**Q. Code: 238196**

**Reg. No.** | | | | | | | | | | | | | |

# B.E./ B. TECH DEGREE EXAMINATIONS, MAY 2024

Seventh Semester

## MR18704 – STABILITY OF SHIPS

*(Marine Engineering)*

**(Regulation 2018)**

**TIME: 3 HOURS** **MAX. MARKS: 100**

| COURSE OUTCOMES | STATEMENT | RBT LEVEL |
|---|---|---|
| **CO 1** | Students will have knowledge on the Basic Hydrostatics and Stability Calculations of Ships. | **4** |
| **CO 2** | Students will have knowledge on Geometry of Ships. | **4** |
| **CO 3** | Students will have knowledge on calculations Viz. various coefficients. | **4** |
| **CO 4** | Students will have knowledge on calculating the Area of wetted Surface, Volume etc., | **4** |
| **CO 5** | Students will have knowledge on Transverse Stability and Heel etc. | **4** |

### PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

| | | CO | RBT LEVEL |
|---|---|---|---|
| **1.** | What is the difference between density and relative density? | **1** | **1** |
| **2.** | State the theorem of parallel axis. | **1** | **1** |
| **3.** | What is displacement of a vessel? | **2** | **2** |
| **4.** | What factors does the 'TPC' of a vessel depend upon? | **2** | **2** |
| **5.** | State Simpson's first rule for 'n' ordinates. | **3** | **1** |
| **6.** | State how the shift in centre of gravity is calculated due to movement of mass? | **3** | **1** |
| **7.** | What is the effect of free surface in a tank on a vessel's metacentric height? | **4** | **2** |
| **8.** | What is the purpose of conducting inclining experiment of a new vessel? | **4** | **2** |
| **9.** | What is MCT1cm? | **5** | **1** |
| **10.** | What is meant by dynamic stability? | **5** | **1** |

## PART- B (5 x 14 = 70 Marks)

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **11. (a)** | A double bottom tank is 1.2 m deep and has a sounding pipe extending 11 m above the tank top. The tank is filled with oil (rd 0.89) to the top of the sounding pipe. The double bottom floors are spaced 750 mm apart and are connected to the tank top by riveted angles, the rivets having a pitch of 7 diameters. If the maximum allowable stress in the rivets is 30 $MN/m^2$, calculate the pressure in $kN/m^2$ on the outer bottom and the diameter of the rivets. | **(14)** | **1** | **3** |
| | **(OR)** | | | |
| **(b)** | A bulkhead is in the form of a trapezoid 9 m wide at the deck, 5 m wide at the bottom and 8 m deep. Find the load on the bulkhead if it has oil (rd 0.85) on one side only:<br>(A) to a depth of 6m<br>(B) with 4 m head to the top edge. | **(14)** | **1** | **3** |
| **12. (a)** | The half girths of a ship 90 m long are as follows: 2.1, 6.6, 9.3, 10.5, 11.0, 11.0, 11.0, 9.9, 7.5, 3.9 and 0 m respectively. The wetted surface area of the appendages is 30 $m^2$ and 1/2% is to be added for longitudinal curvature. Calculate the wetted surface area of the ship. | **(14)** | **2** | **3** |
| | **(OR)** | | | |
| **(b)** | A ship 150 m long and 20.5 m beam floats at a draught of 8 m and displaces 19,500 tonne. The TPC is 26.5 and midship Section area coefficient 0.94. Calculate the block, prismatic and Waterplane area coefficients. | **(14)** | **2** | **3** |
| **13. (a)** | An oil tanker of 17,000 tonne displacement has its centre of gravity 1m aft of midships and has 250 tonne of oil fuel in its forward deep tank 75 m from midships.<br>This fuel is transferred to the after oil fuel bunker whose centre is 50m from midships.<br>200 tonne of fuel from the after bunker is now burned.<br>Calculate the new position of the centre of gravity: | **(7+7)** | **3** | **3** |

(A) after the oil has been transferred (B) after the oil has been used.

**(OR)**

| | | | | | |
|---|---|---|---|---|---|
| **(b)** | A vessel of 8000 tonne displacement has 75 tonne of cargo on the deck. It is lifted by a derrick whose head is 10.5 m above the centre of gravity of the cargo, and placed in the lower hold 9 m below the deck and 14 m forward of its original position. Calculate the shift in the vessel's centre of gravity from its original position when the cargo is:<br>(a) just clear of the deck<br>(b) at the derrick head<br>(c) in its final position. | **(14)** | **3** | **3** |

| | | | | | |
|---|---|---|---|---|---|
| **14. (a)** | **(i)** | The righting levers of a ship of 15,000 tonne displacement at angles of heel of 15°, 30°, 45° and 60° are 0.29, 0.70, 0.93 and 0.90 m respectively. Calculate the dynamical stability of the ship at 60° heel. | **(8)** | **4** | **3** |
| | **(ii)** | Explain the precautions to be taken while carrying our inclining experiment of a vessel? How the readings are recorded? | **(6)** | **4** | **3** |

**(OR)**

| | | | | | |
|---|---|---|---|---|---|
| **(b)** | A raft is made from two cylinders each 1.5 m diameter and 6 m long. The distance between the centres of the cylinders is 3 m. If the draught is 0.75 m, calculate the transverse BM. | **(14)** | **4** | **3** |

| | | | | | |
|---|---|---|---|---|---|
| **15. (a)** | A ship 150 m long has draughts of 7.70 m forward and 8.25 m aft, MCTI cm 250 tonne m, TPC 26 and LCF 1.8 m forward of midships. Calculate the new draughts after the following masses have been added:<br>50 tonne, 70 m aft of midships<br>170 tonne, 36 m aft of midships<br>100 tonne, 5 m aft of midships<br>130 tonne, 4m forward of midships<br>40 tonne, 63 m forward of midships | **(14)** | **5** | **3** |

**(OR)**

| | | | | | |
|---|---|---|---|---|---|
| **(b)** | A ship 90 m long displaces 5200 tonne and floats at draughts of 4.95 m forward and 5.35 m aft when in sea water of 1023 kg/m$^3$. The waterplane area is 1100 m$^2$, $GM_L$, 95 m, LCB 0.6 m forward of midships and LCF 2.2 m aft of midships. | **(14)** | **5** | **3** |

Calculate the new draughts when the vessel moves into fresh water of 1002 $kg/m^3$.

## PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **16.** | What do you understand by the terms of bilging and permeability and analyze its significance in design of a vessel? | **(10)** | **5** | **4** |

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