Indian Maritime University

(A Centr8al University, Govt of India)

End Semester Examinations – June 2025

Programme Name: B Tech (ME)

Semester: Six

Subject Code: UG11T4603

Subject Name: Marine Propulsion Plant: Configuration And Characteristics

Date: 04.06.2025	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.

QP setters to specify the following as applicable:-

Section A

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

1. Which propulsion arrangement is widely used in cruise ships and large ferries for excellent manoeuvrability and dynamic positioning?

a) Waterjet propulsion system

b) Azimuth thrusters with fixed-pitch propellers

c) Podded propulsion with integrated electric motors

d) Conventional diesel-electric shaft drive

2. How can misalignment in gear teeth be accurately detected during inspection?

a) By observing surface flaking

b) By installing a flexible coupling

c) By applying blue dye to a tooth and examining contact patterns

d) By checking for general wear marks on the gear face

3. At lower Froude number the required power by a vessel is proportional to_____ of speed.

a) square
b) cube
c) to power 4
d) none of above

4. What is a key benefit of using a direct-drive diesel engine (without gearbox) in marine propulsion?

a) Better fuel consumption at all speeds

b) Simpler design with reduced mechanical losses

c) Superior manoeuvrability at low speeds

d) Lower cost of auxiliary systems

5. What is a characteristic of high-speed diesel engines?

a) Heavier weight than medium-speed engines

b) Similar merits to medium-speed engines

c) Limited applications in marine vessels

d) Preferential use of low-grade fuels

6. In a 3 phase Propulsion induction motor, the rotor field rotated at synchronous speed with respect to

a) Stator

b) Rotor

c) Stator flux

d) None of the above

7. What type of propulsion motor is likely to be used in a diesel a-c electric-drive system?

a) Asynchronous motor

b) Synchronous motor

c) Induction motor

d) DC motor

8. If the field of a synchronous motor is under excited, the power factor will be

a) Lagging

b) Leading

c) Unity

d) More than unity

9. Why are quill shafts commonly used in marine gearing systems?

a) To increase the overall weight

b) To compensate for misalignment between components

c) To minimize gear tooth failures

d) To enhance the lubrication process

10. Which propulsion option is preferred for its good power/weight ratio and operating flexibility?

a) Steam Turbines

b) Diesel Engines

c) Gas Turbines

d) Electric Propulsion

Section B

Five Questions of 02 Marks each

11. State and explain the advantages of double helical gears?

12. State the difference between sea margin and engine marine in an engine layout curve/propeller layout curve.

13. What are the design objectives for gear cases, and why is it important for them to be oil-tight?

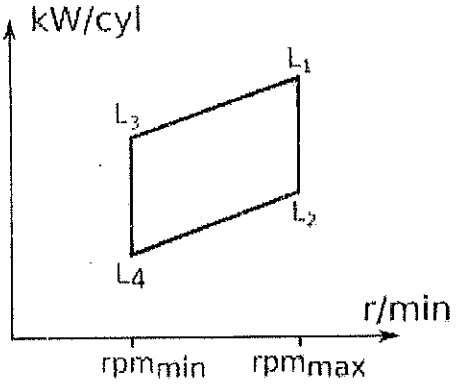
14. Compare the advantages and disadvantages of a Controllable Pitch Propeller (CPP) with a Fixed Pitch Propeller (FPP) in ship propulsion systems?

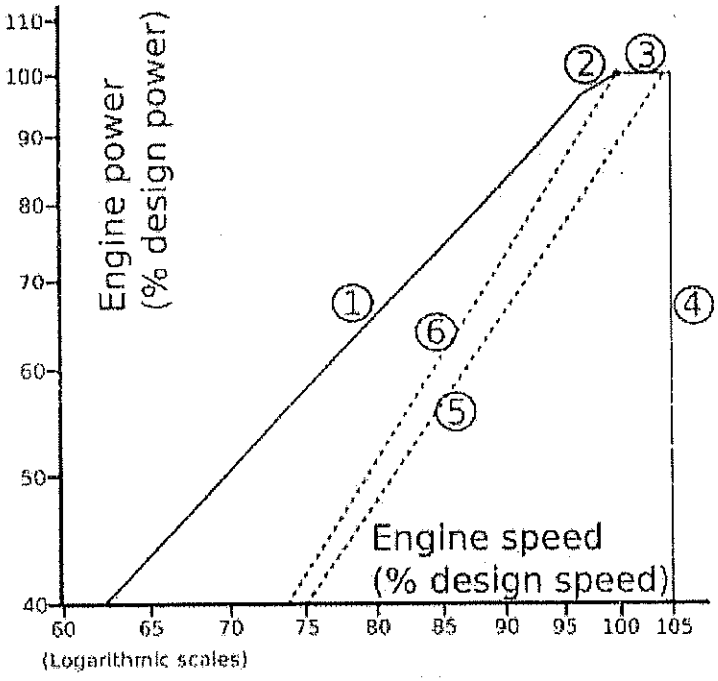
15. What impact does a "heavy propeller" have on a ship's overall performance?

