Total No. of printed pages = 6

BES-304/AM/3rd Sem/2013/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) What do you mean by system of forces? State any five system of forces. 1+4=5

   (b) State triangle law of forces and polygon law of forces. 5

   (c) State the laws of static friction. 4

2. (a) What are the various characteristics of a force? 3

   (b) State Lami's theorem. 2

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(c) What is a frame ? Discuss its classification. 5

(d) State clearly the difference between a perfect frame and an imperfect frame. 3

(e) What do you mean by derived unit ? 1

3. (a) Two forces of 80N and 70N act simultaneously at a point. Find the resultant force, if the angle between them is 150^{o}. 4

(b) Find the angle between two equal forces P, when their resultant is equal to (i) P and (ii) P/2. 3+3=6

(c) An electric light fixture weighting 15N hangs from a point C, by two strings AC and BC. The string AC is inclined at 60^{o} to the horizontal and BC at 45^{o} to the horizontal as shown in fig (i). Using Lami's theorem, determine the forces in the strings AC and BC. 4

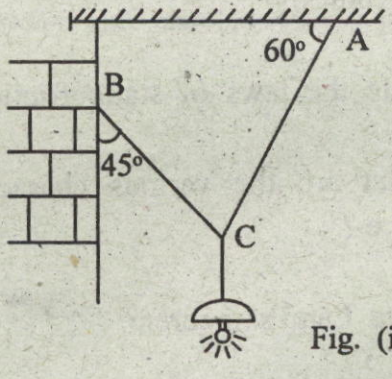

Fig. (i)

4. (a) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300N at the free end E as shown in fig. (ii)

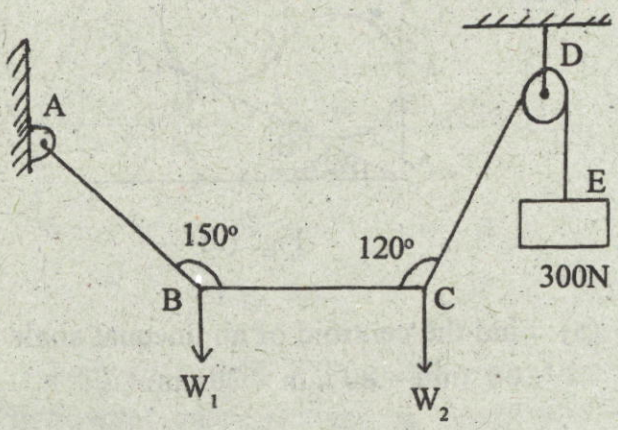

Fig. (ii)

If in the equilibrium position, BC is horizontal and AB and CD make 150° and 120° with BC, find (i) tensions in the portion AB, BC and CD of the string and (ii) magnitudes of W_1 and W_2. 7

(b) Two smooth circular cylinder of radius 100 mm and weights 200N each is lying in a triangular groove, one side of which makes

90° angle and the other 40° angle with the horizontal. Find the reactions at the surfaces of contact. 7

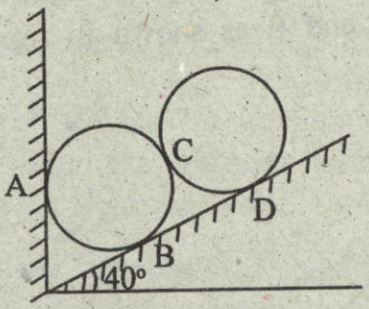

Fig. (iii)

5. (a) Find the centroid of an unequal angle section 100 mm × 80 mm × 20 mm. 7

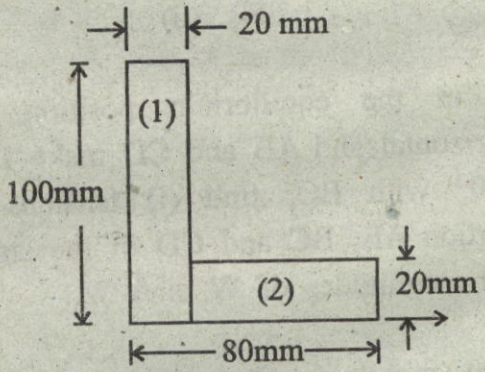

Fig. (iv)

(b) A triangle is cut out from a trapezium as shown in fig. (v). Find the position of the centre of gravity of the figure. 7

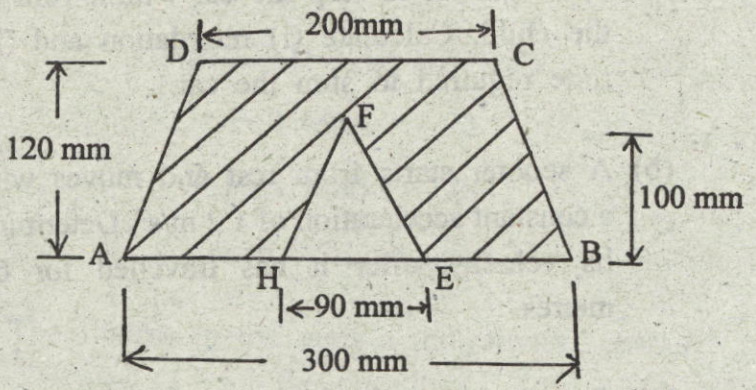

Fig. (v)

6. (a) A body of weight 300N is lying on a rough horizontal plane having a coefficient of friction as 0·3. Find the magnitude of the force, which can move the body, while acting at an angle of 25° with the horizontal. 6

(b) A body, resting on a rough horizontal plane, required a pull of 100N inclined at 30° to the plane just to move it. It was found that a push of 160N inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. 8

7. (a) On turning a corner, a motorist rushing at 20 m/s, finds a child on the road 50m ahead. He instantly stops the engine and applies brakes, so as to stop the car within 10m of the child. Calculate (i) retardation and (ii) time required to stop the car. 5

(b) A scooter starts from rest and moves with a constant acceleration of 1·2 m/s^2. Determine its velocity, after it has travelled for 60 metres. 3

(c) 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) is in seconds, calculate—

(i) velocity and acceleration at start, and

(ii) acceleration, when the velocity is zero. 6