relevant to Critical Care Medicine based on the CoBaTrICE syllabi. **This knowledge will be evaluated internally and not included in midterm (MTA) examinations OR final examinations.** This may be repeated in different domains as needed.

Anatomy

1) Respiratory system:

TOPICS			
1	Mouth, nose, pharynx, larynx, trachea, main bronchi, segmental bronchi, structure of bronchial tree: differences in the child	**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		

2) Cardiovascular system:

TOPICS			
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		

3) Nervous system:

TOPICS			
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, Intercostal nerves	**8**	Nerves of abdominal wall Nerves of leg and foot
9	Autonomic nervous system Sympathetic innervation, sympathetic chain, ganglia and plexuses Parasympathetic innervation.	**10**	Cranial nerves: base of skull: trigeminal ganglion
11	Innervation of the larynx	**12**	Eye and orbit

4) Vertebral column:

TOPICS			
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		

5) Surface anatomy:

TOPICS			
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	Landmarks for pericardiocentesis	**8**	Landmarks for intrapleural drains and emergency pleurocentesis
9	Abdominal wall (including the inguinal region): landmarks for suprapubic urinary and peritoneal lavage catheters		

6) Abdomen:

Gross anatomy of intra-abdominal organs

Blood supply to abdominal organs and lower body

Physiology & Biochemistry

1) General:

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

2) Biochemistry:

TOPICS			
1	Acid base balance and buffers	**2**	Ions e.g. Na + , K+, Ca++ , Cl-, HCO3-, Mg++, PO4-
3	Cellular and intermediary metabolism; variations between organs	**4**	Enzymes

3) Body fluids:

TOPICS			
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		

4) Haematology & immunology:

TOPICS			
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

5) Muscle:

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

6) Heart & circulation:

TOPICS			
1	The cardiac cycle: pressure and volume relationships	**2**	Control of cardiac output (including the Starling relationship)
3	Fluid challenge and heart failure	**4**	Electrocardiogram and arrhythmias
5	Neurological and humoral control of systemic blood pressures, blood volume and blood flow	**6**	Peripheral circulation: capillaries, vascular endothelium and arteriolar smooth muscle
7	Autoregulation and the effects of sepsis and the inflammatory response on the peripheral vasculature	**8**	Characteristics of special circulations including: pulmonary, coronary, cerebral, renal, portal and foetal

7) Renal tract:

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

8) Respiration:

TOPICS			
1	Gaseous exchange: O2 and CO2 transport, hypoxia and hyper- and hypocapnia, 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
5	Mechanics of ventilation: ventilation/perfusion abnormalities	**6**	Control of breathing, acute and chronic ventilatory failure, effect of oxygen therapy
7	Non-respiratory functions of the lungs	**8**	Cardio-respiratory interactions in health & disease

9) Nervous system:

TOPICS			
1	Functions of nerve cells: action potentials, conduction, synaptic mechanisms and transmitters	**2**	The brain: functional divisions Intracranial pressure: cerebrospinal fluid, blood flow
3	Spinal cord: anatomy and blood supply, effects of spinal cord section	**4**	Autonomic nervous system: functions
5	Neurological reflexes	**6**	Motor function: spinal and peripheral
7	Pain: afferent nociceptive pathways, dorsal horn, peripheral and central mechanisms, neuromodulatory systems, supraspinal mechanisms, visceral pain, neuropathic pain, influence of therapy on nociceptive mechanisms		

10) Liver:

Functional anatomy and blood supply
Metabolic functions
Tests of function

11) Gastrointestinal system:

TOPICS			
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

12) Metabolism & nutrition:

TOPICS			
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		

13) Endocrinology:

TOPICS			
1	Mechanisms of hormonal control: feedback mechanisms, effect on membrane and intracellular receptors	**2**	Central neuro-endocrine interactions
3	Adrenocortical hormones	**4**	Adrenal medulla: adrenaline (epinephrine) and noradrenaline (norepinephrine)
5	Body temperature and its regulation	**6**	Pancreas: insulin, glucagon and exocrine function
7	Thyroid and parathyroid hormones and calcium homeostasis		

14) Pregnancy:

TOPICS			
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

1) Principles of pharmacology:

TOPICS			
1	Dynamics of drug-receptor interaction.	**2**	Agonists, antagonists, partial agonists Receptor function and regulation.
3	Enzyme inducers and inhibitors	**4**	Mechanisms of drug action Mechanisms of drug interactions:
5	Action of gases and vapours	**6**	Effects of metabolites and other degradation products.
7	Inhibition and promotion of drug uptake. Competitive protein binding. Receptor inter-actions.		

2) Pharmacokinetics & pharmacodynamics:

TOPICS			
1	Drug uptake from: gastrointestinal tract, lungs, nasal, transdermal, subcutaneous, IM, IV, epidural and intrathecal routes	**2**	Adverse reactions to drugs: hypersensitivity, allergy, anaphylaxis Bioavailability
3	Modes of drug elimination: - Direct excretion - Metabolism in organs of excretion: phase I & II mechanisms - Renal excretion and urinary pH - Non-organ breakdown of drugs	**4**	Effects of acute organ failure (liver, kidney) on drug elimination Influence of renal replacement therapies on clearance of commonly used drugs
7	Inhibition and promotion of drug uptake. Competitive protein binding. Receptor inter-actions.		

Systemic pharmacology:

TOPICS			
1	Hypnotics, sedatives and intravenous anaesthetic agents Neuromuscular blocking agents (depolarising and non-depolarising) and anti-cholinesterases	**2**	Simple analgesics Opioids and other analgesics; Opioid antagonists Non-steroidal anti-inflammatory drugs
3	Drugs acting on the autonomic nervous system (including inotropes, vasodilators, vasoconstrictors, antiarrhythmics, diuretics)	**4**	Drugs acting on the respiratory system (including respiratory stimulants and bronchodilators)
5	Antihypertensives	**6**	Anticonvulsants
7	Anti-diabetic agents	**8**	Diuretics
9	Antibiotics	**10**	Corticosteroids and other hormone preparations
11	Antacids. Drugs influencing gastric secretion and motility	**12**	Antiemetic agents
13	Local anaesthetic agents	**14**	Immunosuppressants
15	Principles of therapy based on modulation of inflammatory mediators indications, actions and limitations	**16**	Plasma volume expanders
17	Antihistamines	**18**	Antidepressants
19	Anticoagulants	**20**	Vitamins A-E, folate, B12

Physics & clinical measurement

TOPICS			
1	**Mathematical concepts:** i. Relationships and graphs ii. SI units: fundamental and derived units iii. Other systems of units where relevant to ICM (e.g. mmHg, bar, atmospheres) iv. Simple mechanics: Mass, Force, Work and Power	**2**	**Gases & vapours:** i. Absolute and relative pressure. ii. The gas laws; triple point; critical temperature and pressure. iii. Density and viscosity of gases. iv. Laminar and turbulent flow; Poiseuille's equation, the Bernoulli principle v. Measurement of volume and flow in gases and liquids. vi. Principles of surface tension
3	**Electricity & magnetism:** i. Amplification of biological potentials: ECG, EMG, EEG. ii. Sources of electrical interference iii. Processing, storage and display of physiological measurements.	**4**	**Electrical safety:** i. Principles of cardiac pacemakers and defibrillators ii. Electrical hazards: causes and prevention. iii. Electrocution, fires and explosions. iv. Diathermy and its safe use v. Basic principles and safety of lasers vi. Basic principles of ultrasound and the Doppler effect
5	**Pressure & flow monitoring:** i. Principles of pressure transducers ii. Resonance and damping, frequency response iii. Measurement and units of pressure. iv. Direct and indirect methods of blood pressure measurement; arterial curve analysis v. Principles of pulmonary artery and wedge pressure measurement vi. Cardiac output: Fick principle, thermodilution	**6**	**Clinical measurement:** i. 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 ii. Measurement of H+, pH, pCO_2 , pO_2 iii. Measurement CO_2 production/ oxygen consumption/ respiratory quotient iv. Simple tests of pulmonary function e.g. peak flow measurement, spirometry. v. Capnography vi. Pulse oximetry vii. Measurement of neuromuscular blockade viii. Measurement of pain

Research methods

<table>
<tr><td colspan="4">TOPICS</td></tr>
<tr><td>1</td><td><u>Data collection:</u>
i. Simple aspects of study design (research question, selection of the method of investigation, population, intervention, outcome measures)
ii. Power analysis
iii. Defining the outcome measures and the uncertainty of measuring them
iv. The basic concept of meta-analysis and evidence based medicine</td><td>2</td><td><u>Descriptive statistics:</u>
i. Types of data and their representation
ii. The normal distribution as an example of parametric distribution
iii. Indices of central tendency and variability</td></tr>
<tr><td>3</td><td colspan="3"><u>Deductive & inferential statistics:</u>
i. Simple probability theory and the relation to confidence intervals
ii. The null hypothesis.
iii. Choice of simple statistical tests for different data types
iv. Type I and type II errors.
v. Inappropriate use of statistics</td></tr>
</table>

Year I MD Critical Care Medicine

DOMAIN I : RESUSCITATION & INITIAL MANAGEMENT OF ACUTELY ILL PATIENT

Knowledge

1) Early warning signs of impending critical illness

2) Causes of cardio-respiratory arrest, identification of patients at risk and corrective treatment of reversible causes

3) Clinical signs associated with critical illness, their relative importance and interpretation

4) Clinical severity of illness and indications when organ dysfunctions or failure are an immediate threat to life

5) Recognition of life threatening changes in physiological parameters

6) Measures of adequacy of tissue oxygenation

7) Causes, recognition and management of:

- **Acute chest pain**
- **Tachypnoea & dyspnea**
- **Upper and lower airway obstruction**
- **Pulmonary oedema**
- **Pneumothorax (simple & tension)**
- **Hypoxaemia**
- **Hypotension**
- **Shock states**
- **Anaphylactic and anaphylactoid reactions**
- **Hypertensive emergencies**
- **Acute confusional states and altered consciousness**
- **Acute seizures / convulsions**
- **Oliguria & anuria**
- **Acute disturbances in thermoregulation**
- **Acute abdominal pain**

8) Treatment algorithms for common medical emergencies

9) Immediate management of acute coronary syndromes

10) Methods for assessing neurological function e.g. Glasgow Coma Scale

11) Methods for securing vascular access rapidly

12) Surface anatomy: structures in the antecubital fossa; large veins and anterior triangle of the neck; large veins of the leg and femoral triangle

13) Intraosseous cannulation

14) Techniques for effective fluid resuscitation

15) Principles of blood and blood component therapy; principles of massive transfusion

16) Treatment strategies for abnormalities of fluid, electrolyte, acid-base and glucose balance

17) Cardiopulmonary resuscitation

18) The modification of resuscitation techniques in the special circumstances of hypothermia, immersion and submersion, poisoning, pregnancy, electrocution, anaphylaxis, acute severe asthma and trauma

19) Risks to the rescuer during resuscitation & methods to minimise these

20) Indications for and methods of ventilatory support

21) Basic and complex cardiac arrhythmias - recognition and management (pharmacological and electrical)

22) Indications, doses and actions of primary drugs used in the management of a cardiac arrest (inc. special precautions and contraindications)

23) Tracheal route for drug administration: indications, contraindications, dosage

24) Indications, dosages and actions of drugs used in the peri-arrest period

25) Cardiac arrhythmias and the principles of their management (treatment algorithm): Peri-arrest arrhythmias (bradycardia, broad complex tachycardia, atrial fibrillation, narrow complex tachycardia) ; ventricular fibrillation (VF) and pulse-less ventricular tachycardia (VT); Non-VF / VT rhythms (asystole / PEA)

26) Defibrillation: principles of monophasic & biphasic defibrillators; mechanism, indications, complications, modes and methods (manual and automated external defibrillators (AED))

27) Electrical safety: conditions which predispose to the occurrence of macro-shock / micro-shock; physical dangers of electrical currents; relevant standards regarding safe use of electricity in patient care; basic methods to reduce electrical hazards.

28) Indications and methods of cardiac pacing in the peri-arrest setting

29) Effect of cardio-respiratory arrest on body systems

30) Principles and application of therapeutic hypothermia

31) Audit of outcome after cardiac arrest

32) Indications for not starting resuscitation or ceasing an initiated attempt

33) Legal and ethical issues relating to the use of the recently dead for practical skills training, research and organ donation

34) Relevance of prior health status in determining risk of critical illness and outcomes

35) Triage and management of competing priorities

36) Criteria for admission to, and discharge from ICU - factors influencing intensity and site of care (ward, high dependency unit (HDU), intensive care unit (ICU))

37) Performance and interpretation of a primary and secondary survey

38) Environmental hazards & injuries: hypo- and hyperthermia, near-drowning, electrocution, radiations, chemical injuries, electrical safety/micro shock

39) Relevance of mechanism of injury to clinical presentation

40) Effects and acute complications of severe trauma on organs and organ systems:

41) Respiratory - thoracic trauma; acute lung injury; tension pneumothorax

42) Cardiovascular - hypovolaemic shock; cardiac tamponade

43) Renal - acute renal failure; rhabdomyolysis

44) Neurological - altered consciousness; traumatic brain injury; post-anoxic brain injury; coup and contra-coup injuries; intracranial haemorrhage and infarction; spinal cord injury

45) Gastrointestinal - abdominal trauma; abdominal tamponade; rupture of liver or spleen

46) Musculoskeletal system - soft tissue injury; short term complications of fractures; fat embolism; crush injury & compartment syndromes; maxillofacial injuries

47) Secondary insults that potentiate the primary injury

48) Immediate specific treatment of life-threatening injury

49) Management of cervical spine injuries

50) Principles of management of closed head injury; coup and contra-coup injuries; methods of preventing 'secondary insult' to the brain; recognition and immediate management of raised intracranial pressure

51) Management of severe acute haemorrhage and blood transfusion; correction of coagulation disorders and haemoglobinopathies

52) Principles, including indications, limitations and therapeutic modalities of basic radiological methods, CT scanning, MRI, ultrasound, angiography and radio nucleotide studies in the critically ill patient

53) Indications for and basic interpretation of chest radiographs: range of normal features on a chest x-ray; collapse, consolidation, infiltrates (including ALI/ARDS), pneumothorax, pleural effusion, pericardial effusion, position of cannulae, tubes or foreign bodies, airway compression, cardiac silhouette, mediastinal masses

54) Principles of outcome prediction / prognostic indicators and treatment intensity scales; limitations of scoring systems in predicting individual patient outcome

55) Pathophysiology and medical/surgical management of the phases of a burn injury

56) Calculation of area burned

57) Principles of calculation of fluid losses & fluid resuscitation in the burned patient

58) Respiratory complications of burn injuries (smoke inhalation, airway burns) - detection and management

59) Burn-related compartment syndrome and escharotomy

60) The environmental control necessary for optimal care of the burned patient

61) Recognition and management of acute disturbances in thermoregulation

62) Prevention of infection in the burned patient

63) Organisational principles for the coordination and management of mass casualties

64) Characteristics and clinical presentations associated with major incidents caused by natural or civilian disasters, infection epidemics or terrorist attack

65) Local major incident plan - the role of the ICU in hospital/community disaster plans

66) Communication tasks and personal role in major incident / accident plan

67) Principles of internal hospital communication

68) Management of public relations and information

69) Alternative forms of external communication

70) Triage methods in use locally

71) Decontamination procedures

72) Principles of crisis management, conflict resolution, negotiation and debriefing

73) Psychological support for patients and relatives

74) Principles of oxygen therapy and use of oxygen administration devices

75) Principles of emergency airway management

76) Management of difficult or failed airway management

77) Surgical techniques to obtain vascular access

Skills & Behaviours

Consider legal and ethical issues: patient autonomy, appropriateness of resuscitation and ICU admission

Conduct a primary survey: obtain relevant information rapidly and accurately

Recognise signs and symptoms of impending cardiac arrest

Assess conscious level, status of airway and cervical spine, and conduct careful systems review

Order and prioritise appropriate investigations

Use emergency monitoring equipment

Monitor vital physiological functions as indicated

Recognise and rapidly respond to adverse trends in monitored parameters

Check & assemble resuscitation equipment

Demonstrate advanced life support skills (ALS standard or equivalent)

Use a defibrillator safely

Initiate routine investigations during resuscitation to exclude reversible problems (e.g. hyperkalaemia)

Recognise and manage choking / obstructed airway

Implement emergency airway management, oxygen therapy and ventilation as indicated

Demonstrate emergency relief of tension pneumothorax

Obtain vascular access sufficient to manage acute haemorrhage, rapid fluid infusion and monitor cardiovascular variables

Initiate emergency cardiac pacing

Act appropriately as a member or leader of the team (according to skills & experience)

Respond to an emergency in a positive, organised and effective manner; able to direct the resuscitation team

Support relatives witnessing an attempted resuscitation

Participate in timely discussion and regular review of 'do not resuscitate' orders and treatment limitation decisions

Assess and communicates effectively the risks and benefits of intensive care admission

Discuss treatment options with a patient or relatives before ICU admission

Take decisions to admit, discharge or transfer patients

Consider the need for stabilisation before transfer

Determine when the patient's needs exceed local resources or specialist expertise (requirement for transfer)

Explain life-sustaining therapies, in clear language, and describe the expected outcome of such therapies in view of the patient's goals and wishes.

