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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

First Semester, B.E. - Make-up Examination; Jan / Feb - 2017

Engineering Mechanics

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Missing data, if any, may suitably assume.

UNIT - I

1 a. State and prove Varignons principle of moments. 4

b. Determine magnitude and direction of resultant force for the system of coplanar forces shown in Fig. Q1(b). 6

c. Three forces and a moment 'M' are applied to a bracket shown in Fig. Q1(c). If the line of action of resultant of forces is to pass through B. Compute the resultant of these forces and moment M. 6

d. Investigate whether given system of forces shown in Fig. Q1(d) are in equilibrium or not? If not state type of motion. 4

2 a. Briefly explain different types of supports with sketches. Mark reaction line. 4

b. Three identical balls weighing 5 kN each are stacked as shown in Fig. Q2(b) on smooth inclined plane inclined at 10^{o} with horizontal. Find reactions at all contact points A, B, C, D and E. 8

c. Determine support reaction for the loaded beam shown in Fig. Q2(c). 8

UNIT - II

3 a. State differences between centroid and centre of gravity. 4

b. From first principle locate centroid of semi circular lamina. 6

c. Locate centroid of the shaded area shown in Fig. Q3(c) with respect to point 'O'. 10

4 a. From method of integration locate centroid of right angled triangle lamina. 6

b. The centroid of rectangular area of size 600 mm x 240 mm is to be shifted by 20 mm as shown in Fig. Q4(b). This is accomplished by removing hatched portion which is 120 mm deep symmetrical about *x*-axis. Determine area of hatched portion and its width '*b*'. 6

c. Locate centroid of shaded area with respect to reference point O for the lamina shown in Fig. Q4(c). 8

UNIT - III

5 a. Define the terms : 4

i) Radius of gyration ii) Polar moment of Inertia.

b. State and prove parallel axis theorem. 4

Contd…..2

c. Find moment of Inertia and radius of gyration about horizontal and vertical centroidal axes of the section shown in Fig. Q5(c). Also calculate polar moment of Inertia and polar radius of gyration. 12

6 a. State and prove perpendicular axis theorem. 4

b. From first principle obtain M.I. of rectangular section about centroidal axes. 6

c. Find M.I. about an axis AA which passes through the base of the section shown in Fig. Q6(c). 5

d. Find M.I. about an axis PQ of the shaded area shown in Fig. Q6(d). 5

UNIT - IV

7 a. Define : i) Limiting friction ii) Angle of friction iii) Angle of repose iv) Coefficient of friction. 4

b. State laws of static friction. 6

c. Find ranges of values of W for which the body of 100 N block neither move up nor down the plane. Take angle of friction for all contact surfaces as $\tan^{-1}(0.2)$ for the block shown in Fig. Q7(c). 10

8 a. Explain briefly cone of friction. 4

b. A 6 m long ladder weighing 300 N rests against vertical wall at an angle of 60º with the horizontal floor. A man weighing 750 N climbs the ladder. At what height along the ladder from the floor does the experience slipping? Take $\mu = 0.2$ for all contact surfaces. 6

c. Determine the force 'P' to start the wedge shown in Fig. Q8(c). Take coefficient of friction for all contact surfaces as ¼. 10

UNIT - V

9 a. Define the terms : i) Dynamics ii) Kinematics iii) Kinetics iv) Projectile. 4

b. A ball is dropped from the top of a tower 30 m high. At the same time (instant) a second ball is thrown upward from the ground with an initial velocity of 15 m/s when and where do they cross. 6

c. A projectile is fired with a velocity of 100 m/s at an angle of 30º with horizontal. Find the horizontal range, maximum height attained and time of flight. Also find the projection angle, if the horizontal range to become three times its maximum height. 10

10a. Briefly explain D'Alembert's principle. 5

b. Define the terms : i) Work ii) Power iii) Energy iv) Kinematic energy. 5

c. A lift weighing 8000 N, when empty, A man weighting 600 N, entered it and lowered with uniform acceleration such that when a distance of 187.5 m was covered, the velocity of the lift was 25 m/s. Determine the tension in the rope/cable of lift and the force exerted by the man of the floor of the lift. 10

