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Question Paper Code:AMEC01

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal-500043, Hyderabad

B.Tech II SEMESTER END EXAMINATIONS (REGULAR) - SEPTEMBER 2022

Regulation:UG20

ENGINEERING MECHANICS

Time: 3 Hours **(Common to AE | ME | CE)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Enumerate and explain in brief the different system of forces that are present in a mechanical system. [BL: Understand| CO: 1|Marks: 7]

   (b) The following forces act at a point: (i) 20 N inclined at 30° towards North of East, (ii) 25 N towards North, (iii) 30 N towards North West, and (iv) 35 N inclined at 40° towards South of West. Identify the magnitude and direction of the resultant force. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) An object is being tried to move on the floor, but an opposing force resists the motion of the block. Recognize this type of force. List and explain the two laws pertaining to the same force. [BL: Understand| CO: 2|Marks: 7]

   (b) An effort of 200 N is required just to move a certain body up an inclined plane of angle 15° the force acting parallel to the plane. If the angle of inclination of the plane is made 20° the effort required, again applied parallel to the plane, is found to be 230 N. Find the weight of the body and the coefficient of friction. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) State and prove the theorem of parallel axis applied to any mechanical structure. Prove the theorem with relevant figures and equations. [BL: Apply| CO: 3|Marks: 7]

   (b) An I-section is made up of three rectangles as shown in Figure 1. Determine the moment of inertia of the section about the horizontal axis passing through the center of gravity of the section. [BL: Apply| CO: 4|Marks: 7]

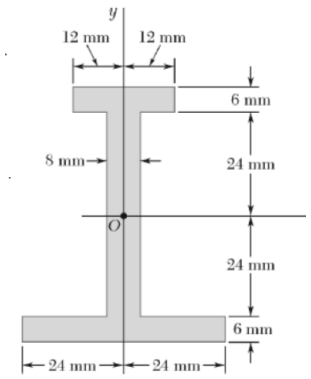

Figure 1

4. (a) Enumerate the different methods to compute the centroid of a cross-section. Explain any one method with relevant diagrams [BL: Understand| CO: 3|Marks: 7]

(b) A uniform lamina shown below in Figure 2 consists of a rectangle, a semicircle and a triangle. Determine the center of gravity of the lamina. All dimensions are in mm.

[BL: Apply| CO: 4|Marks: 7]

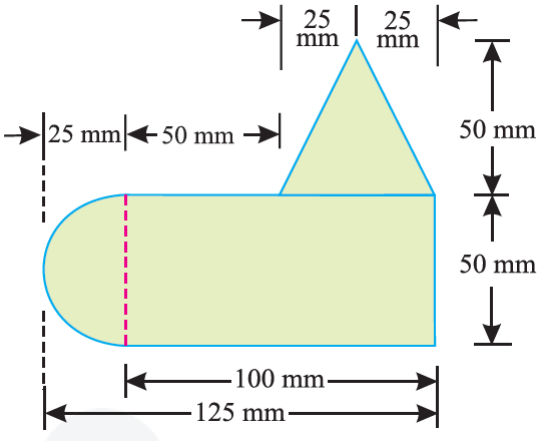

Figure 2

MODULE – IV

5. (a) Develop an expression pertaining to the motion of a lift, while lift moving upwards and downwards. [BL: Apply| CO: 5|Marks: 7]

(b) A bullet of mass 20 g is fired horizontally with a velocity of 300 m/s, from a gun carried in a carriage; which together with the gun has mass of 100 kg. The resistance to sliding of the carriage over the ice on which it rests is 20 N. Find

i) Velocity, with which the gun will recoil

ii) Distance, in which it comes to rest

iii) Time taken to do so. [BL: Apply| CO: 5|Marks: 7]

6. (a) State law of conservation of energy. Explain clearly the term 'recoil of gun'. How will you find the velocity of the bullet? [BL: Understand| CO: 5|Marks: 7]

(b) A block of mass 10 kg slides over a frictionless horizontal plane with a constant velocity of 5 m/s. After some distance, the plane is inclined at an angle of 20^{o} with the horizontal. Find the distance through which the block will slide upwards on the inclined plane before coming to rest.

[BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Determine an equation for the time period of a simple pendulum. Explain the four laws with respect to the same. [BL: Understand| CO: 6|Marks: 7]

(b) A block of mass 50 kg supported by two springs connected in series hangs from the ceiling. It can move between smooth vertical guides. The spring constants are 4 kN /m and 6 kN /m as shown in Figure 3.

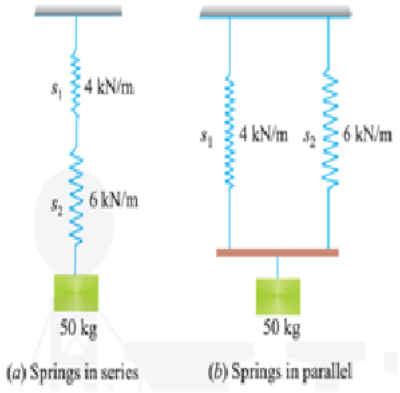

Figure 3

The block is pulled 40 mm down from its position of equilibrium and then released. Determine period of vibrations, maximum velocity and acceleration of the block.

[BL: Understand| CO: 6|Marks: 7]

8. (a) Write the expression for time period of a compound pendulum and determine the equivalent length of a compound pendulum. [BL: Understand| CO: 6|Marks: 7]

   (b) A vertical shaft 5mm in diameter and 1.2m in length has its upper end fixed to the ceiling. At the lower end it carries a rotor of diameter 180mm and weight 30N. The modulus of rigidity for the material of the rotoris $0.85 \text{x} 10^5$ N/mm^2. Find the frequency of torsional vibrations for the system.

   [BL: Apply| CO: 6|Marks: 7]