Professional and reassuring approach - generates confidence and trust in patients and their relatives

Assess and document Glasgow Coma Scale (GCS)

Examine and plan care for the confused patient

Perform a comprehensive secondary survey; integrate history with clinical examination to form a differential diagnosis

Prioritise the order of investigations and interventions for individual injuries according to their threat to life

Protect a potentially unstable cervical spine

Assess, predict and manage circulatory shock

Assess burn severity and prescribe initial fluid resuscitation

Estimate burn wound mortality from published data tables

Describe the endpoints of burn resuscitation and preferred fluids

Prescribe appropriate analgesia

Identify or describe risk factors for airway compromise in the burned patient

Identification and management of carbon monoxide poisoning

Lead, delegate and supervise others appropriately according to expertise

Attitudes

Rapid response to resuscitation

Appreciates the importance of timely institution of organ-system support

Recognises the need for supportive care for all organ systems whether failing / injured or not

Clear in explanations to patient, relatives and staff

Consult and take into account the views of referring clinicians; promote their participation in decision making where appropriate

Establishes trusting relationships with and demonstrates compassionate care of patients and their relatives

Patient safety is paramount

Determination to provide best and most appropriate care possible regardless of environment

Appreciate the importance of ensuring physiological safety as a primary aim

Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 2: DIAGNOSIS: ASSESSMENT, INVESTIGATION, MONITORING AND DATA INTERPRETATION

Knowledge

Importance and principles of obtaining an accurate history of the current condition, comorbidities and previous health status using appropriate sources of information

Clinical signs associated with critical illness, their relative importance and interpretation

Sources and methods of obtaining clinical information

Relevance of prior health status in determining risk of critical illness and outcomes

Significance and impact of co-morbid disease on the presentation of acute illness

Impact of drug therapy on organ-system function

Indications for and the selection of suitable methods of monitoring or investigation taking into account their accuracy, convenience, reliability, safety, cost and relevance to the patient's condition.

Sensitivity and specificity of the investigation as related to a specific disease

Appropriate use of laboratory tests to confirm or refute a clinical diagnosis

Methods and routes of obtaining samples - associated indications and complications

Indications, limitations and basic interpretation of laboratory investigations of blood and other body fluids (e.g. urine, CSF, pleural and ascitic fluids):

- Haematology

- Immunology

- Cytology

- Blood grouping and x-matching

- Urea, creatinine, glucose, electrolytes and lactate

- Liver function tests

- Drug levels in blood or plasma

- Tests of endocrine function (diabetes, thyroid disorders, adrenal failure)

- Blood gas samples (arterial, venous and mixed venous)

- Microbiological surveillance and clinical sampling

- Haematology

- Immunology

- Cytology

- Blood grouping and x-matching

- Urea, creatinine, glucose, electrolytes and lactate

- Liver function tests

- Drug levels in blood or plasma

- Tests of endocrine function (diabetes, thyroid disorders, adrenal failure)

- Blood gas samples (arterial, venous and mixed venous)

- Microbiological surveillance and clinical sampling

Types of organisms - emergence of resistant strains, mode of transfer, opportunistic and nosocomial infections; difference between colonisation & infection

Universal precautions and preventative infection control techniques (hand washing, gloves, protective clothing, sharps disposal etc.)

Principles of aseptic technique and aseptic handling of invasive medical devices

Local patterns of bacterial resistance and antibiotic policy; difference between contamination, colonisation and infection

Interpretation of information from monitoring devices, and identification of common causes of error; principles of monitoring trends of change and their significance

Hazards of inappropriate monitoring including misuse of alarms; principles of disconnection monitors

Principles of invasive pressure monitoring devices: components & functions of an electromanometer system (catheter, tubing, transducer, amplifier and display unit); zero and calibration techniques; dynamics of the system - natural frequency and damping

Anatomy and physiology of the heart and cardiovascular system

Principles of haemodynamic monitoring - invasive & non invasive methods, indications & limitations, physiological parameters and waveform interpretation

Recognition of life threatening changes in physiological parameters

Invasive & non-invasive systems available for measuring cardiac output and derived haemodynamic variables, the principles involved and the type and site of placement of the monitoring device

Interpretation of, relationships between, sources of error and limitations of measured and derived cardiovascular variables including pressure, flow, volume and gas transport

Methods for measuring temperature

Principles, indications and limitations of pulse oximetry

Principles of ECG monitoring (heart rate, rhythm, conduction, ST segment change & QT interval) - indications, limitations and techniques. Advantages and disadvantages of different lead configurations

Clinical measurement: pH, pCO_2, pO_2, SaO_2, FiO_2, CO_2 production, oxygen consumption, respiratory quotient

Principles of monitoring ventilation - significance of respiratory rate, tidal volume, minute volume, mean, peak, end expiratory and plateau pressure, intrinsic and extrinsic PEEP, inspired oxygen

concentration, arterial blood gas and acid base status; relationship between mode of ventilation and choice of parameters monitored; airflow and airway pressure waveforms

Physical principles, indications and limitations of end tidal CO2 monitoring, and relationship

between end tidal CO2 and arterial pCO2 in various clinical circumstances

Surface anatomy: structures in the antecubital fossa; large veins and anterior triangle of the neck; large veins of the leg and femoral triangle; arteries of the arms and legs

Pre-analytical errors of arterial blood gas sampling (choice of sample site, sampling device, heparin, mixing, storage and transport)

Homeostatic regulation of acid base balance and buffer ions (e.g. Na+, K+, Ca++, Cl-, HCO3-, Mg++, PO4-)

Respiratory physiology: gas exchange, O2 and CO2 transport, hypoxia, hypo- and hypercarbia, functions of haemoglobin in oxygen carriage and acid-base balance

Renal physiology: regulation of fluid and electrolyte balance

Methods for assessing pain and sedation

Methods for assessing neurological function e.g. Glasgow Coma Scale

Systems available for intracranial pressure monitoring - indications, principles, type and site of placement of the monitoring device, data collection and trouble-shooting

Indications and techniques of jugular bulb oximetry

Principles, including indications, limitations and therapeutic modalities of basic radiological methods, CT scanning, MRI, ultrasound, angiography and radio nucleotide studies in the critically ill patient

Risks to patient and staff of radiological procedures and precautions to minimise risk

Indications for and basic interpretation of chest radiographs: range of normal features on a chest x-ray; collapse, consolidation, infiltrates (including ALI/ARDS), pneumothorax, pleural effusion, pericardial effusion, position of cannulae, tubes or foreign bodies, airway compression, cardiac silhouette, mediastinal masses

Effect of projection, position, penetration and other factors on the image quality

Basic interpretation of radiological investigations:

- Neck and thoracic inlet films

- X-rays of abdominal fluid levels / free air

- X-rays of long bone, skull, vertebral and rib fractures

- CT or MRI scans of head demonstrating fractures / haemorrhage

- Ultrasound of the abdomen (liver, spleen, large abdominal vessels, kidney, urinary bladder)

- Echocardiography (ventricular function, filling status, valve abnormality, size of the heart, any akinetic or dyskinetic segments, pericardial effusion with or without evidence of tamponade)

Principles, indications, limitations and basic interpretation of:

- Respiratory function tests
- Diagnostic bronchoscopy
- Diagnostic ECG (EKG)
- Echocardiography
- Electroencephalogram (EEG) and evoked potentials
- Intra-abdominal pressure monitoring
- Intrathoracic pressure (oesophageal pressure) measurements
- Fluid input-output monitoring
- Basic principles of ultrasound and the Doppler effect

Skills & Behaviours

Examine patients, elicit and interpret clinical signs (or relevant absence of clinical signs) in the ICU environment

Obtain relevant information from the patient, relatives and other secondary sources

Professional and reassuring approach - generates confidence and trust in patients and their relatives

Listen effectively

Integrate history with clinical examination to create a diagnostic and therapeutic plan

Acquire, interpret, synthesize, record, and communicate (written and verbal) clinical information

Develop a working, and limited differential diagnosis based on presenting clinical features

Recognise impending organ system dysfunction

Order and prioritise appropriate investigations

In emergency situations, confirm or refute early diagnoses before data collection / analysis is complete - make contingency plans based on these diagnoses to combat further threats to the patient's life

Integrate clinical findings with results of investigations

Interpret laboratory results in the context of the patient's condition

Evaluate benefits and risks related to specific investigations

Monitor vital physiological functions as indicated

Obtain and accurately record data from monitors

Set monitor alarms appropriately

Differentiate real change from artefact & respond appropriately

Identify deviations from normal range and interpret these in the context of the clinical circumstances

Recognise and rapidly respond to adverse trends in monitored parameters

Recognise patterns in trends - early diagnosis and outcome prediction

Review the need for continued monitoring regularly Use emergency monitoring equipment

Obtain and interpret data from:

- **Invasive and non-invasive arterial blood pressure measurement**
- **ECG / EKG (3 and 12 lead)**
- **Central venous catheters**
- **Pulmonary artery catheters or oesophageal Doppler**
- **Pulse oximetry**
- **FVC, spirometry and peak flow measurement**
- **Inspired and expired gas monitoring for O2, CO2 and NO**
- **Intracranial pressure monitoring**
- **Jugular bulb catheters and SjO2 monitoring**

Set and interpret data from ventilator alarms

Obtain blood gas samples using aseptic techniques; interpret data from arterial, central venous or mixed venous samples

Confirm adequate oxygenation and control of PaCO2 and pH

Obtain blood cultures using aseptic techniques

Interpret chest x-rays in a variety of clinical contexts

Interpret data from scoring or scaling systems to assess pain and sedation

Assess and document Glasgow Coma Scale (GCS)

Recognise changes in intracranial and cerebral perfusion pressure which are life threatening

Identify abnormalities requiring urgent intervention

Recognise significant changes and the need for repeated testing (i.e. that a single normal result is not as significant as identifying trends of change by repeated testing where indicated)

Document investigations undertaken, results and action taken

Assemble clinical and laboratory data, logically compare all potential solutions to the patient's problems, prioritise them and establish a clinical management plan

Undertake further consultation / investigation when indicated

Communicate effectively with radiological colleagues to plan, perform and interpret test results

Communicate and collaborate effectively with all laboratory staff

Lead, delegate and supervise others appropriately according to experience and role

Attitudes
Consults, communicates and collaborates effectively with patients, relatives and the health care team
Promotes respect for patient privacy, dignity and confidentiality
Avoids extensive invasive procedures or monitoring which can not be adequately interpreted at the bedside
Minimises patient discomfort in relation to monitoring devices
Responds rapidly to acute changes in monitored variables
Ensures safe and appropriate use of equipment
Supports other staff in the correct use of devices
Considers patient comfort during procedures / investigations
Avoids unnecessary tests
Demonstrates compassionate care of patients and relatives
Desire to minimise patient distress
Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

DOMAIN 3: DISEASE MANAGEMENT

Knowledge

Pathophysiology, diagnosis and management of commonly encountered acute and chronic medical conditions including:

***RESPIRATORY DISORDERS*: the unprotected airway; pneumonia, lung or lobar collapse, asthma, chronic obstructive airways disease, pulmonary oedema, acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) and their causative factors; pulmonary haemorrhage, pulmonary embolus, pleural effusion, pneumothorax (simple and tension); upper and lower airway obstruction including epiglottitis, respiratory muscle disorders; pulmonary fibrosis; pulmonary thrombo-embolic disease**

***CARDIOVASCULAR DISORDERS:* shock states (anaphylactic, cardiogenic, hypovolaemic, septic); crescendo / unstable / chronic angina; acute myocardial infarction; left ventricular failure; chronic heart failure; cardiomyopathies; valvular heart disease and prosthetic valves; vaso-occlusive diseases; pulmonary hypertension; right ventricular failure; cor pulmonale; malignant hypertension; cardiac tamponade; common arrhythmias and conduction disturbances, pacing box failure; peripheral vascular disease**

***NEUROLOGICAL DISORDERS*: acute confusional states and coma; post-anoxic brain damage; intracranial haemorrhage and infarction; sub-arachnoid haemorrhage; cerebro-vascular accidents (CVA / stroke); convulsions and status epilepticus; meningitis and encephalitis; medical causes of raised intracranial pressure; acute neuromuscular diseases causing respiratory difficulty (e.g. Guillain-Barre, myasthenia gravis, malignant hyperpyrexia); critical illness polyneuropathy, motor neuropathy and myopathy; cerebro-vascular accidents (CVA / stroke); dementia**

***RENAL AND GENITO-URINARY DISORDERS*: urological sepsis; acute renal failure; chronic renal failure; renal manifestations of systemic disease including vasculitides; nephrotoxic drugs and monitoring; rhabdomyolysis**

***GASTROINTESTINAL DISORDERS*: peptic/stress ulceration; upper GI haemorrhage; diarrhoea and vomiting; pancreatitis; cholecystitis; jaundice; acute and chronic liver failure; fulminant hepatic failure; paracetamol (acetaminophen)-induced liver injury; cirrhosis; inflammatory bowel diseases; peritonitis; ascites; mesenteric infarction; perforated viscus; bowel obstruction & pseudo-obstruction; abdominal trauma; intra-abdominal hypertension & compartment syndrome; short-bowel syndrome; rupture of liver or spleen.**

***HAEMATOLOGICAL AND ONCOLOGICAL DISORDERS*: disseminated intravascular coagulation (DIC) and other coagulation disorders, hemolytic syndromes, acute and chronic anaemia, immune disorders; lymphoproliferative disorders. High risk groups: the immunosuppressed or immunoincompetent patient, chemotherapy, agranulocytosis and bone marrow transplant patients. Massive blood transfusion. Malignancy including complications of chemotherapy and radiotherapy**

***INFECTIONS*: pyrexia and hypothermia; organ-specific signs of infection including haematogenous (venous catheter-related, endocarditis, meningococcal disease), urological, pulmonary, abdominal**

