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Total No. of Questions : **5**

No. of Printed Pages : **12**

M0912010

CIVIL ENGINEERING

First Paper

Time : **3 Hours**

Total Marks : **300**

Instructions to the candidates :

1. There are five questions in this question paper. *All* the five questions have to be answered.
2. The total number of marks is **300** and the time allotted is **3** hours. *All* questions carry equal marks, unless specifically stated.
3. The first question will be of short answer type consisting of **20** questions, each one is to be answered in *one or two* lines.
4. Questions should be answered preferably in order in which they appear in the question paper. Answers to the various parts of the same question should be written together compulsorily and no answers of other questions should be inserted between them.
5. Assume suitable data wherever required.
6. All symbols have their usual meanings unless mentioned otherwise.
7. Give neat sketches or diagrams wherever necessary.
8. Where word limit has been given, it must be adhered to.
9. Use of I.S. codes is permitted.

Use of IS : 456-2000 and IS : 800-2007 is allowed. Use of steel tables is allowed. Assume any missing data suitably.

1. Answer the following questions in *one* or *two* lines each : 20×3=60
- (A) What are statically indeterminate structures ?
 - (B) What is principle of Virtual Work ?
 - (C) A level cantilever beam of uniform section, propped at the free end on an unyielding support, carries a point load 'W' at mid span. What will be the reaction at the prop ?
 - (D) Draw influence line for B.M. at mid span in case of a simply supported beam.
 - (E) Name various methods for approximate analysis of frames carrying lateral loads.
 - (F) What is shape factor in plastic analysis ?
 - (G) Differentiate between one-way and two-way slab.
 - (H) What are purlins ?
 - (I) What are situations when gusseted bases for columns are used ?

- (J) Differentiate between pre-tensioning and post-tensioning in Prestressed concrete.
- (K) What are the different types of estimates ?
- (L) What is a lump sum contract ?
- (M) State the purpose of scheduling in a construction project.
- (N) What is the direct cost in any construction project ?
- (O) Define the terms total float and free float.
- (P) What is meant by per capita demand ? Explain how the per capita demand is worked out ?
- (Q) What are water-borne diseases and how are they prevented ?
- (R) What is meant by 'hydraulically equivalent section' in sewer design ?
- (S) Find out the percentage reduction in the volume of the sludge, if moisture content of the sludge is reduced from 95% to 90%.
- T What is the 3R s concept in solid waste management ?

2. (a) For the beam shown in Fig. 1 determine the value of 'a' and 'b' for reaction at supports A and B to be equal. Also determine the position of point of inflexion and draw the bending moment diagram for the beam. 15

