

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 (S), JULY 2021

Course Code: 20EST100

Course Name: ENGINEERING MECHANICS

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

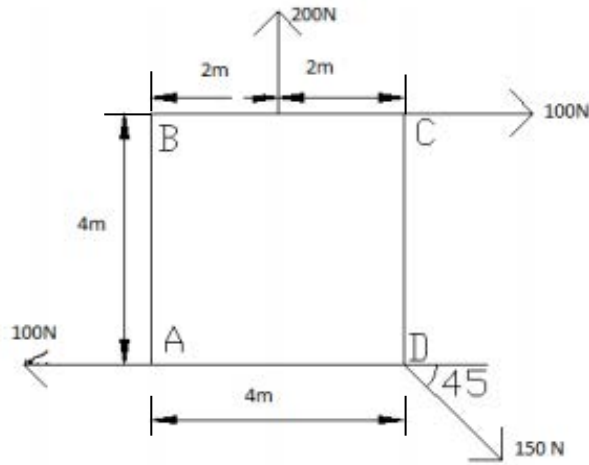
1. State and explain Varignon's theorem of moments.
2. State and explain the conditions of equilibrium of coplanar concurrent force system.
3. Define coefficient of friction and angle of friction. Establish a relation between them.
4. Define radius of gyration and polar moment of inertia.
5. State Pappus Guldinus theorems.
6. A force of magnitude 60N is applied at the origin of the x-y-z axes and through the point A (1,1.5,2.25). Determine the components of force along x,y,z axes and the direction of force with respect to the axes.
7. A force of 300N acts on a body of weight 500N. Find the acceleration of the body by using D'Alembert's principle.
8. The angular acceleration of a particle $\alpha=5t \text{ rad/s}^2$. Determine expression for angular velocity ' ω ' at any instant 't' of the motion, if the particle starts from rest.
9. What do you mean by instantaneous centre of rotation? How can it be located?
10. A body performing Simple Harmonic Motion has an amplitude of 1m and a period of oscillation 2.05 seconds. Find the velocity and acceleration of the body.

PART B

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

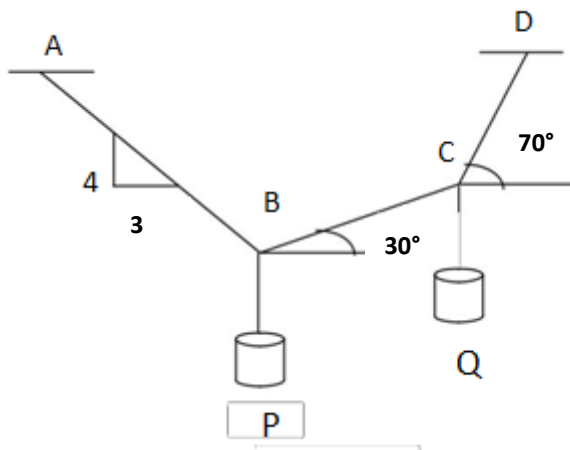
MODULE I

11. a) Explain the concept of free body diagram with examples. (5)
- b) For the system of forces, determine the magnitude, direction and position of the resultant force about A. (9)

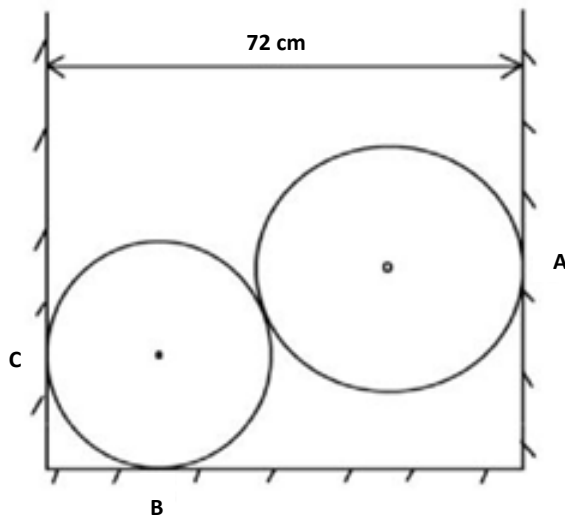


OR

12. a) Block P=0.5 kg and block Q of mass m kg are suspended through a chord, which is in equilibrium as shown in figure. Determine the mass of block Q. (6)



- b) Two homogeneous spherical balls rest between two vertical walls as shown in figure. The radius of smaller ball is 16cm and weight is 1.15kN. The radius of the larger ball is 24cm and its weight is 3.45kN. The distance between the walls is 72cm. Assuming the contact surfaces to be smooth, (a) Draw the free body diagram of two balls (b) Determine the reactions at A, B and C. (8)

