Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – June 2026

Programme Name: B Tech (ME)

Semester: IV

Subject Code: UG11T5403

Subject Name: SHIPBOARD POWER GENERATION AND DISTRIBUTION

Date: 09.06.2026 Max Marks: 70

Duration: 03 Hrs Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

(Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.)

1. Which electrical diagram is intentionally drawn without regard to physical layout, focusing exclusively on the logical electrical sequence to assist technicians in step-by-step troubleshooting?

   a. System Diagram
   b. Block Diagram
   c. Circuit Diagram
   d. Wiring Diagram

2. In hybrid power systems, what feature allows a shaft generator to provide redundancy in the event of a main engine failure?

   a. Acting as a static frequency converter
   b. Acting as an emergency "take-home" motor
   c. Functioning as a transformer-rectifier set
   d. Automatically starting the emergency switchboard

3. During a sea-going laden voyage, over-current relays are specifically set with a "Long Time Delay" (LTD) to:

   a. Protect against catastrophic short circuits only
   b. Prevent tripping from minor load fluctuations
   c. Compensate for harmonic distortion
   d. Manage the "Locked Rotor Current" of pump motors

4. On ships with very large power demands, High Voltage (HV) systems like 6.6kV or 11kV are used primarily to:

   a. Increase the speed of propulsion motors
   b. Reduce current and cable size
   c. Eliminate the need for transformers
   d. Prevent galvanic corrosion of the hull

5. During routine performance checks, what is the minimum acceptable insulation resistance value for a main generator?

   a. 0.5 MΩ
   b. 1 MΩ
   c. 10 MΩ
   d. 100 MΩ

6. Which system is designed to operate in the "milliseconds to minutes" time domain, focusing on real-time fault handling and load sharing?

   a. Energy Management System (EMS)
   b. Power Management System (PMS)
   c. Supervisory Control and Data Acquisition (SCADA)
   d. Shore Power Connection Box

7. In the context of intrinsically safe (Ex i) equipment, what is the critical difference between the Ex i(a) and Ex i(b) standards?

   a. Ex i(a) is for dust, while Ex i(b) is for gases.
   b. Ex i(b) can be used in Zone 0, while Ex i(a) is restricted to Zone 2.
   c. Ex i(a) must maintain safety with up to two faults; Ex i(b) is safe with only up to one fault.
   d. Ex i(a) requires a flameproof casing, while Ex i(b) uses encapsulated electronics.

8. Why is Reverse Power Protection a mandatory safety feature for shipboard generators?

   a. To prevent the generator from overspeeding during a sudden load drop.
   b. To ensure the generator remains connected to the busbar even if it loses excitation.
   c. To prevent the generator from "motoring" if the prime mover fails.
   d. To reverse the phase sequence of the generator automatically during synchronization.

9. A ship of 10,000 gross tonnage and upwards is required by regulations to maintain emergency power to its steering gear for a specific continuous duration. What is this duration?

   a. 10 minutes
   b. 45 seconds
   c. 30 minutes

d. 1 hour

10. To ensure operational integrity during heavy weather or a casualty, an emergency diesel engine must be designed to function at full rated power even if the ship is inclined at:

a. A list of 15° and a trim of 5°
b. A list of 22.5° and a trim of 10°
c. A list of 45° and a trim of 20°
d. A list of 30° and a trim of 15°

Section B

(Five Questions of 02 Marks each)

11. List the Standard Shipboard AC voltage Specifications.
12. Discuss the benefits of diesel-electric systems for electric propulsion.
13. Write a short note on preferential trips of ship board power system.
14. Compare Zone'0' and Zone'1' area of Tankers.
15. What do you mean by blackout?

Section C

(Seven Questions of 10 Marks each of which any 05 questions to be answered)

16. (a). With suitable drawing, explain the block diagram, circuit diagram and wiring diagram. [5]

(b). Explain different configurations of electric power generation plants used in electric propulsion ships. [5]

17. Explain the power requirements for various operating conditions namely

(i) Sea going ballast condition – normal sailing
(ii) Sea going ballast condition with cargo / ballast operations
(iii) Seagoing laden voyage
(iv) Sea going laden voyage with cargo / ballast operations
(v) Manoeuvring in / out of power or restricted areas

[10]

18. (a). Make a drawing for shipboard electric power generation and distribution arrangement showing diesel, turbo and emergency generator and explain 220 V lighting and 24V Dc arrangement. [7]

(b). As per ABS rules, what are the key points to be considered for the location of an emergency power source? [3]

19. Describe the different types of earthing systems used on ships namely TN-S, TN-C, TN-C-S, TT, and IT with circuit diagrams for each system. [10]

20. (a). With a neat diagram, explain the emergency generator layout. Mention the function of interlock. [6]

(b). List the loads connected to the emergency switch board based on the duration of power supply to them [4]

21. (a). Explain the integration and coordination of backup power systems with the main power supply. [6]

(b). Draw the block diagram of the battery charger. [4]

22. (a). Discuss the use of SF6 circuit breakers and their environmental impact. [4]

(b). Briefly describe the different hazardous zones on ships. Give examples of areas for each zone and state the types of protection used for electrical equipment in these zones. Draw an example diagram of a tanker showing the hazardous zones. [6]