

Program Name : Diploma in Medical Electronics
Program Code : MU
Semester : Fifth
Course Title : Intensive Care Equipment
Course Code : 22548

1. RATIONALE

In the hospitals, Intensive Care Unit (ICU) is equipped with various emergency and special care equipment. Intensive Care Unit equipment are pacemaker, defibrillator, patient monitors etc. Such equipment are also used in operation theatre. This course will cover detail study of their working principle, operating modes, block diagram and technical specifications. The skills developed through this course will facilitate to maintain Intensive Care Unit equipment needed for hospitals as well as medical equipment manufacturing industry.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Maintain intensive care equipment.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

- Identify intensive care equipment for the upkeep and maintenance of ICCU.
- Maintain and troubleshoot defibrillator.
- Maintain various types of respiratory aids like ventilator and nebulizer.
- Maintain bed side monitor to record various physiological parameters.
- Maintain the performance of life support equipment.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
12	Use Infusion pump.	IV	02
13	Test the performance of hemodialysis machine.	V	02
14	Plot characteristics of temperature control in baby incubator.	V	02
	Total		28

Note

- Given in above tables is suggestive list of practical exercises. Teachers can design other similar exercises.
- To attain the COs and competency, a judicious mix of 10 or more practicals/exercises from the above listed LOs need to be performed to achieve up to the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy'.

Assessment of the 'Process' and 'Product' related skills in the laboratory/workshop/field work should be done as per suggested sample below:

S.No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
	Total	100

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Practice energy conservation.
- Work as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.



8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit– I Critical care Instrumentation and Cardiac Pacemaker	1a. Describe the layout of specified critical care unit with sketch. 1b. Explain need of given type of cardiac pacemaker along with block diagram. 1c. Compare between internal and external pacemaker with respect to specified aspect. 1d. Explain with sketches the use of given type of leads of pacemaker. 1e. Describe the procedure to use given type of leads. 1f. List the technical specifications of the specified type of pacemaker.	1.1 Critical care instruments used in ICU of the hospital. 1.2 Concepts of NICU, ICU, ICCU 1.3 Cardiac arrhythmias; heart block and need of cardiac pacemaker 1.4 Types of pacing modes, types of pacemaker; internal, external, fixed /asynchronous, demand /synchronous and programmable pacemaker 1.5 Pacemaker leads 1.6 Technical specifications of pacemaker
Unit– II Defibrillator	2a. Describe the function of specified section of dc-defibrillator with simplified circuit diagrams. 2b. Explain with sketches the use of given type of electrode of DC-defibrillator. 2c. Describe the advantage of DC- defibrillator as compared to AC defibrillator with respect to specific aspect. 2d. Explain with sketches the working principle and waveform of specified type of defibrillator along with its merits and demerits. 2e. Prepare the technical specifications and important steps of maintenance of given DC defibrillator.	2.1 Fibrillation of heart, need of defibrillator, types of defibrillator 2.2 Modes of defibrillator; asynchronous and synchronous 2.3 Electrodes of defibrillator 2.4 Charging and discharging of DC-defibrillator 2.5 Automated External Defibrillator (AED), biphasic and monophasic defibrillator 2.6 Technical specifications of DC defibrillator
Unit-III Ventilator, Nebulizer and Suction Apparatus	3a. Describe with sketches the function of specified type of ventilator with respect to the concept of artificial ventilation. 3b. Explain the specified measurable parameter related with respiratory system. 3c. Describe with sketches the given mode of ventilator. 3d. Explain with sketches the working	3.1 Respiration and apnea, artificial ventilation, types of ventilator 3.2 Measurable parameters related to lung mean airway pressure, inspiratory pause time, tidal volume, minute volume, conventional mechanical ventilation, positive end expiratory pressure (PEEP) 3.3 Ventilator, nebulizer, suction



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
II	Defibrillator	08	03	04	06	13
III	Ventilator, Nebulizer and Suction Apparatus	10	03	04	06	13
IV	Patient monitoring systems, Infusion pump and Balloon Pump	10	03	04	06	13
V	Life Support Equipment	10	04	04	08	16
Total		48	16	21	33	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a) Visit a hospital and prepare a report on following basis.
 - i) Name of equipment, manufacturer, Cost of the equipment.
 - ii) Location of the equipment where it is utilized.
 - iii) Problems frequently encountered in various intensive care equipment.
- b) Identify the component from the given intensive care equipment.
- c) Guide student(s) in undertaking micro-projects.
- d) Library / Internet survey of Instruments used in Intensive Care Unit of the hospital
- e) Collect the videos/ animations on working of given following equipment;
 - i) Defibrillator
 - ii) Pacemaker
 - iii) Bedside monitor

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c) About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d) With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e) Guide student(s) in undertaking micro-projects.
- f) Correlate subtopics with power system utility and electrical equipments.
- g) Use proper equivalent analogy to explain different concepts.

