



**SRM VALLIAMMAI ENGINEERING COLLEGE**

**(An Autonomous Institution)**

SRM Nagar, Kattankulathur – 603 203.



**DEPARTMENT OF MEDICAL ELECTRONICS**

**QUESTION BANK**



**VI SEMESTER**

**PMD603 Critical Care Equipment**

**Regulation–2023**

**Academic Year 2025–26 Even Semester**

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**AP (Sel.G)/MDE**



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### DEPARTMENT OF MEDICAL ELECTRONICS



#### QUESTION BANK

**SUBJECT : PMD603 CRITICAL CARE EQUIPMENT**

**SEM / YEAR: VI / III**

| Unit-I INTENSIVE CARE UNIT EQUIPMENT   |  |     |          |            |
|--|--|-----|----------|------------|
| Suction apparatus, Different types; Sterilizers, Chemical, Radiation, Steam for small and large units. ICU ventilators. Automated drug delivery systems, Infusion pumps, components of drug infusion system, closed loop control infusion system, implantable infusion system. BMD Measurements – SXA – DXA - Quantitative ultrasound bone densitometer. |  |     |          |            |
| PART-A   |  |     |          |            |
| Q.No   | Questions  | COs | BT Level | Competence |
| 1.   | Define suction apparatus.  | CO1 | BTL1     | Remember   |
| 2.   | List the types of suction apparatus.                                   | CO1 | BTL1     | Remember   |
| 3.   | Differentiate between manual and electric suction apparatus.           | CO1 | BT 1     | Understand |
| 4.   | Mention one clinical application of suction apparatus.                 | CO1 | BTL1     | Remember   |
| 5.   | State the working principle of a suction apparatus.                    | CO1 | BTL2     | Understand |
| 6.   | Define sterilization.  | CO1 | BTL1     | Remember   |
| 7.   | Name the different types of sterilizers.                               | CO1 | BTL1     | Remember   |
| 8.   | Define chemical sterilization and give one example.                    | CO1 | BTL2     | Understand |
| 9.   | Differentiate between steam and radiation sterilization.               | CO1 | BTL2     | Understand |
| 10.  | Mention one advantage of steam sterilization.                          | CO1 | BTL1     | Remember   |
| 11.  | Mention one limitation of chemical sterilization.                      | CO1 | BTL1     | Remember   |
| 12.  | What is the difference between small and large unit steam sterilizers? | CO1 | BTL2     | Understand |
| 13.  | Define ventilator.   | CO1 | BTL1     | Remember   |
| 14.  | What is the function of an ICU ventilator?                             | CO1 | BTL1     | Remember   |

|               |  |     |      |            |
|---------------|--|-----|------|------------|
| 15.           | List two types of ventilators.   | CO1 | BTL1 | Remember   |
| 16.           | Differentiate between volume-controlled and pressure-controlled ventilation.   | CO1 | BTL2 | Understand |
| 17.           | What is an infusion pump?  | CO1 | BTL1 | Remember   |
| 18.           | List the components of a drug infusion system.   | CO1 | BTL1 | Remember   |
| 19.           | Explain closed-loop control in infusion systems.   | CO1 | BTL2 | Understand |
| 20.           | What is an implantable infusion system?  | CO1 | BTL1 | Remember   |
| 21.           | Mention one advantage of automated drug delivery systems.  | CO1 | BTL1 | Remember   |
| 22.           | What is Bone Mineral Density (BMD)?  | CO1 | BTL1 | Remember   |
| 23.           | List different methods of BMD measurement.   | CO1 | BTL1 | Remember   |
| 24.           | Differentiate between SXA, DXA, and quantitative ultrasound bone densitometer.   | CO1 | BTL2 | Understand |
| <b>PATR-B</b> |  |     |      |            |
| 1.            | Analyze the working principle of a medical suction apparatus and compare different types based on performance and applications. (16) | CO1 | BTL4 | Analyze    |
| 2.            | Apply the knowledge of suction apparatus to select suitable systems for ICU, OT, and emergency care environments. (16)               | CO1 | BTL3 | Apply      |
| 3.            | Analyze the classification of sterilizers and compare chemical, radiation, and steam sterilization methods. (16)                     | CO1 | BTL4 | Analyze    |
| 4.            | Apply steam sterilization principles to design sterilization protocols for small and large hospital units. (16)                      | CO1 | BTL3 | Apply      |
| 5.            | Analyze the construction and working of chemical sterilizers used for heat-sensitive medical equipment. (16)                         | CO1 | BTL4 | Analyze    |
| 6.            | Analyze radiation sterilization techniques with respect to microbial inactivation and material safety. (16)                          | CO1 | BTL4 | Analyze    |
| 7.            | Analyze the block diagram and functional operation of ICU ventilators. (16)  | CO1 | BTL4 | Analyze    |
| 8.            | Apply ventilator modes for adult, pediatric, and neonatal patients in ICU settings with justification. (16)                          | CO1 | BTL3 | Apply      |
| 9.            | Analyze the architecture and working of automated drug delivery systems used in clinical practice. (16)                              | CO1 | BTL4 | Analyze    |
| 10.           | Apply infusion pump principles to determine suitable drug delivery methods for continuous and bolus infusion. (16)                   | CO1 | BTL3 | Apply      |
| 11.           | Analyze the components of a drug infusion system and explain their role in safe medication delivery. (16)                            | CO1 | BTL4 | Analyze    |
| 12.           | Analyze closed-loop control infusion systems and compare them with open-loop systems. (16)   | CO1 | BTL4 | Analyze    |

