U.S.N.										

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

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: I**
Branch: Common to all Branches **Duration: 3 hrs.**
Course Code: 22CV1ESENM **Max Marks: 100**
Course: Engineering Mechanics **Date: 15.05.2023**

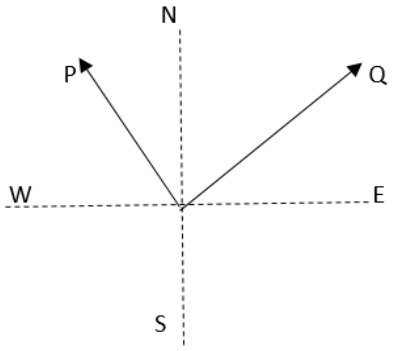
Instructions: Answer FIVE FULL questions choosing one question from each Module
Internal choice provided in Module 1 & Module 5
Assume any missing data and clearly state them

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 with examples the terms particle, rigid body and continuum. **06**

b) The resultant of two concurrent forces P and Q acting as shown in FigQ1(b) is 780 N and directed vertically up. If the force P=450 N acting N 38^0 W. find the force Q in magnitude and direction. Solve using Triangle law of forces. **06**



FigQ1(b)

c) A set of forces act through one of the vertices of a regular pentagon of side 5 m as shown in Fig Q1 (c). Determine the magnitude and direction of the resultant force. **08**

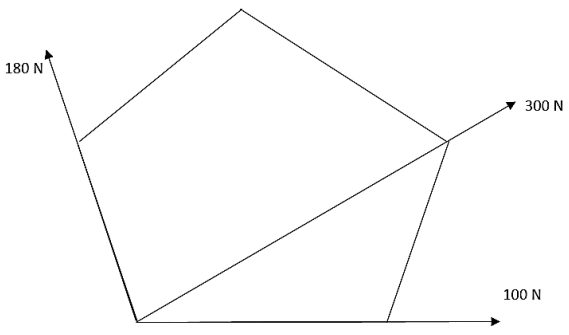


Fig Q1 (c)

OR

2 a) Explain the characteristics of a couple. **04**

b) A force of 800 N acts on a simply supported beam as shown in Fig Q2 (b). Replace the force by an equivalent force –couple system acting through 'A '. **04**

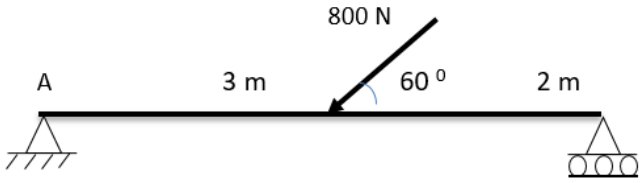


Fig Q2 (b).

c) Three forces shown in Fig Q 2(c) cause a vertically upward resultant through 'A '. If P=300 N, determine the magnitudes of the forces T and F. **12**

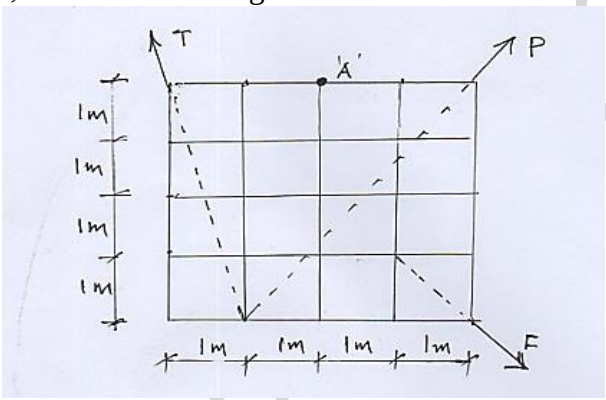
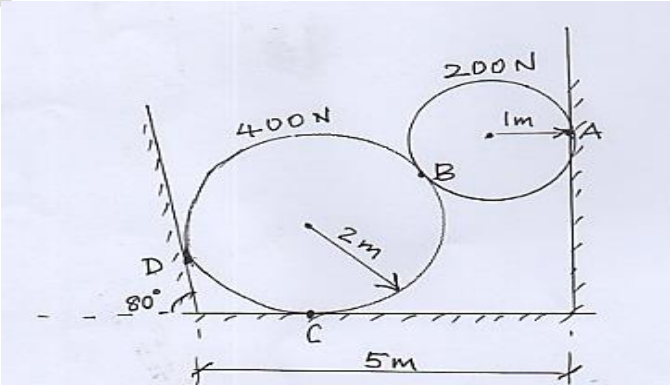


Fig Q 2(c)

MODULE - II

3 a) Explain with examples statically determinate beams. **04**

b) Two cylindrical rollers weighing 200 N and 400 N, are placed inside a trench 5 m wide at its base as shown in Fig Q3(b). Assuming all contact surfaces to be smooth, determine the reactions at the points A, C and D **08**



