Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 73838

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Second Semester

18/4 FN

Civil Engineering

ME 2151/CE 1151/10122 ME 205/ME 25/080120002 — ENGINEERING MECHANICS

(Common to all Branches)

(Regulations 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Explain the principle of transmissibility.
2. State the necessary and sufficient conditions for equilibrium of a particle in two dimensions.
3. State Varignon's theorem.
4. Write the equations of equilibrium of a rigid body in two dimension.
5. Distinguish between centroid and centre of gravity.
6. Define principal axes and principal moment of inertia.
7. For the system shown in Fig. Q. 7 find the work done by the force in moving the object by 2 m.

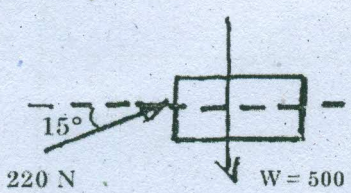


Fig. Q. 7

8. A body is moving with a velocity of 5 m/s. After 3 Seconds the velocity is 8 m/s. Find the acceleration.

9. When do we say that the motion of a body is impending?

10. How do, at any given instant, the velocity and acceleration of different points of a rigid body vary when it is undergoing translation?

PART B — (5 × 16 = 80 marks)

11. (a) Determine the magnitude and direction of force $\overline{F}$ shown in Fig. 11 (a) so that particle 'A' is in equilibrium.

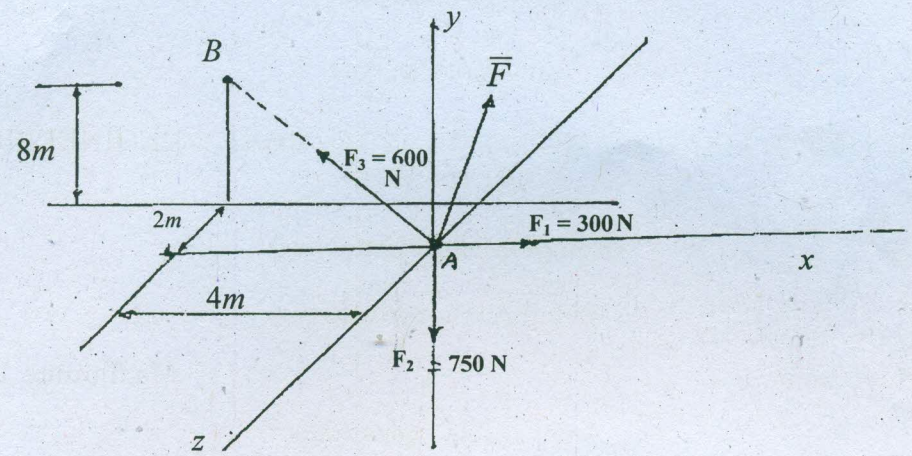


Fig. 11 (a)

Or

(b) Three cables are used to support the 10 kg cylinder shown in Fig. 11 (b). Determine the force developed in each cable for equilibrium.

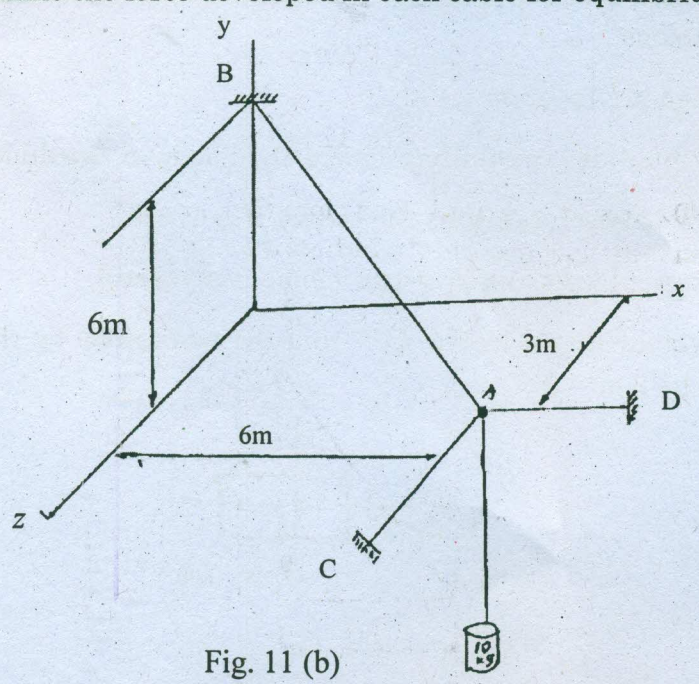


Fig. 11 (b)

12. (a) 4000 N load acts on the beam held by a cable PQ as shown in Fig. 12 (a). The weight of the beam can be neglected. Draw the free-body diagram of the beam and find the tension in the cable PQ. Also find the reaction force at R.

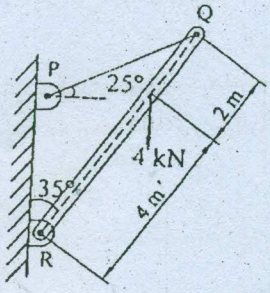


Fig. 12 (a)

Or

(b) A beam is acted upon by a system of forces as shown in Fig. 12 (b). Find the support reactions.

