

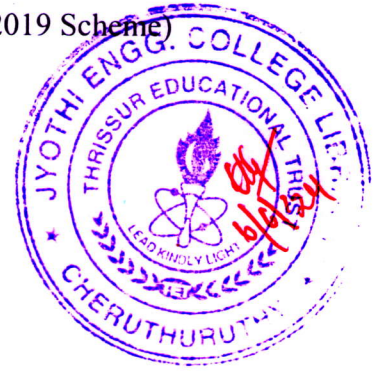
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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Second Semester B.Tech Degree (R,S) Examination May 2024 (2019 Scheme)



Course Code: EST 100

Course Name: ENGINEERING MECHANICS

(2019 -Scheme)

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks*

- |    |   | Marks |
|----|---|-------|
| 1  | Determine the magnitude of the resultant of the two forces of magnitude 12 N and 9 N acting at a point, if the angle between the two forces is 30°. | (3)   |
| 2  | State and prove parallelogram law of vectors with neat sketch.  | (3)   |
| 3  | Distinguish between Static friction and Dynamic friction.   | (3)   |
| 4  | Explain different types of beams with neat sketch.  | (3)   |
| 5  | Define Radius of gyration, Product of inertia and moment of inertia.  | (3)   |
| 6  | State the conditions of equilibrium for a particle in space.  | (3)   |
| 7  | Define angle of projection, time of flight and horizontal range.  | (3)   |
| 8  | Explain impulse momentum equation.  | (3)   |
| 9  | Distinguish between free vibration and forced vibration.  | (3)   |
| 10 | For a particle undergoing SHM, the displacement is prescribed by the cosine function given by $x = 4 \cos 3t$ . Determine                           | (3)   |
|    | a. the position of the particle at $t = 1.25$ sec   |       |
|    | b. the Amplitude and Frequency of the particle.   |       |

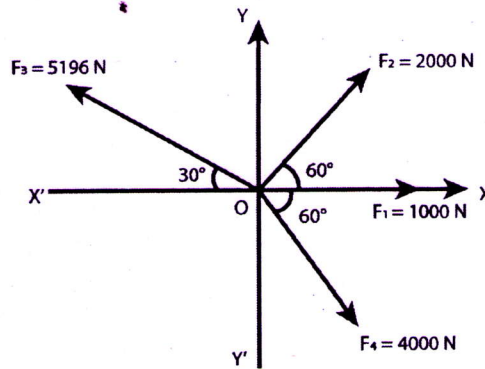
**PART B**

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

**MODULE 1**

- 11 Two smooth cylinders each of weight 1000 N and radius 15 cm are connected at their centers by a string of length 40 cm and rest on a horizontal plane. The third cylinder of weight 2000 N of 15 cm radius is placed on top in between the other two cylinders. Find the tension in the string and the pressure exerted at all contact points. (14)

- 12 The four coplanar forces are acting at a point as shown in Figure. Determine the resultant force in magnitude and direction. (14)



**MODULE 2**

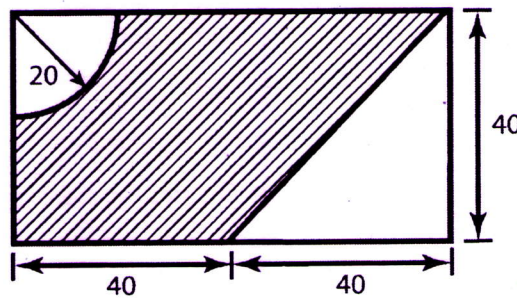
- 13 A cord connects two bodies of weights 500 N and 1000 N. The two bodies are placed on an inclined plane and the cord is parallel to the inclined plane. The coefficient of friction for the weight of 500 N and that of 1000 N is 0.4. Determine the inclination of the plane to the horizontal and tension in the cord when the motion is about to take place, down the inclined plane. The body weighing 500 N is below the body weighing 1000 N. (14)

- 14 A uniform ladder of weight 250 N and of length 5 m rests on a horizontal ground and leans against a rough vertical wall. The coefficient of friction between the ladder and floor is 0.3 and between the ladder and vertical wall is 0.2. When a weight of 900 N is placed on the ladder at a distance of 2 m from the top of the ladder; the ladder is at the point of sliding. Find: (14)

- a) The angle made by the ladder with horizontal.
- b) Reaction at the foot of the ladder, and
- c) Reaction at the top of the ladder.

