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Question Paper Code : 57415

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Second Semester

Civil Engineering

GE 6253 T – ENGINEERING MECHANICS

(Common to Mechanical Engineering)

(Regulations 2013)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Two forces 30 N and 40 N act at a point 'O'. The included angle between them is 60°. Find the magnitude and the direction of the resultant.
2. What are the minimum requirements for equilibrium of a particle in space ?
3. How free body diagram is constructed ?
4. State Varignon's theorem.
5. State Pappus-Guldinus theorem.
6. When will the product of inertia of an area become zero ?
7. State D'Alembert's principle.
8. What happens if two perfectly elastic bodies are in impact ?
9. What is angle of repose ?
10. A motor bike wheel of radius 80 cm is moving along a straight road with a speed of 60 km/hr. Find the angular speed of the wheel.

PART – B (5 × 16 = 80 Marks)

11. (a) (i) Two forces P and Q of magnitude 40 N and 60 N respectively act on a bolt A. Determine their resultant if P and Q makes 20° and 45° respectively with horizontal.

(ii) Two forces are applied to a hook support as shown in Fig. 11. (a)(ii) Knowing that the magnitude of P is 35 N determine (1) the required angle α if the resultant R of the two forces applied to the support is to be horizontal, (2) the corresponding magnitude of R. **(12)**

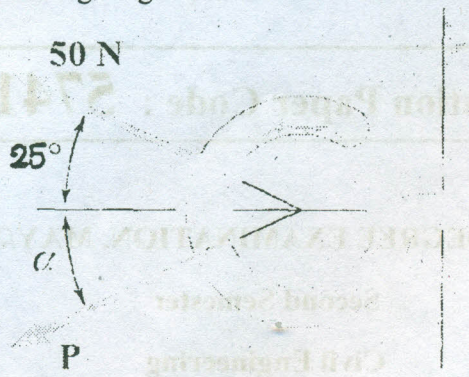

Fig. 11 (a) (ii)

OR

(b) The x, y, z component of a force are 36 kN, –24 kN and 24 kN respectively. Find the component of this force along the line joining A (1, 2, –3) and B (–1, –2, 2).

12. (a) A bracket is subjected to a force as shown in Fig. 12 (a). Determine : (i) an equivalent force couple system at A and B. (ii) an equivalent system consisting of 90 kN force at B and another force at A.

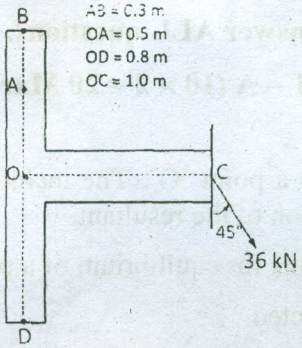

Fig. 12 (a)

OR

(b) A fixed crane has a mass of 1000 kg and is used to lift a 2400 kg crate as shown in Fig. 12(b). It is held in place by a pin at A and a rocker at B. The center of gravity of the crane is located at G. Determine the reactions at supports A and B.

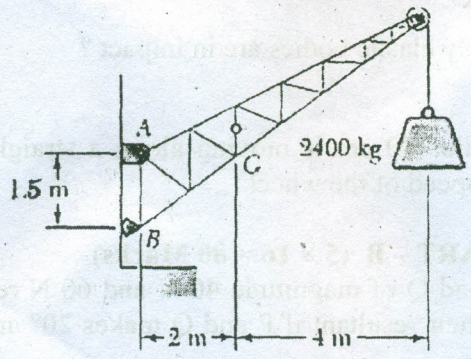

Fig. 12 (b)

13. (a) Locate the centroid for Area shown in Fig. 13 (a).

