(Pages : 4) **8679**

Reg. No. : .....

Name : .....

Combined First and Second Semester B.Tech. Degree Examination, December 2015
(2013 Scheme)

13.105 : ENGINEERING MECHANICS (ABCEFHMNPRSTU)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

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1. State and explain polygon law of forces.
2. Write the equations of equilibrium for a general case of force system in space.
3. State principle of virtual work.
4. Write expressions for mass moment of inertia of ring, solid disc and sphere.
5. Define simple harmonic motion. Explain the terms
   i) Amplitude ii) Period and iii) Frequency. **(5×4=20 Marks)**

PART – B

Answer **one full** question from **each** Module. **Each** question carries **20** marks.

Module – I

6. a) Four coplanar forces are acting at a point A as shown in Figure 1. Their resultant is 450 N as shown. Determine the unknown force P and its inclination with X – axis. **10**

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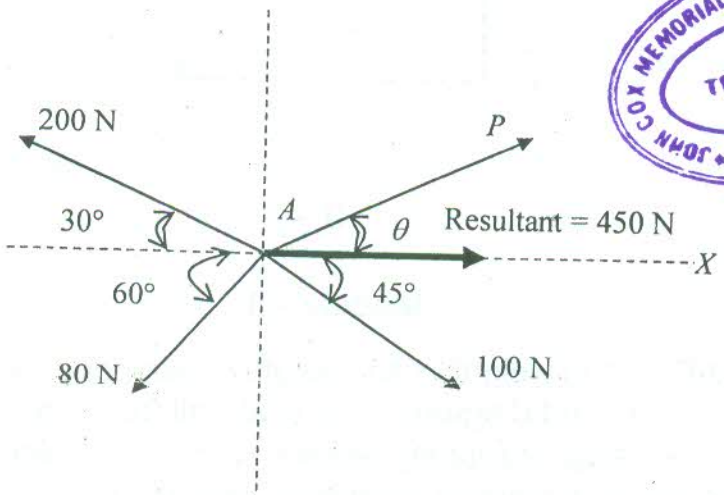

Fig. 1

b) State and prove Varignon's theorem of moments. **10**

OR

7. a) A tripod is resting with its legs on a horizontal plane at points A, B and C as shown in Figure 2. Its apex point D is 6 m above the floor and carries a downward load of 25 kN. Determine the forces developed in the legs. Use vector approach. 10

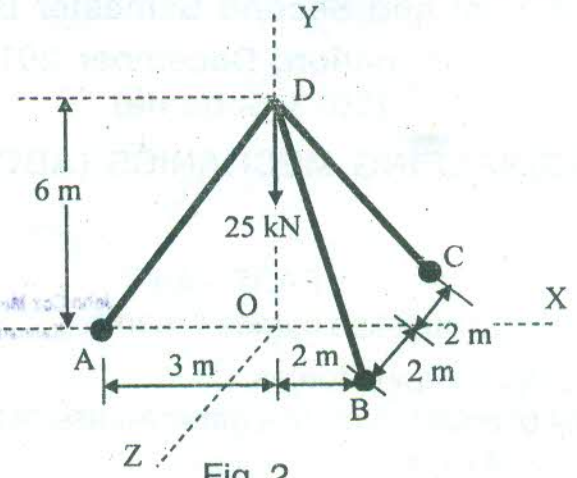

Fig. 2

b) For the non-concurrent coplanar force system shown in Figure 3, determine the magnitude, direction and position of resultant force with reference to point A using vector approach. 10

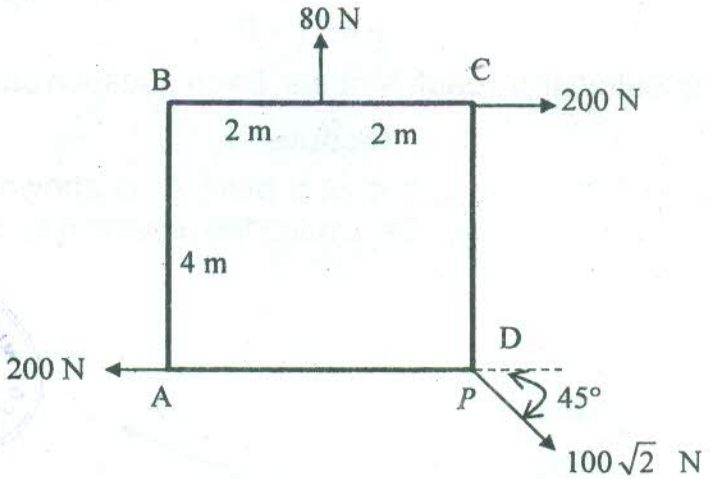

Fig. 3

Module – II

8. A uniform rod AB having weight W and length l is supported at its end A against a horizontal floor and end B against a vertical wall (both are of same material). If the rod is on the verge of slipping when $\theta = 25°$, determine the coefficient of static friction at A and B. Neglect the thickness of the rod for the calculation.

