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

(An Autonomous Institution affiliated to VTU, Belgaum)

First Semester, B.E. - Semester End Examination; Dec - 2016/Jan - 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 may suitably be assumed.

UNIT - I

1 a. Explain briefly:
i) Force ii) Rigid body
iii) Composition and Resolution of a force system iv) Lami's theorem — 6

b. Two forces are acting at a point having magnitude and direction as shown in the Fig. 1 (b). If the resultant of these forces is 28 kN directed vertically upward find the angles "ϕ" & "ψ". — 6

c. Find the magnitude and direction of the resultant of a force system given in Fig. 1(c). — 8

2 a. With neat sketches, explain briefly different force systems. — 4

b. A ball of weight 200 N is resting on two inclined planes as shown in Fig. 2(b). Determine the reaction at A and B. — 5

c. Write a brief note on different types of loads that are commonly used. — 3

d. A simply supported beam is loaded with the different loads as shown in Fig. 2(d). Find the reaction at the supports. — 8

UNIT - II

3 a. Differentiate between centroid and a centre of gravity. — 3

b. Using method of integration, find the centroid of quarter of a circle. — 5

c. Determine the centroid coordinates of the hatched portion of the lamina shown in Fig. 3(c). — 12

4 a. With neat sketches, explain axis of reference and its importance in locating centroidal coordinates. — 4

b. Determine the *y* coordinates of a rectangle of breadth "*b*" and depth "*d*" from the first principles. — 4

c. Determine the centroidal coordinates of the hatched portion of the plane figure along axis *XX* and *YY* shown in Fig. 4(c). — 6

d. Find the centroid of the sketch shown in Fig. 4(d). — 6

UNIT - III

5 a. With neat sketch, explain polar moment of Inertia. — 3

b. State and prove Parallel axis theorem. — 7

c. Determine the moment of inertia of the section shown in Fig. 4(d) about its centroidal *XX* axis. — 10

Contd … 2

6 a. Write a brief note on radius of Gyration. 3

b. From the first principles obtain moment of inertia for a rectangular of dimension b x d about its base. 7

c. Determine the radius of Gyration of the area shown in Fig. 6(c) about base AB. 10

UNIT - IV

7 a. Write a brief note on Friction and angle of Friction. 4

b. Illustrate the Laws of static friction. 4

c. A uniform Ladder of length 15 m an 850 N weight rests against a vertical wall at an angle of 60º with the horizontal, coefficient of friction between wall and ladder is 0.3 and between floor and the ladder is 0.25. A man weighing 500 N ascends the ladder. How long will be able to go along the ladder before it slips? Also find the minimum weight of the man who can climb the complete length of the ladder without any slip. 12

8 a. With neat sketches explain:

i) Angle of Repose ii) Cone of friction. 4

b. Determine the force "P" required to impend the motion of the block 'B' shown in Fig. 8(b) given the coefficient of friction for all the contact surfaces is 0.3. 8

c. A block weighing 5 kN is attached to a wire which passes over a friction less pulley supports a weight of 2 kN. A force of P is applied on the block as in Fig. 8(c). Determine the value of "P", if the motion is impending to,

i) The right ii) The left given coefficient of friction $\mu = 0.35$. 8

UNIT - V

9 a. Define the terms:

i) Displacement ii) Velocity iii) Acceleration iv) Retardation. 4

b. A ball is dropped from top of tower 30 m high at the same instant a second ball is thrown upward from the ground with an initial velocity of 15 m/s. When and where do they cross with what velocity assume $g = 9.81\ m/s^2$? 8

c. A particle under a constant deceleration is moving in a straight line and covers a distance of 20 m in first 2 seconds and 40 m in next 5 seconds. Calculate the distance covered before it comes to rest. 8

10a. What are projectiles? Explain the terms Trajectory, Range and Time of flight pertaining to projectiles. 8

b. Write a note on: i) Work, power, energy ii) D' Alembert's principle. 6

c. A bomber flight at a height of 2000 m is moving with a uniform horizontal velocity of 600 KMPH wants to strike a target, at what distance before the target it should release the bomb. Assume gravitational acceleration = $9.81\ m/s^2$. 6