|     |   |     |      |         |
|-----|---|-----|------|---------|
| 13. | Apply closed-loop control concepts to design an insulin-glucose infusion system. (16)                         | CO1 | BTL3 | Apply   |
| 14. | Analyze the design and working of implantable infusion systems and discuss associated challenges. (16)        | CO1 | BTL4 | Analyze |
| 15. | Analyze Bone Mineral Density (BMD) measurement techniques such as SXA, DXA, and Quantitative Ultrasound. (16) | CO1 | BTL4 | Analyze |
| 16. | Apply BMD measurement techniques for osteoporosis diagnosis and patient monitoring. (16)                      | CO1 | BTL3 | Apply   |
| 17. | Analyze DXA and Quantitative Ultrasound bone densitometers based on accuracy, safety, and clinical use. (16)  | CO1 | BTL4 | Analyze |

## Unit-II MEDICAL DEVICES AND EQUIPMENTS

*Defibrillators, Hemodialysis Machine, Different types of Dialyzers, Membranes, Machine controls and measurements. Heart Lung Machine, different types of oxygenators, peristaltic pumps, Incubators.*

### PART – A

| Q.No | Questions  | COs | BTLevel | Competence    |
|------|--|-----|---------|---------------|
| 1.   | Define a defibrillator and state its primary function.                               | CO2 | BTL1    | Remember      |
| 2.   | List the main components of a defibrillator.   | CO2 | BTL1    | Remember      |
| 3.   | Explain the basic principle of operation of a defibrillator.                         | CO2 | BTL2    | Understanding |
| 4.   | State the types of defibrillators used in clinical practice.                         | CO2 | BTL1    | Remember      |
| 5.   | Define a hemodialysis machine and state its purpose.                                 | CO2 | BTL1    | Remember      |
| 6.   | List the major components of a hemodialysis machine.                                 | CO2 | BTL1    | Remember      |
| 7.   | Explain the working principle of a hemodialysis machine.                             | CO2 | BTL2    | Understanding |
| 8.   | State the different types of dialyzers used in hemodialysis.                         | CO2 | BTL1    | Remember      |
| 9.   | Explain the role of a dialyzer in the hemodialysis process.                          | CO2 | BTL2    | Understanding |
| 10.  | List the commonly used dialysis membrane materials.                                  | CO2 | BTL1    | Remember      |
| 11.  | Explain the function of dialysis membranes in solute exchange.                       | CO2 | BTL2    | Understanding |
| 12.  | List the important controls available on a hemodialysis machine.                     | CO2 | BTL1    | Remember      |
| 13.  | Explain the purpose of measurements and monitoring systems in hemodialysis machines. | CO2 | BTL2    | Understanding |
| 14.  | Define a heart–lung machine and state its clinical use.                              | CO2 | BTL1    | Remember      |
| 15.  | List the major components of a heart–lung machine.                                   | CO2 | BTL1    | Remember      |
| 16.  | Explain the working principle of a heart–lung machine.                               | CO2 | BTL2    | Understanding |
| 17.  | State the different types of oxygenators used in heart–lung machines.                | CO2 | BTL1    | Remember      |