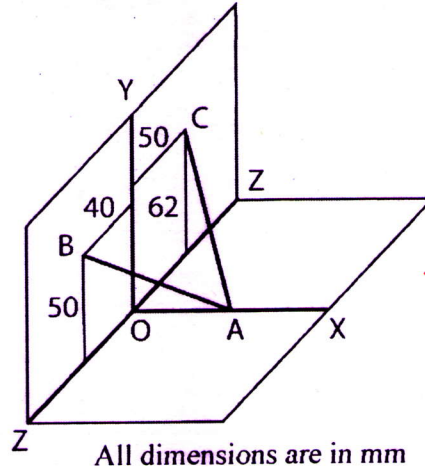
**MODULE 3**

- 15 Calculate the Moment of Inertia of the shaded area with respect to its centroidal axes. (14)



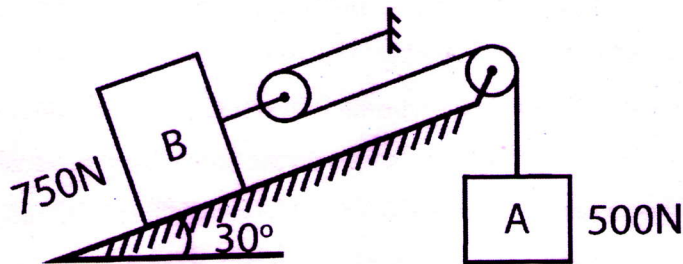
All dimensions are in mm.

- 16 Two cables AB and AC are attached at A as shown. Determine the resultant of the forces exerted at A by the two cables, if the tension is 2000 N in the cable AB and 1500 N in the cable AC. Distance from O to A is 50 mm. (14)



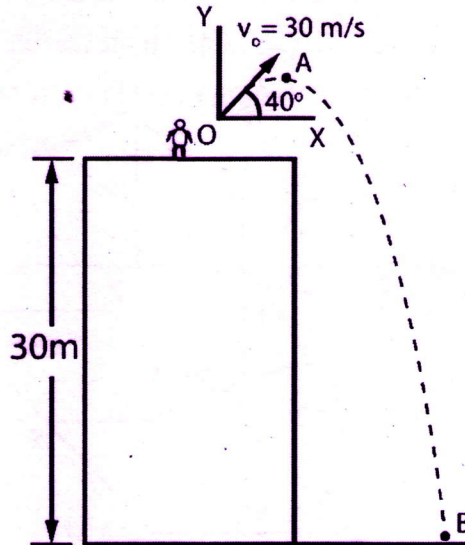
**MODULE 4**

- 17 The system of bodies starts from rest. Determine the acceleration of body B and the tension in the string supporting body A. Coefficient of friction between B and inclined plane is 0.45. (14)



- 18 A stone is thrown from the top of a building, of height 30m, upward at an angle of  $40^\circ$  to the horizontal with an initial speed of 30 m/s as shown in the figure. Neglecting air resistance, determine (14)

- The horizontal distance from the point of projection to the point where the stone strikes the ground.
- The greatest elevation reached by the projectile above the ground.
- Velocity when it strikes the ground.
- Time of flight.



### MODULE 5

- 19 In a connecting rod and crank mechanism, the stroke length is 0.5 m and the crank (14) turns 150 rpm. If it is having SHM, determine a) Velocity and acceleration of the piston when it is 0.15 m from one of the dead centers b) Maximum velocity and acceleration of the piston c) Maximum accelerating force the crank is required to exert if mass of the piston is 10 kg.
- 20 A grinding wheel is attached to the shaft of an electric motor with a rated speed of (14) 1800 rpm. When the power is switched on the unit attains the rated speed in 5 sec, and when the power is switched off the unit comes to rest in 90 seconds. Assuming uniformly accelerated motion, determine the number of revolutions the unit turns.
- to attain the rated speed and
  - to come to rest.

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