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

Question Paper Code : 90283

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Second/Third Semester
Civil Engineering
GE 8292 : ENGINEERING MECHANICS

(Common to Aeronautical Engineering/Aerospace Engineering/Agriculture Engineering/Automobile Engineering/Environmental Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/Material Science and Engineering/Mechanical Engineering/Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Mechatronics Engineering/Petrochemical Engineering/Production Engineering/Robotics and Automation Engineering/ Petrochemical Technology/ Petroleum Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. State Newton's first law of motion.

2. Find out the force system on which the following belong to :

   i) Forces acting on a moving bus

   ii) Forces on a rod resting against a wall

3. State the concept of equilibrium of connected bodies.

4. Find the moment of 100 N force acting at B about point A as shown in Fig 4.

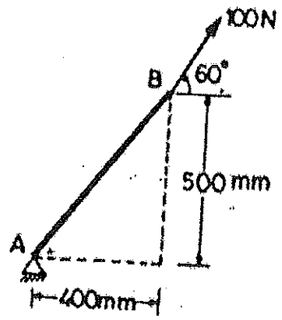

Fig. 4

5. What are principal axes ? What are principal axes of inertia of an area ?

6. When a lamina possesses axes of symmetry, what does it indicate ?

7. Indicate the concept involved the following games.

   i) Billiards

   ii) Boxing

8. Distinguish Power and Energy.

9. What is rolling resistance ?

10. How ladder friction varies from a wedge friction ?

PART – B **(5×13=65 Marks)**

11. a) A roller of weight 10 kN rests on a smooth horizontal floor and is connected to the floor by the bar AC as shown in Fig. 11 (a). Determine the force in the bar AC and reaction from floor, if the roller is subjected to a horizontal force of 5 kN and an inclined force of 7 kN as shown in the figure.

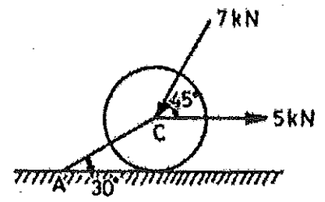

Fig. 11 (a)

(OR)

b) A rope AB, 4.5 m long is connected at two points A and B at the same level 4m apart. A load of 1500 N is suspended from a point C on the rope 1.5 m from A as shown in Fig. 11 (b). What load connected at a point D on the rope. 1 m from B will be necessary to keep the position CD level ?

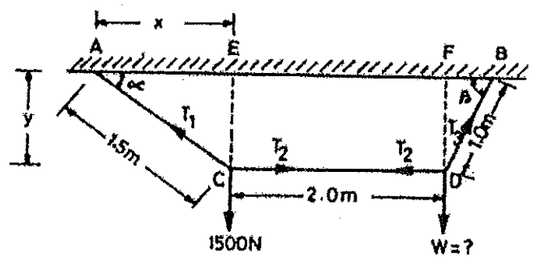

Fig. 11 (b)

12. a) The system of forces acting on a bell crank is shown in Fig. 12 (a). Determine the magnitude, direction and the point of application of the resultant.

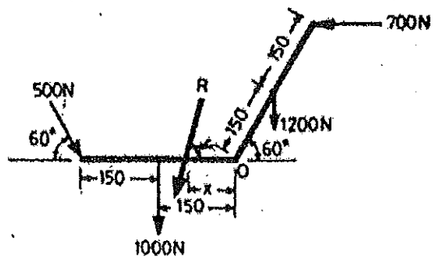

Fig. 12 (a)

(OR)

b) Determine the reactions at A and B of the over-hanging beam shown in Fig. 12 (b).

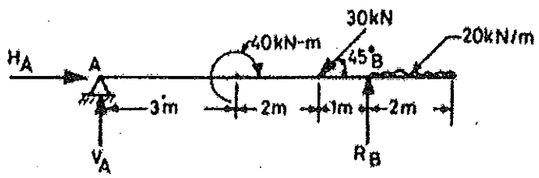

Fig. 12 (b)

13. a) From a semicircular lamina of radius r, a circular lamina of radius (r/2) is removed as shown in Figure 13 (a). Find the position of centre of gravity of the remainder.

