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Following Paper ID and Roll No. [illegible] in your Answer Book.

PAPER ID : 43502 Roll No.

B. Tech. Examination 2023-24

(Even Semester)

ENGINEERING MECHANICS

Time : Three Hours] *[Maximum Marks : 60*

Note :– Attempt all questions.

SECTION–A

1. Attempt all parts of the following : $8 \times 1 = 8$

   (a) State Lami's theorem.

   (b) Define limiting friction.

   (c) Explain the term 'force' and list its characteristics.

   (d) State the Varignon's theorem.

   (e) Define bulk modulus.

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(f) Write the conditions of perfect trusses.

(g) Define shear force and bending moment.

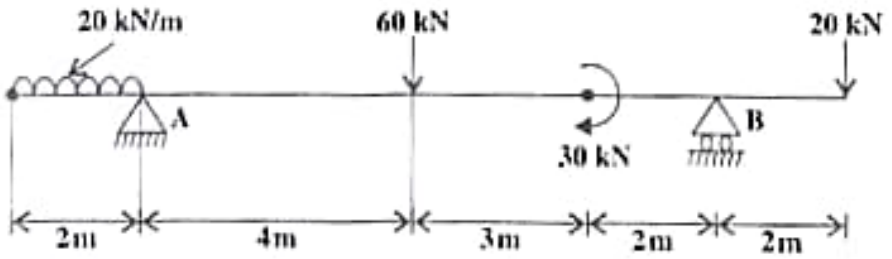
(h) Explain angle of repose.

SECTION – B

2. Attempt any two parts of the following : 2×6=12

(a) Three forces of 2P, 3P and 4P act along the three sides of an equilateral triangle of side 100 mm taken in order. Find the magnitude and position of the resultant force.

(b) Find the reactions at supports A and B of the beam shown in figure :



(c) Determine moment of inertia of a triangle about its base.

(d) A 2 m long steel bar having uniform diameter of 40 mm for a length of 1500 mm and in the next 500 mm its diameter gradually reduces from 40

mm to 20 mm. Determine elongation of this rod when subjected to an axial tensile load 200 kN. Assume E = 200000 N/mm^2.

SECTION – C

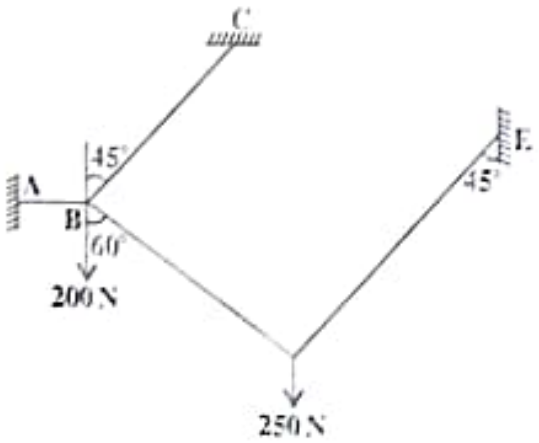
Note :– Attempt all questions. Attempt any two parts from each questions. $8 \times 5 = 40$

3. (a) State and explain the following laws of forces :

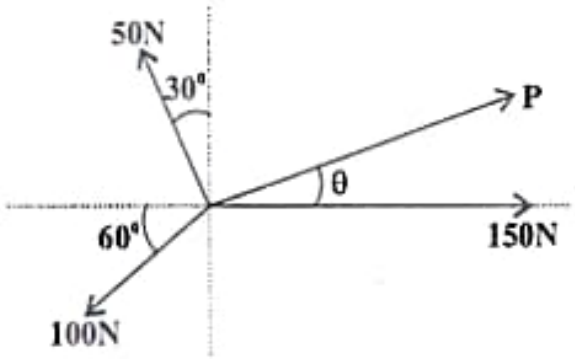
(i) Triangle law of forces

(ii) Parallelogram law of forces

(b) A system of connected flexible cable shown in figure is supporting two vertical forces 200 N and 250 N at point B and D. Determine the forces in various segments of the cable :



