Roll No. _

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B. Tech. III - Sem. (Main) Exam., February - 2021
Civil Engineering
3CE3-04 Engineering Mechanics

Time: 2 Hours

Maximum Marks: 80

Instructions to Candidates:

Part – A: Short answer questions (up to 25 words) 5 × 2 marks = 10 marks. All five questions are compulsory.

Part – B: Analytical/Problem Solving questions (up to 100 words) 4 × 10 marks = 40 marks. Candidates have to answer four questions out of six.

Part – C: Descriptive/Analytical/Problem Solving questions 2 × 15 marks = 30 marks. Candidates have to answer two questions out of three.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting materials is permitted during examination. (Mentioned in form No. 205)

1. NIL _____   2. NIL _____

PART – A

Q.1 What is the Principle of transmissibility of forces? [2]

Q.2 For a perfect frame, what is the relationship between number of joints and number of members? [2]

Q.3 Differentiate between limiting friction and dynamic friction. [2]

Q.4 What is bulk modulus? [2]

Q.5 What is Hooke's Law? [2]

PART – B

Q.1 Two smooth spheres each of radius 100 mm and 100 N, rest in a horizontal channel having vertical walls 360 mm apart. Find the reactions at the points of contacts A, B, C and D as shown below.   [10]
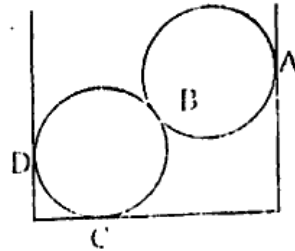

Q.2 Block A weighing 1000 N rests over block B which weighs 2000 N as shown in Figure. Block A is tied to wall with a horizontal string. If the coefficient of friction between A and B is 1/4 and between B and the floor is 1/3. What should be the value of P to move the block B?   [10]
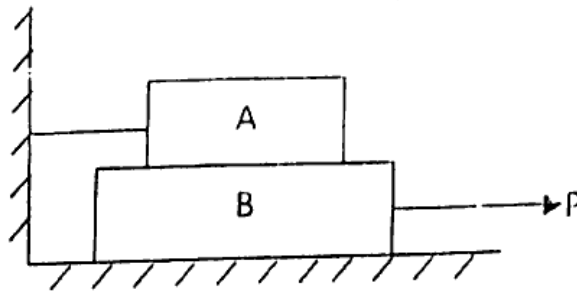
Q.3 Determine the reactions R_A and R_B developed in the simply supported beam as shown below using virtual work method.   [10]
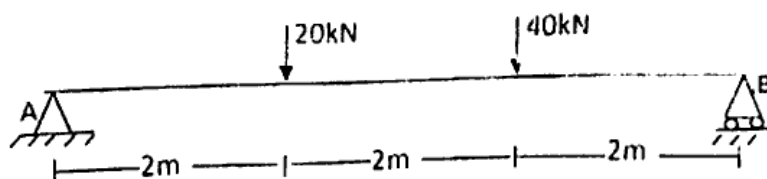
Q.4 Determine the moment of inertia of the section shown in the Figure below about an axis passing through the centroid and parallel to the top most fiber of the section. [10]
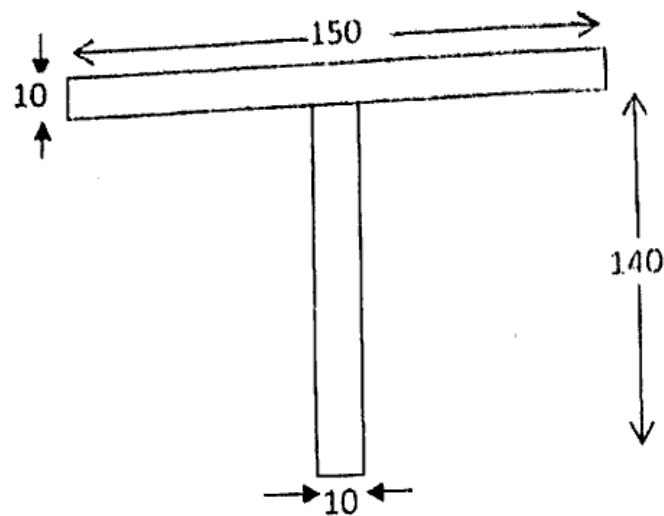
Q.5 A close coiled helical compression spring of 12 active coils has a spring stiffness of k. It is cut into two springs having 5 and 7 turns. Determine the spring stiffness of resulting springs. What would be the stiffness if these two springs are joined in series? [10]

Q.6 What are the different elastic constants? Derive an expression that establishes a relationship among them. [10]

PART – C

Q.1 Determine the forces in all the members of the truss shown in the figure below and tabulate the results. [15]
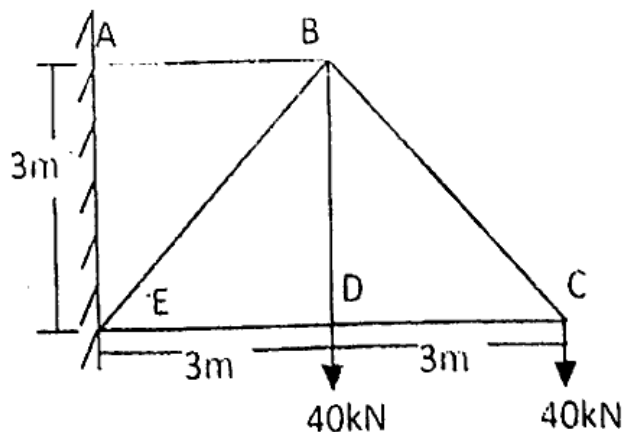
Q.2 A block weighing 2500 N rests on a level horizontal plane for which coefficient of friction is 0.20. This block is pulled by a force of 1000 N acting at an angle of 30° to the horizontal. Find the velocity of the block after it moves 30m starting from rest. If the force of 1000 N is then removed. How much further will it move? Use work energy method. [15]

Q.3 Consider a steel spherical pressure vessel of radius 1000 mm having a wall thickness of 10 mm. [15]

(a) Determine the maximum membrane stresses caused by an internal pressure of 0.80 MPa.

(b) Calculate the change in diameter in the sphere caused by pressurization. Let E = 200 GPa, and Poisson ration ν = 0.25.

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