|               |  |     |      |               |
|---------------|--|-----|------|---------------|
| 18.           | Explain the function of an oxygenator in cardiopulmonary bypass.   | CO2 | BTL2 | Understanding |
| 19.           | Define a peristaltic pump and state its role in extracorporeal circulation.  | CO2 | BTL1 | Remember      |
| 20.           | Explain the operating principle of a peristaltic pump.   | CO2 | BTL2 | Understanding |
| 21.           | Define a neonatal incubator and state its purpose.   | CO2 | BTL1 | Remember      |
| 22.           | List the main components of a neonatal incubator.  | CO2 | BTL1 | Remember      |
| 23.           | Explain the working principle of a neonatal incubator.   | CO2 | BTL2 | Understanding |
| 24.           | Explain the importance of temperature and humidity control in incubators   | CO2 | BTL2 | Understanding |
| <b>PART-B</b> |  |     |      |               |
| 1.            | Analyze the working principle and energy delivery mechanism of a defibrillator used in cardiac emergencies. (16)     | CO2 | BTL4 | Analyze       |
| 2.            | Apply defibrillator selection criteria to choose suitable devices for ICU, CCU, and emergency medical services. (16) | CO2 | BTL3 | Apply         |
| 3.            | Analyze the construction and functional block diagram of a hemodialysis machine. (16)                                | CO2 | BTL4 | Analyze       |
| 4.            | Apply hemodialysis principles to determine appropriate dialysis parameters for different patient conditions. (16)    | CO2 | BTL3 | Apply         |
| 5.            | Analyze the different types of dialyzers used in hemodialysis and compare their performance characteristics. (16)    | CO2 | BTL4 | Analyze       |
| 6.            | Analyze dialysis membrane materials and evaluate their biocompatibility and solute transport properties. (16)        | CO2 | BTL4 | Analyze       |
| 7.            | Apply membrane selection criteria for dialysis based on toxin clearance and patient safety requirements. (16)        | CO2 | BTL3 | Apply         |
| 8.            | Analyze the machine controls and measurement systems used in modern hemodialysis machines. (16)                      | CO2 | BTL4 | Analyze       |
| 9.            | Apply dialysis monitoring parameters to ensure safe and effective hemodialysis treatment. (16)                       | CO2 | BTL3 | Apply         |
| 10.           | Analyze the working principle and functional components of a heart–lung machine used during cardiac surgery. (16)    | CO2 | BTL4 | Analyze       |
| 11.           | Analyze different types of oxygenators used in heart–lung machines and compare their efficiency. (16)                | CO2 | BTL4 | Analyze       |
| 12.           | Apply oxygenator selection criteria for pediatric and adult cardiopulmonary bypass procedures. (16)                  | CO2 | BTL3 | Apply         |
| 13.           | Analyze the construction and working of peristaltic pumps used in extracorporeal circulation systems. (16)           | CO2 | BTL4 | Analyze       |
| 14.           | Apply peristaltic pump operating parameters to ensure controlled blood flow during bypass procedures. (16)           | CO2 | BTL3 | Apply         |
| 15.           | Analyze the design and working of neonatal incubators and their role in thermal regulation. (16)                     | CO2 | BTL4 | Analyze       |
| 16.           | Apply incubator control parameters to maintain optimal environmental conditions for preterm infants. (16)            | CO2 | BTL3 | Apply         |
| 17.           | Analyze safety features and alarm systems used in defibrillators, dialysis machines, and incubators. (16)            | CO2 | BTL4 | Analyze       |

### Unit-III OPERATION THEATRE EQUIPMENT

*Craniotomy, Electrosurgical Machines (ESU), electrosurgical analyzers, surgical aspirator, Instruments for operation. Anesthesia Machine, Humidification, Sterilization aspects, Boyles apparatus. Endoscopy – Laparoscopy - Cryogenic Equipment - Anesthesia gas, Anesthesia gas monitor, - surgical microscope.*