(peritonitis, diarrhoea), skeletal (septic arthritis) soft tissue and neurological. Pyometra. Septic abortion. Organisms causing specific infections: Gram positive and Gram negative bacteria, fungi, protozoa, viruses; nosocomial infections

METABOLIC DISORDERS: **electrolyte disorders; acid-base disorders; fluid-balance disorders; thermoregulation and associated disorders**

ENDOCRINE DISORDERS: **critical illness-induced hyperglycaemia; diabetes mellitus; over- and under-activity of thyroid; adrenal and pituitary disorders; sepsis-induced relative adrenal insufficiency; endocrine emergencies**

Treatment algorithms for common medical emergencies

Diagnosis and management of other acute medical conditions until appropriate specialist assistance is available

Definitive / long term management of commonly encountered acute medical conditions

Investigation of impaired organ function

Range of therapeutic interventions available to support organ function and treat the underlying causes

Multi-system effects of acute medical conditions and implications for clinical management

Indications and contraindications for treatment; circumstances when treatment is unnecessary or futile

Therapies available for the treatment of commonly encountered medical conditions, their efficacy and potential side-effects

Complications of specific therapies, their incidence and management

Concept of risk : benefit ratio and cost effectiveness of therapies

Complications of the disease processes; effects of disease and its treatments on other organ systems

Effects of concomitant treatment and/or co-morbid conditions on an individual patient's response to treatment

Impact of occupational and environmental exposures, socio-economic factors, and life style factors on critical illness

Principles of outcome prediction / prognostic indicators and treatment intensity scales; limitations of scoring systems in predicting individual patient outcome

Causes and consequences of decompensation in chronic organ failure; diagnosis and management of acute-on-chronic organ failure

Long term effects of acute medical conditions and late complications

Pathogenesis of multiple organ dysfunction (MODS) and the inflammatory response in relation to organ system dysfunction

Risk factors, recognition and assessment of single or multiple organ failure

Cardiopulmonary resuscitation

Techniques for effective fluid resuscitation

Use of fluids and vasoactive / inotropic / anti-arrhythmic drugs to support the circulation (see 4.4)

Use of mechanical assist devices to support the circulation (see 4.4)

Indications, complications, interactions, selection, monitoring, and efficacy of common antimicrobial drugs (antibacterial, antifungal, antiviral, antiprotozoal, antihelmintics)

Local patterns of bacterial resistance and antibiotic policy; difference between contamination, colonisation and infection

Safe use of therapies which modify the inflammatory response

Principles of management of closed head injury

Coup and contra-coup injuries

Methods of preventing the 'second insult' to the brain

Methods for assessing neurological function e.g. Glasgow Coma Scale

Principles of cerebral perfusion pressure, cerebral oxygenation and the methods by which they may be optimised

Factors and therapies which may influence intracranial and cerebral perfusion pressure

Application of techniques to treat or induce hypo/hyperthermia

Systems available for intracranial pressure monitoring - indications, principles, type and site of placement of the monitoring device, data collection and trouble-shooting

Cerebral spinal fluid (CSF) drainage for raised ICP

Indications, contraindications and complications of lumbar puncture (see 5.18)

Management of vasospasm

Principles of measurement of jugular venous saturation, cerebral Doppler velocities and cerebral blood flow.

Principles, indications and limitations of electroencephalogram (EEG) and evoked potentials

Indications for urgent imaging of the brain and neurosurgical consultation

Functions of the liver - biosynthetic, immunologic, and detoxification

Signs and symptoms of acute liver failure and assessment of severity

Causes and complications of acute and acute-on-chronic liver failure, their prevention and management

Supportive therapy for the failing liver including extracorporeal liver support and indications for emergency liver transplantation

Principles and techniques for insertion of gastro-oesophageal balloon tamponade tube (e.g. Sengstaken-Blakemore)

Etiology and management of raised intracranial pressure (ICP)

Hepatotoxic drugs and adjustment of drug doses in hepatic impairment / failure

Indications for transcutaneous & transjugular liver biopsies and transjugular intrahepatic portosystemic shunt (TIPSS)

Principles of blood glucose control: indications, methods, monitoring of safety & efficacy

Causes and complications of renal failure - methods to prevent or treat these

Signs, symptoms and causes of renal failure (acute / chronic / acute on chronic) and indications for intervention

Distinguishing features of acute versus chronic renal failure and implications for management

Investigation of impaired renal function

Indications, complications and selection of renal replacement therapies (continuous and intermittent)

Nephrotoxic drugs and adjustment of drug doses in renal impairment/failure

Urinary catheterisation techniques: transurethral and suprapubic

Factors and therapies which may influence intra-abdominal pressure; etiology and management of raised intra-abdominal pressure

Principles of nutritional assessment and support (see 4.9)

Signs and symptoms of acute airway insufficiency and acute respiratory failure, and indications for intervention

Causes of respiratory failure, their prevention and management

Indications for and methods of invasive and non-invasive mechanical ventilation Modes of mechanical ventilation - indications, contraindications & expected results of each mode (CMV, IRV, PRVC, HFOV, SIMV, PS, CPAP, BiPAP, NIV)Initial set-up and modification of ventilator settings according to the condition or response of the patient

Lung protective ventilation for acute lung injury (ALI)

Pharmacological and non-pharmacological adjunct therapies for ALI

Detection and management of haemo/pneumothorax (simple and tension)

Principles of weaning from mechanical ventilation and factors which may inhibit weaning

Potential adverse effects and complications of respiratory support and methods to minimise these

Indications for and basic interpretation of chest radiographs: range of normal features on a chest x-ray; collapse, consolidation, infiltrates (including ALI/ARDS), pneumothorax, pleural effusion, pericardial effusion, position of cannulae, tubes or foreign bodies, airway compression, cardiac silhouette, mediastinal masses

Ventilator associated pneumonia: definition, pathogenesis and prevention

Principles of extra-corporeal membrane oxygenation (ECMO)

Pathogenesis, definitions and diagnostic criteria of sepsis, severe sepsis, septic shock and systemic inflammatory response syndrome (SIRS)

Occult indicators of sepsis

Causes, recognition and management of sepsis-induced organ dysfunction; multi-system effects of sepsis and their impact on clinical management

Prognostic implications of multiple systems dysfunction or failure

Evidence based guidelines: sepsis care bundles - rationale and indications; principles of early goal-directed therapy

Signs and symptoms of acute intoxication associated with common intoxicants

Multi-system effects of acute intoxication and implications for clinical management

General supportive therapy and specific antidotes pertinent to individual intoxicants

Specific management of poisoning with aspirin, paracetamol/acetaminophen, paraquat, carbon monoxide, alcohol, ecstasy, tricyclic and quadricyclic antidepressants

Strategies to reduce absorption and enhance elimination (haemodialysis, haemoperfusion, gastric lavage and charcoal therapy)

Pharmacology of common intoxicants

Indications for and basic interpretation of drug levels in blood or plasma

Indications and complications of hyperbaric oxygenation

Services available to patients and families to provide emotional or psychiatric support

Physiological changes associated with a normal pregnancy and delivery

Pathophysiology, identification and management of peripartum complications: pre-eclampsia and eclampsia; HELLP syndrome; amniotic fluid embolism; ante-partum and post-partum haemorrhage; ectopic pregnancy; septic abortion

Risks and avoidance of pulmonary aspiration in pregnant patients

Methods of avoiding aorto-caval compression

Cardiopulmonary resuscitation of the pregnant patient

Identification of unexpected concurrent pregnancy in a critically ill woman

Awareness of the psychological impact of separation on the family

Skills & Behaviours

Recognise and diagnose commonly encountered acute medical conditions (according to national case mix)

Acquire, interpret, synthesize, record, and communicate (written and verbal) clinical information

Develop a working, and limited differential diagnosis based on presenting clinical features

Recognise impending organ system dysfunction

Order and prioritise appropriate investigations

Establish a management plan based on clinical and laboratory information

Critically appraise the evidence for and against specific therapeutic interventions or treatments

Prioritise therapy according to the patient's needs

Consider potential interactions when prescribing drugs & therapies

Identify and manage chronic co-morbid disease

Identify and evaluate requirements for continuation of chronic treatments during and after the acute illness

Take chronic health factors into account when determining suitability for intensive care

Evaluate the impact of chronic disease and prior health on outcomes

Define targets of therapy and review efficacy at regular intervals

Consider modifying diagnosis and/or therapy if goals are not achieved

Optimise myocardial function

Use fluids and vasoactive / inotropic drugs to support the circulation

Identify and avoid factors contributing to impaired renal function

Identify patients at risk of developing renal failure

Initiate, manage and wean patients from renal replacement therapy

Perform aseptic urinary catheterisation: male and female

Identify patients at risk of acute liver failure

Interpret laboratory tests of liver function

Prevent, identify and manage hyper / hypoglycaemia

Identify and manage coagulopathies

Examine and plan care for the confused patient

Assess and document Glasgow Coma Scale (GCS)

Recognise changes in intracranial and cerebral perfusion pressure which are life threatening

Take prompt action to reduce acutely elevated intracranial pressure

- **Undertake or assist in the insertion and maintenance of an intracranial pressure monitor**
- **Obtain and interpret data from intracranial pressure monitoring**
- **Manage cardiorespiratory physiology to minimise rises in intracranial pressure**
- **Prevent, identify and treat hyponatraemia**
- **Implement emergency airway management, oxygen therapy and ventilation as indicated**
- **Demonstrate emergency relief of tension pneumothorax**
- **Perform thoracocentesis and manage intercostal drains**
- **Select the appropriate type and mode of ventilation for an individual patient**
- **Plan, implement, review and adapt lung protective approach during mechanical ventilation**
- **Plan, perform and review lung recruitment manoeuvres**
- **Assess, predict and manage circulatory shock**
- **Measure and interpret haemodynamic variables (including derived variables)**
- **Resuscitate a patient with septic shock using appropriate monitoring, fluid therapy and vasoactive agents**
- **Manage antimicrobial drug therapy**
- **Obtain and interpret results of microbiological tests**
- **Perform a lumbar puncture under supervision**
- **Perform abdominal paracentesis**
- **Liaise with obstetric and midwifery services**
- **Manage pregnancy induced hypertension**
- **Determine when the patient's needs exceed local resources or specialist expertise (requirement for transfer)**
- **Lead, delegate and supervise others appropriately according to experience and role**
- **Recognise and manage emergencies; seek assistance appropriately**

Attitudes

- **Demonstrates compassionate care of patients and relatives**
- **Appreciates the importance of timely institution of organ-system support**
- **Appreciates the differences between organ system support and specific treatment**
- **Enquiring mind, undertakes critical analysis of published literature**
- **Adopts a problem solving approach**
- **Desire to minimise patient distress**
- **Consults, communicates and collaborates effectively with patients, relatives and the health care team**
- **Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)**

DOMAIN 4: THERAPEUTIC INTERVENTIONS / ORGAN SYSTEM SUPPORT IN SINGLE OR MULTIPLE ORGAN FAILURE

Knowledge

Mode of action of drugs (see basic sciences)

Pharmacokinetics & pharmacodynamics (see basic sciences)

SYSTEMIC PHARMACOLOGY:

Indications, contraindications, effects and interactions of commonly used drugs including:

- hypnotics, sedatives and intravenous anaesthetic agents

- simple & opioid analgesics; opioid antagonists

- non-steroidal anti-inflammatory agents

- neuromuscular blocking agents (depolarising & non-depolarising) & anti-cholinesterases

- drugs acting on the autonomic nervous system (inotropes, vasodilators, vasoconstrictors, antiarrhythmics)

- respiratory stimulants and bronchodilators

- anti-hypertensives

- anti-convulsants

- anti-diabetic agents

- diuretics

- antibiotics (antibacterial, antifungal, antiviral, antiprotozoal, antihelmintics)

- corticosteroids and hormone preparations

- drugs influencing gastric secretion & motility; antiemetic agents

- local anaesthetic agents

- immunosuppressants

- antihistamines

- antidepressants

- anticoagulants

- plasma volume expanders

Adverse effects and interactions of drugs and their management

Recognition and management of serious adverse reactions and anaphylaxis

Local policies and procedures governing the prescription of drugs and therapies

Indications for and basic interpretation of drug levels in blood or plasma

Impact of drug therapy on organ-system function

Effects of concomitant treatment and/or co-morbid conditions on an individual patient's response to treatment

Prophylactic therapies and indications for their use

Concept of risk : benefit ratio and cost effectiveness of therapies

Complications of specific therapies, their incidence and management

Circumstances when treatment is unnecessary

Principles of prevention of multiple organ failure

Epidemiology and prevention of infection in the ICU

Types of organisms - emergence of resistant strains, mode of transfer, opportunistic and nosocomial infections; difference between contamination, colonisation & infection

Risk factors for nosocomial infection and infection control measures to limit its occurrence

Local patterns of bacterial resistance and antibiotic policy

Indications, complications, interactions, selection, monitoring, and efficacy of common antimicrobial drugs (antibacterial, antifungal, antiviral, antiprotozoal, antihelmintics)

Requirements for microbiological surveillance and clinical sampling

Safe use of therapies which modify the inflammatory response

Interpret data from an arterial blood gas sample

Effect of critical illness upon homeostatic mechanisms and causes of homeostatic disturbances

Physiology of fluid, electrolyte, acid-base and glucose control

Methods to assess and monitor intravascular volume and state of hydration using clinical signs and modern technology

Pathophysiological consequences, signs and symptoms of disordered fluid, electrolyte, acid-base and glucose balance

Treatment strategies for abnormalities of fluid, electrolyte, acid-base and glucose balance

Fluid therapies: components, physical properties, distribution and clearance of commonly used fluids; indications, contraindications and complications of their administration

Indications for and interpretation of fluid balance charts

Theoretical advantages and disadvantages of crystalloid and colloid solutions

Indications for and basic interpretation of haematological tests (including coagulation and sickle tests)

Indications for and basic interpretation of blood grouping and x-matching

The pathogenesis and management of anaemia, thrombocytopenia, neutropenia and pancytopaenia
Indications for, contraindication, risks and alternatives to blood transfusion

Local protocols which govern the ordering, storage & verification procedures, monitoring during administration of blood products and reporting of adverse incidents

Principles of blood and blood component therapy; principles of massive transfusion

Infections from contaminated blood / body fluids; strategy if contaminated (e.g. needle stick injury)

Coagulation and fibrinolytic pathways, and their associated disorders; clinical and laboratory evaluation of haemostasis

Principles of plasma exchange

Pathophysiology, detection and management of shock states according to aetiology and in response to physiological data

Principles of haemodynamic monitoring - invasive & non invasive methods, indications & limitations, physiological parameters and waveform interpretation

Invasive & non-invasive systems available for measuring cardiac output and derived haemodynamic variables, the principles involved and the type and site of placement of the monitoring device

Indications, limitations and complications of techniques of measurement of cardiac output (e.g. pulmonary artery catheters, oesophageal Doppler, PiCCO, LiDCO) and action to prevent them

Integration of data from clinical examination and haemodynamic monitoring to characterise haemodynamic derangements

Receptor-specific effects of inotropic and vasopressor agents; effects of critical illness and concomitant therapies on receptor function (e.g. down-regulation)

Indications and contraindications, limitations and complications of inotropic / vasoactive drug therapy

Interactions between inotropic agents and concomitant therapies and/or co-morbid diseases (e.g. ischaemic heart disease)

Pathophysiology and treatment of cardiac failure

Principles of right and left ventricular assist devices

Principles and techniques of cardiac pacing

Indications, contraindications, complications and basic principles of intra-aortic counter pulsation balloon pump