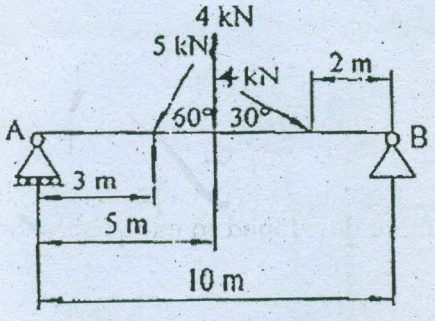


Fig. 12 (b)

13. (a) (i) Derive the expressions for the location of the centroid of 'a triangular area shown in figure 13 (a) (i), by direct integration. (6)

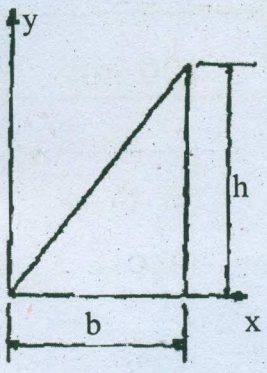


Fig. 13 (a) (i)

(ii) Locate the centroid of the plane area shown in figure 13 (a) (ii) below. (10)

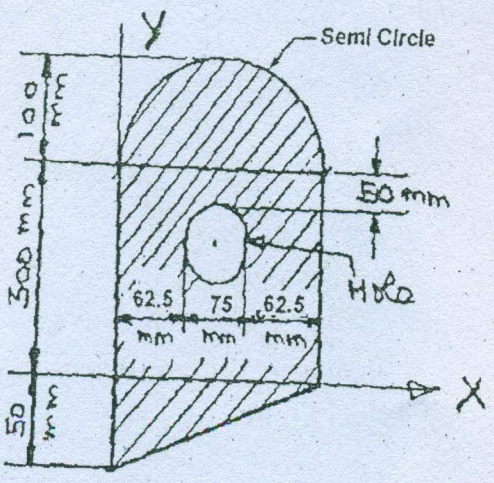


Fig. 13 (a) (ii)

Or

(b) An area in the form of L section is shown in figure 13 (b).

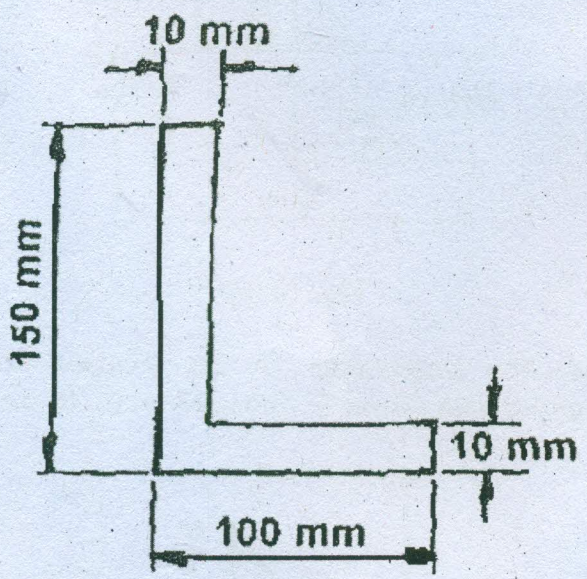


Fig 13 (b)

(i) Find the moments of inertia I_{xx}, I_{yy} and I_{xy} about its centroidal axes. (11)

(ii) Also determine the principal moments of inertia. (5)

14. (a) (i) A body is moving with uniform acceleration and covers 15 m in fifth second and 25 m in 10th second.

Determine the initial velocity and acceleration of the body. (10)

(ii) State Newton's first law, second law and law of Transmissibility. (6)

Or

(b) (i) Derive the work, energy equation. (6)

(ii) A ball of mass 20 kg moving with a velocity of 5 m/s strikes directly another ball of mass 10 kg moving in the opposite direction with a velocity of 10 m/s. If the coefficient of restitution is 5/6, find the velocity of each ball after impact. (10)

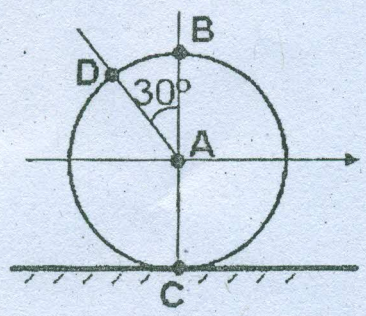
15. (a) (i) A block weighing 36 N is resting on a rough inclined plane having an inclination of 30°. A force of 12 N is applied at an angle of 10° up the plane and the block is just on the point of moving down the plane. Determine the coefficient of friction. (8)

(ii) A flat belt develops a tight side tension of 2000 N during power transmission; the coefficient of friction between pulley and belt is 0.3; the angle of lap on smaller pulley is 165° and the belt speed is 18 m/s. Determine the power that can be transmitted, if the belt is assumed to be perfectly elastic and without mass. (8)

Or

(b) (i) A rigid body is undergoing general plane motion. Write down the relationship of the velocities of two points A and B on it and explain. (6)

(ii) An automobile travels to the right at a constant speed of 72 km/h. The diameter of the wheel is 560 mm.



Determine the magnitude and direction of the following:

(1) Angular velocity of the wheel. (2)

(2) Velocity of the point B. (2)

(3) Velocity of the point C. (2)

(4) Velocity of the point D. (4)