#### PART-A

| Q.No | Questions  | COs | BT Level | Competence    |
|------|--|-----|----------|---------------|
| 1.   | Define craniotomy.   | CO3 | BTL1     | Remember      |
| 2.   | List the basic instruments used in craniotomy surgery.                       | CO3 | BTL1     | Remember      |
| 3.   | Explain the purpose of craniotomy in neurosurgical procedures.               | CO3 | BTL2     | Remembering   |
| 4.   | Define an electrosurgical unit (ESU).  | CO3 | BTL1     | Remember      |
| 5.   | List the main components of an electrosurgical machine.                      | CO3 | BTL1     | Remember      |
| 6.   | Explain the working principle of an electrosurgical unit.                    | CO3 | BTL2     | Understanding |
| 7.   | Define an electrosurgical analyzer.  | CO3 | BTL1     | Remember      |
| 8.   | Explain the function of an electrosurgical analyzer in testing ESUs.         | CO3 | BTL2     | Analyze       |
| 9.   | Define a surgical aspirator.   | CO3 | BTL1     | Remember      |
| 10.  | Explain the role of a surgical aspirator during surgical procedures.         | CO3 | BTL2     | Understanding |
| 11.  | Define an anesthesia machine.  | CO3 | BTL1     | Remember      |
| 12.  | List the major components of an anesthesia machine.                          | CO3 | BTL1     | Remember      |
| 13.  | Explain the working principle of an anesthesia machine.                      | CO3 | BTL2     | Understanding |
| 14.  | Define humidification in anesthesia systems.                                 | CO3 | BTL1     | Remember      |
| 15.  | Explain the importance of humidification during anesthesia delivery.         | CO3 | BTL2     | Understanding |
| 16.  | List the sterilization aspects related to anesthesia and surgical equipment. | CO3 | BTL1     | Remember      |
| 17.  | Explain the need for sterilization in operation theatres.                    | CO3 | BTL2     | Understanding |
| 18.  | Define Boyle's anesthesia apparatus.   | CO3 | BTL1     | Remember      |
| 19.  | Explain the working principle of Boyle's apparatus.                          | CO3 | BTL2     | Understanding |
| 20.  | Define endoscopy and laparoscopy.  | CO3 | BTL1     | Remember      |
| 21.  | Explain the basic principle of endoscopic and laparoscopic systems.          | CO3 | BTL2     | Understanding |

|     |  |     |      |               |
|-----|--|-----|------|---------------|
| 22. | Define cryogenic equipment used in medical applications.   | CO3 | BTL1 | Remember      |
| 23. | Define anesthesia gases and an anesthesia gas monitor.   | CO3 | BTL1 | Remember      |
| 24. | Explain the importance of anesthesia gas monitoring and the use of a surgical microscope in surgery. | CO3 | BTL2 | Understanding |

PART – B

|     |   |     |      |         |
|-----|---|-----|------|---------|
| 1.  | Analyze the procedure of craniotomy and explain the biomedical instruments used during the operation. (16)                    | CO3 | BTL4 | Analyze |
| 2.  | Apply knowledge of neurosurgical instruments to select appropriate tools for different stages of a craniotomy procedure. (16) | CO3 | BTL3 | Apply   |
| 3.  | Analyze the working principle and modes of operation of electro-surgical units (ESU). (16)                                    | CO3 | BTL4 | Analyze |
| 4.  | Apply ESU operating parameters for cutting and coagulation in various surgical procedures. (16)                               | CO3 | BTL3 | Apply   |
| 5.  | Analyze the construction and working of an electro-surgical analyzer and its role in equipment testing and safety. (16)       | CO3 | BTL4 | Analyze |
| 6.  | Analyze the working principle and clinical application of a surgical aspirator used in operative procedures. (16)             | CO3 | BTL4 | Analyze |
| 7.  | Apply suction and flow control settings of a surgical aspirator for neurosurgical and general surgical applications. (16)     | CO3 | BTL3 | Apply   |
| 8.  | Analyze the construction and working of an anesthesia machine with a neat block diagram. (16)                                 | CO3 | BTL4 | Analyze |
| 9.  | Apply principles of anesthesia delivery to set up an anesthesia machine for adult and pediatric patients. (16)                | CO3 | BTL3 | Apply   |
| 10. | Analyze the importance and working of humidification systems in anesthesia and respiratory care. (16)                         | CO3 | BTL4 | Analyze |
| 11. | Analyze sterilization aspects related to anesthesia circuits and surgical instruments. (16)                                   | CO3 | BTL4 | Analyze |
| 12. | Apply Boyle's anesthesia apparatus principles in delivering controlled anesthetic gases. (16)                                 | CO3 | BTL3 | Apply   |
| 13. | Analyze the working principle and applications of endoscopy and laparoscopy systems. (16)                                     | CO3 | BTL4 | Analyze |
| 14. | Apply endoscopic and laparoscopic equipment selection for minimally invasive surgical procedures. (16)                        | CO3 | BTL3 | Apply   |