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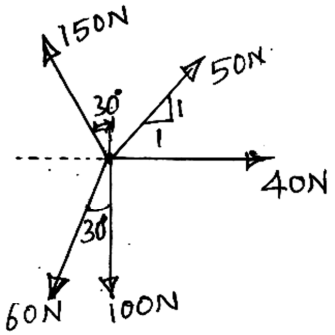

Fig. Q 1(b)

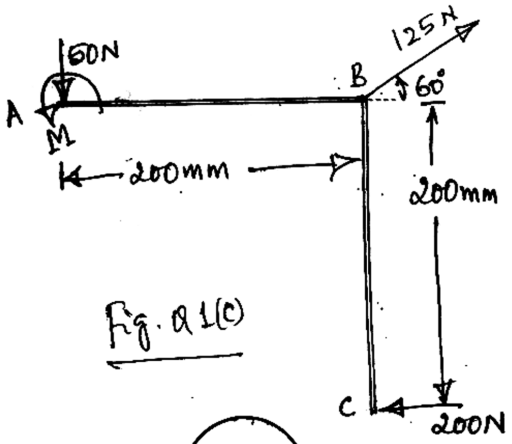

Fig. Q 1(c)

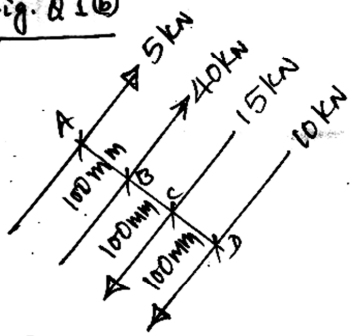

Fig Q 1(d)

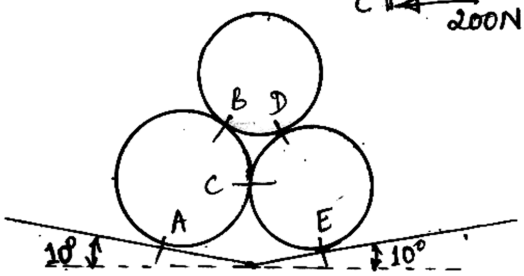

Fig Q. 2(b)

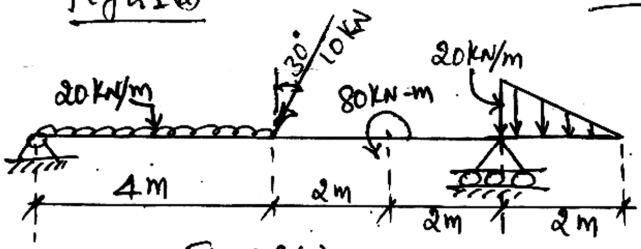

Fig Q 2(c)

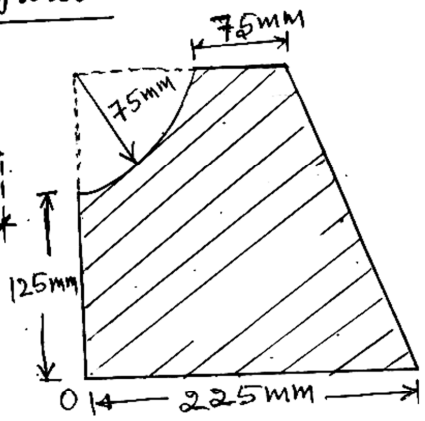

Fig. Q 3(c)

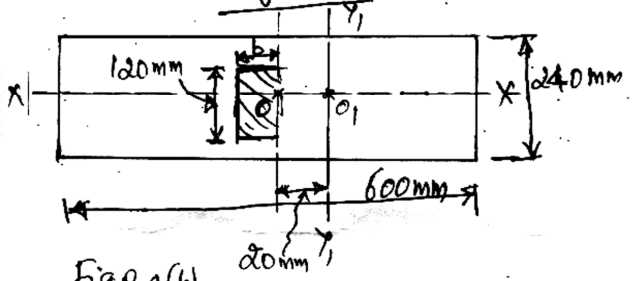

Fig Q 4(b)

