

I B.TECH II Sem Supplementary Examination, September-2022
Engineering Mechanics
 (CIVIL, MECH)

Time: 3 Hours.**Max. Marks: 70**

Note: 1. Question paper consists: Part-A and Part-B.

2. In Part - A, answer all questions which carries 20 marks.

3. In Part - B, answer any one question from each unit.

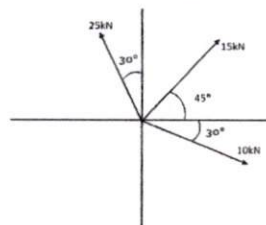
Each question carries 10 marks and may have a, b as sub questions.

PART- A**(10*2 Marks = 20 Marks)**

- | | | | | |
|-------|---|----|-----|-----|
| 1. a) | State Lami's theorem with a sketch. | 2M | C01 | BL2 |
| b) | Distinguish between units and dimensions with examples. | 2M | C01 | BL4 |
| c) | Define cone of friction. | 2M | C02 | BL1 |
| d) | Differentiate between centroid and center of gravity. | 2M | C02 | BL2 |
| e) | Define polar moment of inertia | 2M | C03 | BL1 |
| f) | State parallel axis theorem | 2M | C03 | BL2 |
| g) | Illustrate rectilinear motion with examples. | 2M | C04 | BL2 |
| h) | The motion of a particle in rectilinear motion is defined by the relation $s = 3x^3 - 9x^2 + 8x - 10$ where s is expressed in meters and x in seconds. Find the acceleration of the particle when the velocity is zero. | 2M | C04 | BL3 |
| i) | State D'Alemberts principle. | 2M | C05 | BL2 |
| j) | What is the work-energy principle | 2M | C05 | BL1 |

PART- B**(10*5 Marks = 50 Marks)**

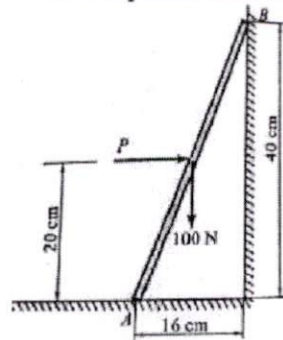
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|------|---|----|-----|-----|
| 2 a) | Classify the various kinds of systems of forces with illustrative sketches. | 5M | C01 | BL2 |
| b) | Determine the resultant of the force system shown in the figure. | 5M | C01 | BL5 |

**OR**

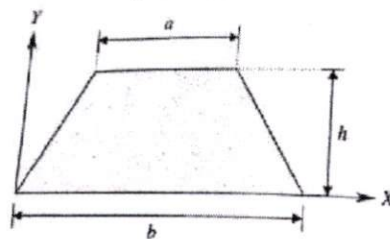
- 3 a) Two forces of magnitude 50 kN and 80 kN are acting on a particle, such that the angle between the two is 135° . If both forces are acting away from the particle, calculate the resultant and find its direction. 5M C01 BL3
- b) Distinguish the moment and a couple with reference to their characteristics. 5M C01 BL4
- 4 a) Explain the concept of the cone of friction. 5M C02 BL5
- b) Define the following terms 5M C02 BL2
- Wedge friction
 - Screw friction
 - Belt friction

OR

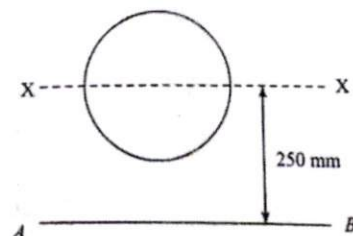
- 5 a) A 100N uniform rod AB is held in the position as shown in the figure. If the coefficient of friction is 0.2 at A and B. Calculate the range of values of P for which equilibrium is maintained. 5M C02 BL3



- b) Derive the centroid of the trapezium shown in the figure. 5M C02 BL5



- 6 a) A circle of diameter 120 mm is placed above axis AB in such a way that its center is 250 mm above the axis AB as shown in the figure. Using the parallel axis theorem, determine the moment of inertia about the axis A-B. 5M C03 BL2



- b) Determine the mass moment of inertia of a solid sphere of radius R about its diametric axis. 5M C03 BL5

OR

- 7 a) Derive the mass moment of inertia of the rectangular plate about a line passing through the base. 5M C03 BL3
- b) State the theorem of the perpendicular axis. How will you prove this theorem? 5M C03 BL2

- 8 a) State and explain all principles of dynamics. 5M C04 BL1
 b) A particle moves along a straight line. Its motion is represented by the equation $S = 16t + 4t^2 - 3t^3$ 5M C04 BL5
 Where S is in meters and t, is in seconds. Determine
 i. Displacement, velocity, and acceleration 2 seconds after start.
 ii. Displacement and acceleration when velocity is zero and
 iii. Displacement and velocity when acceleration is zero.

OR

- 9 a) Derive the impulse-Momentum equation of a body in motion 5M C04 BL6
 b) A stone is thrown upwards from the top of a tower 70 m in height with a velocity of 19.2 m/s. Determine its position and velocity when $t = 6$ seconds. 5M C04 BL3
- 10 a) Derive Work-energy equation 5M C05 BL3
 b) A man weighing W Newton entered a lift that moves with an acceleration of "a" m/s^2 . Find the force exerted by the man on the floor of the lift when:
 i) lift is moving upwards 5M C05 BL4
 ii) lift is moving downwards

OR

- 11 a) A homogeneous sphere with a radius of $r=100$ mm and weight $W=100$ N can rotate freely about a diameter. If it starts from rest and gains, with constant angular acceleration, an angular speed $n=180$ rpm, in 12 revolutions, find the acting moment. 5M C05 BL4
 b) A bullet of 25 g mass is fired with a speed of 400 m/s. What is its kinetic energy? If the bullet can penetrate 20 cm in a block of wood, what is the average resistance of the wood? 5M C05 BL3

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CO: Course Outcome

BL - Blooms Taxonomy Levels