Risk of bleeding: indications, contraindications, monitoring and complications of therapeutic anticoagulants, thrombolytic and anti-thrombolytic agents

Causes of respiratory failure, their prevention and management

Principles of oxygen therapy and use of oxygen administration devices (see 5.1)

Signs and symptoms of acute airway insufficiency and acute respiratory failure, and indications for intervention

Distinguishing features of acute versus chronic respiratory failure and implications for management

Principles of emergency airway management (see 5.3)

Indications for and methods of invasive and non-invasive mechanical ventilation

Principles of continuous positive airways pressure (CPAP) and positive end-expiratory pressure (PEEP) and CPAP & PEEP delivery systems

Modes of mechanical ventilation - indications, contraindications & expected results of each mode (CMV, IRV, PRVC, HFOV, SIMV, PS, CPAP, BiPAP, NIV)

Operation of at least one positive pressure ventilator, one non-invasive ventilator, and a constant positive airway pressure (CPAP) device

A systematic approach to checking ventilator, breathing circuit and monitoring devices

Initial set-up and modification of ventilator settings according to the condition or response of the patient

Principles of monitoring ventilation - significance of respiratory rate, tidal volume, minute volume, mean, peak, end expiratory and plateau pressure, intrinsic and extrinsic PEEP, inspired oxygen concentration, arterial blood gas and acid base status; relationship between mode of ventilation and choice of parameters monitored; airflow and airway pressure waveforms

Measures of adequacy of tissue oxygenation

Measurement and interpretation of pulmonary mechanics during mechanical ventilation

Potential adverse effects and complications of respiratory support and methods to minimise these

Ventilator associated pneumonia: definition, pathogenesis and prevention

Safe prescribing of oxygen; manifestations of pulmonary oxygen toxicity

Causes of lung injury in ventilated patients; effects and clinical manifestations of pulmonary barotrauma

Effect of ventilation upon cardiovascular and oxygen delivery parameters, other organ function and how these effects can be monitored (heart-lung interactions)

Principles of physiotherapy in the ICU

Principles of weaning from mechanical ventilation and factors which may inhibit weaning

Indications and contraindications to tracheostomy (percutaneous and surgical) and minitracheostomy

Management of and complications associated with tracheostomy tubes Principles of extra-corporeal membrane oxygenation (ECMO)

Signs, symptoms and causes of renal failure (acute / chronic / acute on chronic) and indications for intervention

Investigation of impaired renal function

Distinguishing features of acute versus chronic renal failure and implications for management

Indications, complications and selection of renal replacement therapies (continuous and intermittent)

Placement & management of invasive devices necessary for renal replacement therapy (e.g. temporary haemodialysis catheter)

Principles of haemofiltration, haemodialysis, peritoneal dialysis, haemoperfusion and plasmapheresis

Function and operation of continuous haemodiafiltration devices (key components & trouble-shooting)

Effect of renal failure and its treatment on other organ systems

- **Nephrotoxic drugs and adjustment of drug doses in renal impairment/failure**
- **Patterns of nutritional impairment; consequences of starvation and malnutrition**
- **Methods to assess nutritional status and basal energy expenditure**
- **Fluid & caloric requirements in the critically ill patient including electrolytes, vitamins, trace elements and principles of immunonutrition**
- **Indications, limitations, methods, and complications of enteral and parenteral nutritional techniques**
- **Nutritional formulations: indications, complications and their management**
- **Principles of nasogastric cannulation in the intubated and non-intubated patient**
- **Alternative routes for enteral feeding: indications, contraindications and complications of post-pyloric and percutaneous feeding tube placement**
- **Prevention of stress ulceration**
- **Gut motility: effects of drugs, therapy and disease**
- **Causes of regurgitation and vomiting; prevention and management of pulmonary aspiration**
- **Prevention and management of constipation and diarrhoea**
- **Techniques for preventing gastrointestinal microbial translocation**
- **Principles of blood glucose control: indications, methods, monitoring of safety & efficacy**

Skills & Behaviours

- **Prioritise therapy according to the patient's needs**
- **Establish a management plan based on clinical and laboratory information**
- **Consider potential interactions when prescribing drugs & therapies**
- **Consider risk-benefit and cost-benefit of alternative drugs & therapies**
- **Obtain informed consent/assent from the patient where appropriate**
- **Critically appraise the evidence for and against specific therapeutic interventions or treatments**
- **Set realistic goals for therapy (independently or in collaboration with other teams)**
- **Define targets of therapy and review efficacy at regular intervals**
- **Consider modifying diagnosis and/or therapy if goals are not achieved**
- **Recognise when treatment is unnecessary or futile**
- **Administer intravenous drugs (prepare, select route and mode of administration and document)**
- **Use infusion pumps to administer drugs and fluids**

Prescribe appropriate antimicrobial therapy based on history, examination and preliminary investigations

Collaborate with microbiologists / infectious diseases clinicians to link clinical, laboratory and local (hospital / regional / national) microbiological data

Choose appropriate fluid, volume, rate and method of administration

Administer and monitor response to repeated fluid challenges

Consider and exclude unknown pathology if goals of fluid therapy are not achieved (e.g. continued bleeding)

Select an appropriate inotrope / vasopressor - dose, physiological endpoint, rate and route of administration

Order, check, verify and administer blood products according to local protocols

Identify and correct haemostatic and coagulation disorders

Resuscitate a patient with septic shock using appropriate monitoring, fluid therapy and vasoactive agents

Measure and interpret haemodynamic variables (including derived variables)

Identify and treat underlying causes for a metabolic acidosis

Select the appropriate type and mode of ventilation for an individual patient

Identify and correct ventilator misassembly and disconnections

Stabilise a patient on a constant positive airway pressure (CPAP) device

Stabilise a patient on a non-invasive ventilator (NIV)

Stabilise a patient on a positive pressure ventilator

Confirm adequate oxygenation and control of $PaCO_2$ and pH

Set and interpret data from ventilator alarms

Construct, monitor and review a weaning plan

Identify and avoid factors contributing to impaired renal function

Supervise the provision of continuous renal replacement therapy

Set appropriate exchange and fluid balances for renal replacement therapies

Modify fluid and electrolyte therapy according to clinical features and fluid balance charts

Prescribe and manage anticoagulation therapy

Correct electrolyte disorders (e.g. hyperkalaemia, hyponatraemia)

Prevent hypokalaemia

Institute and manage a regimen to control blood glucose within safe limits

- **Prescribe an appropriate standard enteral feeding regimen**
- **Identify surgical and other contraindications to enteral feeding**
- **Prescribe and supervise safe administration of a standard / customized parenteral (TPN) preparation**
- **Collaborate with nursing staff / clinical dietician in monitoring safe delivery of enteral and parenteral nutrition**
- **Liaise with clinical dieticians / medical team to plan feeding regimens after discharge from the ICU**
- **Recognise and manage emergencies; seek assistance appropriately**

Attitudes

- **Appreciates the importance of timely institution of organ-system support**
- **Appreciates the differences between organ system support and specific treatment**
- **Recognises the need for supportive care for all organ systems whether failing / injured or not**
- **Responds rapidly to acute changes in monitored variables**
- **Consults, communicates and collaborates effectively with patients, relatives and the health care team**
- **Demonstrates compassionate care of patients and relatives**
- **Desire to minimise patient distress**
- **Respects the ideas and beliefs of the patient and their family and their impact on decision making (does not impose own views)**
- **Respects the expressed wishes of competent patients**
- **Lead, delegate and supervise others appropriately according to experience and role**
- **Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)**

DOMAIN 5: PRACTICAL PROCEDURES

Knowledge

GENERIC

Patient selection - indications, contraindications and potential complications of the procedure / intervention

Universal precautions and preventative infection control techniques (hand washing, gloves, protective clothing, sharps disposal etc.)

Principles of aseptic technique and aseptic handling of invasive medical devices

Methods and routes of insertion - associated indications and complications

Appropriate use of drugs to facilitate the procedure

Detection of potential physiological alterations during the procedure

Indications for specific monitoring to ensure patient safety during an intervention / procedure

Complications of the technique, how to prevent/recognise them and initiate appropriate treatment

Methods of sterilisation and cleaning or disposal of equipment

Management and use of the device once in situ necessary to minimise the risks of complications

Indications and technique for removal

RESPIRATORY SYSTEM

Anatomy and bronchoscopic appearance of the upper and lower airways

Signs, symptoms and causes of acute airway insufficiency and indications for intervention

Methods of maintaining a clear airway

Indications, selection and insertion of oral (guedel) airways, nasopharyngeal airways and laryngeal mask airways (LMA)

Tracheal intubation: selection of tube type, diameter & length; indications and techniques; methods to confirm correct placement of a tracheal tube

Appropriate use of drugs to facilitate airway control

Monitoring during sedation/induction of anaesthesia for endotracheal intubation

Airway management in special circumstances, (head injury, full stomach, upper airway obstruction, shock, cervical spine injury)

Causes of regurgitation and vomiting; prevention and management of pulmonary aspiration

Cricoid pressure: indications and safe provision

Management of difficult intubation and failed intubation (local algorithm or protocol)
Indications for and principles of fibreoptic intubation; use of fibreoptic intubation with airway adjuncts
Indications and methods of securing an emergency surgical airway
Anatomical landmarks for cricothyroidotomy/tracheostomy/mini-tracheotomy
Indications and techniques for needle and surgical cricothyroidotomy
Indications and contraindications to tracheostomy (percutaneous and surgical) and mini-tracheostomy
Techniques for percutaneous and surgical tracheotomy
Manage anaesthesia and control the airway during initial tracheostomy tube insertion in the intensive care unit (ICU)
Management of and complications associated with tracheostomy tubes
Principles of endotracheal suctioning
Consequences of the procedure during ventilation
Indications, contraindications and complications of oxygen therapy
Environmental hazards associated with storage and use of oxygen; strategies to promote safety
Use of pipeline gas and suction systems
Storage and use of oxygen, nitric oxide (NO), compressed air and helium, including use of gas cylinders
Principles of pressure regulators, flow meters, vaporizers and breathing systems
Indications for and operation of fixed and variable performance oxygen therapy equipment, humidification and nebulising devices
Respiratory physiology: gaseous exchange; pulmonary ventilation: volumes, flows, dead space; mechanics of ventilation: ventilation/perfusion abnormalities; control of breathing, acute and chronic ventilatory failure, effect of oxygen therapy
Indications for different modes of ventilation and operation of at least one positive pressure ventilator, one non-invasive ventilator, and a constant positive airway pressure (CPAP) device
Indications and complications of hyperbaric oxygenation
Methods of bronchoscopy via an endotracheal tube
Methods of bronchoscopic broncho-alveolar lavage (BAL) in an intubated patient
Safety and maintenance of flexible fibreoptic endoscopes
Detection and management of haemo/pneumothorax (simple and tension)
Anatomical landmarks for intrapleural drains
Insertion and management of chest drains and air exclusion devices
Patient groups at risk who may require chest drain placement under ultrasound or CT guidance

CARDIOVASCULAR SYSTEM

Surface anatomy: structures in the antecubital fossa; large veins and anterior triangle of the neck; large veins of the leg and femoral triangle; arteries of the arms and legs

Methods for securing vascular access rapidly

Principles, routes and techniques of peripheral and central venous cannulation

Principles and techniques for surgical isolation of a vein or artery

Methods for insertion of a tunnelled central venous catheter (e.g. for parenteral nutrition)

Indications, contraindications, and complications of peripheral intravenous infusion / injection and central venous infusion / injection

Principles of arterial catheterisation

Allens test - application & limitations

Recognition and management of inadvertent intra-arterial injection of harmful substances

Principles of haemodynamic monitoring - invasive & non invasive methods, indications & limitations, physiological parameters and waveform interpretation

Zero and calibration techniques for invasive pressure monitoring

Invasive & non-invasive systems available for measuring cardiac output and derived haemodynamic variables, the principles involved and the type and site of placement of the monitoring device

Interpretation of, relationships between, sources of error and limitations of measured and derived cardiovascular variables including pressure, flow, volume and gas transport

Indications, limitations and complications of techniques of measurement of cardiac output (e.g. pulmonary artery catheters, oesophageal Doppler, PiCCO, LiDCO) and action to prevent them

Principles of ECG monitoring (heart rate, rhythm, conduction, ST segment change & QT interval) - indications, limitations and techniques. Advantages and disadvantages of different lead configurations

Basic and complex cardiac arrhythmias - recognition and management (pharmacological and electrical)

Principles and techniques of cardiac pacing

Treatment (algorithm) of patients in ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT)

Defibrillation: principles of monophasic & biphasic defibrillators; mechanism, indications, complications, modes and methods (manual and automated external defibrillators (AED))

Electrical safety: conditions which predispose to the occurrence of macro-shock / micro-shock; physical dangers of electrical currents; relevant standards regarding safe use of electricity in patient care; basic methods to reduce electrical hazards.

Basic principles of ultrasound and the Doppler effect

Principles and basic interpretation of echocardiography (see 2.3)

Detection and acute management of cardiac tamponade

Anatomical landmarks and technique for percutaneous pericardial aspiration

CENTRAL NERVOUS SYSTEM

Physiological effects of pain and anxiety

Recognition and methods of assessment of pain

Pharmakokinetics, pharmacodynamics, indications and complications of opiates and local anaesthetic agents

Indications, contraindications, methods and complications of epidural catheterisation

Indications, contraindications and complications of epidural infusion / injection; principles of safe epidural drug administration

Contraindications, methods and complications of epidural catheter removal

Indications for lumbar puncture and CSF sampling; laboratory analysis of CSF samples

GASTROINTESTINAL SYSTEM

Principles of nasogastric cannulation in the intubated and non-intubated patient

Principles and techniques for insertion of gastro-oesophageal balloon tamponade tube (e.g. Sengstaken-Blakemore)

Anatomy of the abdominal wall; landmarks for abdominal paracentesis and abdominal drainage catheters

Principles of peritoneal lavage

Indications, contraindications, complications and technique of abdominal paracentesis

Alternative routes for enteral feeding: indications, contraindications and complications of post-pyloric and percutaneous feeding tube placement

GENITOURINARY SYSTEM

Anatomy of the genitourinary system and anatomical landmarks for suprapubic catheterisation

Urinary catheterisation techniques: transurethral and suprapubic

Urinary catheterisation in pelvic trauma: indications, contraindications and techniques

Skills & Behaviours

GENERIC

Prioritise tasks and procedures

Select appropriate equipment or device & use resources efficiently

Prepare equipment, patient and staff prior to undertaking the procedure

Obtain informed consent/assent from the patient where appropriate

Use drugs as indicated to facilitate the procedure

Choose an appropriate route / method of insertion and position the patient accordingly

Identify relevant anatomical landmarks

Use protective clothing (gloves / mask / gown / drapes) as indicated

Perform the procedure in a manner which minimises the risks of complications

Undertake appropriate investigation to confirm correct placement of device or exclude complications

Sterilise, clean or dispose of equipment appropriately

Recognise and manage emergencies; seek assistance appropriately

RESPIRATORY SYSTEM

Accurately assess the airway for potential difficulties with airway management

Choose a safe environment to undertake airway management (or optimise environment as circumstances allow)

Optimise the patient's position for airway management

Maintain a clear airway using oral / nasal airways

Support ventilation using bag and mask

Insert and check correct placement of laryngeal mask airway

Select appropriate tracheal tube type, size and length

Perform intubation and verify correct placement of tube

Manage and minimise cardiovascular and respiratory changes during and after intubation

Apply an end-tidal CO_2 detector post-intubation and interpret a capnograph trace

