Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 91376

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Third Semester

Mechanical Engineering

ME 3351 – ENGINEERING MECHANICS

(Common to : Automobile Engineering/Civil Engineering/
Industrial Engineering/Industrial Engineering and Management/
Materials Science and Engineering/Mechanical Engineering (sandwich)/
Mechanical and Automation Engineering/Mechatronics Engineering/
Production Engineering/Robotics and Automation/Safety and Fire Engineering)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State Lami's theorem.
2. Two forces 28 N and 38 N act at a point 'A'. The included angle between them is 45°. Find the magnitude and direction of the resultant.
3. Name a beam which is statically determinate structure.
4. The position vector and force are $i-2j+3k$ and $21i-62j+23k$. Find the moment of the force about the origin. And also find the scalar quantity of the moment.
5. Find the radius of gyration for the rectangular section whose MI about its base is 9×10^4 cm^4 and cross sectional area is 300 cm^2.
6. Distinguish between centroid and centre of gravity.
7. A body is rotating with an initial angular velocity 5 rad/s. Its angular velocity increases to 20 rad/s in 6 seconds. Find the angular acceleration of the body.
8. What is meant by impulsive force?
9. State Newton's law (second law) of motion.
10. A train running at 85 km/h is brought to a standing halt after 38 seconds. Find the retardation and the distance travelled by the train before it comes to a halt.

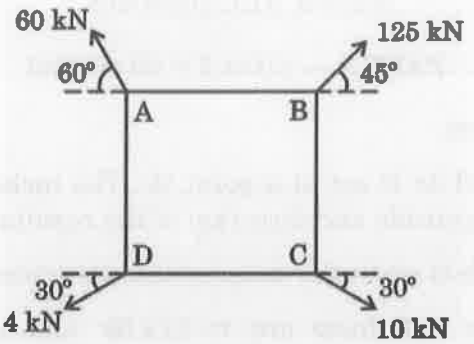
PART B — (5 × 13 = 65 marks)

11. (a) Five forces are acting on a particle. The magnitude of forces are 200 N, 300 N, 400 N, 500 N and P and their respective angles made with the horizontal are 0°, 45°, 115°, 200° and 280°. If the vertical component of all forces is –900 N, find the value of P. Also calculate the magnitude and the direction of the resultant, assuming that the first force acts towards the point, while all the remaining forces act away from the point.

Or

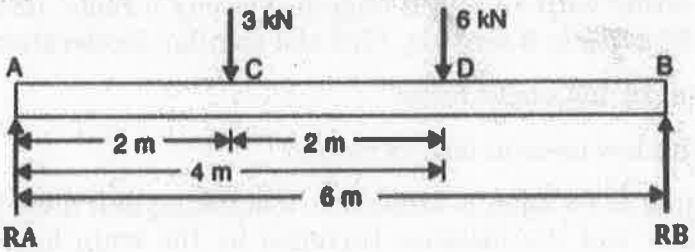
(b) Forces of 3N, 4N, 5N, 6N and 7N are acting at one of the angular points of regular hexagon towards the other angular points taken in order. Find the resultant and its direction.

12. (a) Four forces of magnitude and direction acting on a square ABCD of side 2 m are shown in the figure. Calculate the resultant in magnitude and direction and also locate its point of application with respect to the sides AB and AD.

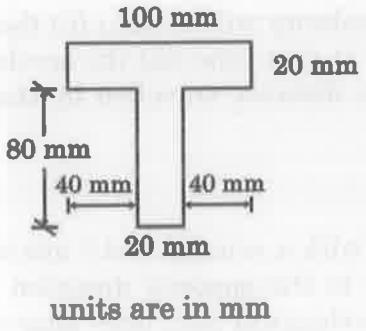


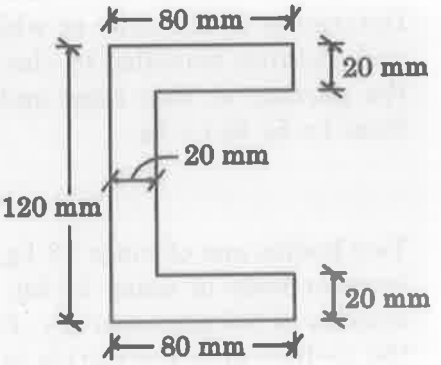
Or

(b) Find the reactions at the supports A and B of the beam shown in the figure.



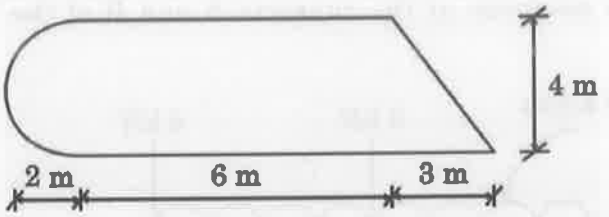
13. (a) Calculate the centroid point for the given figures :



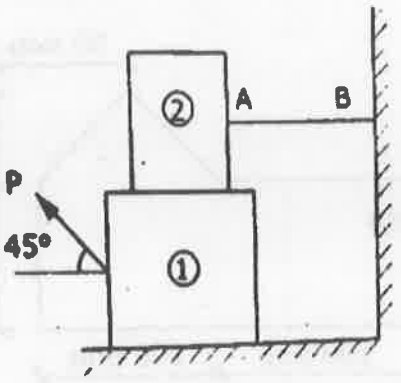


Or

(b) Calculate the moment of Inertia for the given figure.



14. (a) Block (2) rests on block (1) and is attached by a horizontal rope AB to the wall as shown in fig. What force P is necessary to cause motion of block (1) to impend? The co-efficient of friction between the blocks is 1/4 and between the floor and block (1) is 1/3. Mass of blocks (1) and (2) are 14 kg and 9 kg respectively.



Or

(b) A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750N stands on a rung 1.5 meter from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor.

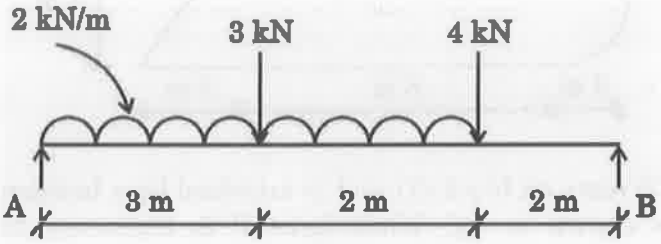
15. (a) The position of the particle is given by the relation $S = 5t^3 - 8t^2 - 38.5t + 58$, where S is expressed in meters and t in seconds. Determine (i) the time at which the velocity will be zero (ii) the position and distance travelled by the particle at that time (iii) the acceleration of the particle at that time and (iv) the distance travelled by the particle from $t = 5s$ to $t = 8s$.

Or

(b) Two bodies one of mass 28 kg, moves with a velocity of 8.5 m/s strikes on another body of mass 14 kg, moving in the opposite direction with the velocity of 8.5 m/s centrally. Find the velocity of each body after impact, if the coefficient of restitution is 0.8.

PART C — (1 × 15 = 15 marks)

16. (a) Find the reactions at the supports A and B of the beam shown in the figure.



Or

(b) Calculate the Moment of Inertia for the given figure.