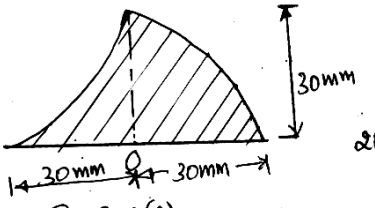

Fig Q 4(c)

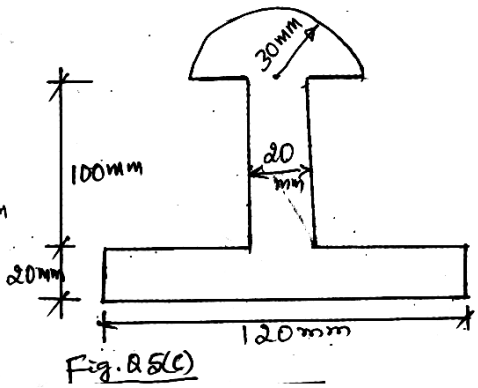

Fig. Q 5(c)

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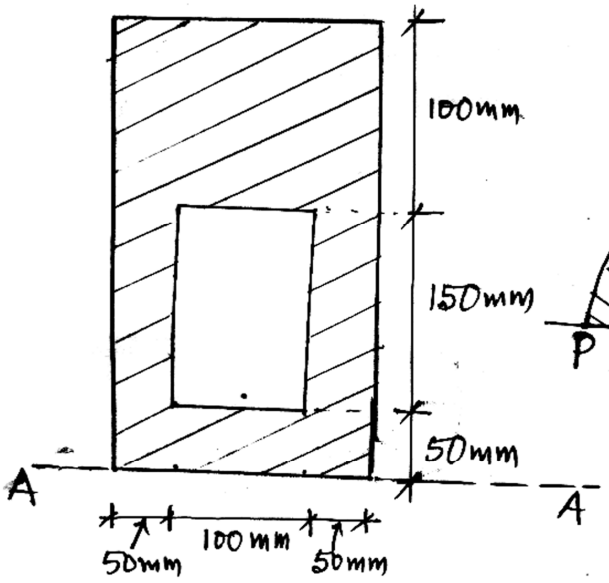

Fig Q 6(c)

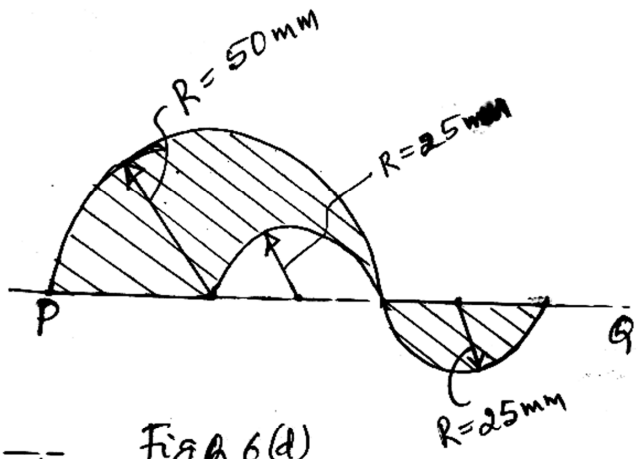

Fig Q 6(d)

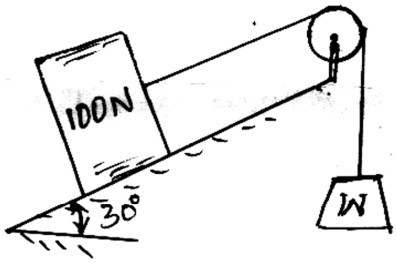

Fig Q 7(c)

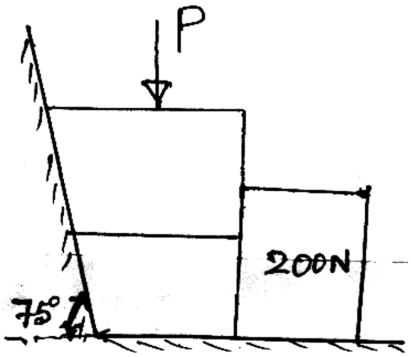

Fig. Q 8(c)

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