Demonstrate rapid sequence induction of anaesthesia / cricoid pressure

Change an orotracheal tube

Perform extubation

Prepare equipment for difficult or failed intubation

Demonstrate failed intubation drill (according to local algorithm or protocol)

Demonstrate minitracheotomy or needle cricothyroidotomy

Change a tracheostomy tube electively

Identify patients requiring tracheostomy; discuss indications and contraindications for percutaneous tracheostomy

Perform endotracheal suction (via oral / nasal / tracheostomy tube)

Check pipelines; check and change portable cylinders

Undertake bronchoscopy to assess tube position

Undertake bronchoscopy to perform bronchoalveolar lavage

Demonstrate aseptic insertion of an intrapleural chest drain and connection to a one-way seal device

Demonstrate emergency relief of tension pneumothorax

CARDIOVASCULAR SYSTEM

Insert peripheral cannulae via different routes

Establish peripheral venous access appropriate for resuscitation in major haemorrhage

Chest x-ray interpretation

Insert central venous catheters by different routes

Describe a method for tunnelled intravenous catheterisation

Minimise blood loss related to clinical investigations and procedures

Insert arterial catheters by different routes

Distinguish between arterial and venous blood samples

Prepare equipment for intravascular pressure monitoring

Measure and interpret haemodynamic variables (including derived variables)

Obtain and interpret data from central venous catheters

Obtain and interpret data from a pulmonary artery catheter, oesophageal Doppler or alternative cardiac output measurement technique

Obtain and interpret data from ECG (3- and 12-lead)

Insert a temporary pacing wire

Demonstrate emergency percutaneous pericardial aspiration

Establish & review pacing box settings

Use manual external defibrillators

Use automated external defibrillators (AED)

CENTRAL NERVOUS SYSTEM

Select an appropriate epidural infusion regimen and titrate safely

Select & determine adequacy and route of administration of analgesia

Manage an established epidural infusion

Administer bolus analgesia via an epidural catheter

Minimise complications associated with opioid and non-opioid analgesics

GASTROINTESTINAL SYSTEM

Insert a nasogastric tube in an intubated and non-intubated patient

Insert an abdominal drain

GENITOURINARY SYSTEM

Perform aseptic urinary catheterisation: male and female

Attitudes

Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

Considers patient comfort during procedures / investigations

Desire to minimise patient distress

Accepts personal responsibility for the prevention of cross infection and self infection

Lead, delegate and supervise others appropriately according to experience and role

Supports other staff in the correct use of devices

Promotes respect for patient privacy, dignity and confidentiality

DOMAIN 6: PERIOPERATIVE CARE

Knowledge

Factors determining perioperative risk

Methods of optimising high risk surgical patients

Importance of preoperative health status on postoperative outcomes

Indications for, and interpretation of pre-operative investigations

Dangers of emergency anaesthesia & surgery

Effect of gastric contents and dehydration on perioperative risk

Anaesthetic risk factors complicating recovery: suxamethonium apnoea, anaphylaxis, malignant hyperpyrexia, difficult airway

Criteria for admission to, and discharge from ICU - factors influencing intensity and site of care (ward, high dependency unit (HDU), intensive care unit (ICU))

Perioperative implications of current drug therapy

Consent and assent in the competent and non-competent patient

Implications for postoperative care of common acute and chronic medical conditions (see 3.1 & 3.2)

Implications of type of anaesthesia (general/regional/local) for perioperative care

Implications of type / site of surgery for postoperative management and potential complications within the first 24 hours of surgery

Assessment and management of commonly encountered perioperative conditions & complications including:

***RESPIRATORY*: Interpretation of symptoms and signs of respiratory insufficiency in the surgical patient; the unprotected airway; upper and lower airway obstruction including laryngeal trauma & oedema; pneumonia, collapse or consolidation, pulmonary infiltrates including acute lung injury (ALI) and the acute respiratory distress syndrome (ARDS) and their causative factors; pulmonary oedema; pleural effusion, haemo/pneumothorax (simple and tension); use of chest drains; factors affecting patients following thoracotomy, lung resection, oesophagectomy, cardiac surgery and thymectomy.**

***CARDIOVASCULAR*: Interpretation of symptoms and signs of cardiovascular insufficiency in the surgical patient; recognition of bleeding; management of hypo/hypertension; operative risk factors in patients with ischaemic heart disease; pulmonary embolus; cardiac tamponade; surgery for acquired and congenital cardiac disease; management of patients following cardiac surgery (coronary grafting, valve replacement) and aortic surgery (arch, thoracic, abdominal); heart and heart-lung transplantation**

***RENAL*: Causes of perioperative oliguria and anuria; prevention and management of acute renal failure; rhabdomyolysis; consequences of nephrectomy, ileal conduits; management post-renal transplantation**

***NEUROLOGICAL*: causes of post-operative confusion, stroke (CVA), coma and raised intracranial pressure; determinants of cerebral perfusion and oxygenation; prevention of secondary brain injury; perioperative management of patients with neuropathies and myopathies; intracranial pressure**

monitoring; intracerebral haemorrhage; spinal cord injury & ischaemia; brachial plexus injury; complications of neuromuscular blockade

***GASTROINTESTINAL*: Interpretation of abdominal pain and distension; peptic ulceration and upper GI haemorrhage; diarrhoea, vomiting and ileus; peritonitis; intestinal ischaemia; perforation; abdominal hypertension; pancreatitis; jaundice; cholecystitis; management of the pre- and post-liver transplant patient; perioperative nutrition; post operative nausea & vomiting**

***HAEMATOLOGY AND ONCOLOGY:* Care of the immunosuppressed or immunoincompetent patient; complications of chemotherapy; management of severe acute haemorrhage and blood transfusion; correction of coagulation disorders and haemoglobinopathies.**

***METABOLIC AND HORMONAL*: Perioperative management of patients with diabetes; blood glucose control; hypo- and hyper adrenalism, surgery to thyroid, adrenal and pituitary glands; perioperative management of electrolyte disorders.**

***SEPSIS AND INFECTION*: fever and hypothermia; postoperative hypoperfusion and impaired oxygen delivery; wound infection; opportunistic and nosocomial infection; perioperative infection risk and prophylactic antibiotics; necrotising fasciitis; peritonitis; intestinal ischaemia; antibiotic selection and prescribing**

***MUSCULO-SKELETAL:* principles and management of external fixators and casts; perioperative positioning; pressure area care; compartment syndromes; paralysed patients; principles of salvage surgery**

Recognition, assessment and management of acute pain

Indications and choice of agent for antibiotic prophylaxis

Indications for and methods of perioperative anti-thrombotic treatment

Surgical interventions in patients with cardiac disease, perioperative management of the cardiovascular surgery patient and potential complications occurring within 24 hours of cardiac surgery

Major neurosurgical procedures, peri-operative management of the patient undergoing major neurosurgery, and potential complications occurring within 24 hours of surgery

Solid organ-specific transplantation (heart-lung, liver, renal): peri-operative considerations, pharmacological management, post operative care and potential complications

Immunosuppression and rejection

Skills & Behaviours

Optimise high-risk surgical patients before surgery: consider site of care and management plan

Communicate the risk of surgery to patients and family

Consider the impact of long-term and chronic treatment on acute surgical care

Accurately assess the airway for potential difficulties with airway management

- **Ensure the necessary resources are available for safe post-operative care**
- **Identify pre-operative health status and intercurrent disease, medications, allergies and their interaction with the nature of anaesthetic and surgery**
- **Obtain relevant information from the patient, relatives and other secondary sources**
- **Interpret pre-operative investigations, intra-operative findings and events/complications, and respond to them appropriately**
- **Assess conscious level and conduct a careful systems review**
- **Select & determine adequacy and route of administration of analgesia**
- **Document, monitor and manage fluid balance, circulating volume, drains, systemic oxygen supply**
- **Establish a plan for postoperative management**
- **Recognise and manage perioperative emergencies and seek assistance appropriately**
- **Identify life-threatening cardiorespiratory complications; manage hypovolaemia and impaired oxygen delivery**
- **Manage post-operative hypo and hypertension**
- **Differentiate and manage tension pneumothorax, cardiac tamponade & pulmonary embolus**
- **Manage post-operative stridor**
- **Review and monitor perioperative immunosuppressive therapy**
- **Monitor and manipulate cerebral perfusion pressure (CPP)**
- **Describe the risk period for use of depolarizing neuromuscular blocking agents in patients undergoing repeated surgical procedures**
- **Lead, delegate and supervise others appropriately according to experience and role**

Attitudes

- **Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)**
- **Consults, communicates and collaborates effectively with anaesthesiologist, surgeon, nursing staff, other professionals, patients and relatives where appropriate**
- **Desire to minimise patient distress**
- **Attention to and control of pain**

DOMAIN 7: COMFORT & RECOVERY

Knowledge
Common symptomatology following critical illness
The role of patient's relatives and their contribution to care
Causes and methods of minimising distress in patients
Physiological effects of pain and anxiety
Stress responses
Recognition and methods of assessment of pain
Recognition and assessment of anxiety
Pharmakokinetics, pharmacodynamics, indications and complications of commonly used analgesic, hypnotic, and neuromuscular blocking drugs in patients with normal and abnormal organ system function
Principles of acute pain management
Patient-controlled analgesia
Indications, contra-indications, methods and complications of regional analgesia in critical illness
Methods of measuring depth of sedation; effects of over-sedation and strategies to avoid this
Environmental and drug-related psychopathology associated with critical illness (e.g. anxiety, sleep disorders, hallucinations, drug withdrawal)
Sensory deprivation / sensory overload
Sleep deprivation and its consequences
Consequences of immobilisation and mobilisation techniques (including disuse atrophy, foot-drop, ectopic calcification)
Causes, prevention and management of critical illness polyneuropathy, motor neuropathy, and myopathy
Fluid & caloric requirements in the critically ill patient including electrolytes, vitamins, trace elements and principles of immunonutrition
Methods to assess nutritional status and basal energy expenditure
Prevention & management of pressure sores
Relevance and methods to care for skin, mouth, eyes and bowels, and to maintain mobility and muscle strength in critically ill patients
Causes and management of acute confusional states

Methods of communicating with patients who are unable to speak

Principles of rehabilitation: physical and psychological

Supportive services integral to the long term rehabilitation of critically ill patients (physiotherapy, occupational therapy, orthotics, social services).

Resources available to patients and relatives for education and support (e.g. societies, local groups, publications, referral to allied health care professionals)

Criteria for admission to, and discharge from ICU - factors influencing intensity and site of care (ward, high dependency unit (HDU), intensive care unit (ICU))

Potential psychological impact of inter-hospital transfer and family dislocation

Common risk factors for post-ICU mortality or re-admission and their minimisation

Methods to minimise potential psychological trauma to the patient and their family of transfer from the ICU (especially with regard to long term ICU patients)

Post-traumatic stress disorders

Impact of staff-patient contact and environmental factors on patient stress

The implications for relatives of adopting a role as a carer at home

Methods for assessing or measuring quality of life

Impact of chronic illness post-ICU on socialisation and employment

Management of tracheostomy care and avoidance of complications outside the ICU

Long-term ventilation outside the ICU environment (e.g. home ventilation)

Persistent vegetative state

Skills & Behaviours

Identify complications associated with critical illness

Work with colleagues and relatives to minimise patient distress

Anticipate the development of pain and/or anxiety and adopt strategies for its prevention or minimisation

Interpret data from scoring or scaling systems to assess pain and sedation

Use analgesic, hypnotic and neuromuscular blocking drugs appropriately and safely

Select & determine adequacy and route of administration of analgesia

Minimise complications associated with opioid and non-opioid analgesics

Obtain and interpret data from a nerve stimulator to monitor the degree of neuromuscular blockade

Propose and implement a plan to provide adequate sleep and rest in ICU patients

- **Communicate effectively with families who may be anxious, angry, confused, or litigious**
- **Participate in the education of patients/families**
- **Appropriate and timely referral to specialists / allied health professionals**
- **Identify discharge criteria for individual patients**
- **Ensure effective information exchange before patient discharge from ICU**
- **Take decisions to admit, discharge or transfer patients**
- **Liaise with medical and nursing staff in other departments to ensure optimal communication and continuing care after ICU discharge**
- **Change a tracheostomy tube electively**
- **Follow-up patients after discharge to the ward**
- **Participate in follow-up clinics / services where available**
- **Lead, delegate and supervise others appropriately according to experience and role**

Attitudes

- **Appreciates that physical and psychological consequences of critical illness can have a significant and long lasting effect for both patients and their relatives**
- **Desire to minimise patient distress**
- **Establishes trusting relationships with and demonstrates compassionate care of patients and their relatives**
- **Seeks to modify the stresses which the intensive care environment places upon patients, their relatives and members of staff**
- **Acknowledges the consequences of the language used to impart information**
- **Regards each patient as an individual**
- **Respects the religious beliefs of the patient and is willing to liaise with a religious representative if requested by patient or family**
- **Willingness to communicate with and support families / significant others**
- **Early planning for rehabilitation**
- **Recognises that intensive care is a continuum throughout the 'patient journey'**
- **Promotes appropriate and timely discharge from ICU**
- **Fosters effective communication and relationships with medical and nursing staff in other wards / departments**
- **Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)**

DOMAIN 8: END OF LIFE CARE

Knowledge
Basic ethical principles: autonomy, beneficence, non-maleficence, justice
Ethical and legal issues in decision-making for the incompetent patient
Difference between euthanasia and allowing death to occur: doctrine of double effect
With-holding and withdrawing treatment: omission and commission
The limitations of intensive care medicine - expectations of what can and cannot be achieved
Decision-making processes for withholding and withdrawing life sustaining therapies including documentation and iterative review
Principles of delivering bad news to patients and families
Local resources available to support dying patients and their families, and how to access them
Bereavement: anticipating and responding to grief
Cultural and religious practices of relevance when caring for dying patients and their families
Principles of pain and symptom management
Procedure for withdrawing treatment and support
Causes and prognosis of vegetative states
Causes of brain stem death
Applied anatomy and physiology of the brain and nervous system including cerebral blood supply, base of skull, autonomic nervous system and cranial nerves
Physiological changes associated with brain stem death
Preconditions and exclusions for the diagnosis of brain stem death
Clinical, imaging and electrophysiologic tests to diagnose brain death
Legal aspects of brain stem death diagnosis
Cultural and religious factors which may influence attitude to brain stem death and organ donation
Principles of management of the organ donor (according to national / local policy)
Common investigations and procedures undertaken in the ICU prior to organ harvesting
Role of national organ/tissue procurement authority and procedures for referral
Responsibilities and activities of transplant co-ordinators
Responsibilities in relation to legal authorities for certifying death (e.g. coroner, procurator fiscal or equivalent), and reasons for referral
The value of autopsy (post-mortem) examination.
Procedure for completion of death certification

Skills & Behaviours

Recognise when treatment is unnecessary or futile

Discuss end of life decisions with members of the health care team

Willing and able to communicate and discuss issues pertaining to end of life with patients and relatives

Differentiate competent from incompetent statements by patients

Discuss treatment options with a patient or relatives before ICU admission

Participate in timely discussion and regular review of 'do not resuscitate' orders and treatment limitation decisions

Participate in discussions with relatives about treatment limitation or withdrawal

Communicate effectively with relatives who may be anxious, angry, confused, or litigious

Lead a discussion about end of life goals, preferences and decisions with a patient and/or their relatives

Explain the concept of brain stem death and organ donation clearly

Obtain consent/assent for treatment, research, autopsy or organ donation

Withdraw life sustaining treatment or organ support

Relieve distress in the dying patient

Document pre-conditions and exclusions to brain stem death testing

Perform and document tests of brain stem function

Consult and confirm findings of brain stem function tests with colleagues as required by local / national policy or as indicated