Contd…3

Fig 1(b)

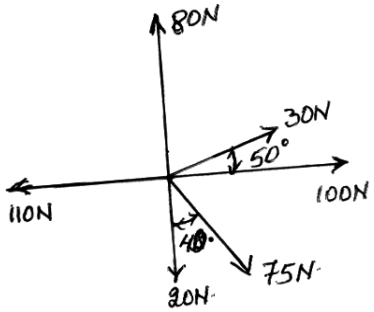


Fig 1(c)

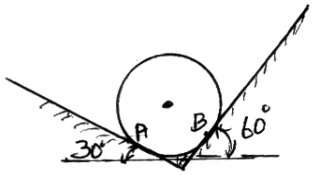


Fig 2(b)

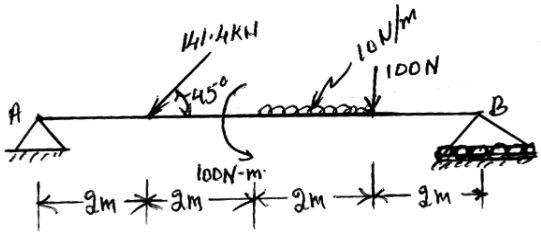


Fig 2(d)

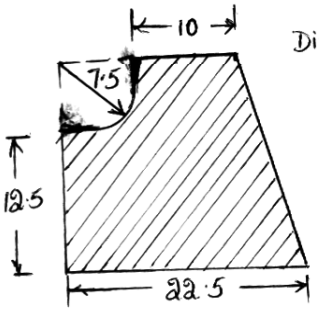
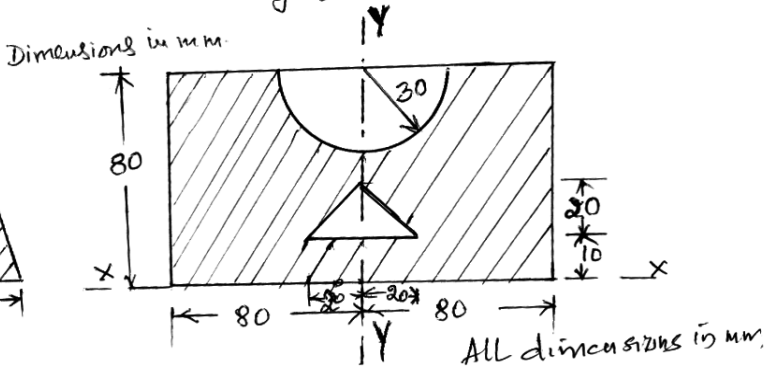


Fig 3 (c)



All dimensions in mm

Fig 4(c)

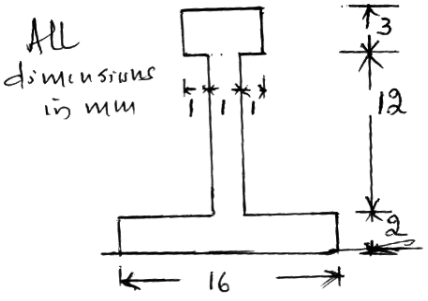
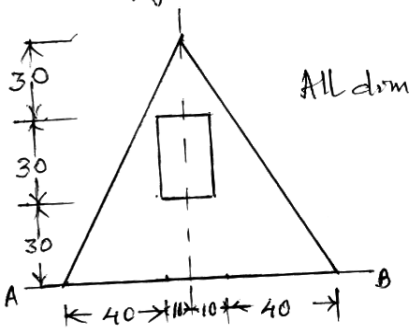


Fig 4(d)



All dimensions in mm

Fig 6(c)

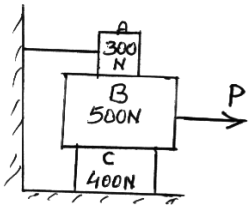
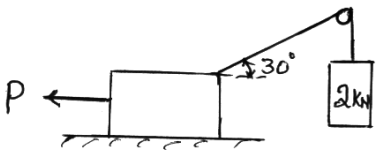


Fig 8(b)



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