U.S.N.										

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

Autonomous Institute Affiliated to VTU

February / March 2024 Semester End Main Examinations

Programme: B.E. **Semester: I / II**
Branch: Common to all Branches **Duration: 3 hrs.**
Course Code: 21CV1ESECM / 21CV2ESECM **Max Marks: 100**
Course: Elements of Civil Engineering and Engineering Mechanics

Instructions:

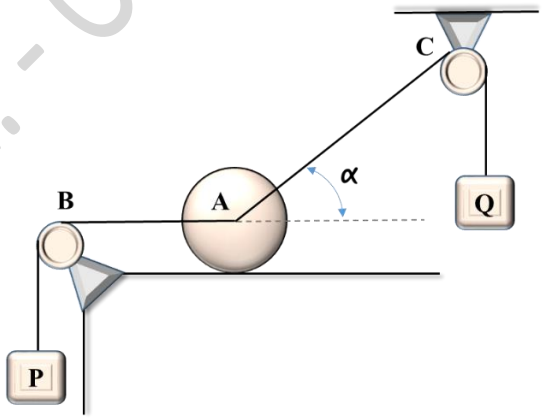
1. **Answer Any FIVE Full Questions choosing ONE question from each Unit**
2. **Missing data may be assumed suitably.**

MODULE - 1

1. a) Explain internal and external forces with examples. **04**

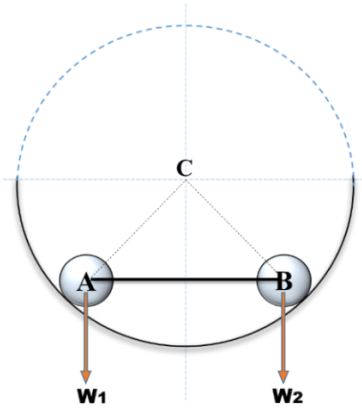
   b) State and prove Varignon's theorem. **06**

   c) A ball weighing 400 N rests upon a smooth horizontal plane and has attached to its center two strings AB and AC which pass over frictionless pulleys at B and C and carry loads P and Q, respectively, as shown in figure. If the string AB is horizontal, find the angle α that the string AC makes with the horizontal when the ball is in a position of equilibrium. Also find the reaction R between the ball and the plane. Take P = 75N and Q = 150N **10**

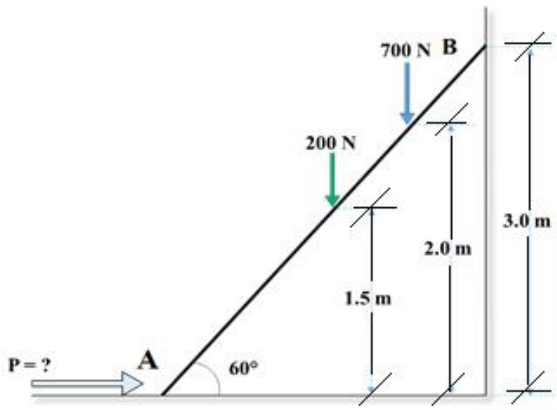


OR

2. a) A rigid bar AB, with rollers of weights W_1=222.5 N and W_2 = 445 N at its ends is supported inside a circular ring in a vertical plane as shown in figure. The radius of the ring and the length AB are such that the radii AC and BC form a right angle at 'C'. Neglecting friction and the weight of the bar AB, find the reactions at contact points and the compressive force S in the bar AB. **10**



b) A ladder AB weighing 200 N to be kept in position as shown in figure, is resting on a smooth floor and leaning against a smooth wall. Determine the horizontal force 'P' required to prevent it from slipping when a man weighing 700 N is at a height 2m above the floor level. **06**

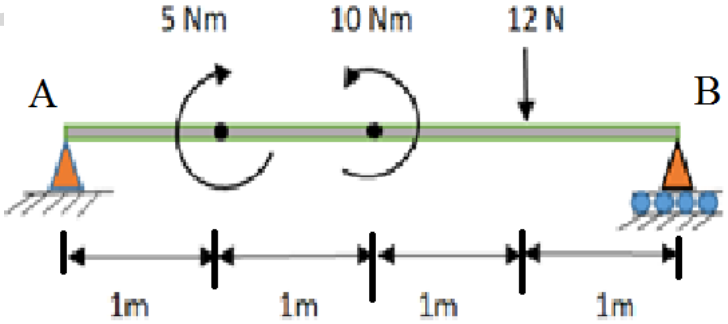


c) Explain free body diagram with a neat sketch **04**

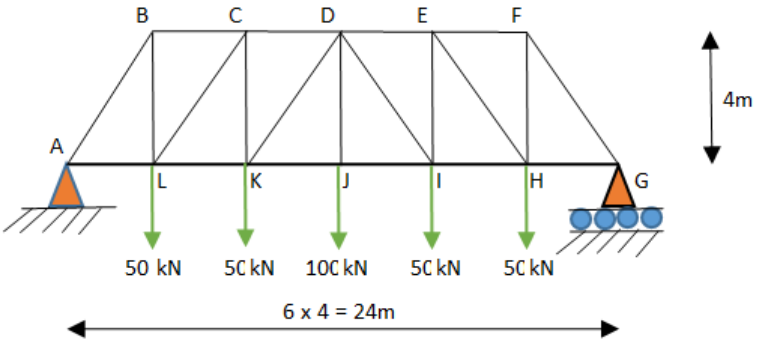
MODULE - 2

3. a) Explain the types of loading on beams with sketches. **04**

b) Find support reactions for the beam shown in figure below. **06**



c) Using method of sections, find the axial force in each of the members EF, EH and IH of the plane truss shown in figure below. **10**