Liaise with transplant co-ordinators (local organ donation authority) to plan management of the organ donor

Monitor vital physiological functions as indicated

Recognise and rapidly respond to adverse trends in monitored parameters

Aware of the emotional needs of self and others; seeks and offers support appropriately

Establishes trusting relationships with and demonstrates compassionate care of patients and their relatives

Integrity, honesty & respect for the truth underpin relationships with patients, relatives and colleagues

Appreciates that the decision to withhold or withdraw treatment does not imply the termination of care

Consult and take into account the views of referring clinicians; promote their participation in decision making where appropriate

Attitudes

- **Values clear decision-making and communication**
- **Acknowledges the consequences of the language used to impart information**
- **Willingness to communicate with and support families / significant others**
- **Respects the ideas and beliefs of the patient and their family and their impact on decision making (does not impose own views)**
- **Respects the expressed wishes of competent patients**
- **Respects the religious beliefs of the patient and is willing to liaise with a religious representative if requested by patient or family**
- **Offers psychological, social and spiritual support to patients, their relatives or colleagues as required**
- **Desire to support patient, family, and other staff members appropriately during treatment withdrawal**
- **Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)**

DOMAIN 9: PEDIATRIC CARE

Knowledge
Key stages of physical and psychological development
Major anatomical and physiological differences between adults and children
Pathophysiology and principles of management of disorders which are life-threatening to paediatric patients (determined by national case mix, but may include: acute respiratory failure, cardiac failure, trauma, severe infections including meningitis and epiglottitis, intoxications, metabolic disorders, seizures, croup, diarrhoea)
Paediatric management of conditions common to both children and adults (e.g. acute severe asthma, renal failure, trauma)
Paediatric resuscitation and the differences between adult and paediatric resuscitation
Principles of paediatric airway management: methods & techniques; calculation of tube sizes; selection of masks and airways
Principles of mechanical ventilation in a child
Preparation for and methods of securing venous access
Intraosseous cannulation
Estimation of blood volume, replacement of fluid loss
Paediatric dosing of common emergency drugs
General principles for stabilising the critically ill or injured child until senior or more experienced help arrives
Operation of local paediatric referral /retrieval services
Principles of communication (verbal and non verbal) with children of different ages; awareness of the consequences of the language used to impart information
Legal and ethical aspects of caring for children
Issues of consent in children
National child protection guidelines
Impact of occupational and environmental exposures, socio-economic factors, and life style factors on critical illness

Skills & Behaviours

- **Paediatric resuscitation at advanced life support level (APLS, PALS or equivalent)**
- **Prepare equipment & drugs for paediatric intubation**
- **Demonstrate paediatric tracheal intubation**
- **Secure venous access (including local anaesthesia pre-medication)**
- **Manage mechanical ventilation in a critically ill child**
- **Communicate effectively with, and attempt to reassure the child and parents**
- **Recognise and manage paediatric emergencies until senior or more experienced help arrives**
- **Manage and stabilise the injured child until senior or more experienced help arrives**

Attitudes

- **Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)**

DOMAIN 10: TRANSPORT

Knowledge

- **Indications, risks and benefits of patient transfer (intra / inter hospital)**
- **Criteria for admission to, and discharge from ICU - factors influencing intensity and site of care (ward, high dependency unit (HDU), intensive care unit (ICU))**
- **Principles of safe patient transfer (before, during and after)**
- **Strategies to manage the unique problems associated with patient transfer - limitations of space, personnel, monitoring & equipment**
- **Advantages and disadvantages of road ambulance, fixed and rotary wing aircraft including problems associated with altitude, noise, lighting conditions, vibration, acceleration and deceleration**
- **Selection of mode of transport based upon clinical requirements, distance, vehicle availability and environmental conditions**
- **Determination of required number of physicians / nurses / others during transfer and the role of paramedical personnel**
- **Selection and operation of transport equipment: size, weight, portability, power supply/battery life, oxygen availability, durability and performance under conditions of transport**
- **Principles of monitoring under transport conditions**
- **Physiology associated with air transport**
- **Homeostatic interaction between patient and environment (e.g. thermoregulation, posture / positioning)**
- **Communication prior to and during transport**
- **Operation of locally available retrieval services**
- **Potential psychological impact of inter-hospital transfer and family dislocation**

Skills & Behaviours

- **Determine when the patient's needs exceed local resources or specialist expertise (requirement for transfer)**
- **Take decisions to admit, discharge or transfer patients**
- **Communicate with referring and receiving institutions and teams**
- **Check transfer equipment and plan transfers with personnel prior to departure**
- **Select appropriate staff based upon patient need**
- **Prepare patients prior to transfer; anticipate and prevent complications during transfer - maintain patient safety at all times**

- **Adapt and apply general retrieval principles where appropriate to pre-, intra-, and inter-hospital transportation.**
- **Consider the need for stabilisation before transfer**
- **Undertake intra-hospital transfer of ventilated patients to theatre or for diagnostic procedures (e.g. CT)**
- **Undertake inter-hospital transfers of patients with single or multiple organ failure**
- **Maintain comprehensive documentation of the patient's clinical condition before, during and after transport including relevant medical conditions, therapy delivered, environmental factors and logistical difficulties encountered**
- **Lead, delegate and supervise others appropriately according to experience and role**

Attitudes

- **Appreciates the importance of communication between referring, transporting and receiving staff**
- **Anticipates and prevents problems during transfer**
- **Desire to minimise patient distress**
- **Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)**

DOMAIN 11: PATIENT SAFETY & HEALTH SYSTEMS MANAGEMENT

Knowledge

- **Principles of local / national health care provision; strategic planning of the ICU service (structure, function, financing) within the wider health care environment**
- **The non-clinical role of the ICU specialist and how these activities contribute to the efficacy of the ICU, the profile of the ICU within the hospital and the quality of patient management**
- **Principles of administration and management**
- **Physical requirements of ICU design**
- **Principles of resource management; ethics of resource allocation in the face of competing claims to care**
- **Concept of risk : benefit ratio and cost effectiveness of therapies**
- **Difference between absolute requirement and possible benefit when applying expensive technology to critically ill patients**
- **Equipment requirements and selection: clinical need & priority; accuracy, reliability, safety and practical issues (ease of use, acceptance by staff)**
- **Local process for ordering consumables and maintaining equipment**
- **Principles of health economics, departmental budgeting, financial management and preparation of a business plan**
- **Factors that determine the optimum staff establishment for specialist and junior medical staff, nurses and allied professional and non-clinical ICU staff**
- **Principles of workforce planning**
- **Practical application of equal opportunities legislation**
- **Principles of national / local health care legislation applicable to ICM practice**
- **Methods of effective communication of information (written; verbal etc)**
- **Triage and management of competing priorities**
- **Principles of crisis management, conflict resolution, negotiation and debriefing**
- **Roles of different members of the multidisciplinary team and local referral practices**
- **Purpose and process of quality improvement activities such as evidence based practice, best practice guidelines & benchmarking and change management**
- **Purpose and methods of clinical audit (e.g. mortality reviews, complication rates)**
- **Recent advances in medical research relevant to intensive care**
- **Principles of appraisal of evidence: levels of evidence; interventions; diagnostic tests; prognosis; integrative literature (meta-analyses, practice guidelines, decision & economic analyses)**

Electronic methods of accessing medical literature

Identification and critical appraisal of literature; integration of findings into local clinical practice

Research methods (see basic sciences)

Statistical concepts (see basic sciences)

Principles of applied research and epidemiology necessary to evaluate new guidelines / forms of therapy

Local policies and procedures relevant to practice

Treatment algorithms for common medical emergencies

Published standards of care at local, national and international level (including consensus statements and care bundles)

Principles of risk prevention

Common sources of error and factors which contribute to critical incidents / adverse events (ICU environment, personnel, equipment, therapy and patient factors)

Critical incident or error monitoring

Recognition of patient groups at high risk for developing complications

Pathogenesis, risk factors, prevention, diagnosis and treatment of complications of ICU management including: nosocomial infection ventilator associated pneumonia (VAP) ventilator associated lung injury - pulmonary barotrauma pulmonary oxygen toxicity thromboembolism (venous, arterial, pulmonary, intracardiac) stress ulceration pain malnutrition critical illness poly-neuropathy, motor-neuropathy & myopathy

Risk of bleeding: indications, contraindications, monitoring and complications of therapeutic anticoagulants, thrombolytic and anti-thrombolytic agents

Modification of treatment or therapy to minimise the risk of complications and appropriate monitoring to allow early detection of complications

Epidemiology and prevention of infection in the ICU

Types of organisms - emergence of resistant strains, mode of transfer, opportunistic and nosocomial infections; difference between contamination, colonisation & infection

Risk of colonisation with potentially pathogenic micro-organisms and the factors associated with patient, staff, equipment and environmental colonisation

Autogenous infection: routes and methods of prevention

Cross infection: modes of transfer and common agents

Universal precautions and preventative infection control techniques (hand washing, gloves, protective clothing, sharps disposal etc.)

Requirements for microbiological surveillance and clinical sampling

Local patterns of bacterial resistance and antibiotic policy

Benefits and risks of different prophylactic antibiotic regimens

Principles of aseptic technique and aseptic handling of invasive medical devices

Methods of sterilisation and cleaning or disposal of equipment

Infections from contaminated blood / body fluids; strategy if contaminated (e.g. needle stick injury)

Staff safety: susceptibility to harmful physical, chemical and infectious hazards in the ICU

Environmental control of temperature, humidity, air changes and scavenging systems for waste gases and vapours

Measurement of gas and vapour concentrations, (oxygen, carbon dioxide, nitrous oxide, and volatile anaesthetic agents) - environmental safety

Hazards associated with ionising radiation and methods to limit these in the ICU

Electrical safety: conditions which predispose to the occurrence of macro-shock / micro-shock; physical dangers of electrical currents; relevant standards regarding safe use of electricity in patient care; basic methods to reduce electrical hazards.

Confidentiality and data protection - legal and ethical issues

Professional responsibility and duty of care to patients placed at risk by the actions of fellow clinicians

Plan of action / local procedures to be followed when a health care worker is noticed to be in distress, whether or not patients are considered to be at risk

Principles of outcome prediction / prognostic indicators and treatment intensity scales; limitations of scoring systems in predicting individual patient outcome

Process and outcome measurement

Principles of general and organ-specific scoring systems and their usefulness in assessing likely outcome of an illness (e.g. Glasgow Coma Scale, APACHE II and III, PRISM, organ system failure scores, injury severity scores)

Influence of injury or illness being considered on the validity of a scoring system as a predictor of likely outcome (e.g. Glasgow Coma Score (GCS) in head injury versus drug overdose)

One general method for measuring severity of illness (severity scoring systems)

Principles of case-mix adjustment

Skills & Behaviours

Lead, delegate and supervise others appropriately according to experience and role

Respect, acknowledge & encourage the work of others

Listen effectively

Collaborate with other team members to achieve common goals

Manage inter-personal conflicts which arise between different sectors of the organisation, professionals, patients or relatives

Demonstrate initiative in problem solving

Propose realistic initiatives / projects to promote improvement

Contribute to departmental / ICU activities

Acquire, interpret, synthesize, record, and communicate (written and verbal) clinical information

Assemble clinical and laboratory data, logically compare all potential solutions to the patient's problems, prioritise them and establish a clinical management plan

Confirm accuracy of clinical information provided by members of the health care team

Consider risk-benefit and cost-benefit of alternative drugs & therapies

Consider potential interactions when prescribing drugs & therapies

Establish a management plan based on clinical and laboratory information

Aware of relevant guidelines and consensus statements and apply these effectively in every day practice under local conditions

Implement and evaluate protocols and guidelines

Use a systematic approach to locate, appraise, and assimilate evidence from scientific studies relevant to a patient's health problem

Use electronic retrieval tools (e.g. PubMed) to access information from the medical & scientific literature

Recognise the need for clinical audit and quality improvement activities to be non-threatening and non-punitive to individuals

Participate in the processes of clinical audit, peer review and continuing medical education

Manage resistance to change in the ICU / hospital environment in order to optimize the outcome of a task

Record relevant clinical information accurately

Professional and reassuring approach - generates confidence and trust in patients and their relatives

Organise multidisciplinary care for groups of patients in the ICU

Plan long-term multidisciplinary care for patients in the ICU

Identify members of the health care team which require representation at a case conference
Timely organisation - liaise with members of the health care team to identify a suitable time and place for a case conference to maximise attendance
Identify necessary notes / investigations to support discussion during a case conference
Summarise a case history
Accept personal responsibility for the prevention of cross infection and self infection
Demonstrate routine application of infection control practices to all patients, particularly hand washing between patient contacts
Use protective clothing (gloves / mask / gown / drapes) as indicated
Apply methods to prevent autogenous infection (e.g. posture, mouth hygiene)
Implement prophylactic regimens appropriately
Maximise safety in everyday practice
Prescribe antibiotics safely and appropriately
Demonstrate an interest in quality control, audit and reflective practice
Seek expert help to ensure all equipment in the ICU conforms with and is maintained to the relevant safety standard
Monitor complications of critical illness
Document adverse incidents in a timely, detailed and appropriate manner
Inform colleagues, patients and relatives as applicable, of medical errors or adverse events in an honest and appropriate manner

Attitudes

Accepts responsibility for patient care and staff supervision

Recognises impaired performance (limitations) in self and colleagues and takes appropriate action

Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

Consults, communicates and collaborates effectively with patients, relatives and the health care team

Desire to minimise patient distress

Seeks to modify the stresses which the intensive care environment places upon patients, their relatives and members of staff

Establishes collaborative relations with other health care providers to promote continuity of patient care as appropriate

Consult and take into account the views of referring clinicians; promote their participation in decision making where appropriate

Ensures effective information transfer

Adopts a problem solving approach

Enquiring mind, undertakes critical analysis of published literature

DOMAIN 12: PROFESSIONALISM

Knowledge

Basic ethical principles: autonomy, beneficence, non-maleficence, justice

Consent and assent in the competent and non-competent patient

Ethical and legal issues in decision-making for the incompetent patient

Confidentiality and data protection - legal and ethical issues

Methods of effective communication of information (written; verbal etc)

Management of information

Principles of crisis management, conflict resolution, negotiation and debriefing

Principles of delivering bad news to patients and families

Sources of information about different cultural and religious attitudes and beliefs to life threatening illness and death available to health care professionals.

Impact of occupational and environmental exposures, socio-economic factors, and life style factors on critical illness

Strategies to communicate to the general population critical care issues and their impact on the maintenance and improvement of health care.

