

INDIAN MARITIME UNIVERSITY
(A Central University, Govt. of India)

B.Tech (Marine Engineering) - Semester V
December 2015 End Semester Examinations

Naval Architecture - I
Subject Code: UG11T2506/UG11T1506

Time: 3 hrs
Date : 21.12.2015

Max Marks : 100
Pass Marks : 50

Part-A (3x10=30 Marks)
Compulsory Question

1. Define / explain the following terms

- a) Center of pressure
- b) Angle of vanishing stability
- c) Wake coefficient
- d) Angle of loll
- e) MCT1
- f) Stability of a floating body in water
- g) Dynamical stability of a ship
- h) TPC
- i) Fresh water allowance
- j) Metacentric radius

Part B (5x14=70 Marks)
Answer any five of the following.

2.

a) Describe the key geometry aspects of a fixed pitch marine screw propeller, with suitable sketches. (7 Marks)

b) A ship of 8000 tonnes displacement has $KM = 8.7$ m, and $KG = 7.6$ m. The following weights are then either loaded or discharged as mentioned:

- Load 250 tonnes cargo $KG = 6.1$ m and centre of gravity 7.6 m to starboard of the centre line.
- Load 300 tonnes fuel oil $KG = 0.6$ m and centre of gravity 6.1 m to port of the centre line.
- Discharge 50 tonnes of ballast $KG = 1.2$ m and centre of gravity 4.6 m to port of the centre line.

Find the final list. (7 Marks)

3.

a) A ship of 6000 tonnes displacement has $KM = 7.3$ m, and $KG = 6.7$ m, and is floating upright. A weight of 60 tonnes already on board is shifted 12 m transversely. Find the resultant list. (4 Marks)

- b) A ship of 9900 tonnes displacement has $KM = 7.3$ m, and $KG = 6.4$ m. The ship will load two 50 tonne masses with her own gear and the first lift is to be placed on deck on the inshore side (KG 9 m and centre of gravity 6 m out from the centre line). When the derrick swings to the quay to reach the load, its head is 15 m above the keel and 12 m out from the centre line. Calculate the maximum list during the operation, when first load is placed and second load is just lifted from quay. **(10 Marks)**
- 4.
- a) A lower hold bulkhead is 12 metres deep. The transverse widths of the bulkhead, commencing at the upper edge and spaced at 3 m intervals, are 15.4, 15.4, 15.4, 15.3 and 15 meters respectively. Find the depth of the centre of pressure below the waterplane when the hold is flooded to a depth of 2 metres above the top of the bulkhead. **(7 Marks)**
- b) A box shaped vessel 90m x 10m x 6m floats in salt water on an even keel at 3m drafts fore and aft. Find the new drafts if a weight of 64 tonnes already on board is shifted a distance of 40 meters aft. **(7 Marks)**
5. What do you understand by the term resistance of a ship? Discuss the total ship resistance using ITTC definitions where applicable. **(14 Marks)**
6. Discuss the stability of a solid cone of base diameter 'D' and height 'H' floating in water with its vertex up at a draft 'T'. Find out under which conditions the cone can float. Assume the cone is made up of material of uniform density R_c and density of water as R_w . **(14 Marks)**
- 7.
- a) The wetted surface area of a ship is 5946 m². When travelling at its service speed, the effective power required is 11250 kW with frictional resistance 74% of the total resistance and specific fuel consumption of 0.22 kg/kWh. To conserve fuel the ship speed is reduced by 10%, the daily fuel consumption is then found to be 83.0 tonne. Frictional coefficient in sea water is 1.432. Speed in with index $(n) = 1.825$ m/s. Propulsive coefficient may be assumed constant at 0.6. Determine:
- Service speed of the ship
 - The percentage increase in specific fuel consumption when running at reduced speed. **(7 Marks)**
- b) A ship of 160m long, 22m beam and 9.2m draught has a block coefficient of 0.765. The pitch of the propeller is 4m and when it turns at 96 rpm, the true slip is 33%, the wake fraction 0.335 and shaft power 2900 kW. Calculate the admiralty coefficient and the shaft power at 15 knots. **(7 Marks)**
- 8.
- a) A ship of 6000 tonnes displacement, floating in salt water, has a double bottom tank 20 m x 12 m x 2 m which is divided at the centre line and is partially filled with oil of relative density 0.82. Find the virtual loss of GM due to the free surface of the oil. **(7 Marks)**
- b) A ship of 8000 tonnes displacement has KM 7.5 m, and KG 7.0 m. A double bottom tank is 12 m long, 15 m wide and 1 m deep. The tank is divided longitudinally at the centre line and both sides are full of salt water. Calculate the list if one side is pumped out until it is half empty. **(7 Marks)**