Section C

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

Q.16.



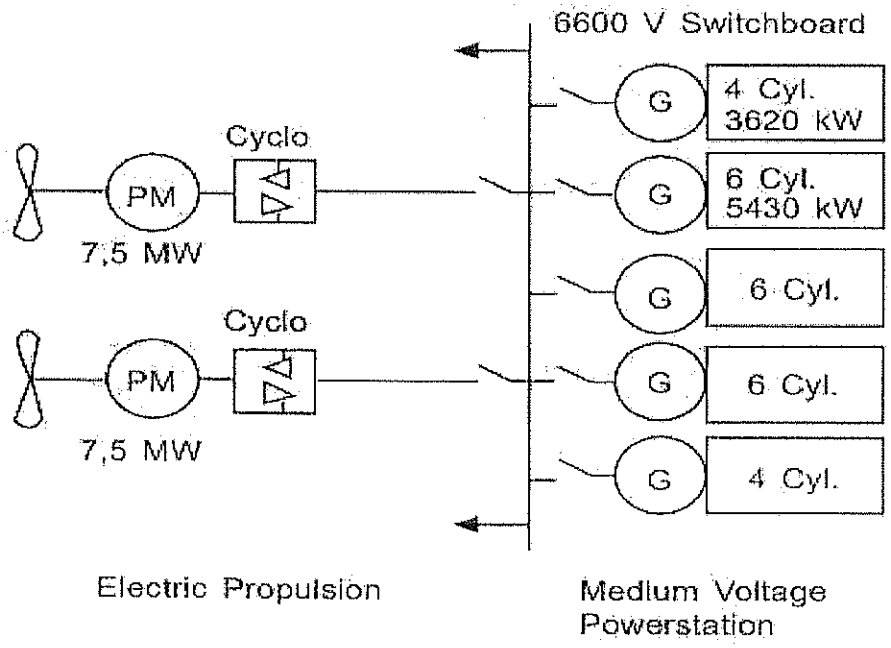


With respect to the diagrams shown above.

a) Explain the significance of the area bounded by L1-L2-L3-L4 [3]
b) Explain the significance of the lines 1, 2, 3, 4, 5, 6 [3]
c) Explain the consequence of running an engine for extended periods to the left of line 1 and right of line 4 [4]

Q17. (a). Describe the working principles of a marine reduction gear and its significance in ship propulsion? (5 marks)
(b). Briefly describe different types of lubricants used in gears system and its purpose? (5 marks)

Q18



Explain the working principle of the ship's electric propulsion system as illustrated in the diagram. Your answer should include: (10 marks)

