Dec 1999

GENERAL ENGINEERING SCIENCE I

Attempt ALL questions

Marks for each part question are shown in brackets

1. Solve for x in the following equation:

$$2(x + 5) - 3(x - 4) = x + 8 \quad (6)$$

2. Determine the base diameter of a right cone having a perpendicular height of 2.9 m and a volume of $1.5 m^3$. (8)

3. A power hoist is used to raise a mass of 140 kg through a height of 6.2 m in 11 seconds.

   Determine the efficiency of the system if the power input is 1.53 kW. (8)

4. A sphere has a diameter of 0.38 m.

   Determine EACH of the following:

   (a) the surface area; (4)

   (b) the volume. (4)

5. A hole, 18.75 mm in diameter, is to be punched through a piece of plate 25 mm thick.

   The shear strength (stress) is not to exceed $350 N/mm^2$.

   Determine the load on the punch. (8)

6. The base of a triangle is 90 cm long.

   An adjacent side is 50% longer and makes an angle of 65° to the base.

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

7. A Western differential pulley block has a small wheel of 87.5 mm diameter and a velocity ratio of 16.

   Determine EACH of the following:

   (a) the diameter of the large wheel; (6)

   (b) the mechanical advantage of the machine if the efficiency is 45%. (4)

8. A tank is 3.4 m deep and is 70% full of seawater which has a density of 1025 kg/m^3.

Determine EACH of the following:

(a) the pressure on the bottom of the tank; (4)

(b) the increase in pressure on the bottom of the tank if the seawater is now pressed 2.5 m up the sounding pipe. (5)

9. A flywheel has a diameter of 1.8 m and rotates at 1.85 rad/s.

Determine EACH of the following:

(a) the linear velocity of a point on the rim; (3)

(b) the rotational speed of the flywheel in rev/min; (3)

(c) the number of radians turned through in 305°. (3)

10. A right angled triangle ABC, with base BC of 5cm, has a hypotenuse AB of 13cm.

Determine EACH of the following:

(a) the length of side AC (2)

(b) the sine of the angle ABC (2)

(c) the tangent of the angle CAB (2)

(d) the sum of angle ABC and angle CAB in degrees. (2)

11. Fig. Q.11 shows a uniform simply supported beam having a mass of 1.5 tonne.

Determine the value of the reactions R_A and R_B. (9)

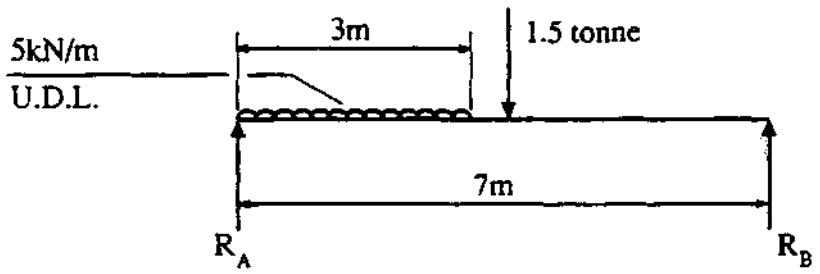

Fig. Q.11

12. The velocity of a 43kg mass is increased from 1.7m/s to 2.4m/s in 3.5 seconds.

(a) Determine the accelerating force required. (4)

(b) The mass is now retarded at 0.33 m/s^2 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)