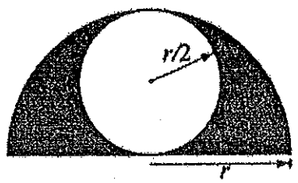

Fig. 13 (a)

(OR)

b) Find the moment of inertia of a hollow rectangular plane shown in Figure 13 (b) about x-axis and y-axis through the centroid.

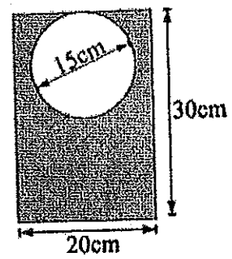

Fig. 13 (b)

14. a) An insect crawls at a constant speed u along the spoke of a bicycle wheel (Fig. 14 (a)), which is rotating with a constant angular velocity ω. Find the acceleration of insect in radial and perpendicular directions to the spoke.

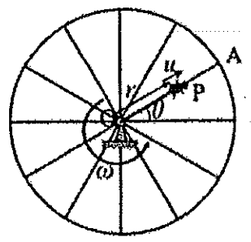

Fig. 14 (a)

(OR)

b) A package of mass 60 kg, moving with velocity 2.5 m/s on a surface of friction μ_k hits a spring of constant 20 kN/m and compressed initially by 12.0 cm. If block compresses the spring further to the maximum of 4.0 cm and the block is initially 60 cm away from end of spring, determine μ_k and velocity of block when it just starts pressing spring (see Figure 14.b).

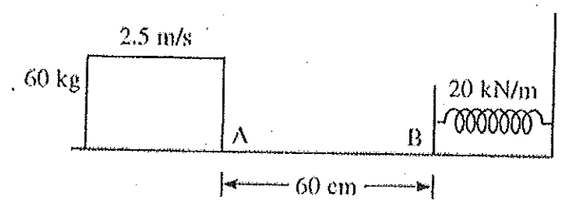

Fig. 14(b)

15. a) A body weighing 700 N rests on a rough horizontal surface. If $\mu_s = 0.4$,

a) Will the body move if a pull of 200 N is applied to it at 30° to the horizontal ?

b) If this force is increased to 300 N, investigate the condition of the body.

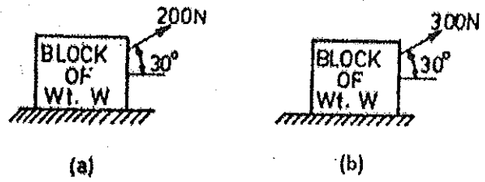

Fig. 15 (a)

(OR)

b) i) Explain absolute and relative velocity of particles of rigid body in plane motion. **(8)**

ii) Explain instantaneous centre of zero velocity in plane motion. **(5)**

PART – C **(1×15=15 Marks)**

16. a) Find the moment of inertia of circular plate of radius R and thickness t about its centroidal axis.

(OR)

b) A pole is held in place by three cables. If the force of each cable acting on the pole is shown, determine the position (x, y, 0) for fixing cable DC so that the resultant force exerted on the pole is directed along its axis.

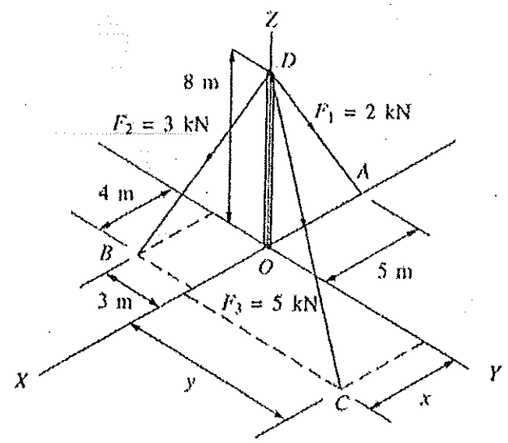

Fig 16(b)