Total No. of printed pages = 5

BES-304/App. Mech/3rd Sem/2014/N

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 and explain parallelogram law of forces. 3

   (b) Explain the term 'force' and list its characteristics. 5

   (c) What is meant by moment of a force ? Explain clearly the difference between clockwise moments and anticlockwise moments. 4

   (d) State the Varignon's principle of moments. 2

2. (a) Enunciate any three principles of equilibrium. 5

[Turn over

(b) State and prove Lami's theorem. 8

(c) Define the terms 'centre of gravity'. 1

3. (a) How will you distinguish between static friction and dynamic friction ? 3

(b) Define coefficient of friction and limiting friction. 3

(c) How would you find out, if a particular body is at rest or in motion ? 3

(d) Distinguish clearly between speed and velocity. 3

(e) Distinguish clearly between resolution of forces and composition of forces. 2

4. (a) The resultant of the two forces, when they act at an angle of 60^{o} is 14N. If the same forces are acting at right angles, their resultant is $\sqrt{136}$ N. Determine the magnitude of the two forces. 8

(b) The resultant of two concurrent forces is 1500N and the angle between the forces is 90^{o}. The resultant makes an angle of 36^{o} with one of the force. Find the magnitude of each force. 6

5. (a) Two spheres are kept within a conical channel, as shown in Fig.(i). All contact surfaces are smooth. Determine all contact reactions. Size of spheres are same but with different weight. 8

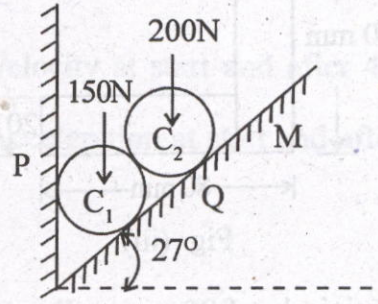

Fig. (i)

(b) A body of weight 500N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by an effort (P) parallel to the plane as shown in Fig. (ii). Determine the minimum and maximum values of P, for which the equilibrium can exist, if the angle of friction is 20°. 6

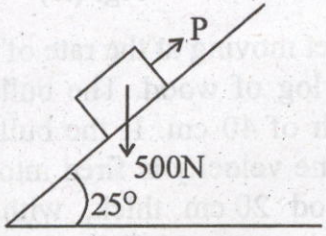

Fig. (ii)

6. (a) Find the centroid of an unequal angle section 10 mm×80 mm×20 mm as shown in Fig (iii). 7

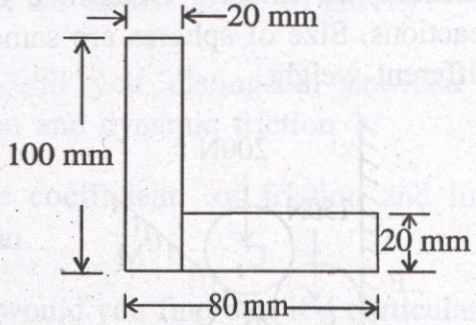

Fig. (iii)

(b) A semicircle of 90 mm radius is cut out from a trapezium as shown in Fig.(iv). 7

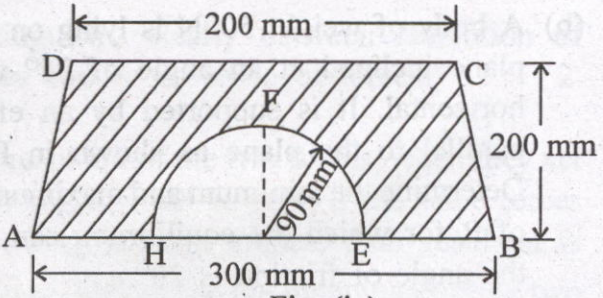

Fig. (iv)

7. (a) A bullet moving at the rate of 250 m/s is fired into a log of wood. The bullet penetrates to a depth of 40 cm. If the bullet moving with the same velocity is fired into a similar piece of wood 20 cm thick, with what velocity would it emerge ? Take the resistance to be uniform in both cases. 7

(b) A particle moves along a straight line so that its displacement in metre from a fixed point is given by

$$s = t^3 + 3t^2 + 4t + 5.$$

Find :

(i) Velocity at start and after 4 seconds.

(ii) Acceleration at start and after 4 seconds.

7