FigQ3(b)

c) Analyse the pin jointed plane truss loaded as shown in Fig 3Q (c) and obtain forces in all members. Tabulate the results indicating the nature of the forces. **08**

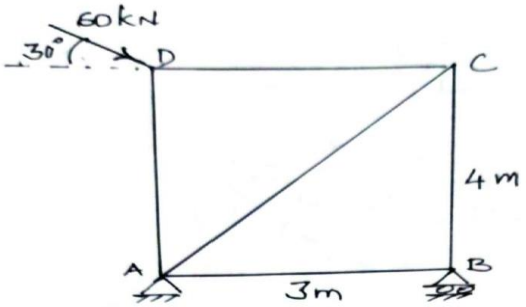


Fig3Q (c)

MODULE - III

4 a) In the system of blocks shown in in Fig Q 4(a), the co-efficient of friction between block A and the incline is 0.20 and between the block B and the horizontal plane is 0.30, block A weighs 800 N and B weighs 900 N. Determine the magnitude of force P to cause the impending motion of the system of blocks to the right. Assume pulley is frictionless. **10**

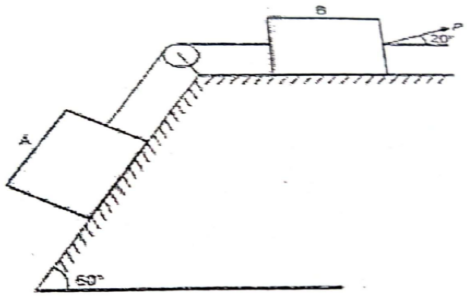


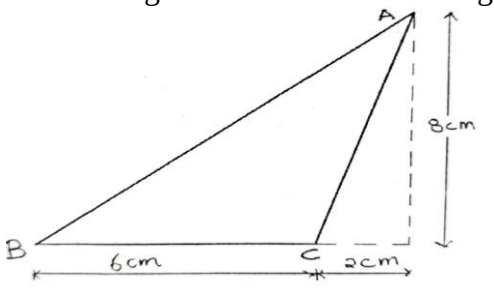
Fig Q 4(a),

b) A ladder 5 m long and weighing 400 N, rests against a vertical wall at one end and a horizontal floor at the other end making 60 ^{0} with the floor. Co efficient of friction is 0.20 at all contact surfaces. When a man weighing 1000 N climbs the ladder for a distance of 4 m measured along the ladder from the foot of the ladder, the ladder is at the verge of slipping. Determine what minimum horizontal push is to be applied at the foot of the ladder to avoid the slipping. **10**

MODULE - IV

5 a) Explain the term radius of gyration and mention its significance. **04**

b) Locate the centroid of the triangle ABC area shown in Fig Q5 (b). **07**



FigQ5(b)

c) Determine the moment of inertia of the shaded area shown in Fig Q 5(c) about the horizontal axis A-A **09**

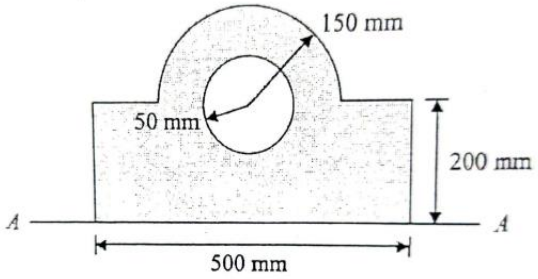


Fig Q 5(c)

MODULE - V

6 a) Show that the path traced by projectile is parabolic **05**

b) A stone is thrown vertically up with a velocity of 25 m/s from the top of a tower 28 m high. Calculate **07**

(i) Time taken for the stone to reach the ground

(ii) The maximum height reached by the stone above ground level.

(iii) Velocity of the stone in its downward travel at the same level as point of projection

c) A projectile leaves the muzzle of gun with an initial velocity of 125 m/s and at an angle of 32^0 with the horizontal. It strikes the ground which is 120 m below the level of point of projection. Calculate the magnitude and direction of velocity with which the projectile hits the ground and the time of flight. **08**

OR

7 a) State and explain D' Alembert's principle **05**

b) In a police investigation of tyre marks, it was concluded that a car while in motion along a straight level road has skidded for a total of 60 m after the brakes were applied. If the coefficient of friction is 0.45 for tyres and pavement, what was the probable speed of the car just before the brakes were applied? **07**

c) A projectile projected with velocity of 18 m/s in air at a certain angle with the horizontal. The x and y coordinates of point lying on trajectory w.r.t point of projection are 15 m and 5m respectively. Find the angle of projection **08**

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