Principles of adult education and factors that promote learning

Principles of professional appraisal and constructive feedback

Purpose and process of quality improvement activities such as evidence based practice, best practice guidelines & benchmarking and change management

Methods of audit and translating findings into sustained change in practice

Use of information technology to optimize patient care and life-long learning

Electronic methods of accessing medical literature

Identification and critical appraisal of literature; integration of findings into clinical practice

Principles of appraisal of evidence: levels of evidence; interventions; diagnostic tests; prognosis; integrative literature (meta-analyses, practice guidelines)

Principles of applied research and epidemiology necessary to evaluate new guidelines/therapies

Principles of medical research: research questions; protocol design; power analysis, data collection, data analysis and interpretation of results; manuscript preparation and publication

Ethical principles involved in conducting research (including subject protection, consent, confidentiality and competing interests) and national ethical approval processes

Ethical management of relationships with industry

Requirements of ICM training at local and national level

Skills & Behaviours

Communicate with patients and relatives - give accurate information and re-iterate to ensure comprehension; clarify ambiguities

Discuss treatment options with a patient or relatives before ICU admission

Differentiate competent from incompetent statements by patients

Communicate effectively with relatives who may be anxious, angry, confused, or litigious

Obtain consent/assent for treatment, research, autopsy or organ donation

Use non-verbal communication appropriately

Use available opportunities and resources to assist in the development of personal communication skills

Manage inter-personal conflicts which arise between different sectors of the organisation, professionals, patients or relatives

Acquire, interpret, synthesize, record, and communicate (written and verbal) clinical information

Listen effectively

Involve patients in decisions about their care and treatment

Professional and reassuring approach - generates confidence and trust in patients and their relatives

Act appropriately as a member or leader of the team (according to skills & experience)

Lead, delegate and supervise others appropriately according to experience and role

Communicate effectively with professional colleagues to obtain accurate information and plan care

Collaborate with other team members to achieve common goals

Consult and take into account the views of referring clinicians; promote their participation in decision making where appropriate

Liaise with medical and nursing staff in other departments to ensure optimal communication and continuing care after ICU discharge

Participate appropriately in educational activities and teaching medical and non-medical members of the health care team

Contribute to professional meetings - understand their rules, structure and etiquette

Respect, acknowledge & encourage the work of others

Take decisions at a level commensurate with experience; accept the consequences of these decisions

Attentive to detail, punctual, reliable, polite and helpful

Contribute to departmental / ICU activities

Participate in the processes of clinical audit, peer review and continuing medical education

- **Propose realistic initiatives / projects to promote improvement**
- **Utilise personal resources effectively to balance patient care, learning needs, and outside activities.**
- **Develop, implement and monitor a personal continuing education plan including maintenance of a professional portfolio**
- **Use learning aids and resources to undertake self directed learning**
- **Use electronic retrieval tools to access information from the medical & scientific literature**
- **Use a systematic approach to locate, appraise, and assimilate evidence from scientific studies relevant to a patient's health problem**
- **Demonstrate initiative in problem solving**
- **Maximise safety in everyday practice**

Attitudes

- **Well-being of the patient takes precedence over the needs of society or research**
- **Desire to contribute to the development of new knowledge**
- **Seeks to recognise those changes in the specialty, medicine or society, which should modify their practice and adapt their skills accordingly**
- **Integrity, honesty & respect for the truth underpin relationships with patients, relatives and colleagues**
- **Establishes trusting relationships with and demonstrates compassionate care of patients and their relatives**
- **Consults, communicates and collaborates effectively with patients, relatives and the health care team**
- **Sensitive to the reactions and emotional needs of others**
- **Approachable and accessible when on duty**
- **Regards each patient as an individual**
- **Willingness to communicate with and support families / significant others**
- **Promotes respect for patient privacy, dignity and confidentiality**
- **Acknowledges the consequences of the language used to impart information**
- **Recognises that communication is a two-way process**
- **Assesses, communicates with, and supports patients and families confronted with critical illness**
- **Sensitive to patients' expectations and responses; considers their perspective in order to understand their conduct and attitudes**
- **Respects the cultural and religious beliefs of the patient; demonstrate an awareness of their impact on decision making**

Respects the expressed wishes of competent patients

Desire to minimise patient distress

Seeks to modify the stresses which the intensive care environment places upon patients, their relatives and members of staff

Recognises personal limitations, seeks and accepts assistance or supervision (knows how, when and who to ask)

Recognises impaired performance (limitations) in self and colleagues and takes appropriate action

Recognises personal strengths and limitations as a consultant to other specialists

Adopts a problem solving approach

Fosters effective communication and relationships with medical and nursing staff in other wards / departments

Accepts responsibility for patient care and staff supervision

Generates enthusiasm amongst others

Desire and willingness to share knowledge

Contributes effectively to interdisciplinary team activities.

Participates in, and promotes continuing education of members of the health care team.

Takes responsibility for his/her personal physical and mental health, especially where impairment may affect patient care and professional conduct

Enquiring mind, undertakes critical analysis of published literature

Recognises and uses teaching and learning opportunities arising from clinical experiences, including errors

Recognises and manages circumstances where personal prejudices or biases may affect behaviour, including cultural, financial and academic aspects

TEACHING PROGRAMME

A comprehensive teaching program will be part of the training. A multi-faceted approach will be taken in the teaching program. It will comprise of classroom sessions, workshops, clinical teaching on the patients as well as practical assessment of skills.

PRACTICAL ASSIGNMENTS

On the job assignments are the main component of the residency. The residents will be following regular shift duties (Morning – 6 hours, Evening – 6 hours, Night – 12 hours). It is considered that 2/3rd of the time of the shift duties are dedicated to the learning process and skills development at the bedside under supervision. The residents will be supervised in each shift by the senior registrars of the department.

TEACHING SESSIONS

Teaching sessions will be held thrice a week from 12 pm to 1 pm and will be regularly followed. Attendance will be mandatory for all residents and the following schedule will be implemented.

Monday – Case Discussion / Long Case presentation

Thursday – Topic presentation

Saturday – Journal Club / Morbidity & Mortality Meeting

MODULE LECTURES

In addition, regular teaching sessions / lectures will be carried out by the faculty or the senior registrars based on the modules of the corresponding year. These sessions will be held on a weekly basis and classes will be held from 2 pm – 3 pm, three days a week namely Tuesday, Wednesday & Friday.

INTERNATIONAL SESSIONS

A monthly case discussion will be held with the international faculty via skype sessions in which a problematic case will be presented by one of the residents. This will allow the residents gain valuable insight into the international protocols and guidelines being followed in critical care medicine as well polishing their presentation skills.

THESIS

The residents are expected to decide about the topic of their thesis within the first six months of initiation of residency. The synopsis shall be submitted within the first year of training programme and data collection of the thesis shall start from the second year of training.

The final thesis will be written by the resident in year VI of training and submitted at least 2 months before the final examination.

ROTATION PLAN

The residents will be rotated in various medical and surgical departments for a period of no less than one year. The rotations will be decided upon by the program director and after taking into account the previous experience of the residents as well as their personal preferences. The first year of residency would consist of rotations within the department of critical care medicine (Medical and Surgical Intensive Care units) and external rotations would be started from the second year onwards. However, the timing of the rotations can be changed by the program director. Residents can opt for any of the following rotations,

- Internal Medicine or Anesthesia – 4 months
    - Residents with previous medicine background would be rotated to anesthesia whereas residents who have no background medicine exposure would be rotated to Internal medicine.
- Neurology – 2 months
- Pulmonology – 1 month
- Emergency Medicine – 2 months
- Radiology – 1 month
- Cardiology – 1 month
- Nephrology – 1 month
- Anesthesia (additional rotation) – 2 months
- Surgical Rotations
    - Neurosurgery / General Surgery / Orthopedics – 1 month each

In addition to the basic rotations, residents can also opt for rotations to specialized ICU's which, in total, would not exceed a period of 6 months. These rotations are not compulsory and subject to the program director's approval. The specialized rotations can be done in the following ICU's

- Burn ICU
- Cardiac Surgery ICU
- Pediatric ICU
- Neonatal ICU
- Neurosurgical ICU / Neurocritical care ICU
- External ICU (ICU in another tertiary care hospital – within or outside Pakistan, approved for level- III training)
    - Note : Residents already holding a level – II (a or b) level qualification (PMDC equivalence) would be exempt from rotations including rotations to specialized ICU's, however they may rotate to said units on recommendation of the program director

TOTAL DURATION OF ROTATIONS (MANDATORY/SPECIALIZED) WILL BE BETWEEN 12-18 MONTHS DEPENDENT UPON THE APPROVAL OF THE PROGRAM DIRECTOR.

ASSESSMENT

ASSESSMENT

Assessment of trainees will cover the cognitive, psychomotor and affective domains. It will take two forms

- Formative Assessment
- Summative Assessment

Formative Assessment

It is the continuous assessment of progress and competence. It will be conducted through workplace based assessment throughout the training. Assessment will be undertaken by a range of assessors and will cover a range of procedures appropriate to the stage of training. Formative assessment will include

- Directly observed practical skills (DOPS)
- Case based discussion (CbD)
- Mini clinical examination exercises (Mini-CEX)
- Multiple source feedback (MSF)

Summative Assessment

Summative assessment will be held twice

- Mid Term Assessment (MTA) Examination (At the end of 3rd year)
- Final/Exit Examination (At the end of Final Year)

The level of performance required for passing the exam will depend on the knowledge and skills necessary for acceptable performance and will not be adjusted to regulate the number or proportion of persons passing the examination. The pass point will be determined by careful analysis and judgment of acceptable performance.

Record of Clinical Cases

The trainees will be required to keep a record of the allocated clinical work in a log book. It will be the responsibility of trainee to keep the log book up to date with the signature of the faculty certifying the work.

Assessment of the residents will be multi-pronged and based on several factors. It will not be limited to the intermediate module examination and the final examination rather there will be yearly internal assessments based on the pattern of the final examination.

1) **ANNUAL INTERNAL ASSESSMENT**
    a. The annual internal assessment will be carried out by the department based on that years domains and modules
    b. Its pattern will be based on the final and intermediate examination and will consist of,
        i. Written examination
            1. Multiple choice questions (MCQs)
            2. Essay type / Scenario based questions (SAQs)
        ii. Practical examination
            1. Long case discussion
            2. OSCE examination
            3. Short case discussion / Table Viva
        iii. Peer & Supervisor reviews
            1. An internal assessment will be carried out regarding the conduct, attendance, behavior and attitudes of the residents
            2. Peer review of these attributes will be carried out by fellow residents both junior as well as seniors.
            3. In addition, SR reviews will carry equal importance in determining the attributes of the residents
            4. All reviews will be based on the domains of good medical practice and domains described earlier in this curriculum.

2) **INTERMEDIATE MODULE**
    a. The intermediate module examination (IMM) will be conducted after three years of training as based of SZABMU guidelines and will comprise of the domains and modules of the first three years of the curriculum.

3) FINAL EXAMINATION

a. Final examination will be conducted after completion of the six year training program as laid down in the guidelines of SZABMU.
b. Pattern of the examination would be based on the University Guidelines and International practices
    i. Written examination
        1. Multiple choice questions (MCQs)
    ii. Practical examination
        1. Long case discussion
            a. Note : Long case discussion will be scenario based and does not necessarily need to be carried out on a patient's bedside. It can be a computer based simulation (If resources are available) OR it can be a scenario

            b. Scenario Guidelines : A clinical scenario (relevant to ICU care) would be handed to the examiner with a set of guidelines regarding the minimum amount of knowledge required to pass each step. It would include steps including but not limited to presentation to hospital, initial evaluation, investigations, diagnosis, ICU admission, ICU course of management, Complications developed during ICU care, ICU discharge and ICU follow-up.
        2. OSCE examination
    iii. Short case discussion / Table Viva
    iv. Thesis Defense
    v. Log Book
c. The marks for each section would be set according to the prevalent University pattern.
d. A separate section for examination guidelines will be submitted to the University.

WORKSHOP & COURSES

The residents will have to attend and complete the mandatory workshop schedule as mandated by the University which will include the following,

1. **Communication Skills**
2. **Computer Skills**
3. **Research Methodology, Biostatistics & Medical Writing**
4. **BLS**

In addition, once the university is approved for **ACLS training or certified for ACLS provision**, all new inductees into MD critical care medicine will have to complete ACLS within the first year of their training. Following which they will be given two warnings to complete the ACLS certification before strict action is to be taken.

The BASIC (Basic Assessment & Support in Intensive Care) course will also be a part of the training course once the university and instructors are approved for imparting training to the residents. Once the university has been approved, all residents would have to complete the BASIC course within the first year of training, preferably within the first six months of initiation of training.

TABLE OF SPECIFICATIONS

Table of specifications or Mid Term Assessment (MTA) and Final (Exist) Examination is here as under

TOS FOR MID TERM ASSESSMENT (MTA)
MD-CCM

There will be theory paper as well as Practical examination

- **Theory Paper (MCQs)** **100 Marks**
- **Practical (OSCE)** **100 Marks**

TOS FOR MTA THEORY EXAMINATION

MODULE : General Concepts		Percentage in MTA	MCQs
1.1	Historical perspective	10%	10
1.2	Minimal requirements of an ICU		
1.3	Organisation of care in the ICU		
1.4	Triage, admission / discharge criteria		
1.5	ICU scoring systems		
1.6	Patient Safety		
1.7	Learning resources		
1.8	Communicating with families		

MODULE : Respiration		Percentage in MTA	MCQs
2.1	Ventilation, perfusion and gas exchange in the critically ill	20%	20
2.2	Airway management		
2.3	Acute asthma and COPD in the ICU		
2.4	Acute Respiratory Distress Syndrome		
2.5	Extrapulmonary causes of respiratory failure		
2.6	Acute respiratory failure in pregnancy		
2.7	Venous thrombo-embolism: Pulmonary embolism & Deep Venous thrombosis		
2.8	Aspiration & Drowning		
2.9	Mechanical Ventilation : Invasive, Non Invasive ventilation & Weaning		
2.10	Acute Infectious Pneumonias		
2.11	Gas Embolism Syndrome		
2.12	Acute Inhalation Injury		

MODULE : Circulation		Percentage in MTA	MCQs
3.1	Oxygen transport and delivery, regulation of blood pressure and blood volume	15%	15
3.2	Hypotension and hemodynamic instability		
3.3	Evaluation and Management of hypertension in ICU		
3.4	Management of advanced heart failure		
3.5	Unstable angina / NSTEMI		
3.6	ST- segment elevation MI & complications		
3.7	Ventricular Tachycardias		
3.8	Supraventricular Tachyarrhythmias		
3.9	Bradyarrhythmias		
3.10	ACLS & Cardiac Arrest		
3.11	Hemodynamic monitoring		
3.12	Infectious Endocarditis		

MODULE : Renal & Endocrine Disturbances		Percentage in MTA	MCQs
4.1	Metabolic Acidosis & Alkalosis	20%	20
4.2	Disorders of Sodium & Potassium		
4.3	Acute Kidney Injury in the ICU		
4.4	Renal replacement therapy in ICU		
4.5	Disorders of calcium, phosphate and magnesium		
4.6	Thyroid storm & myxedema coma		
4.7	Addisons disease & syndrome		
4.8	Management of hyperglycemia in ICU		
4.9	Diabetic Ketoacidosis & Hyperglycemic Hyperosmolar State		
4.10	Sick euthyroid syndrome		

MODULE : Neurology		Percentage in MTA	MCQs
5.1	Evaluation of a patient with altered consciousness in ICU	20%	20
5.2	Metabolic Encephalopathy		
5.3	Cerebrovascular disease		
5.4	Status epilepticus		
5.5	Gullian-Barre syndrome & Myasthenia Gravis		
5.6	Subarachnoid Hemorrhage		
5.7	Critical illness myopathy & neuropathy		
5.8	Generalized anoxia of the CNS		
5.9	Miscellaneous Neurologic problems in ICU		
5.10	Neuroimaging in critically ill patients		
5.11	CNS infections including cerebral malaria		

MODULE : Gastroenterology & Nutrition		Percentage in MTA	MCQs
6.1	Upper & Lower GI bleeding	15%	15
6.2	Gastrointestinal motility in the critically ill		
6.3	Stress ulcer syndrome		
6.4	Fulminant colitis & toxic megacolon		
6.5	Evaluation & Management of Liver failure		
6.6	Diarrhea		
6.7	Acute Pancreatitis		
6.8	Nutritional therapy in the critically ill		
6.9	Parenteral & enteral nutrition in the ICU		

TOS FOR MTA PRACTICAL EXAMINATION

10 OSCE-Stations (100 Marks)

(5 minutes each station)

TOS MODULE	TITLE	STATIONS
01	General Concepts	1
02	Respiration	2
03	Circulation	2
04	Renal & Endocrine Disturbances	2
05	Neurology	2
06	Gastroenterology & Nutrition	1
Total		10

TOS for Final/Exit Examination MD-CCM

Final Examination (After completion of 6 years)

The student shall submit completion of training certificate, Log Book, mandatory workshop attendance, thesis on research topic approved by supervisor, through the Dean to the Controller of Examination. If the thesis not approved by the supervisor, application for extension may be recommended by supervisor through Registrar to the AS&RB. The final examination of major subject, thesis evaluation and viva voce examination will be conducted by board of Six (06) examiners in major subjects. The candidate will be examined in major subject and thesis as under: supervisor will not be paper setter/Examiner of his/her candidate as per PMDC regulation 2001.