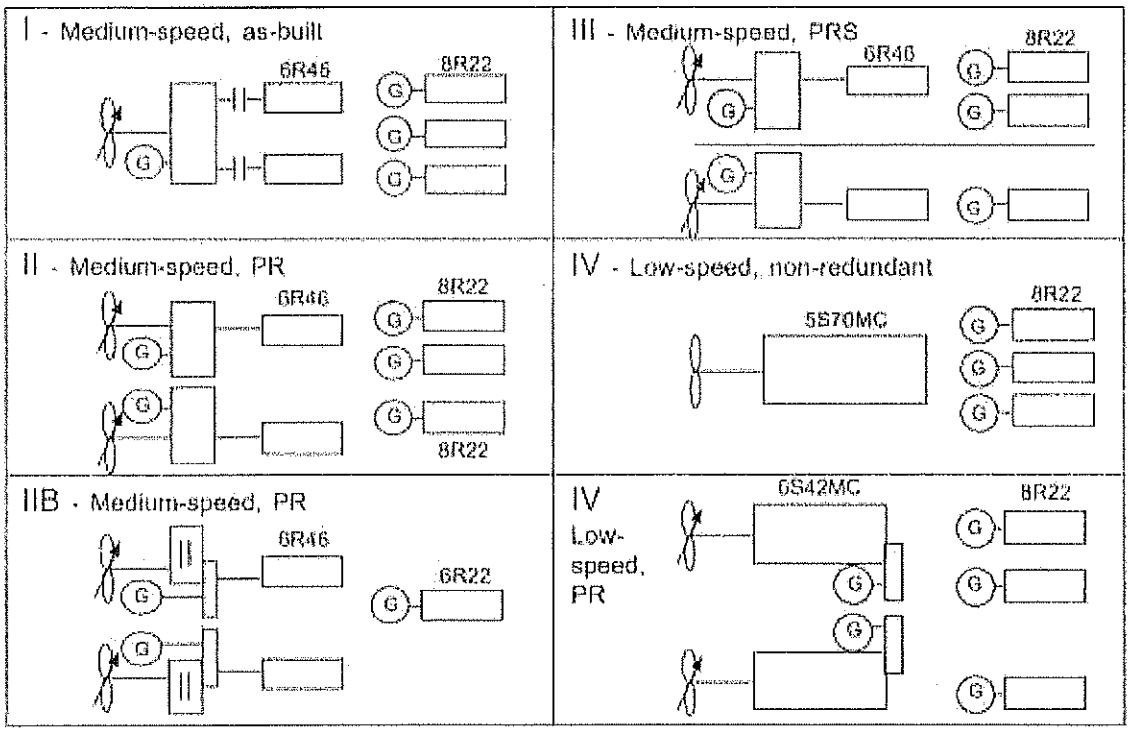
- The role of the medium-voltage power station and generators
- The purpose of the 6600 V switchboard
- The function of the cyclo-converter and propulsion motor (PM)
- The advantages and operational benefits of using electric propulsion in ships compared to conventional mechanical propulsion systems
- Common applications or ship types where electric propulsion is preferred

Q19. Discuss the various gas turbine propulsion configurations used in ships, as illustrated in the figure (CODAG, COGOG, COGAG, and combined gas-steam systems). In your discussion, explain the following: (10 marks)

- The operational principle of each configuration
- The type of turbines and fuel flexibility involved
- The benefits and limitations of each system with respect to fuel efficiency, maintenance, space requirement, and operational flexibility
- Suitability of each configuration for different types of vessels (e.g., naval ships, fast ferries, or commercial cargo ships)

Support your discussion with labelled sketches and real-world examples, if possible.

Q20. With reference to the figure showing low and medium-speed diesel-based propulsion machinery options:



a) Compare and contrast the different propulsion configurations (I, II, IIB, III, and IV) in terms of:

- Type of engine (medium-speed or low-speed)
- Redundancy and reliability
- Propeller arrangement
- Number and configuration of auxiliary generators
- Operational flexibility and maintenance considerations

b) Discuss the advantages and disadvantages of using medium-speed engines with power take-in/take-out (PTI/PTO) systems versus low-speed direct drive engines in terms of fuel efficiency, space requirements, and engine room layout.

(5 + 5)

Q21. With reference to the use of Reduction Gears in ships propulsion:

a) Explain the tooth cutting process for gears and the significance of involute shape.
b) Discuss the factors governing the suitability of materials for gears and the advantages of using the "hard on soft" principle in gear manufacturing.
c) What factors contribute to gear defects such as Abrasive Wear, Flaking, pitting and scuffing? (Support your discussion with sketches)

(2+2+6)

Q22. With reference to selection of propulsion plant for ships:

a) How might advancements in fuel technology impact the selection of marine propulsion plants in the future?

b) Discuss the trade-offs between traditional shaft line propulsion systems and podded propulsion systems in terms of performance, maintenance, and cost.

c) How could renewable energy sources be integrated into marine propulsion systems? (3+3+4)