

Register No.: ..... Name: .....

**SAINTGITS COLLEGE OF ENGINEERING  
KOTTAYAM, KERALA**

(AN AUTONOMOUS COLLEGE AFFILIATED TO  
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)  
**FIRST SEMESTER B.TECH DEGREE EXAMINATION (R), FEBRUARY 2022**

**Course Code: 20EST100****Course Name: ENGINEERING MECHANICS****Max. Marks: 100****Duration: 3 Hours****PART A***(Answer all questions. Each question carries 3 marks)*

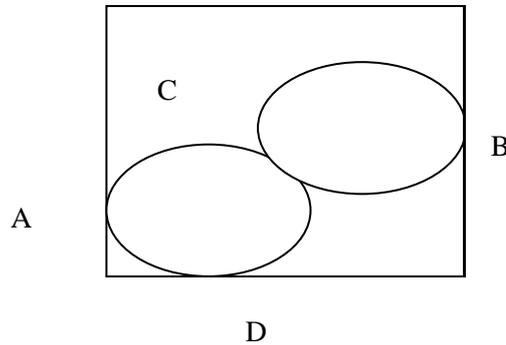
1. With the help of sketches, explain how forces involved in the lifting of a load by a wedge are analysed.
2. Distinguish between free vibration and forced vibration.
3. Distinguish between angle of friction and angle of repose.
4. The motion of a particle moving in a straight line is given by  $t^3 - 3t^2 + 7t - 2 = 0$ . Determine the acceleration of the particle after 4 seconds.
5. Explain composition and resolution of forces with examples.
6. State the theorems of Pappus Guldinus and explain their significance.
7. A body of weight 5kN is kept on the floor of an elevator which is moving downward with an acceleration of  $2\text{m/s}^2$ . Determine the reaction exerted by the floor on the body.
8. Discuss the importance of centroid and moment of inertia in the field of engineering.
9. Two springs of stiffnesses 10kN/m and 20kN/m respectively are connected in series. Determine the equivalent spring stiffness.
10. Two forces of 200N and 300N are acting simultaneously at a point. Determine the resultant of the forces if the angle between them is  $60^\circ$ .

**PART B**

*(Answer one full question from each module, each question carries 14 marks)*

**MODULE I**

11. Two smooth spheres each of radius 75mm and weight 150N rest in a horizontal channel having vertical walls as shown in figure. The distance between the vertical walls is 300mm. Determine the reactions at contact points. (14)

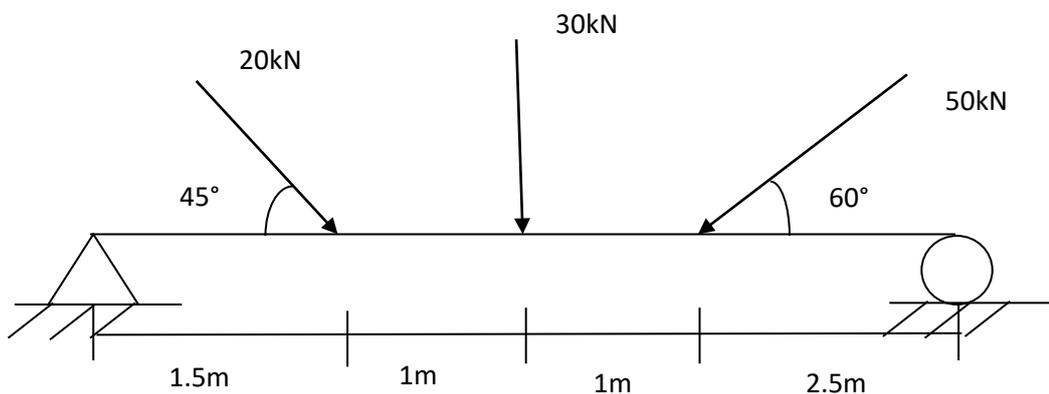


**OR**

12. The forces 10N, 20N, 30N, 40N and 50N are acting at one of the angular points of a regular hexagon towards the other five angular points taken in order. Find the magnitude and direction of the resultant. (14)

**MODULE II**

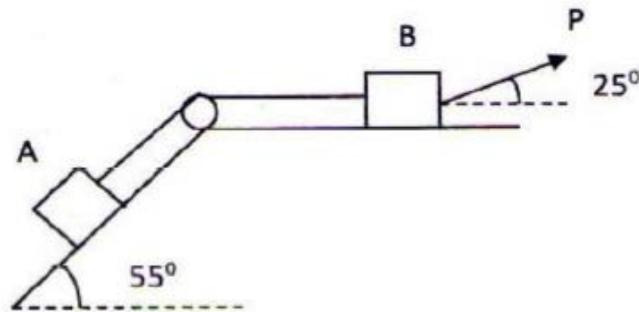
13. a) A simply supported beam is subjected to loads as shown in figure. Determine the reactions at the supports. (10)



- b) State the laws of friction. (4)

