

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – June 2023
Programme Name: M Tech (NAOE)
Semester: Second
Subject Code: - PG11E2203
Subject Name: DESIGN OF MARINE VEHICLES

Date: 24.05.2023

Max Marks: 60

Duration: 03 Hrs

Pass Marks: 30

General Instructions

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

Section A:

10 MCQs of 01 Mark Each = 10 Marks

1. The forward of a ships having two configuration U and V sections with the same underwater sectional area. Which of the two have lesser angle of entrance
 - a. U section
 - b. V section
 - c. None of the above
2. In the General Arrangement drawing the altering long and two short lines is use as an indication for
 - a. To locate above cutting plane
 - b. Outer boundary of cutting plane
 - c. Tank compartment
 - d. To locate below cutting plane
3. Spot market is generally used for what type of chartering
 - a. Time Charter
 - b. Bareboat Charter
 - c. Contract of Affreightment
 - d. None of the above
4. In the class notation GL ✕ 100 A5 E . the number 100 indicates
 - a. machinery have been designed such as to comply with the requirements for navigation
 - b. the maintenance condition of the ship's hull in relation to the requirements of the construction rules
 - c. shows proof of subdivision and damage stability requirements for the hull
 - d. Hull and/or machinery have been designed such as to comply with the requirements for navigation in ice
5. The sectional area curve of a ship is a trapezium having 50 % of length as parallel middle body. What will be its prismatic coefficient?
 - a. 0.55

- b. 0.65
 - c. 0.75
 - d. 0.85
6. Which of the following options is used to increase the ship slipstream area for shallow water displacement vessels
 - a. Single screw propulsion
 - b. Multi-screw propulsion
 - c. Cavitating propellers
 - d. None of the above
 7. What should be the slop tank capacity in oil tanker
 - a. Over 4% of total cargo tank capacity
 - b. Over 2% of total cargo tank capacity
 - c. Over 3% of total cargo tank capacity
 - d. Over 5% of total cargo tank capacity
 8. Which of the following tanks are general located in the double bottom in way of the engine room
 - a. Lubrication oil sump tank
 - b. Bilge holding tank
 - c. Ballast tank
 - d. Both A&B
 9. This optimum position of the centre of buoyancy is usually described in terms of a relatively as a function of
 - a. Block coefficient and the Froude number
 - b. Prismatic area coefficient and the Froude number
 - c. Midship area coefficient and the Froude number
 - d. All of the above
 10. Attained EEDI means:
 - a. The actual EEDI of a ship as calculated according to IMO Guidelines and verified by Flag Administration or a Recognised Organisation on its behalf.
 - b. The reference EEDI value for a specific ship.
 - c. The regulatory limit for EEDI of a vessel as calculated from the Reference Line and Reduction Factor
 - d. None of the above

Section B:

5 out of 7 Questions of 8 Marks Each = 40 Marks

11. What are the different stages in ship Design Spiral?
12.
 - a. What are the different economic criteria? Explain any one criteria in detail? [4M]
 - b. Explain how Optimal Speed for Ship Size is analysed? [4M]
13.
 - a. What are the criteria to be considered for midship section area coefficient and midship section design? [4M]
 - b. What are different methods of fixing main dimensions of the ship at initial design stage? [4M]
14. Explain the effects of bulbous bows on ships characteristics
15. Draw the typical General Arrangement of Tanker? Label and list out all the different spaces to be allocated on the vessel in a GA.

- 16.
- Discuss about the Navigation and Control Spaces on board the vessel. [4M]
 - Discuss about the consideration to be taken when designing the Engine room spaces [4M]
- 17.
- Explain about EEDI with the formula and definitions. [4M]
 - What are the different components in shipbuilding cost estimation? [4M]

Section C:

1 out of 3 Questions of 10 Marks Each = 10 Marks

18. A multipurpose cargo ship has the following particulars:

| | | |
|-------------------------------------|---|----------------------|
| Deadweight (dwt) | = | 15800 tonnes |
| Length between perpendiculars (LPP) | = | 134.0 m |
| Breadth moulded (B) | = | 21.4 m |
| Depth moulded (D) | = | 12.2 m |
| Design draft (T) | = | 8.94 m |
| Service speed (V) | = | 14.5 knots |
| Block coefficient (CB) | = | 0.780 |
| Vertical centre of buoyancy (VCB) | = | 4.7 m |
| Vertical centre of gravity (VCG) | = | 8.2 m |
| Metacentric Radius (BMT) | = | 4.3 m |
| Grain capacity | = | 22000 m ³ |

The ratio of steel weight (WS), outfit weight (WO) and machinery weight (WM) is 77: 15: 18

Find the principal parameters and grain capacity of a new multipurpose cargo ship, which is to carry a deadweight of 16500 tonnes at a speed of 15.5 knots service speed. The design ship has the same standard of sophistication and the same fullness as the ship for which data is supplied above. The route restricts the draft of the ship to a maximum of 9.0 m. Transverse metacentric height (GMT) of the design ship is not to be less than 0.6 m. During iteration the weight balance is to be achieved within a margin of 200 tonnes.

Assume:

$$PB \text{ (MCR) in kW} = \frac{\Delta^{2/3} V^3}{K}, \quad \text{where } \Delta = \text{displacement in tonnes}$$

V = service speed in knots

K = Admiralty coefficient

$$WM \text{ in tonnes} = \text{constant} + 0.05 * P_B \text{ (in kW)}$$

$$\text{Block coefficient at Depth } C_{BD} = C_B + 0.35 \frac{D-T}{T} (1 - C_B)$$

N.B. Necessary assumptions should be made in conformity with the ship design process and should be stated clearly

19.

The average data for a bulk carrier is projected for a 15 year life-span as given below :

| | | |
|------------------------------------|---|--|
| Deadweight | = | 70,000 tonnes |
| Service Speed | = | 15 knots |
| Average loading available | = | 80% of deadweight |
| Distance between two ports of call | = | 12,000 nautical miles |
| Time spent at each port of call | = | 5.5 days |
| Ship out of commission in a year | = | 30 days |
| Ship acquisition cost | = | Rs 25 crores raised by borrowing |
| Repayment terms | = | 8 year equal installment repayment with 10% compound interest payable from 1st year. |
| Fuel consumed at sea | = | 25 tonnes per day |
| Fuel consumed at port | = | 15 tonnes per day |
| Fuel price | = | Rs 1500 per tonne |
| Cargo handling cost per year | = | Rs 7,500,000 |
| Other operating expenses per year | = | Rs 12,500,000 |
| Escalation rate | = | 7% per year |
| Discount rate | = | 10% per year |
| Scrap value | = | 10% of the original ship price |

Estimate the required freight rate (RFR) for zero NPV.

20. Explain in detail the different methods of generation of lines design (lines plan) at initial design stage?