

Code: 20BS1305

II B.Tech - I Semester – Regular Examinations - FEBRUARY 2022

**MECHANICS
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. a) Explain about different type of force systems. 7 M
 b) Systems of forces are acting at the corners of a rectangular block as shown in Fig 1.

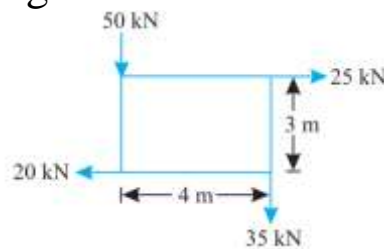


Fig 1

Determine the magnitude and direction of the resultant force. 7 M

OR

2. a) Explain about principle of transmissibility. 7 M
 b) A smooth sphere of weight W is supported by a string fastened to a point A on the smooth vertical wall, the other end is in contact with point B on the wall as shown in Fig 2. If length of the string AC is equal to radius of the sphere, find tension (T) in the string and reaction of the wall.

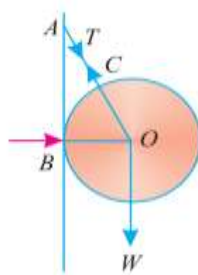


Fig 2

7 M

UNIT – II

3. a) State the laws of static and dynamic friction. 7 M
b) A 4 m ladder weighing 250 N is placed against a smooth vertical wall with its lower end 1.5 m away from the wall. If the coefficient of friction between the ladder and the floor is 0.3, show that the ladder will remain in equilibrium in this position. 7 M

OR

4. Find the forces in all the members of the truss shown in Fig 3

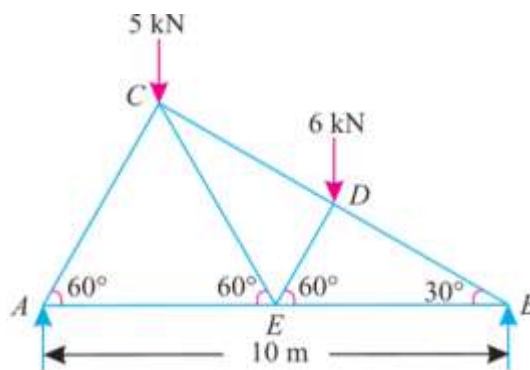


Fig 3

14 M

UNIT-III

5. a) Determine the centroid of the rectangular section by integration. 7 M
b) A semicircular area is removed from a trapezium as shown in Fig 4. (all the dimensions in mm). Determine the centroid of the remaining area.

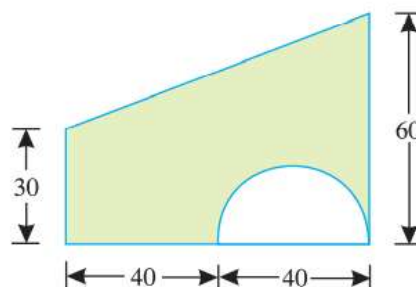


Fig 4

7 M

OR

6. a) State and prove Parallel axis theorem. 7 M

- b) Find the moment of inertia of a T-section with flange as $150 \text{ mm} \times 50 \text{ mm}$ and web as $150 \text{ mm} \times 50 \text{ mm}$ about X-X and Y-Y axes through the centre of gravity of the section as shown in Fig 5.

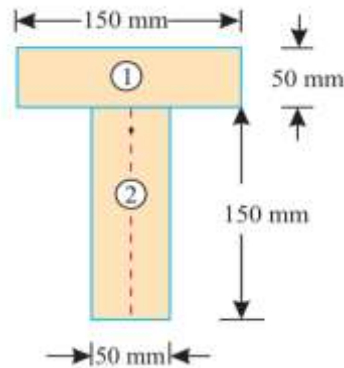


Fig 5

7 M

UNIT – IV

7. a) Explain about the equations of motion for rigid bodies under variable acceleration. 7 M
- b) The motion of a particle is defined by the relation $X = t^3 - 12t^2 + 36t + 30$, where X is expressed in meters and t is in sec. Determine the time, position and acceleration, when $v = 0$. 7 M

OR

8. a) Illustrate the types of motion of a particle with the help of neat sketches. 7 M
- b) A particle moves along straight line. Its motion is represented by the equation $S = 16t + 4t^2 - 3t^3$ where S is in meters and t , in seconds. Determine
 i) Displacement, velocity and acceleration 2 seconds after start. ii) Displacement and acceleration when velocity is zero iii) Displacement and acceleration when acceleration is zero. 7 M

UNIT – V

9. a) Define work energy principle. Also derive the equation for work energy. 7 M
- b) Determine the tension in the string and accelerations of blocks A and B weighing 1500 N and 500 N connected by 7 M

an inextensible string as shown in Figure 6. Assume pulleys as frictionless and weightless.

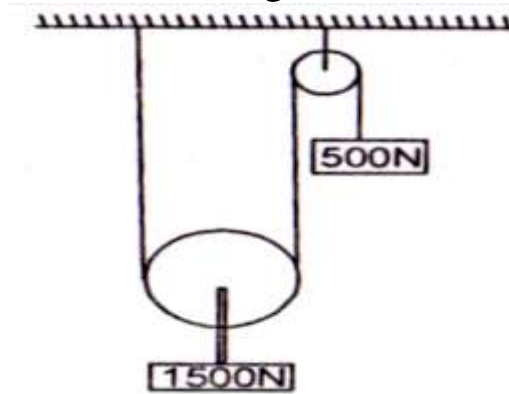


Fig 6
OR

10. a) Differentiate kinematics and kinetics?

7 M

b) Find the tension S in the string during the motion of the system shown in Fig 7. If $W_1 = 300\text{ N}$ and $W_2 = 200\text{ N}$, the system is in the vertical plane and coefficient of friction between the inclined plane and block W_1 is $\mu = 0.3$. Assume the pulley is without weight and friction.

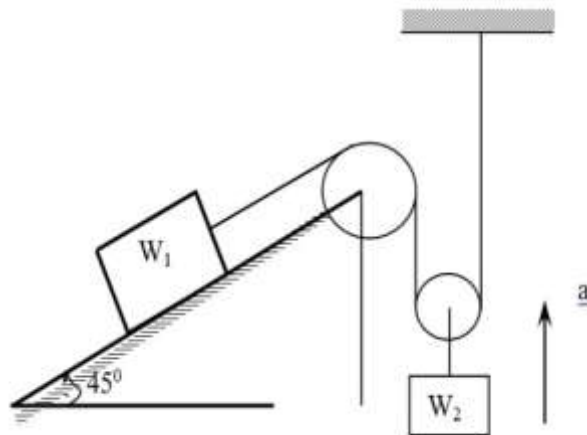


Fig 7

7 M