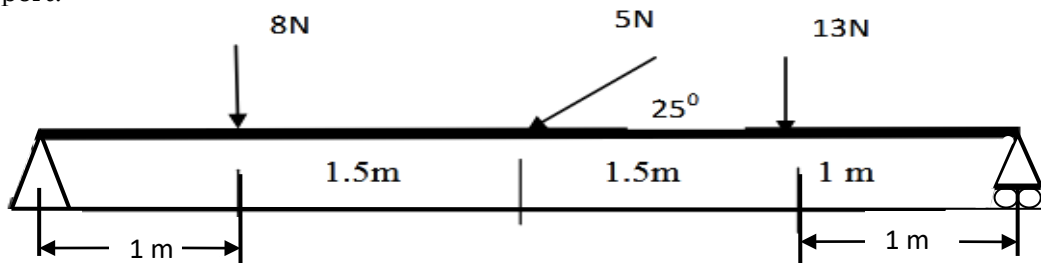


MODULE II

13. A ladder AB 3m in length and weighing 180N, is placed against a wall with A at the floor level and B on the wall. The ladder is inclined at an angle of 60° with the floor. The coefficient of friction between the wall and the ladder is 0.25 and that between floor and the ladder is 0.35. In addition to the self-weight of the ladder, it has to support a man weighing 900N, at the top B. To prevent slipping a force is applied horizontally at the level of floor. Find the minimum horizontal force in this condition. (14)

OR

14. a) What do you understand by reactions at supports? (4)
 b) Find the reactions at the supports of the beam given. A is a hinged support and B is a roller support. (10)

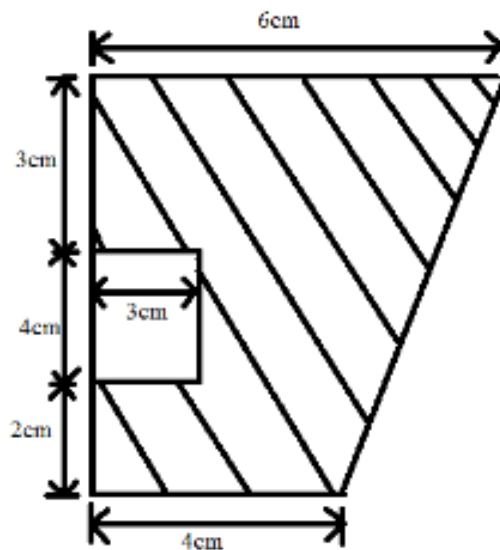


MODULE III

15. A force P is directed from a point A(4,1,4) and a point B(-3,4,-1). If it causes a moment $M_z=1900\text{Nm}$, determine the magnitude of force P and the moment of this force about X and Y axes. (14)

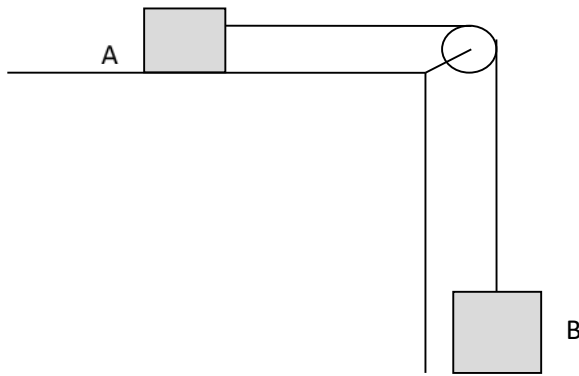
OR

16. a) Define principal axes and principal moment of inertia. (6)
 b) Determine the centroid of the shaded area. Also find moment of inertia of the shaded area about a horizontal axis passing through the centroid (8)



MODULE IV

17. a) Explain how you can apply work energy Principle in dynamics (5)
 b) Two blocks of weights 100N (A) and 50N (B) are connected by a flexible but inextensible string as shown in figure. Assuming coefficient of friction between block 100N and horizontal surface is 0.25, find the acceleration of masses and tension in the string. (9)



OR

18. A body of mass 4.5kg is placed on a smooth table at a distance of 2m from the edge. The body is connected by a light string passing over a smooth pulley. The other end of the string is connected with a body of mass 2.5kg. Find i) acceleration of the system and ii) time that elapses before the body reaches the edge of the table. (14)

MODULE V

19. a) With neat sketches differentiate between motion of translation and motion of rotation. (4)
- b) A clock provided with a seconds pendulum is gaining 160seconds a day. Find by how much the length of the pendulum should be increased so as to correct the clock. If it is running at correct time at a place where acceleration due to gravity is 9.81m/s^2 , find by how much the clock will lose or gain if it is taken to a place where the acceleration due to gravity is 9.79m/s^2 . (10)

OR

20. a) A flywheel rotates with a constant retardation due to breaking, in the first 10 seconds, it made 300 revolutions. At $t = 7.5$ sec, its angular velocity was 40π rad/s. Determine i) The value of constant retardation ii) The total time taken to come to rest and iii) The total revolutions made till it comes to rest. (7)
- b) Two blocks of masses 10kg and 25kg are attached to the two ends of a flexible rope. The rope passes over a pulley of diameter 500mm. The mass of the pulley is 7.5kg and its radius of gyration is 200mm. Find the acceleration of the masses and the tension on either side of the rope. (7)
