GENERAL ENGINEERING SCIENCE I

<u>Attempt</u> **ALL questions**

Marks for each part question are shown in brackets

1. Solve for x in the following equation:

    $2(x + 4) - 4(x - 5) = x - 8$ (8)

2   Calculate the base diameter of a right cone having a perpendicular height of 2.4 metre and a volume of 0.91m^3. (8)

3. A power hoist is used to raise a mass of 280 kg through a height of 6.2 metres in 5.5 seconds.

    Calculate the efficiency of the system given that the power input is 6.2 kW. (8)

4   A sphere has a diameter of 0.8 metres.

    Calculate EACH of the following:

    (a) the surface area; (4)

    (b) the volume. (4)

5. A hole, 25mm diameter, is to be punched through a piece of plate 32mm thick.

    The shear strength is not to exceed 350MN/m^2.

    Calculate the force exerted by the punch. (8)

6. The base of a triangle is 107 cm long. An adjacent side is 45% longer and makes an angle of 1.3 radian to the base.

    Calculate the area of the triangle in m^2. (8)

7. A ship's tank, 4m x 4m, is 3.7m deep and is 67% full of sea water of density 1025kg/m^3.

    Calculate EACH of the following:

    (a) the pressure on the bottom of the tank due to the sea water; (4)

    (b) the load on the tank bottom given that the tank is now filled so that the water level is 1.8 m above the tank top up the sounding pipe. (4)

8. A ship has an underwater volume of 5325m^3 when floating in sea water of density 1025 kg/m .

   A mass of 342 tonne is now loaded on the centreline with its centre of gravity 5.3 m above the keel.

   Calculate the shift in the centre of gravity of the ship, given that KG = 4.9 m. (8)

9. Fig. Q.9 shows a uniform simply supported beam having a mass of 1.8 tonne and loaded as shown.

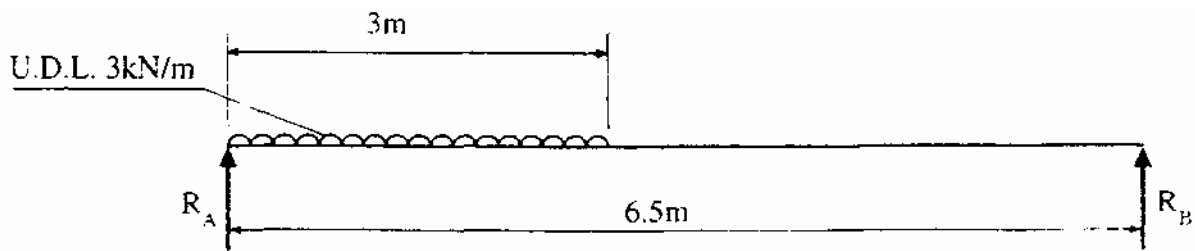   Calculate the value of the reactions R$_A$ and R$_B$. (10)

Fig. Q.9

10. A ship of 2300 tonne displacement has a list of 1.8°.

    Calculate the mass to be added on the centreline and moved 4.6 m across the deck to bring the ship upright.

    Note: m × d = Δ GM tan θ, and KM = 4.9 m, KG = 4.1 m (10)

11. *(a)* The velocity of a 45 kg mass is increased uniformly from 1.9 m/s to 2.6 m/s in 3.5 seconds.
    Calculate the accelerating force required. (3)

    (b) The mass is now retarded uniformly at 0.4 m/s^2 from 1.9 m/s until the mass just comes to rest.

    Calculate for the retardation period EACH of the following:

    (i) the time taken to come to rest; (3)
    (ii) the distance travelled. (2)

12. A flywheel has a diameter of 2.1m and rotates at 2.35rad/s.

    Calculate EACH of the following:

    (a) the linear velocity of a point on the rim; (2)

    (b) the rotational speed of the flywheel in rev/min; (4)

    (c) the number of radian turned when the flywheel rotates through 275°. (2)