CBCS SCHEME

USN | | | | | | | | | | | **18MR52**

Fifth Semester B.E. Degree Examination, June/July 2023
Naval Architecture

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define :
   i) Density
   ii) Relative density.   **(04 Marks)**
   b. Derive an expression for liquid load on an immersed plane. **(06 Marks)**
   c. A peak bulkhead is in the form of a triangle, apex down, 6m wide at the top, 9m deep. The tank is filled with sea water calculate the load on the bulkhead and the position of centre of pressure relative to the top of the bulkhead if the water is ;
   i) At the top of the bulkhead
   ii) 4m up the sounding pipe.   **(10 Marks)**

OR

2 a. Define
   i) Centre of pressure
   ii) Simpson's Rule.   **(04 Marks)**
   b. A piece of aluminium has a mass of 300gm and its volume is 42cm^3. Calculate :
   i) Its density in kg/m^3
   ii) Its relative density
   iii)The mass of 100cm^3 of aluminium.   **(06 Marks)**
   c. The immersed cross-sectional areas through a ship 180m long, at equal intervals are 5, 118, 233, 291, 303, 304, 304, 302, 283, 171 and 0 m^2 respectively. Calculate the displacement of the ship in sea water of 1.025 tonne/m^3.   **(10 Marks)**

Module-2

3 a. Explain Archimede's principle.   **(04 Marks)**
   b. Derive an expression for tone per centimeter immersion.   **(06 Marks)**
   c. A ship 150m long and 20.5m beam floats at a draught of 8m and displaces 19500 tonne. The TPC is 26.5 and mid ship section area co-efficient 0.94. Calculate the block, prismatic and water plane area co-efficients.   **(10 Marks)**

OR

4 a. Define centre of gravity. Derive an expression for shift in centre of gravity due to movement of mass.   **(06 Marks)**
   b. Explain the effect of a suspended mass.   **(04 Marks)**
   c. A vessel of 8000 tonne displacement has 75 tonne of cargo on the deck. It is lifted by a derrick whose head is 10.5m above the centre of gravity of the cargo, and placed in the lower hold 9m below the deck and 14m forward of its original position. Calculate the shift in the vessel's centre of gravity from its original position when the cargo is :
   i)   Just clear of the deck
   ii) At the derrick head
   iii) In its final position.   **(10 Marks)**

Module-3

5 a. Explain how metacentric height and transverse metacentre can be determined using an inclining experiment. (12 Marks)

b. A ship of 8000 tonne displacement has its centre of gravity 4.5m above the keel and transverse metacentre 5m above the keel when a rectangular tank 7.5m long and 15m wide contains sea water. A mass of 10 tonne is moved 12m across the deck. Calculate the angle of heel :
   i) If there is no free surface of water
   ii) If the water does not completely fill the tank. (08 Marks)

OR

6 a. Explain briefly about free surface effect. (10 Marks)

b. A plate drawn through fresh water at 3m/s has a frictional resistance of $12N/m^2$. Estimate the power required to overcome the frictional resistance of a ship at 12 knots if the wetted surface area is $3300m^2$ and the index of speed is 1.9. (10 Marks)

Module-4

7 a. Explain the effect of adding small masses on end draughts. (12 Marks)

b. A ship of 5000 tonne displacement, 96m long, floats at draughts of 5.6m forward and 6.3m aft. The TPC is 11.5, $GM_L = 105m$ and centre of flotation 2.4m aft of midships. Calculate :
   i) The MCTI cm
   ii) The new end draughts when 88 tonne are added 3/m forward of midships. (08 Marks)

OR

8 a. Derive an expression for fresh water allowance. (08 Marks)

b. A ship 120m long and 9100 tonne displacement floats at a level keel draught of 6.5m in fresh water of $1t/m^3$. MCTIcm 130 tonne m, TPC in sea water 16.5, LCB 2.3m forward of midships. LCF 0.6m aft of midships calculate the new draughts if the vessel moves into sea water of $1.024t/m^3$ without change in displacement. (12 Marks)

Module-5

9 a. With the help of a neat diagram explain the relationship between the various speeds in a ship. (10 Marks)

b. Explain the phenomenon of cavitation and its effects on the ship's propellers. (06 Marks)

c. Explain the measurement of pitch of a propeller. (04 Marks)

OR

10 a. Explain briefly about rudder theory. (12 Marks)

b. Explain about angle of heel due to force on rudder. (08 Marks)

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