



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:IV
Class:SY	Program:B.Tech
Branch Code:MEC	Pattern:2023
Name of Course:Solid Mechanics	Course Code:2305213
Max. Marks:60	Duration:2.30 Hrs.

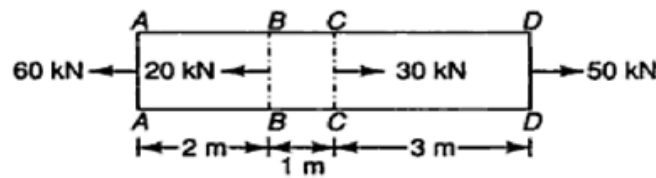
Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 03 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Marks CO

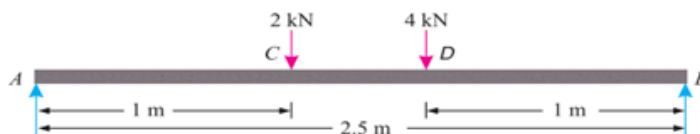
Question No. 1

- 1a) A steel bar of 25 mm diameter is acted upon by forces as shown in figure. What is the elongation of (6) CO1 bar? Take $E = 190\text{GPa}$



Question No. 2

- 2a) A simply supported beam AB of span 2.5 m is carrying two point loads as shown in Fig. Draw the (6) CO2 shear force and bending moment diagrams for the beam.



Question No. 3

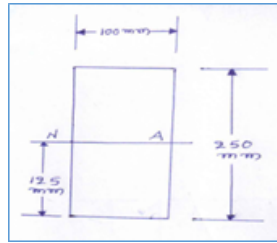
- 3a) A rectangular beam 60 mm wide and 150 mm deep is simply supported over a span of 6 m. If the (8) CO3 beam is subjected to central point load of 12 kN, find the maximum bending stress induced in the beam section.

OR

- 3b) A simply supported rectangular beam of span $L=5.0\text{ m}$ has width $b=80\text{ mm}$ and depth (8) CO3 $d=120$. It carries a concentrated central load $P=10\text{ kN}$. Find the maximum bending stress in the section.

- 3c) A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50 kN. Determine: (8) CO3

- (i) Average shear stress
(ii) Maximum shear stress, and
(iii) Shear stress at a distance of 25 mm above the neutral axis

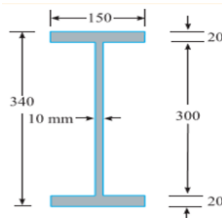


OR

- 3d) An I-section, with rectangular ends, has the following dimensions: (8) CO3

Flanges = 150 mm × 20 mm, Web = 300 mm 10 mm.

Find the maximum shearing stress developed in the beam for a shear force of 50 kN.



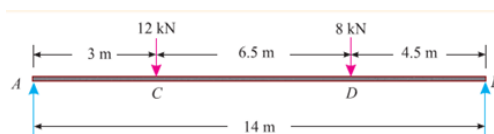
Question No. 4

- 4a) A simply supported beam of span 3 m is subjected to a central load of 10 kN. Find the maximum slope and deflection of the beam. Take (8) CO4

$I = 12 \times 10^6 \text{ mm}^4$ and $E = 200 \text{ GPa}$

OR

- 4b) A horizontal steel girder having uniform cross-section is 14 m long and is simply supported at its ends. It carries two concentrated loads as shown in Fig. Calculate the deflections of the beam under the loads C and D. Take $E = 200 \text{ GPa}$ and $I = 160 \times 10^6 \text{ mm}^4$ (8) CO4



- 4c) A steel rod 5 m long and of 40 mm diameter is used as a column, with one end fixed and the other free. Determine the crippling load by Euler's formula. Take E as 200 GPa. (8) CO4

OR

- 4d) A hollow alloy tube 4 m long with external and internal diameters of 40 mm and 25 mm respectively was found to extend 4.8 mm under a tensile load of 60 kN. Find the buckling load for the tube with both ends pinned. Also find the safe load on the tube, taking a factor of safety as 5. (8) CO4

Question No. 5

- 5a) A point in a strained material is subjected to two mutually perpendicular tensile stresses of 200 MPa and 100 MPa. Determine the intensities of normal, shear and resultant stresses on a plane inclined at 30° with the axis of minor tensile stress. (8) CO5

OR

- 5b) The principal tensile stresses at a point across two perpendicular planes are 80 N/mm^2 and 40 N/mm^2 . Find the normal and shear stresses, resultant stress and its obliquity on plane at 20° . Also find the resultant and Angle of obliquity. Take Poisson's ratio 0.25. (8) CO5

- 5c) A solid circular shaft of 100 mm diameter is transmitting 120 kW at 150 r.p.m. Find the intensity of shear stress in the shaft. (8) CO5

OR

- 5d) A solid shaft is subjected to a torque of 1.6 kN-m. Find the necessary diameter of the shaft, if the allowable shear stress is 60 MPa. The allowable twist is 1° for every 20 diameters length of the shaft. Take $C = 80 \text{ GPa}$. (8) CO5

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