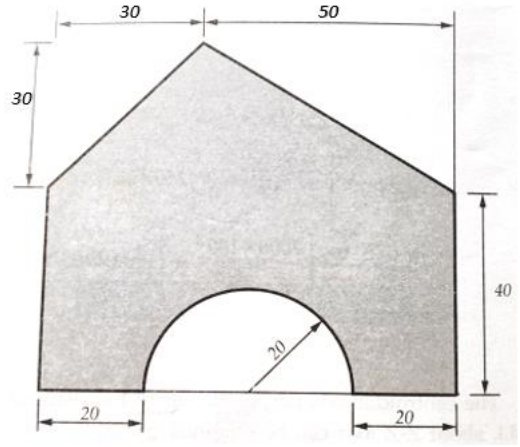


MODULE - 3

4. a) Explain the following with a neat sketch – i. Radius of Gyration ii. Polar Moment of Inertia. **04**

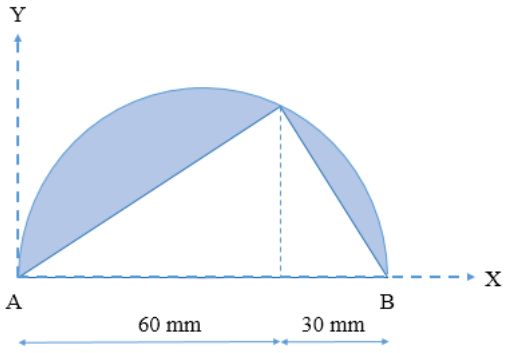
b) Derive an expression for centroid of a quadrant of a circle from first principles. **06**

c) Determine the moment of inertia of the section shown in figure below about horizontal centroidal axis. All dimensions shown in figure are in mm. **10**

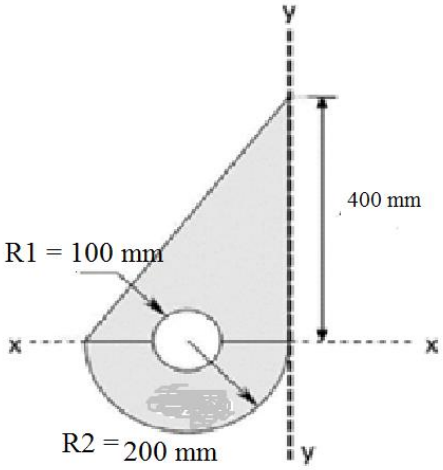


OR

5. a) Locate the centroid of shaded portion of a lamina, if AB = 90 mm is diameter of semicircle. **08**



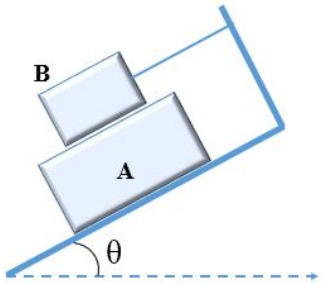
b) Determine the moment of inertia of the composite area shown in figure about the x and y axes indicated. Also find radii of gyration about these axes. **12**



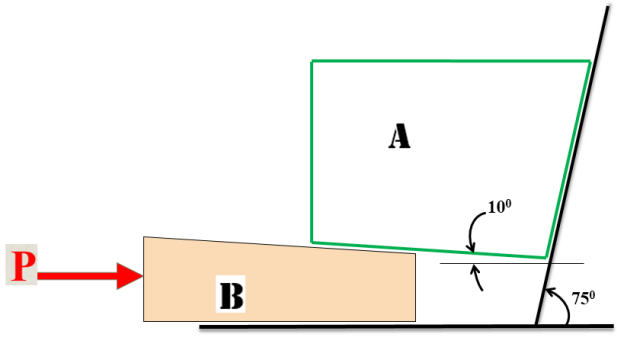
MODULE - 4

6. a) Explain the theory of sliding friction with the help of neat sketch. **04**

b) For the system of blocks shown in figure below, determine the value of 'θ' for impending motion of block A down the plane. The coefficient of friction 'μ' for all the surfaces is 1/3. Mass of block A = 40 kg and that of block B = 13.5 kg. The string connecting the block B is parallel to incline. **08**



c) Two blocks A and B weighing 25 kN, and 5 kN respectively, are held in position against an inclined plane by applying a horizontal force P as shown in figure. Find the least value of P which will induce motion of the block A upwards. Angle of limiting friction for all contact surfaces is 12^{o}. **08**



MODULE - 5

7. a) Write short notes on the following: **10**
   i. GIS
   ii. Transportation Engineering

b) Elaborate on the roles and responsibilities of a civil engineer during the execution of a construction project. **10**

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