GENERAL ENGINEERING SCIENCE I

Attempt ALL questions

Marks for each part question are shown in brackets

1. Simplify EACH of the following:

    (a) $4\frac{1}{6} - 2\frac{3}{5} + \frac{4}{3}$ (4)

    (b) $7\frac{1}{3} - 3\frac{5}{12} - 2\frac{3}{4}$ (4)

2. Evaluate using logarithms and SHOWING ALL WORKING.

$$\sqrt{\frac{7.2 \times 3.5^2}{418}}$$

3. Fig. Q.3 shows a right angled triangle ABC. Determine EACH of the following:

    (a) the length of side BC; (4)
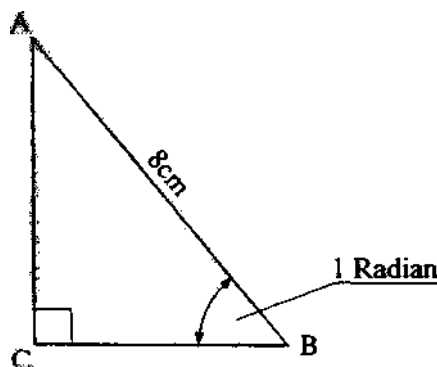
    (b) the area of the triangle. (4)

Fig. Q.3

4. Determine the perpendicular length, to the nearest whole number, of a solid right cone having a total surface area of 333 cm^2 given that the base diameter is 12 cm. (10)

5. A rectangular dock gate is 23 m wide and is subjected to a hydrostatic force of 37 MN when flooded to the top on one side only with water of density 1017 kg/m^5.

    Determine EACH of the following:

    (a) the height of the dock gate; (5)

    (b) the mass in tonnes of water in the dock when flooded to condition in Q5(a) given that the dock is 360 m long and 23 m wide. (5)

6. A screwjack has a single start thread of 5 mm pitch and can lift a load of 1.8 tonne with an effort of 85N.

   The effort is applied to the end of a lever having an effective length of 0.83 m.

   Determine EACH of the following:

   (a) the velocity ratio; (4)

   (b) the mechanical advantage; (2)

   (c) the efficiency when lifting the 1.8 tonne load. (2)

7. A pump discharges sea water through a 75mm diameter pipe to a height of 12.4 m at a constant velocity of 2 m/s. Density of sea water = $1025 kg/m^3$

   Determine EACH of the following:

   (a) the power of the pump; (6)

   (b) the input power to the pump if the system is operating at 58% efficiency. (2)

8. Fig. Q.8 shows a simply supported beam AB loaded as shown.

   Determine the distance of the 350kN load from support A given that the value of the reaction force R_B is to he 2.3 times greater than R_A (8)
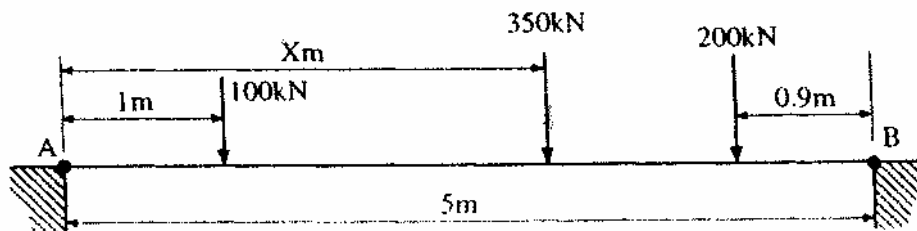

Fig. Q.8

9. (a) Determine the hydrostatic pressure at the bottom of a tank measuring 7.3m long by 6.3m wide and 4.85 m deep when filled with fuel oil of relative density 0.86. (3)

   (b) Determine the mass of fuel to be discharged from the tank in Q.9(a) to reduce the bottom hydrostatic pressure to 28 kN/m^2. (5)

10. A flywheel has a diameter of 580 mm and rotates at 104.7 rad/s.

    Determine EACH of the following:

    (a) the rotary velocity in revolutions per minute; (2)

    (b) the velocity of a point on the rim in Km/hr. (6)

11. A ship with a GM of 0.34 m heels through 1.3° when a mass of 3.8 tonnes, already on board, is moved 7 m across the deck. Given $m \times d = \Delta\, GM\, \tan\, \theta$.

Calculate the displacement of the ship. (8)

12. A ship having a displacement of 5090 tonnes has its centre of gravity G positioned 4.8 m above the keel.

925 tonne of cargo is loaded on the centre line at 2.3 m above the keel.

Calculate the new position of the ship's centre of gravity. (8)