|     |  |     |      |         |
|-----|--|-----|------|---------|
| 15. | Analyze the construction and working of cryogenic equipment used for medical gas storage. (16) | CO3 | BTL4 | Analyze |
| 16. | Analyze anesthesia gas delivery and monitoring systems including anesthesia gas monitors. (16) | CO3 | BTL4 | Analyze |
| 17. | Analyze the design, optics, and clinical applications of a surgical microscope. (16)           | CO3 | BTL4 | Analyze |

#### UNIT-IV: CENTRALISED SYSTEMS

*Centralized Oxygen, Nitrogen, Air supply & Suction. Centralized Air Conditioning, Operation Theatre table & Lighting. C Arm.*

#### PART-A

| Q.No | Questions  | COs  | BT Level | Competence    |
|------|--|------|----------|---------------|
| 1.   | Define a centralized medical oxygen supply system.                               | CO 4 | BTL<br>1 | Remember      |
| 2.   | List the main components of a centralized oxygen supply system.                  | CO4  | BTL<br>1 | Remember      |
| 3.   | Explain the working principle of a centralized oxygen supply system.             | CO 4 | BTL<br>2 | Understanding |
| 4.   | Define a centralized medical air supply system.                                  | CO 4 | BTL<br>1 | Remember      |
| 5.   | Define a centralized medical nitrogen supply system.                             | CO 4 | BTL<br>1 | Remember      |
| 6.   | Explain the purpose of centralized medical air and nitrogen supply in hospitals. | CO 4 | BTL<br>2 | Understanding |
| 7.   | Define a centralized medical suction system.                                     | CO 4 | BTL<br>1 | Remember      |
| 8.   | List the components of a centralized suction system.                             | CO 4 | BTL<br>1 | Remember      |
| 9.   | Explain the working principle of a centralized suction system.                   | CO 4 | BTL<br>2 | Understanding |
| 10.  | Define centralized air-conditioning (HVAC) used in hospitals.                    | CO 4 | BTL<br>1 | Remember      |
| 11.  | List the major components of a centralized air-conditioning system.              | CO 4 | BTL<br>1 | Remember      |
| 12.  | Explain the importance of centralized air-conditioning in operation theatres.    | CO 4 | BTL<br>2 | Understanding |
| 13.  | Define an operation theatre table.   | CO 4 | BTL<br>1 | Remember      |
| 14.  | List the main features of an operation theatre table.                            | CO 4 | BTL<br>1 | Remember      |
| 15.  | Explain the functions and positioning movements of an OT table.                  | CO 4 | BTL<br>2 | Understanding |
| 16.  | Define operation theatre lighting.   | CO 4 | BTL<br>1 | Remember      |
| 17.  | List the characteristics of an ideal OT lighting system.                         | CO 4 | BTL<br>1 | Remember      |
| 18.  | Explain the importance of shadow-free illumination in OT lighting.               | CO 4 | BTL<br>2 | Understanding |
| 19.  | Define a C-Arm imaging system.   | CO 4 | BTL<br>1 | Remember      |
| 20.  | List the main components of a C-Arm system.                                      | CO 4 | BTL<br>1 | Remember      |
| 21.  | Explain the working principle of a C-Arm imaging system.                         | CO 4 | BTL<br>2 | Understanding |
| 22.  | Define the role of a C-Arm in orthopedic and interventional                      | CO 4 | BTL<br>1 | Remember      |