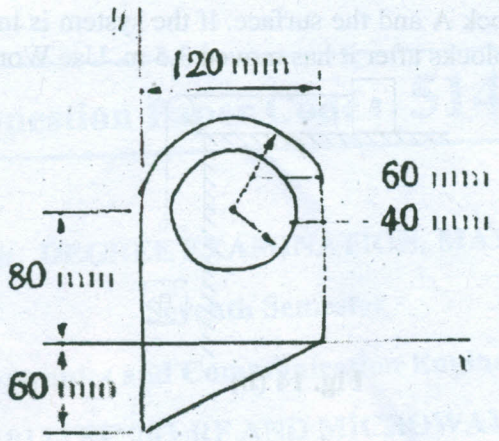

Fig. 13 (a)

OR

(b) Determine the moment of inertia for the area shown in Fig. 13 (b) about the centroidal x and y axes.

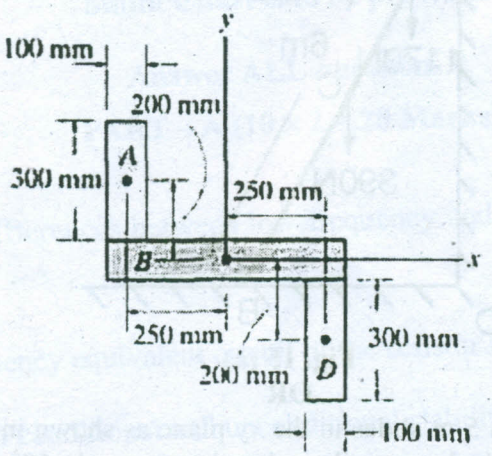

Fig. 13(b)

14. (a) A stone is projected with a speed of 30 m/s at an angle of elevation of 50°. Find its velocity (i) after 2 seconds, (ii) at the highest point of its path, (iii) at the height of 6 m. Find also the time interval between two points at which the stone attains a speed of 23 m/s.

OR

(b) Two blocks 'A' and 'B' of masses m_A = 280 kg and m_B = 420 kg are joined by an inextensible cable as shown in Fig. 14(b). Assume that pulley is frictionless and μ = 0.3 between block A and the surface. If the system is initially at rest, determine the velocity of the blocks after it has moved 3.5 m. Use Work Energy principle.

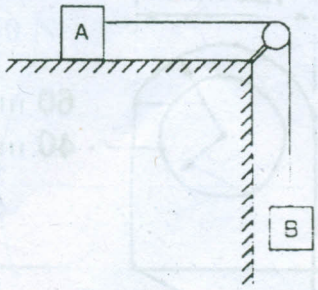

Fig. 14 (b)

15. (a) A ladder of weight 390 N and 6m long is placed against a vertical wall at an angle of 30° as shown in Fig. 15(a). The co-efficient of friction between the ladder and the wall is 0.25 and between ladder and floor is 0.38. Find how high a man of weight 1170 N can climb without sliding.

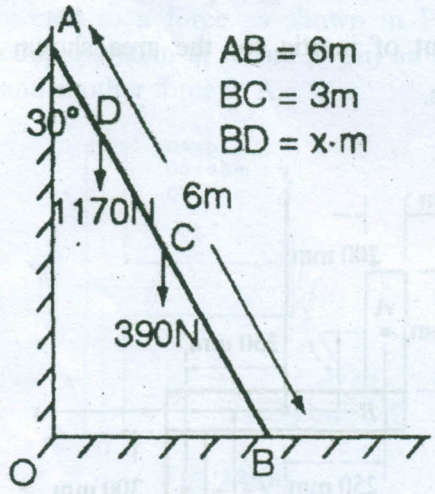

Fig. 15 (a)

OR

(b) A bar AB of length 5 m slides in the *xy* plane as shown in Fig. 15(b). The velocity of point A is 10 m/s downwards and makes an angle 60° with vertical. Determine the velocity of point B and mid point C.

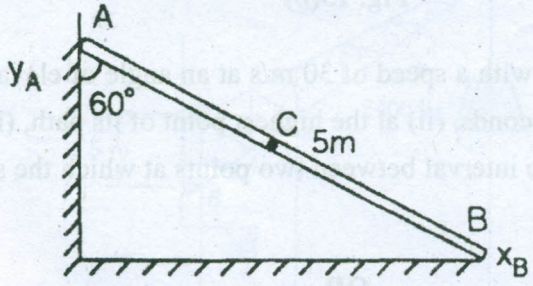

Fig. 15 (b)