Theory Paper **200 Marks**

Paper I	Speciality Course MCQs	100 Marks
Paper II	Speciality Course MCQs	100 Marks

Viva Voce & Practical **200 Marks**

Viva Voce **40 Marks**

Practical and OSCE/OSPE **160 Marks**

a. Long Case (One) (30 Marks)

a. Note : Long case discussion will be scenario based and does not necessarily need to be carried out on a patient's bedside. It can be a computer based simulation (If resources are available) OR it can be a scenario

b. Scenario Guidelines : A clinical scenario (relevant to ICU care) would be handed to the examiner with a set of guidelines regarding the minimum amount of knowledge required to pass each step. It would include steps including but not limited to presentation to hospital, initial evaluation, investigations, diagnosis, ICU admission, ICU course of management, Complications developed during ICU care, ICU discharge and ICU follow-up.

b. Short Case (Four) (50 Marks)

c. OSCE (80 Marks)

Thesis Defense **100 Marks**

TOTAL **500 Marks**

TOS for Theory Paper A & B Final Exit Examination

PAPER A

MODULE : General Concepts		Percentage in Paper A	MCQs
1.1	Historical perspective	10%	10
1.2	Minimal requirements of an ICU		
1.3	Organisation of care in the ICU		
1.4	Triage, admission / discharge criteria		
1.5	ICU scoring systems		
1.6	Patient Safety		
1.7	Learning resources		
1.8	Communicating with families		

MODULE: Respiration		Percentage in Paper A	MCQs
2.1	Ventilation, perfusion and gas exchange in the critically ill	20%	20
2.2	Airway management		
2.3	Acute asthma and COPD in the ICU		
2.4	Acute Respiratory Distress Syndrome		
2.5	Extrapulmonary causes of respiratory failure		
2.6	Acute respiratory failure in pregnancy		
2.7	Venous thromboembolisim : Pulmonary embolism & Deep Venous thrombosis		
2.8	Aspiration & Drowning		
2.9	Mechanical Ventilation : Invasive, Non Invasive ventilation & Weaning		
2.10	Pleural diseases in the critically ill patient		
2.11	Acute Infectious Pneumonias		
2.12	Gas Embolism Syndrome		
2.13	Acute Inhalation Injury		

MODULE: Circulation		Percentage in Paper A	MCQs
3.1	Oxygen transport and delivery, regulation of blood pressure and blood volume	15%	15
3.2	Hypotension and hemodynamic instability		
3.3	Evaluation and Management of hypertension in ICU		
3.4	Management of advanced heart failure		
3.5	Valvular heart disease in ICU		
3.6	Unstable angina / NSTEMI		
3.7	ST- segment elevation MI & complications		
3.8	Ventricular Tachycardias		
3.9	Supraventricular Tachyarrhythmias		
3.10	Bradyarrhythmias		
3.11	ACLS & Cardiac Arrest		
3.12	Hemodynamic monitoring		
3.13	Infectious Endocarditis		

MODULE: Renal & Endocrine Disturbances		Percentage in Paper A	MCQs
4.1	Metabolic Acidosis & Alkalosis	20%	20
4.2	Disorders of Sodium & Potassium		
4.3	Acute Kidney Injury in the ICU		
4.4	Renal replacement therapy in ICU		
4.5	Disorders of calcium, phosphate and magnesium		
4.6	Thyroid storm & myxedema coma		
4.7	Addisons disease & syndrome		
4.8	Management of hyperglycemia in ICU		
4.9	Diabetic Ketoacidosis & Hyperglycemic Hyperosmolar State		
4.10	Sick euthyroid syndrome		

MODULE: Neurology		Percentage in Paper A	MCQs
5.1	Evaluation of a patient with altered consciousness in ICU	20%	20
5.2	Metabolic Encephalopathy		
5.3	Cerebrovascular disease		
5.4	Status epilepticus		
5.5	Gullian-Barre syndrome & Myasthenia Gravis		
5.6	Subarachnoid Hemorrhage		
5.7	Critical illness myopathy & neuropathy		
5.8	Generalized anoxia of the CNS		
5.9	Miscellaneous Neurologic problems in ICU		
5.10	Neuroimaging in critically ill patients		
5.11	CNS infections including cerebral malaria		

MODULE: Gastroenterology & Nutrition		Percentage in Paper A	MCQs
6.1	Upper & Lower GI bleeding	15%	15
6.2	Gastrointestinal motility in the critically ill		
6.3	Stress ulcer syndrome		
6.4	Fulminant colitis & toxic megacolon		
6.5	Evaluation & Management of Liver failure		
6.6	Diarrhea		
6.7	Acute Pancreatitis		
6.8	Severe and complicated biliary tract disease		
6.9	Nutritional therapy in the critically ill		
6.10	Parenteral & enteral nutrition in the ICU		

PAPER B

MODULE: Infectious Diseases & Hematologic diseases		Percentage in Paper B	MCQs
7.1	Fever in an ICU patient	20%	20
7.2	Use of antimicrobials for treatment of infectious diseases in ICU		
7.3	Tetanus		
7.4	Botulism		
7.7	Tuberculosis		
7.6	Severe sepsis		
7.7	HIV in an ICU setting		
7.8	Viral Hemorrhagic Fevers and emerging viral infections		
7.9	Infections associated with vascular catheters & UTI's		
7.10	Disorders of hemostasis in the critically ill patient		
7.11	Thrombocytopenia in ICU		
7.12	Transfusion therapy :Blood components and complications of transfusions		
7.13	Anemia in critical care setting		
7.14	COVID 19 Management		
7.15	Antithrombotic pharmacotherapy		
7.16	Critical care of patients with hematologic malignancies		

MODULE: Toxicology		Percentage in Paper B	MCQs
8.1	General principles – Toxidromes	20%	20
8.2	Acetaminophen Poisoning		
8.3	Organophosphate Poisoning		
8.4	Alcohol & glycols Poisoning		
8.5	Opioid Poisoning		
8.6	Antiarrhythmic, anti-epileptic, anti-psychotic Poisoning		
8.7	Salicylate & NSAID's Poisoning		
8.8	Corrosive Poisoning		
8.9	Beta- blocker & Calcium channel blockers Poisoning		
8.10	Cocaine Poisoning		
8.11	Sedative-Hypnotic Poisoning		
8.12	Heavy Metal Poisoning		
8.13	Envenomations		
8.14	Carbon monoxide poisoning & cyanide poisoning		

MODULE: Surgical Problems in ICU & Trauma		Percentage in Paper B	MCQs
9.1	Management of Post operative Cardiac Surgical Patient	20%	20
9.2	Management of Post operative Neurosurgical Patient		
9.3	Esophageal perforation & acute mediastinitis		
9.4	Acute Mesenteric Ischemia		
9.5	Acute Limb Ischemia		
9.6	Intra-abdominal sepsis		
9.7	Abdominal compartment syndrome		
9.8	Traumatic Brain Injury		
9.9	Spinal cord Trauma		
9.10	Thoracic & Cardiac Trauma		
9.11	Management of critically ill abdominal trauma patient		
9.12	Resuscitation from shock following trauma		
9.13	Fat embolism & orthopedic injury		
9.14	Pressure sores		
9.15	Trauma Systems		

MODULE: Miscellaneous		Percentage in Paper B	MCQs
10.1	Rheumatologic diseases in the ICU	10%	10
10.2	Vasculitis in the ICU		
10.3	Anaphylaxis		
10.4	Delirium, Agitation, Depression in the ICU		
10.5	End of Life care		
10.6	Hypo & Hyperthermia in ICU		
10.7	Burn Management		
10.8	Heat stroke		
10.10	Critical care problems in renal transplant patients		
10.10	Critical care of liver transplant patients		
10.11	Immunosuppression in solid transplant recipients		
10.12	Disaster management		
10.13	Biological & chemical warfare		

MODULE: Pregnancy		Percentage in Paper B	MCQs
11.1	Post partum hemorrhage	15%	15
11.2	Septic abortion		
11.3	Eclampsia & HELLP syndrome		
11.4	Chronic diseases, acute hepatic & renal failure in Pregnancy		
11.5	Cerebral vein Thrombosis in post partum patients		
11.6	Amniotic fluid embolism		
11.7	Management of obstetrical patients in a post operative setting		

MODULE: Radiology in Critically Ill Patients		Percentage in Paper B	MCQs
12.1	Chest Ultrasound in Critically Ill Patient	15%	15
12.2	Echocardiography in Critically Ill Patient		
12.3	FAST SCAN		
12.4	Fluid Responsiveness via Ultrasonography		
12.5	Ultrasound Guided Placement of Catheters		
12.6	CT Scan interpretation Chest/Abdomen/Brain		
12.7	Neuroradiological Evaluation interpretation in Critically Ill Patients		

TOS FOR PRACTICAL EXAMINATION FINAL EXIT EXAMINATION

10 OSCE-Stations (80 Marks)

(5 minutes each station)

TOS MODULE	TITLE	STATIONS
02	Respiration	1
03	Circulation	1
04	Renal & Endocrine Disturbances	1
05	Neurology	1
06	Gastroenterology & Nutrition	1
07	Infectious Diseases & Hematologic diseases	1
08	Toxicology	1
09	Surgical Problems in ICU & Trauma	1
10	Miscellaneous	1
11	Pregnancy	
12	Radiology in Critically Ill Patients	1
Total		10

LEARNING RESOURCES

List of Essential Readings

Books:

Latest edition of all of the following books

1) Critical Care by Civetta, Taylor, and Kirby
2) Intensive Care Medicine by Irwin and Rippe
3) The ICU Book by Paul Maurino
4) Oh's Intensive Care Manual by Andrew Bersten, Jonathan Handy
5) Oxford Textbook of Critical Care
6) The Washington Manual of Critical Care

Journals

Issues of the last two years of the following journals

1) Intensive Care Medicine
2) Journal of Critical Care
3) American Journal of Critical Care
4) Annals of Intensive Care

PROGRAM EVALUATION

PROGRAM EVALUATION

The program director will continue to ensure that the program is fit for purpose in that it provides the trainee with the appropriate knowledge, skills, attitudes and competencies required to meet the requirements of a specialist.

Program evaluation will be carried out after every two years according to the CIPP model of evaluation. Any suggested updates will only be made following appropriate consultation with stakeholders, including trainees and lay members.

Feedback forms are attached as “Annexure **A”**

ANNEXURE A

Supervisor Evaluation Form

Date: _____Supervisor's Name: _____

Your Name:_____ Signature: _____

Evaluations of supervisors by Trainee's are an important process for providing supervisors with an assessment of the quality of their work. Annual supervisor assessments can be used to compliment a supervisor for doing a good job. Annual assessments can also identify areas for improvement. Evaluations can strengthen communications between supervisors and trainee's.

Trainees have three options for evaluating supervisors:

1) Completing the Evaluation of Supervisor form.
2) Writing a signed memo evaluating the supervisor.
3) Meeting with the supervisor's department head.

Evaluations received by the deadline (January 15) will be incorporated into the annual review of the supervisor. Forms and/or signed memos should be sent to the Human Resources department.

* * *

(E=Excellent, G=Good, S=Satisfactory, N=Needs Work, U=Unsatisfactory, Ø=No Opinion)

Performs Supervisory Functions

Provides on-going positive and negative feedback	**E**	**G**	**S**	**N**	**U**	**Ø**
Makes expectations known	**E**	**G**	**S**	**N**	**U**	**Ø**
Is tactful and considerate	**E**	**G**	**S**	**N**	**U**	**Ø**
Promotes teamwork and good working relationships	**E**	**G**	**S**	**N**	**U**	**Ø**
Recognizes and addresses concerns in a timely manner	**E**	**G**	**S**	**N**	**U**	**Ø**
Delegates authority appropriately	**E**	**G**	**S**	**N**	**U**	**Ø**
Provides training of new employees	**E**	**G**	**S**	**N**	**U**	**Ø**
Provides direction of work	**E**	**G**	**S**	**N**	**U**	**Ø**
Communicates openly and honestly with peers, staff and administration	**E**	**G**	**S**	**N**	**U**	**Ø**

Comments: _____

_____

Recognizes contributions	**E**	**G**	**S**	**N**	**U**	**Ø**
Motivates workers	**E**	**G**	**S**	**N**	**U**	**Ø**
Provides relaxed yet efficient work atmosphere	**E**	**G**	**S**	**N**	**U**	**Ø**
Encourages staff development	**E**	**G**	**S**	**N**	**U**	**Ø**

_____

_____

_____

_____

Develops Innovative Procedures

Is receptive to new ideas	**E**	**G**	**S**	**N**	**U**	**Ø**
Is receptive to questions	**E**	**G**	**S**	**N**	**U**	**Ø**
Encourages initiative and innovation	**E**	**G**	**S**	**N**	**U**	**Ø**

Comments: _____

_____

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_____

III. Maintain Positive Works Enivrement

Comments:_____

Acknowledges own limitations and mistakes	**E**	**G**	**S**	**N**	**U**	**Ø**
Maintains a positive work attitude	**E**	**G**	**S**	**N**	**U**	**Ø**
Uses time efficiently and effectively	**E**	**G**	**S**	**N**	**U**	**Ø**
Demonstrates a good work ethic	**E**	**G**	**S**	**N**	**U**	**Ø**

Knows the Operations of the Department

Understands employee workload	**E**	**G**	**S**	**N**	**U**	**Ø**
Is alert to potential problems	**E**	**G**	**S**	**N**	**U**	**Ø**
Keeps staff informed about department and university developments	**E**	**G**	**S**	**N**	**U**	**Ø**

Comments: _____

Work Habits

Comments: _____

_____

_____

_____

_____

_____

_____

Please use the bottom and back of this sheet as space for expanding on any comments above or to make any additional comments.

Program Evaluation Form

Please use the following scale to indicate your response to the statements below:

SA = strongly agree

A = agree

N = neither agree/disagree

D = disagree

SD = strongly disagree

The information was presented effectively	**SA**	**A**	**N**	**D**	**SD**
The information presented was practical	**SA**	**A**	**N**	**D**	**SD**
The program provided a good working knowledge of the subject matter presented	**SA**	**A**	**N**	**D**	**SD**
The program has allowed me to acquire practical skills and knowledge to manage my business more effectively and efficiently	**SA**	**A**	**N**	**D**	**SD**
The program attended was sufficient for my purpose	**SA**	**A**	**N**	**D**	**SD**

AKNOWLEDGEMENT

We are extremely grateful to **Prof. Dr. Iqbal Memon** who during his tenure as Chairman of Anesthesia and Critical Care Department designed the current curriculum of the MD Critical Care Medicine. This would not have been possible without his efforts.