

# CBCS SCHEME

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18MR52

## Fifth Semester B.E. Degree Examination, July/August 2021 Naval Architecture

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

- 1 a. Define the following terms :  
i) Density ii) Relative density iii) Centre of pressure iv) Centroid. (08 Marks)
- b. A rectangular double bottom tank is 20m long, 12m wide and 1.5m deep and is full of sea water having a density of 1.025 tonne/m<sup>3</sup>. Calculate the pressure in kN/m<sup>3</sup> and load in MN on the top and bottom of the tank if the water is :  
i) at the top of the tank ii) 10m up the sounding pipe above the tank top. (12 Marks)

- 2 a. Define the following terms : i) Draught ii) aft perpendicular  
iii) Forward perpendicular iv) Length between perpendiculars. (08 Marks)
- b. The half ordinates of a water plane 180m long are as follows :

Section	AP	½	1	2	3	4	5	6	7	8	9	9½	FP
½ ord (mtrs)	0	5.0	8.0	10.5	12.5	13.5	13.5	12.5	11.0	7.5	3.0	1.0	0

- Calculate i) area of water plane ii) distance of centroid from midships. (12 Marks)
- 3 a. Explain with the help of a neat sketch : i) Water plane area coefficient  
ii) Block coefficient iii) Prismatic coefficient. (10 Marks)
  - b. A ship of 14000 tonne displacement, 130m long, floats at a draught of 8m. Calculate the wetted surface area the ship using : i) Denny's formula ii) Taylor's formula (c = 2.58). (04 Marks)
  - c. A box barge is 75m long, 9m beam of 6m deep. A similar barge having a volume of 3200m<sup>3</sup> is to be constructed. Calculate the length, breadth and depth of the new barge. (06 Marks)
  - 4 a. Define Centre of gravity. Derive an expression for shift in centre of gravity due to movement of mass. (08 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. (08 Marks)
  - 5 a. Explain the following terms related to stability of ship with neat sketches :  
i) Equilibrium ii) Stable iii) Unstable. (10 Marks)
  - b. An oil tanker 24m wide displaces 25000 tonne when loaded in nine equal tanks, each 10m long, with oil rd 0.8. Calculate the total free surface effect with :  
i) no longitudinal divisions.  
ii) a longitudinal centerline bulkhead.  
iii) twin longitudinal bulkheads, forming three equal tanks.  
iv) twin longitudinal bulkheads, the centre compartment having a width of 12m. (10 Marks)

- 6 a. What is Residuary Resistance? Explain 3 types of residuary resistance. (08 Marks)  
 b. A 6m model of a ship has a wetted surface area of  $8\text{m}^2$ . When towed at a speed of 3 knots in fresh water the total resistance is found to be 38N. If the ship is 130m long, calculate the effective power at the corresponding speed. (Take  $n = 1.825$ ,  $\text{SCF} = 1.15$ ). (12 Marks)
- 7 a. Derive the expression for change in trim as an effect of adding small masses in the longitudinal direction. Also obtain expressions for change in 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,  $\text{GM}_L$  105m and center of floatation 2.4m aft of midships. Calculate  
 i) the MCTI cm ii) the new end draughts when 88 tonne are added 31m forward of midships. (08 Marks)
- 8 a. Derive an expression for change in trim due to change in density. (08 Marks)  
 b. Define i) Reserve Buoyancy ii) Permeability. (04 Marks)  
 c. A ship 120m long and 9100 tonne displacement floats at a level draught of 6.5m in fresh water of  $1.00\text{ t/m}^3$ . MCTI cm 130 tonne m, TPC in sea water 16.5, LCB 2.30m forward of midships. LCF 0.6m aft of midships. Calculate the new draughts if the vessel moves into sea water of  $1.024\text{ t/m}^3$  without change in displacement. (08 Marks)
- 9 a. Define the following terms related to propeller : i) Pitch ii) Apparent slip iii) Real slip. (06 Marks)  
 b. Explain about cavitation and its effects on propeller. (06 Marks)  
 c. A propeller of 4.5m pitch turns at 120 rev/min and drives the ship at 15.5 knots. If the wake fraction is 0.30, calculate the apparent slip and real slip. (08 Marks)
- 10 a. Explain Rudder theory. (12 Marks)  
 b. A rudder has an area of  $15\text{m}^2$  with its centre of effort 0.9m from the centre of a stock. The maximum rudder angle is  $35^\circ$  and it is designed for a service speed of 15 knots. Calculate the diameter of the rudder stock if the maximum allowable stress in the stock is  $55\text{MN/m}^2$  and the rudder force parallel to the centre line of the ship is given by :  
 $F = 580 A v^2$ , N with v in m/s. (08 Marks)

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