

310304Roll No. 18EMCCED72Total No of Pages: **3****310304****B. Tech. III Sem. (Main) Exam., Dec. - 2019****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 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. NIL2. NIL**PART - A**

- Q.1 What is a perfect frame? [2]
- Q.2 What is the moment of inertia of a triangular section of base b and height h about an axis through its centre of gravity and parallel to the base? [2]
- Q.3 Explain the principle of virtual work. [2]
- Q.4 State the laws of static friction. [2]
- Q.5 What is the relation between Young's modulus and Poisson's ratio? [2]

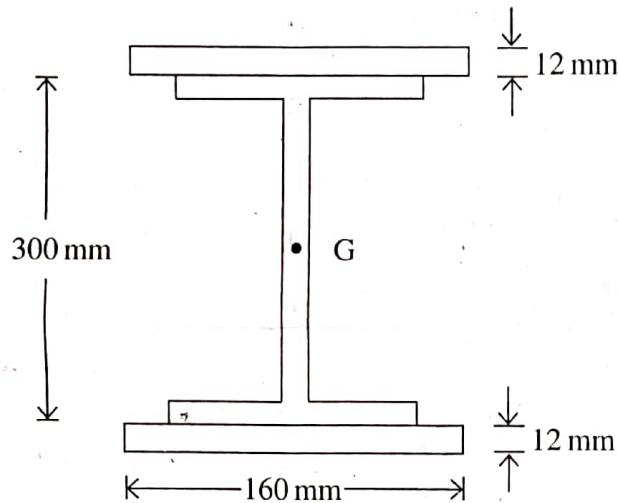
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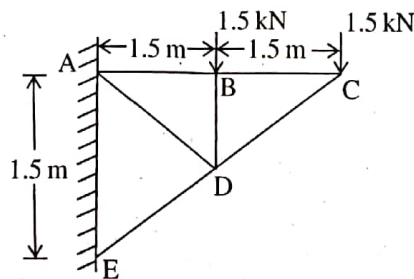
PART - B

- Q.1 Three forces equal to $3P$, $5P$ and $7P$ act simultaneously along the three sides AB , BC and CA (respectively) of an equilateral triangle ABC of side a . Find the magnitude and direction of the resultant. [10]
- Q.2 A compound beam is made by welding two steel plates $160 \text{ mm} \times 12 \text{ mm}$ one on each flange of an ISLB 300 section as shown in the figure (a). Find the moment of inertia of the beam section about an axis passing through its centre of gravity G and parallel to $x-x$ axis. Take moment of inertia of the ISLB 300 section about $x-x$ axis as $73.329 \times 10^6 \text{ mm}^4$. [10]



(Figure a)

- Q.3 Determine the forces in the various members of a pin jointed frame as shown in the figure b. [10]



(Figure b)

- Q.4 A weight of 200 N is suspended from two springs arranged in parallel. Determine the periodic time of the weight, if the spring constants are 800 N/m and 1000 N/m respectively. Also determine the angular velocity of the weight. [10]
- Q.5 A body of weight 300 N is lying on a rough horizontal plane having a coefficient of friction as 0.3. Find the magnitude of the force which can move the body while acting at an angle of 25° with the horizontal. [10]
- Q.6 A uniform ladder of weight 250 N rests against a smooth vertical wall and a rough horizontal floor making an angle of 45° with the horizontal. Find the force of friction at the floor using the method of virtual work. [10]

PART – C

- Q.1 Derive the equation of moment of inertia for a hollow circular section. [15]
- Q.2 A locomotive draws a train of mass 400 tonnes, including its own mass, on a level ground with a uniform acceleration, until it acquires a velocity of 54 kmph in 5 minutes. If the frictional resistance is 40 N/tonne and the air resistance varies with the square of the velocity, find the power of the engine. Take air resistance as 500 N at 18 kmph. [15]
- Q.3 Describe various types of springs along with diagrams. [15]