OR

9. Compute the second moment of area of the composite area shown in Figure 4 about XX-axis.

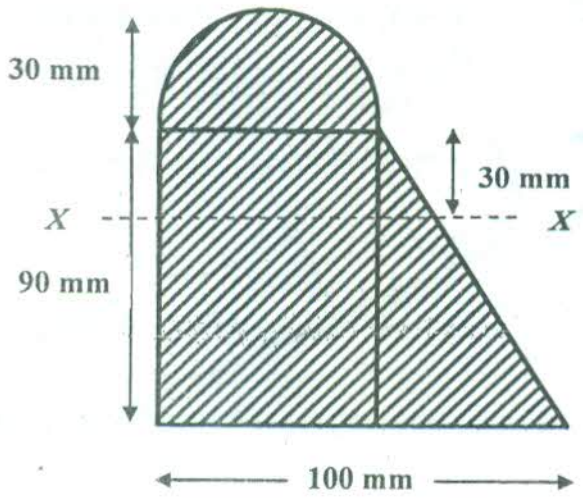

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Fig. 4

Module – III

10. A body weighing 1500 N rests on a rough plane inclined at 20° to the horizontal. It is pulled up the plane by means of a light inextensible rope running parallel to the plane and passing over a light frictionless pulley at the top of the plane as shown in Figure 5. The portion of the rope beyond the pulley hangs vertically downwards and carries a weight of 1000 N at its end. If coefficient of friction for the plane and body is 0.25, determine
    i) Acceleration with which the body moves up the plane,
    ii) Tension in the rope and
    iii) Distance moved by the body in 3 seconds after starting from rest.

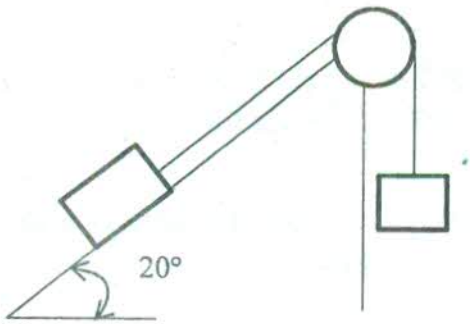

Fig. 5

OR

11. A small car of weight W starts from rest at A and rolls without friction along an inclined plane to B where it strikes a block also of weight W and initially at rest (Figure 6). Assuming plastic impact at B, the car and block will move from B to C as one unit. If the coefficient of friction between the block and plane is 0.5, calculate the distance x to point C where the bodies come to rest.

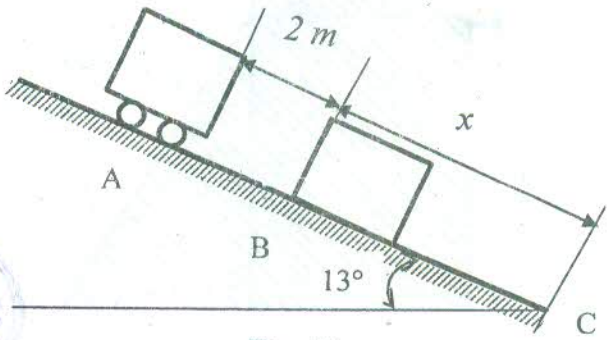

Fig. 6

Module – IV

12. A child of mass m runs along the rim of a circular platform of mass M and radius r starting from point A (Figure 7). The platform is initially at rest ; its support is frictionless.

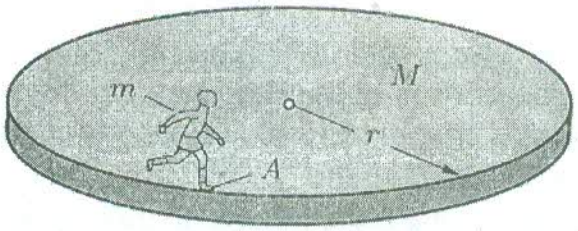

Fig. 7

Determine the angle of rotation of the platform when the child arrives again at point A.

OR

13. a) A motorcycle and rider of total weight 2500 N travel in a vertical plane with constant speed of 72 kmph along a circular curve of radius 300 m. Find the reaction exerted on the motorcycle by the track as it passes the crest of the curve. **10**

b) Small oscillation of a simple pendulum of weight W and length l are defined by the equation $x = x_0 \cos(pt)$, where x_0 is the amplitude of swing and p is a constant equal to $\sqrt{g/l}$. Determine the maximum value of the tensile force in the string. **10**

(4×20=80 Marks)