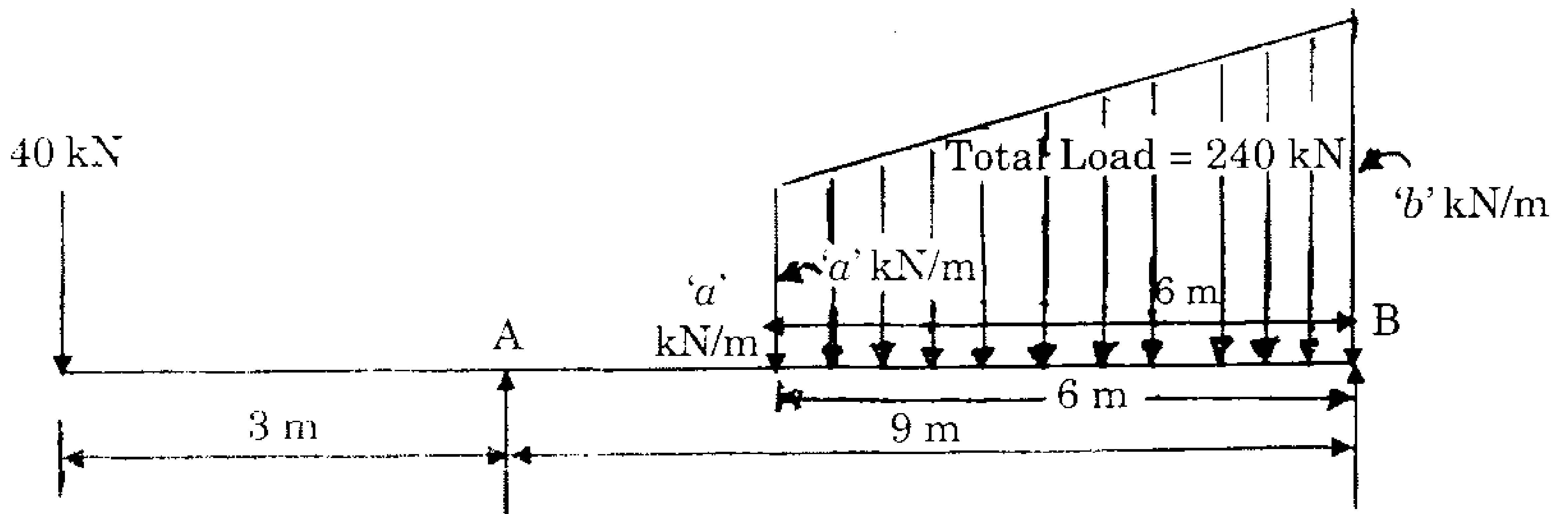


Fig. 1

- (b) For the beam shown in Fig. 2, which is supported on three supports and has a hinge at D distant 3 m from support A. Draw the influence lines for reactions at A, B and C. Also, calculate the maximum reactions which develop at these three supports if a U.D.L. of intensity 2 kN/m of length 3 m travels from left to right. 15

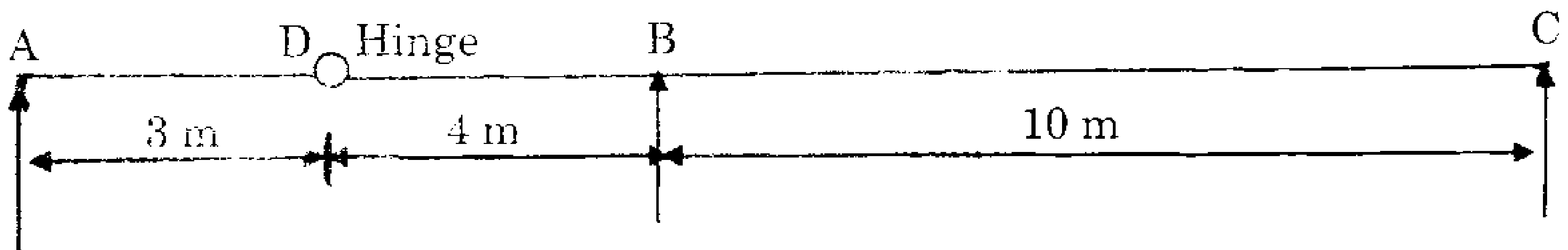


Fig. 2

- (c) For the continuous beam shown in Fig. 3, determine the bending moment at supports and plot the bending moment diagram, using slope deflection method. Ends A and D are fixed and beam is loaded as shown in Fig. The moment of inertia of different spans is shown in the parenthesis.

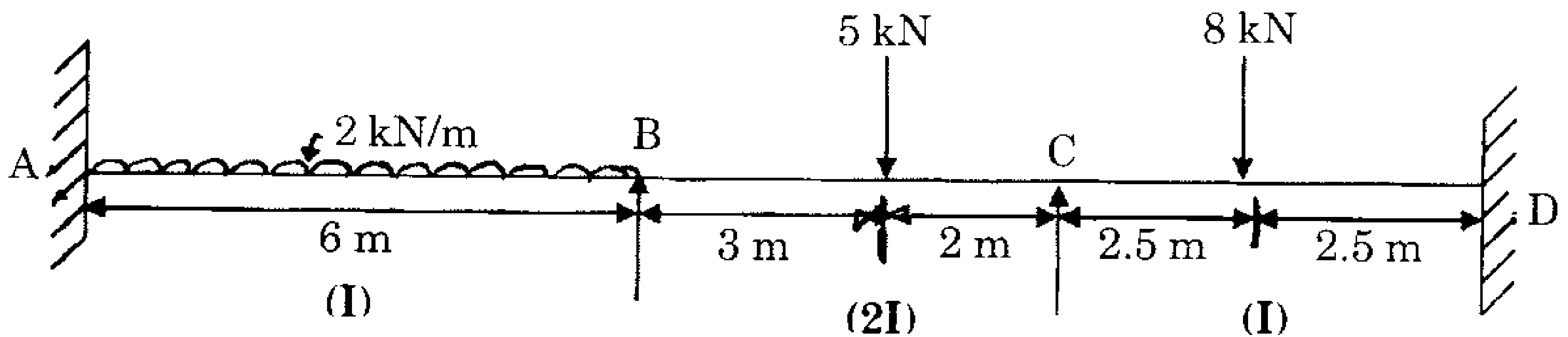
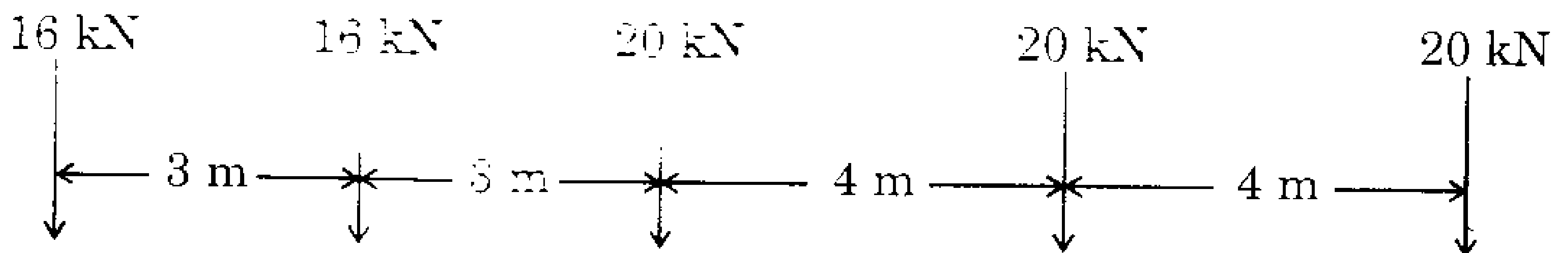