|               |  |      |          |               |
|---------------|--|------|----------|---------------|
| 23.           | Explain basic radiation safety features provided in C-Arm systems.   | CO 4 | BTL      | Understanding |
| 24.           | Explain the importance of integrating medical gas supply, HVAC, OT table, lighting, and C-Arm in operation theatres.               | CO 4 | BTL<br>2 | Understanding |
| <b>PART-B</b> |  |      |          |               |
| 1.            | Analyze the layout and working principle of a centralized medical oxygen supply system in a hospital. (16)                         | CO4  | BTL4     | Analyze       |
| 2.            | Analyze the design and safety features of centralized medical nitrogen and air supply systems. (16)                                | CO4  | BTL4     | Analyze       |
| 3.            | Apply medical gas pipeline system standards to plan centralized oxygen, air, and nitrogen supply for a multi-storey hospital. (16) | CO4  | BTL3     | Apply         |
| 4.            | Analyze the working principle and components of a centralized medical suction system. (16)   | CO4  | BTL4     | Analyze       |
| 5.            | Apply suction system capacity calculations for ICU, OT, and ward requirements. (16)  | CO4  | BTL3     | Apply         |
| 6.            | Analyze the design and functional requirements of centralized air-conditioning systems used in hospitals. (16)                     | CO4  | BTL4     | Analyze       |
| 7.            | Apply HVAC standards to design air-conditioning parameters for operation theatres. (16)  | CO4  | BTL3     | Apply         |
| 8.            | Analyze the construction and functional features of an operation theatre table. (16)   | CO4  | BTL4     | Analyze       |
| 9.            | Apply OT table positioning mechanisms to support different surgical procedures. (16)   | CO4  | BTL3     | Apply         |
| 10.           | Analyze the design and illumination principles of operation theatre lighting systems. (16)   | CO4  | BTL4     | Analyze       |
| 11.           | Apply OT lighting requirements to minimize shadows and improve surgical field visibility. (16)                                     | CO4  | BTL3     | Apply         |
| 12.           | Analyze the working principle and components of a C-Arm imaging system. (16)   | CO4  | BTL4     | Analyze       |
| 13.           | Apply C-Arm positioning and imaging parameters for orthopedic and interventional procedures. (16)                                  | CO4  | BTL3     | Apply         |
| 14.           | Analyze radiation safety features and shielding requirements in C-Arm systems. (16)  | CO4  | BTL4     | Analyze       |
| 15.           | Analyze alarm and monitoring systems used in centralized medical gas supply installations. (16)                                    | CO4  | BTL4     | Analyze       |
| 16.           | Apply preventive maintenance strategies for centralized gas supply and HVAC systems. (16)  | CO4  | BTL3     | Apply         |
| 17.           | Analyze integration of centralized medical gas, HVAC, OT table, lighting, and C-Arm systems in a modern operation theatre. (16)    | CO4  | BTL4     | Analyze       |

**UNIT-V: PATIENT SAFETY**

*Patient electrical safety, Types of hazards, Natural protective mechanisms against electricity, Leakage current, Inspection of grounding and patient isolation, Hazards in operation rooms, ICCU and IMCUs, Opto couplers and Pulse transformers.*

