Total No. of printed pages = 6

BES-304/App.Mech/3rd Sem/2015/M

APPLIED MECHANICS

Full Marks – 70

Pass Marks – 28

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) State triangle law of forces and Lami's theorem. 2+2=4

   (b) Explain the terms : clockwise moments and anti-clockwise moments. 2

   (c) What is the effect of force on a body ? 3

   (d) What is the difference between collinear and concurrent forces ? 3

   (e) What do you mean by resolution of a force ? 2

2. (a) Three forces of magnitude 30 kN, 10 kN and 15 kN are acting at a point O. The angles made by 30 kN force, 10 kN force and 15 kN force with x-axis are 60°, 120° and 240° respectively. Determine the magnitude and direction of the resultant force. 5

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(b) The resultant of two forces when they act at right angles is 10N, whereas when they act at an angle of 60°, the resultant is $\sqrt{148}$. Determine the magnitude of the two forces. 5

(c) A weight of 800N is supported by two chains as shown in figure (i). Determine the tension in each chain. 4

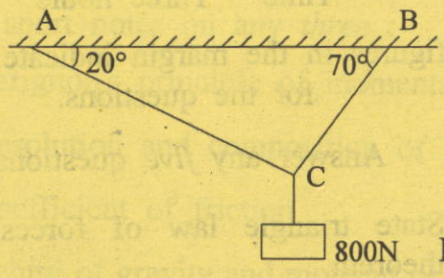


Fig (i)

3. (a) Two spheres, each of weight 1000N and of radius 25 cm rest in a horizontal channel of width 90 cm as shown in figure (ii). Find the reactions on the points of contact A, B and C. 10

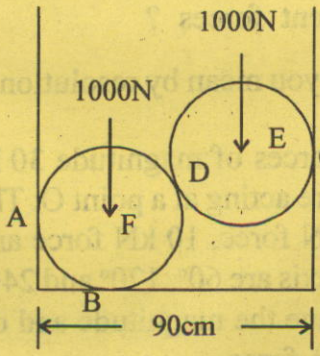


Fig (ii)

(b) Three forces F_1, F_2 and F_3 are acting on a body as shown in figure (iii) and the body is in equilibrium. If the magnitude of force F_3 is 250N, find the magnitudes of force F_1 and F_2. 4

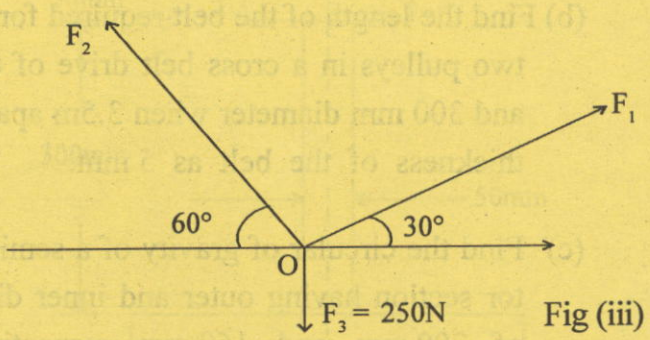


Fig (iii)

4. (a) What is a frame ? State the difference between a perfect frame and an imperfect frame. 1+3=4

(b) State the laws of static and dynamic friction. 5

(c) A body of weight 500N is pulled up an inclined plane by a force of 350N. The inclination of the plane is 30° to the horizontal and the force is applied parallel to the plane. Determine the coefficient of friction. 5

5. (a) Define the following terms : 2+2=4

(i) Slip of the belt

(ii) Creep of a belt.

(b) Find the length of the belt required for driving two pulleys in a cross belt drive of 600 mm and 300 mm diameter when 3.5m apart. Take thickness of the belt as 5 mm. 4

(c) Find the circular of gravity of a semiconductor section having outer and inner diameters of 200 mm and 160 mm respectively as shown in figure (iv). 6

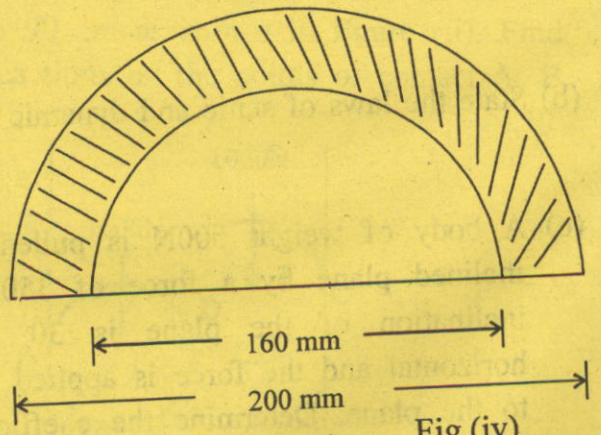
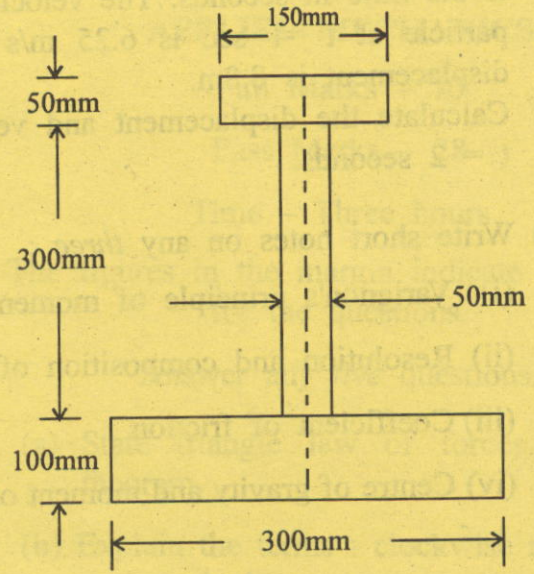


Fig (iv)

6. (a) Find the centre of gravity of the I-section as shown in figure (v). 7



Fig(v)

(b) A car moves along a straight line, whose equation of motion is given by $s = 12t + 3t^2 - 2t^3$, where (s) is in metres and (t) in seconds. Calculate :

(i) velocity and acceleration at start,

(ii) acceleration when velocity is zero. 7

7. (a) The motion of a particle is given by

$$a = t^3 - 3t^2 + 5,$$

where (a) is the acceleration in m/s^2 and (t) is the time in seconds. The velocity of the particle at t =1 sec is 6.25 m/s and the displacement is 8.8m.

Calculate the displacement and velocity at t = 2 seconds. 8

(b) Write short notes on any *three* : 2×3=6

(i) Varignon's principle of moments

(ii) Resolution and composition of forces

(iii) Coefficient of friction

(iv) Centre of gravity and moment of inertia.