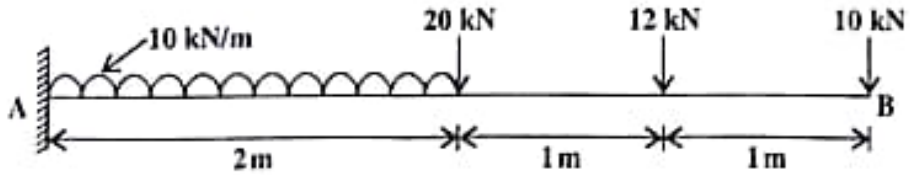
(c) A system of four forces shown in figure has a resultant 50 N along positive X axis. Determine magnitude and direction of unknown force P :



4. (a) Define beam, types of beam and types of loading.

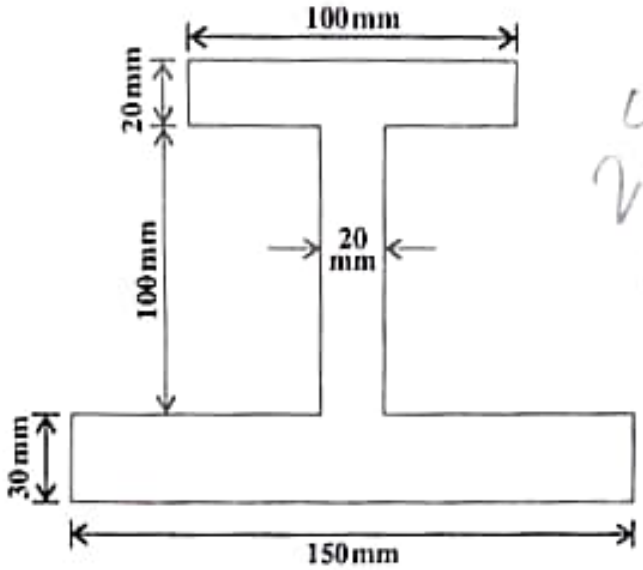
(b) What are the assumptions made in the analysis of simple truss? Explain perfect truss also.

(c) The cantilever shown in figure is fixed at A and free at B. Determine the reaction at support :

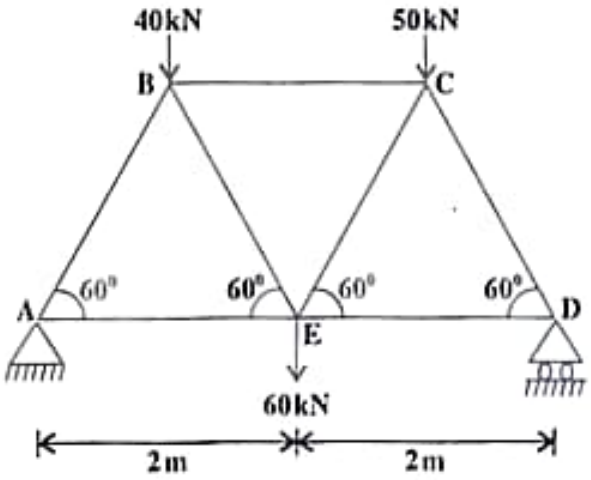


5. (a) What is friction? Derive a relation between tension on tight side and slack side in a rope.

(b) Locate the centroid of the I-section shown in figure :



(c) Determine the forces in all the members of truss shown in figure :



6. (a) Define the term elasticity, elastic limit Young's modulus and modulus of rigidity.

(b) The particle moves along a straight line by given equation :

$$S = 18\,t + 3\,t^2 - 2\,t^3$$

where S = displacement, t = time in second. Determine :

(i) The velocity and acceleration at start.

(ii) The time when particle reaches its maximum velocity.

(c) Draw and explain stress-strain curve for ductile material.

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