U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2023 Semester End Make-Up Examinations

Programme: B.E.
Branch: Common to all Branches
Course Code: 22CV1ESENM
Course: Engineering Mechanics

Semester: I
Duration: 3 hrs.
Max Marks: 100
Date: 11.08.2023

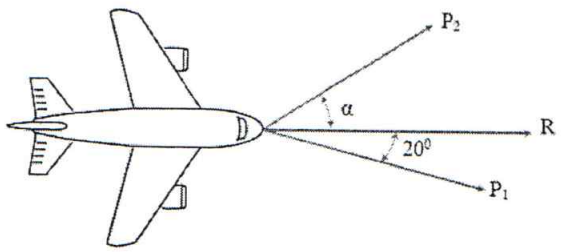
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

MODULE - I

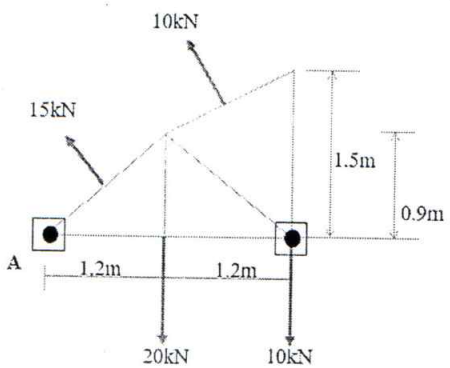
1 a) Explain the concept of idealizations of bodies in Mechanics. **04**

b) A disabled aircraft on runway is pulled by two tractors P_1 and P_2, in the forward direction as shown in Fig\Q1b). If the resultant of the two forces exerted by them is a 300 kN force parallel to the axis of the aircraft, find the value of 'α' such that the force exerted by P_2 is minimum. Also find the corresponding force to be exerted by P_1. **08**



Fig\Q1(b)

c) Loads act on a roof truss as shown in Fig\Q1(c). The loads on the bottom chord are vertical; those on the top chord are perpendicular to the chord lines and act midway between chord points. Find magnitude, direction, and position of the resultant force from 'A'. **08**



Fig\Q1(c)

OR

2 a) List the conditions of equilibrium for a concurrent force system and non-concurrent force system. **04**

b) Illustrate 'Resolution of a force into a force and a couple' system, with a neat sketch. **04**

c) A ladder weighing 250 N is to be kept in position against a smooth wall on a smooth floor as shown in Fig.Q2(c). Determine the horizontal force 'P' required for the equilibrium of the ladder when a man weighing 750 N is positioned at a height of 2m above the floor level as shown. **12**

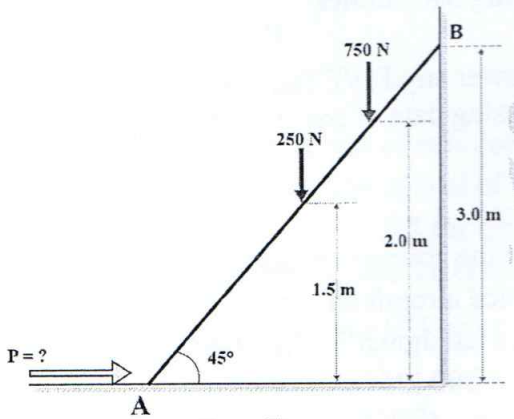


Fig.Q 2 (c)

MODULE - II

3 a) Distinguish between statically determinate and statically indeterminate beams with examples. **04**

b) Determine the reactions at the supports for the beam shown in Fig.Q3 (b) **08**

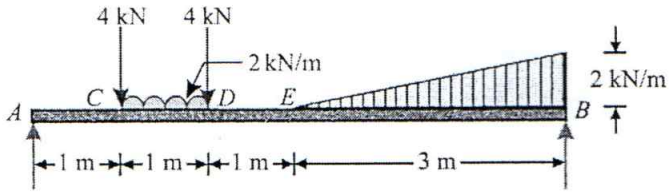


Fig.Q3(b)

c) Analyse the truss shown in Fig.Q3(c) by method of joints and tabulate the forces in all the members indicating their nature. **08**

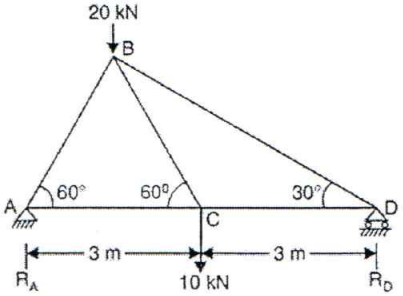


Fig.Q3(c)

MODULE - III

4 a) With a neat sketch explain the theory of dry friction. **04**

b) Define the following: **04**

i. Angle of repose

ii. Cone of friction

c) Two blocks are connected by a uniform rod 1m long that makes an angle of 30^0 with horizontal as shown in Fig.Q4 (c). The weight of the rod is negligible and block A weigh 50 N. The coefficient of friction is 0.35 between the block B and vertical wall. The pins at the ends of the rod are frictionless. Determine the maximum weight of the block B for which equilibrium position is maintained. **12**

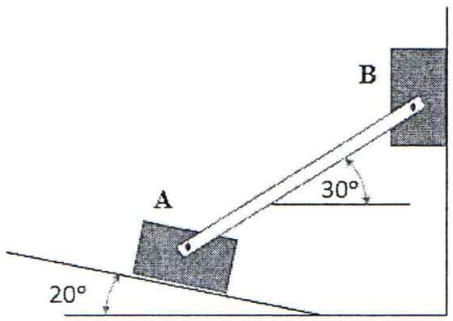


Fig.Q4 (c)

MODULE - IV

5 a) With usual notations, derive an expression for centroid of (i) semi-circle (ii) quadrant of a circle from first principles. **08**

b) Determine the radius of gyration of the lamina shown in Fig.Q5 (b) about the horizontal axis passing through centroid. **12**

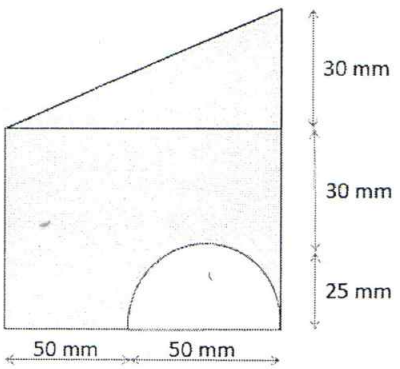


Fig.Q5(b)

MODULE – V

6 a) With reference to projectile motion explain the following terms with relevant equations and sketches. **04**

(i) Horizontal range (ii) Time of flight

b) Derive the expression for the motion of projectile. **06**

c) A ball is thrown from the ground with a velocity of 20 m/s at an angle of 30^0 to the horizontal. Determine **10**

(i) The velocity of the ball at t = 0.5 s
(ii) Total time of flight of the ball
(iii) Maximum height reached
(iv) Range of the ball
(v) Maximum range.

OR

7 a) State and explain D' Alembert's principle. **04**

b) In a police investigation of car accident, it was concluded that a car while in motion along a straight level road has skidded for a total of 60m after the brakes were applied. If the coefficient of friction is $\mu = 0.5$ for tyres and road surface, what was the probable speed of the car just before the brakes were applied? **07**

c) A stone is thrown vertically up with a velocity of 25 m/s from the top of a tower 28 m high. Calculate **09**

(i) Time taken for the stone to reach the ground
(ii) The maximum height reached by the stone above ground level.
(iii) Velocity with which the stone hits ground.

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