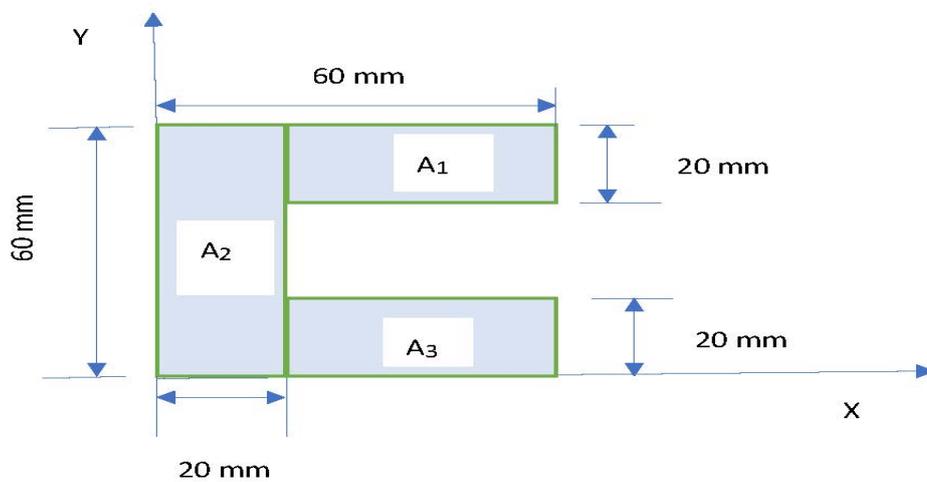
**OR**

14. Two blocks A and B of weights 5kN and 2.5kN respectively are connected by a wire passing over a smooth pulley as shown in figure. Determine the magnitude of force P required to prevent movement of block A down the plane. Take coefficient of friction between blocks and both surfaces as 0.25. (14)



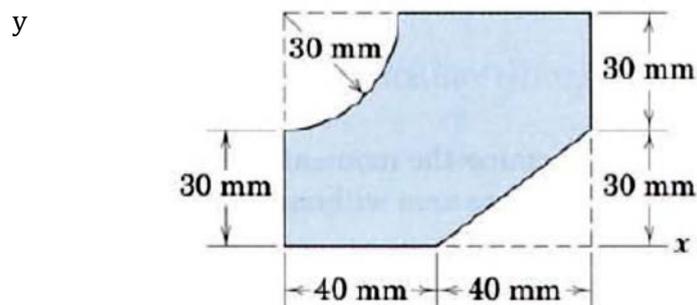
**MODULE III**

15. Determine the moment of inertia of the figure about its centroidal axes (14)



**OR**

16. a) Determine the centroid of the shaded area of the figure shown below (10)

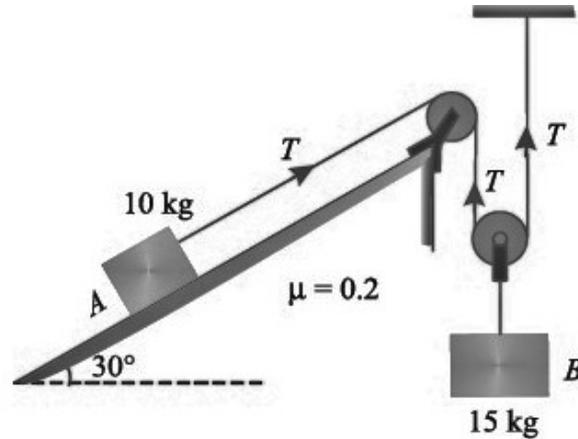


- b) A force of magnitude 300N has a line of action passing through AB. The coordinates of A and B are (3,4,8) and (6,8,8) respectively. Determine the force vector and the angles of its components with the coordinate axes. (4)

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## MODULE IV

17. Determine the acceleration of the blocks assuming the pulleys to be smooth and frictionless. Take coefficient of friction at contact surface as 0.2. (14)



OR

18. a) A bullet is fired upwards at an angle of  $30^\circ$  to the horizontal from a point P on a hill, and it strikes a target which is 80m lower than P. The initial velocity of bullet is 150m/s. Calculate the actual velocity with which the bullet will strike the target (8)
- b) A stone dropped into a well is heard to strike the water in 6seconds. Find the depth of the well assuming velocity of sound to be 335m/s. (6)

## MODULE V

19. a) A wheel is rotating about its axis with constant acceleration of  $1\text{rad/s}^2$ . If the initial and final velocities are 10rpm and 100rpm respectively. Determine the time taken and number of revolutions made during this period. (6)
- b) The amplitude of a particle in SHM is 0.75m and the period is 1.2seconds. Determine the maximum velocity and maximum acceleration. Also determine the displacement, velocity and acceleration after 0.5seconds. (8)

OR

20. a) A pulley of weight 500N has radius of 0.75m. A block of weight 400N is supported by an inextensible wire wound around the pulley. Determine the velocity of the block 2seconds after it is released from rest. Assume the motion is under constant acceleration. (7)
- b) A weight of 100N suspended from a spring vibrates with an amplitude of 9cm and a frequency of 2 oscillation per second. Find a) the stiffness of the spring (7)
- b) maximum tension induced in the spring and c) maximum velocity of the mass.

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