

3E1131	Roll No.	Total No of Pages: 4
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	B. Tech. III - Sem. (Main) Exam., Dec. - 2018	
	ESC Civil Engineering 3CE3 – 04 Engineering Mechanics	
Time: 2 Hours		Maximum Marks: 80

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.

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 material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)

[5×2=10]

All questions are compulsory

- Q.1 State the triangle law of forces. [2]
- Q.2 Differences between truss and frame. [2]
- Q.3 What is co-efficient of friction? [2]
- Q.4 Differentiate between close coiled helical and open coiled spring. [2]
- Q.5 Explain the principle of conservation of energy. [2]

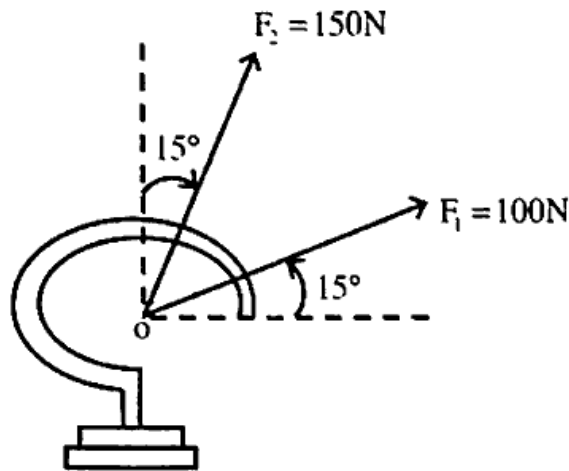
PART – B

(Analytical/Problem solving questions)

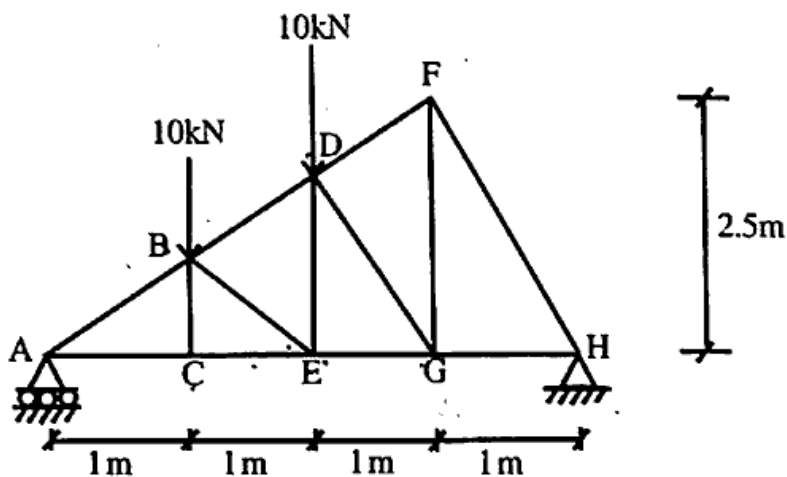
[4×10=40]

Attempt any four questions

- Q.1 An eye bolt as shown in figure below is subjected to two forces $F_1 = 100\text{ N}$ and $F_2 = 150\text{ N}$. Determine the magnitude and direction of resultant force. [10]



- Q.1 Write the basic assumption made in analysis of a truss. For the simply supported truss shown as figures. Find the forces BD, DE, EG & CE using the method of section. [10]



- Q.3 Prove the statement that loss of one form of energy is equal to the gain in other form of energy and total energy remains constant. [10]

Q.4 A semi elliptical laminated spring has the following data: [10]

Length of longest plate = 500 mm

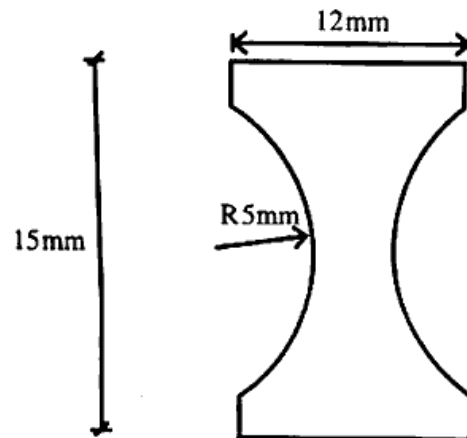
Deflection at the center = 20 mm

Permissible bending stress = 200 MPa

Determine the size of strip, number of plates and radius of curvature. Assume that the width of plate is 10 times the thickness of plate. Take

$$E = 2 \times 10^5 \text{ N/mm}^2$$

Q.5 The cross section of cast iron beam shown in fig. Determine the moments of inertia of section about horizontal & vertical axis passing through the centroid of the section. <http://www.rtuonline.com> [10]



Q.6 Show that the relation between the tensions in the belt on the tight side and slack side is [10]

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

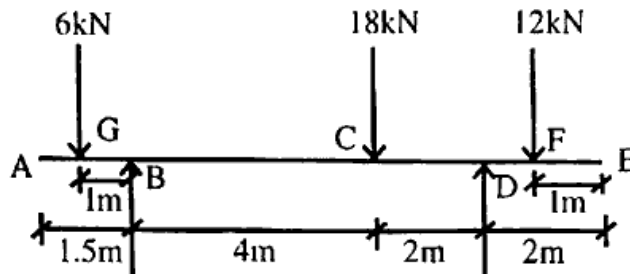
PART – C

(Descriptive/Analytical/Problem Solving/Design Question) [2×15=30]

Attempt any two questions

Q.1 (a) State the principle of virtual work and explain concept of virtual work and virtual displacement with an example. [8]

- (b) Determine the reaction at support by principle of virtual work for the beam shown in fig. [7]



- Q.2 (a) Setup a relation for volumetric strain of a rectangular or cylindrical bar subjected to axial force in terms of longitudinal strain & Poisson's ratio. [8]
- (b) The air vessel of a torpedo having an external diameter of 500 mm is 10 mm thick, has a length of 1.8 m. Determine the increase in its external diameters and length it is charged to 10 N/mm^2 . Take $E = 200 \times 10^9 \text{ N/m}^2$. Poisson's ratio = 0.3. [7]
- Q.3 (a) State and derive the expression for parallelogram law of forces. [7]
- (b) Two spheres of diameter 12 cm and 4 cm rest on three planes as shown in fig. The weight of the bigger sphere is 40 N and that of smaller one 20 N. Determine the normal reaction of the plane and the reactions between the spheres. [8]

