Naval Architecture

Past Paper Questions

Q1. A Ship is a loaded condition is lying at even keel. A mass of 100 tons is moved longitudinally from 50m aft of midships to 30m aft of midships. Describe

a. how this shift of mass would affect the centre of gravity relative to the centre of buoyancy -7m

b. the final condition of the ship -3m

Q2. a. Describe what needs to occur for a ship lying at even keel to be trimmed by the stern -4m

b. Give three examples of how trimming by the stern can be achieved -6m

Q3. State the three conditions required for a ship floating calmly in water to be in stable static equilibrium -10m

Q4. A box barge 50m long, 8m wide is floating in sea water at the draft of 4m, with its center of gravity 4.2m above the keel. Take the seawater density as 1025 kg/m3. Calculate the new position of the center of gravity above the keel when a deck cargo of 500 ton on the centerline at 6.3m above the keel is discharged. -10m

Q5. A box barge 50m long, 8m wide is floating in sea water at a mean draft of 4m with its centre of gravity 4.2m forward of midship. Calculate the new position of the centre of gravity from the midship when a deck cargo of 500 ton on the dentre line 10m forward of midship is discharged. Take the sea water density as 1025 kg/m3 -10m

Q6. A ship of displacement 5000 tons has its center of gravity 'G' positioned 5m above keel. A rectangular centerline double bottom tank 15mX6mX2m deep is now filled with water of density 1020 kg/m3. Calculate

a. the mass of water in the tank -3m

b. the KG of the water in the tank -1m

c. the new position of the ships center of gravity above the keel (KG) -6m

Q7. A ship has a displacement of 17550 ton and when a mass of 16.5 ton is moved transversely 20m across the deck, an angle of heel of 2° is produced, given $m \times d = \Delta \times GM \times tan\theta$ and KM = 7.4m. Calculate the position of the center of gravity above the keel (KG). -10m

Q8. A vessel floating in a river has an underwater volume of 8540m3. The ship's center of gravity is 4m from the keel. The center of buoyancy is 2m from the keel. The second moment of waterplane area about the ships centerline is 29890m4. A mass of 8.5 ton on the port side is now moved transversely 11.5m across the deck to the starboard side. Given $m \times d = \Delta \times GM \times tan\theta$, the density of river water is 1010 kg/m3. Calculate the angle of heel due to the movement of the mass -10m

Q9. A ship of 2300 ton displacement has a list of 1.8°. Calculate the mass to be added on the centerline and moved 4.6m across the deck to bring the ship upright. Note $m \times d = \Delta \times GM \times tan\theta$ and KM=4.9m, KG = 4.1m -10m

Q10. A vessel, floating in a river has an underwater volume of 8540m3. The density of the river water is 1010 kg/m3. The ship's center of gravity and metacenter are at 4.0m and 5.5m from the keel. A mass of 8.5 ton on the portside of the deck to 11.5m to the starboard side. Calculate the angle of heel generated using the formula $m \times d = \Delta \times GM \times tan\theta$ -10m

11. A ship of displacement 5000 tons has its longitudinal center of gravity positioned 5m aft of midship. A centerline double bottom tank, 6m wide and 2m deep whose transverse bulkheads are located 10m and 20m forward of midship is now filled with water of density 1020 kg/m3. Calculate the new position of the ships longitudinal center of gravity from midship -10m