**PART-A**

| Q.No | Questions  | COs | BT Level | Competence    |
|------|--|-----|----------|---------------|
| 1.   | Define patient electrical safety.  | CO5 | BTL1     | Remember      |
| 2.   | List the types of electrical hazards in medical environments.                        | CO5 | BTL1     | Remember      |
| 3.   | Explain the importance of patient electrical safety in hospitals.                    | CO5 | BTL2     | Understanding |
| 4.   | Define leakage current in medical equipment.   | CO5 | BTL1     | Remember      |
| 5.   | Explain the effects of leakage current on patients and staff.                        | CO5 | BTL2     | Understanding |
| 6.   | Define grounding in medical electrical systems.                                      | CO5 | BTL1     | Remember      |
| 7.   | List methods used for inspection of grounding systems.                               | CO5 | BTL1     | Remember      |
| 8.   | Explain how grounding prevents electrical hazards in hospitals.                      | CO5 | BTL2     | Understanding |
| 9.   | Define patient isolation in medical electrical equipment.                            | CO5 | BTL1     | Remember      |
| 10.  | Explain the role of patient isolation in electrical safety.                          | CO5 | BTL2     | Understanding |
| 11.  | Define natural protective mechanisms of the human body against electricity.          | CO5 | BTL1     | Remember      |
| 12.  | Explain how the human body protects itself from low voltage shocks.                  | CO5 | BTL2     | Understanding |
| 13.  | List hazards specific to operation theatres.   | CO5 | BTL1     | Remember      |
| 14.  | Explain preventive measures for electrical hazards in operation theatres.            | CO5 | BTL2     | Understanding |
| 15.  | List hazards in ICCU and IMCU related to electrical equipment.                       | CO5 | BTL1     | Remember      |
| 16.  | Explain safety measures for electrical equipment in ICCU and IMCU.                   | CO5 | BTL2     | Understanding |
| 17.  | Define an opto-coupler used in medical equipment.                                    | CO5 | BTL1     | Remember      |
| 18.  | Explain the working principle of an opto-coupler.                                    | CO5 | BTL2     | Understanding |
| 19.  | Define a pulse transformer in medical electrical systems.                            | CO5 | BTL1     | Remember      |
| 20.  | Explain the working principle of a pulse transformer.                                | CO5 | BTL2     | Understanding |
| 21.  | List common standards for patient electrical safety.                                 | CO5 | BTL1     | Remember      |
| 22.  | Explain the importance of periodic inspection and maintenance for electrical safety. | CO5 | BTL2     | Understanding |
| 23.  | Define equipment leakage current limits.   | CO5 | 1        | Remember      |
| 24.  | Explain the role of opto-couplers and pulse transformers in ensuring patient safety. | CO5 | BTL2     | Understanding |

**PART-B**

|     |   |         |      |         |
|-----|---|---------|------|---------|
| 1.  | Analyze the concept of patient electrical safety and its importance in biomedical equipment.<br>(16)          | CO<br>5 | BTL4 | Analyze |
| 2.  | Analyze different types of electrical hazards encountered in medical environments.<br>(16)                    | CO<br>5 | BTL4 | Analyze |
| 3.  | Analyze the natural protective mechanisms of the human body against electrical shock.<br>(16)                 | CO<br>5 | BTL4 | Analyze |
| 4.  | Analyze the sources and effects of leakage current in medical electrical equipment.<br>(16)                   | CO<br>5 | BTL4 | Analyze |
| 5.  | Apply leakage current limits to evaluate the safety of patient-connected medical devices.<br>(16)             | CO<br>5 | BTL3 | Apply   |
| 6.  | Analyze methods used for inspection and testing of grounding systems in hospitals.<br>(16)                    | CO<br>5 | BTL4 | Analyze |
| 7.  | Apply grounding and bonding inspection procedures to ensure electrical safety in clinical areas.<br>(16)      | CO<br>5 | BTL3 | Apply   |
| 8.  | Analyze techniques used for patient isolation in medical electronic equipment.<br>(16)                        | CO<br>5 | BTL4 | Analyze |
| 9.  | Apply isolation techniques to minimize electrical hazards in patient monitoring systems.<br>(16)              | CO<br>5 | BTL3 | Apply   |
| 10. | Analyze electrical hazards specific to operation theatres and preventive safety measures.<br>(16)             | CO<br>5 | BTL4 | Analyze |
| 11. | Analyze electrical hazards in ICCU and IMCU environments and methods for risk reduction.<br>(16)              | CO<br>5 | BTL4 | Analyze |
| 12. | Apply electrical safety standards to design safe power distribution systems in critical care areas.<br>(16)   | CO<br>5 | BTL3 | Apply   |
| 13. | Analyze the working principle of opto-couplers used for electrical isolation in medical devices.<br>(16)      | CO<br>5 | BTL4 | Analyze |
| 14. | Analyze the construction and working of pulse transformers for patient safety applications.<br>(16)           | CO<br>5 | BTL4 | Analyze |
| 15. | Apply opto-couplers and pulse transformers in the design of isolated biomedical signal circuits.<br>(16)      | CO<br>5 | BTL3 | Apply   |
| 16. | Analyze the role of electrical safety testing equipment in preventive maintenance programs.<br>(16)           | CO<br>5 | BTL4 | Analyze |
| 17. | Apply patient electrical safety guidelines to identify and mitigate hazards in hospital environments.<br>(16) | CO<br>5 | BTL3 | Apply   |