Dec 1996

GENERAL ENGINEERING SCIENCE I

Attempt ALL questions

Marks for each part question are shown in brackets

1. Simplify the following equation:

$$\left(\frac{1}{4}+\frac{5}{18}\right)\div\left(6\frac{1}{4}-1\frac{2}{5}\times 3\frac{1}{3}\right) \qquad (6)$$

2. Fig. Q.2 shows a triangle ABC.
   Determine:

   (a) the area of the triangle ABC; (7)

   (b) the length of the side AB. (3)

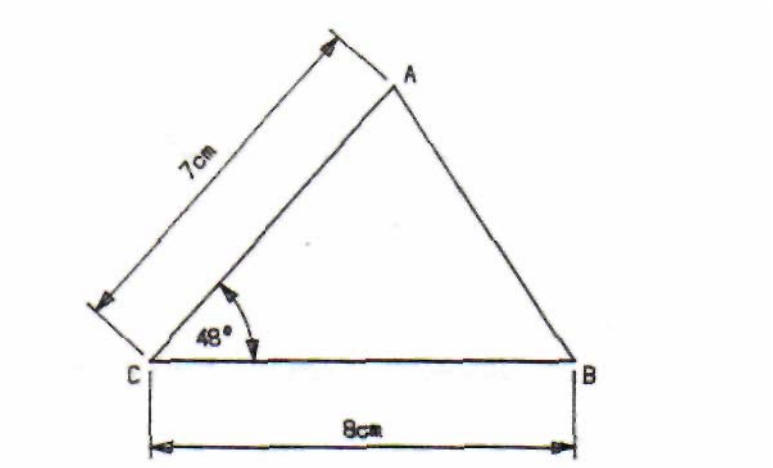

Fig. Q.2

3. A varies as $B^{\frac{1}{2}}$ and has a value of 7.5 when B=9.
   Determine the value of A when B = 25. (8)

4. The following formula relates coupling bolt and shaft diameters:

$$D=\sqrt{\frac{d^3}{3.5\times n\times r}}$$

   (a) Transpose the formula to make n the subject. (4)

   (b) Calculate the number of bolts (n) when D = 100, d = 600, and r = 450. (4)

5. A force of 16 N accelerates a body from 3m/s to 7m/s in 2 seconds.

   Determine:

   (a) the mass of the body; (4)

   (b) how far the body will travel in the 2 seconds. (4)

6. Fig. Q.6 shows a cylindrical flask, with one end hemispherical and the other end flat, containing 45396 mm^3 of liquid.

   Determine the liquid level from the flat end when the flask is inverted. (10)

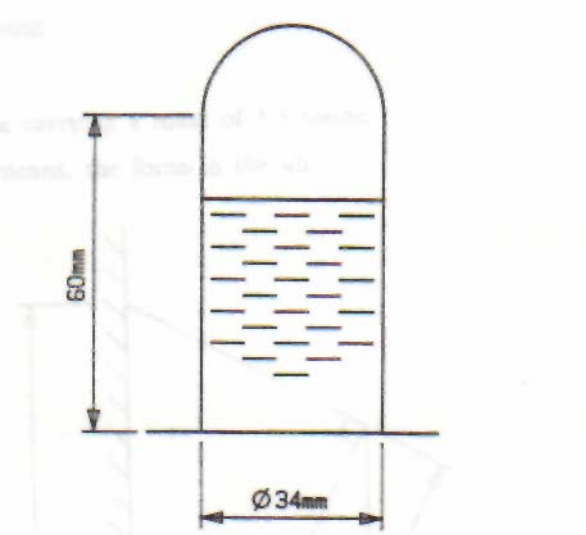

Fig. Q.6

7. A flywheel is accelerated from 350 rpm to 750 rpm in 42 seconds.

   Determine:

   (a) the acceleration in rad/sec/sec; (4)

   (b) the number of revolutions turned during the 42 seconds. (4)

8. A screwjack has a single start thread of 8 mm pitch. An effort of 66N is applied to the end of the operating handle which has an effective length of 240 mm. When lifting a load of 404 kg, determine:

   (a) the velocity ratio; (4)

   (b) the efficiency at this load. (4)

9. A ship of displacement 5050 tonne has its centre of gravity G positioned 5.1 metre above the keel. 995 tonne of cargo is now loaded on the centreline at 2.1 metre above the keel.

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

10. *(a)* Define Hooke's Law. (2)

(b) (i) Sketch a complete load/extension diagram for a typical mild steel specimen. (4)

(ii) Indicate the following points on the diagram:

(1) the limit of proportionality; (2)

(2) the maximum load. (2)

11. A hole 37.5 mm diameter is to be punched through a piece of plate 25 mm thick. The shear strength (i.e. the breaking stress) in the material is 350N/mm^2.

Calculate the load on the punch. (8)

12. Fig. Q.12 shows a wall crane carrying a mass of 1.5 tonne.

Determine, by any suitable means, the force in the jib. (8)

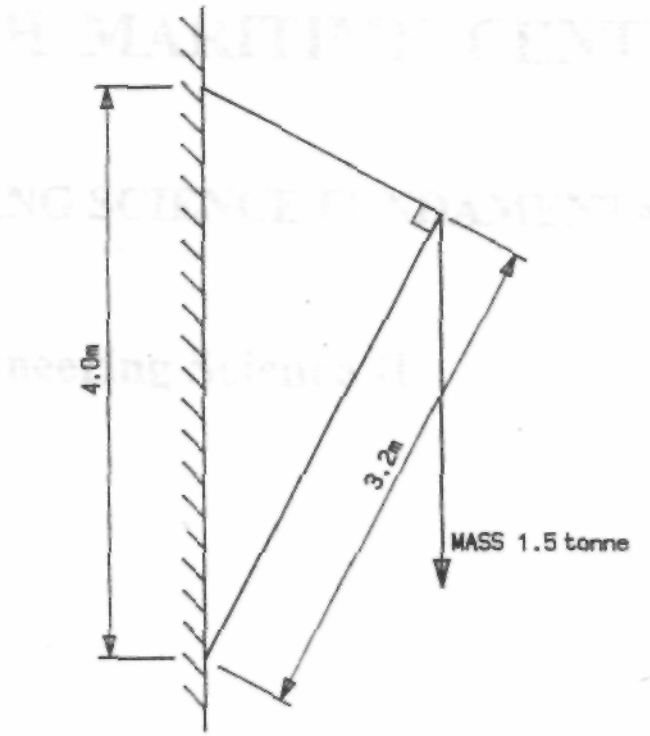

Fig. Q.12