Fig. 3

Or

- (a) The following system of wheel loads crosses a span of 25 mm :

Wheel load Distance between Centre of wheels.



Find the maximum value of the bending moment and shearing force in the span.

30

- (b) Draw the bending moment diagram and sketch the deflected shape of the frame using moment distribution method for the frame shown below Fig. 4. The ends A and D are fixed and BC is loaded with U.D.L. of intensity 6 kN/m. The moment of inertia of different spans is shown in the parenthesis.

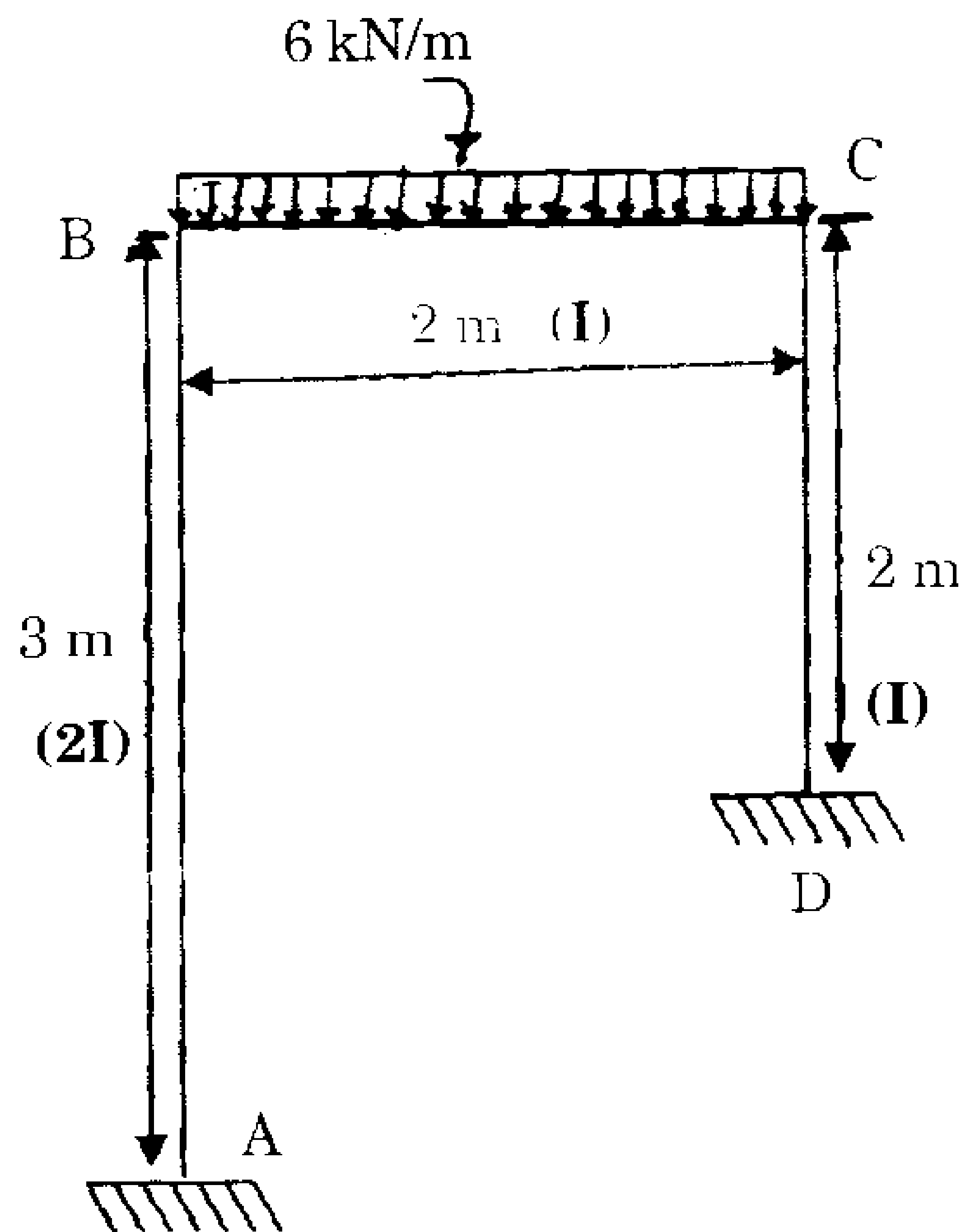


Fig. 4

3. (a) The prestressed concrete beam as shown in Fig. 5, is provided with bent tendon as shown in Fig. below. The beam carries a

point load of 160 kN at the centre. Determine the stress distribution for the end section and the mid section of the beam. The dead load of the beam is 5.76 kN/m. The beam section is 400 mm (Width) \times 600 mm (Depth).

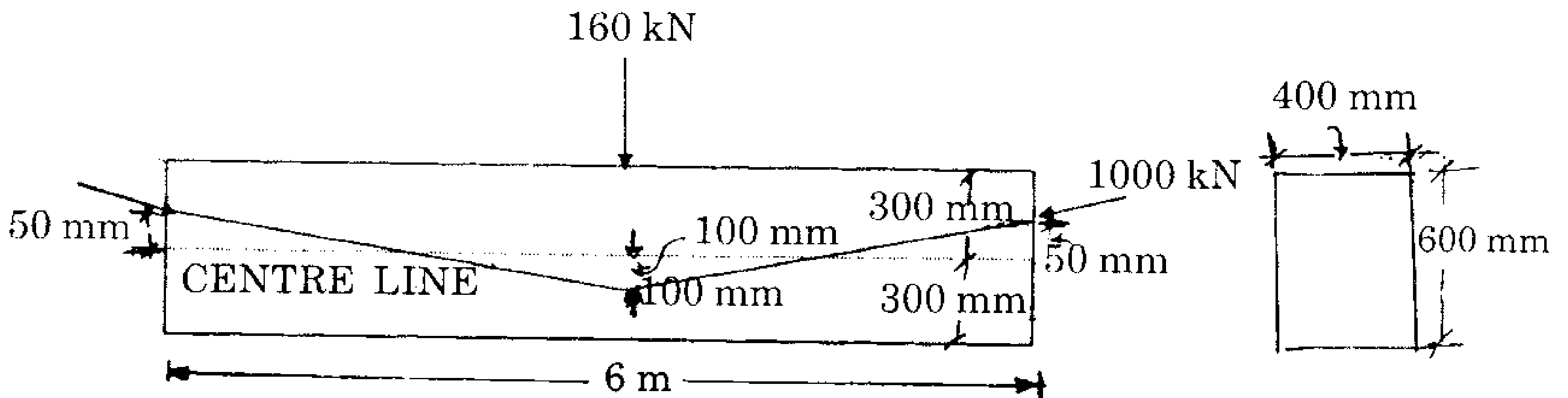


Fig. 5

- (b) A floor slab system covers an area 8.0 m \times 14.5 m (clear spans). The slab rests on a 230 mm thick masonry wall all around. The span of the slab is reduced by providing three equally spaced intermediate beams along 8.0 m direction. The floor loading consists of a live load of 4 kN/m² in addition to self weight. Using limit state method design and detail the floor slab. Use M25 Concrete and Fe415 steel. 30

Or

- (a) Determine the ultimate moment of resistance of a doubly reinforced beam section of size 300 mm (width) \times 700 mm (overall depth) and provided with 2 No. 25 dia bars (Top) at top and 4 No. 25 dia bars (Top) at bottom. Assume M20 Concrete Fe415 steel. Design the shear reinforcement for this beam, if the beam carries uniformly distributed load.

30

Design Stresses at Specified Strains

Fe415	
Strain	Stress (MPa)
0.00000	0.0
0.00144	288.7
0.00163	306.7
0.00192	324.8
0.00241	342.8
0.00276	351.8
≥ 0.003	360.9

- (b) Design and detail an isolated footing for a square column, $450 \text{ mm} \times 450 \text{ mm}$ reinforced with 8 No. 25 dia bars (Tor) and carrying a service load of 1500 kN. Assume soil with safe bearing capacity of 200 kN/m^2 at a depth of 1.5 m. Assume M20 Concrete Fe415 steel for footing as well as column. 30
4. (a) Using Plastic Analysis, calculate the ultimate load which the portal frame shown in Fig. 6 can carry. Draw the BMD at collapse. Assume uniform section for all the members. 30

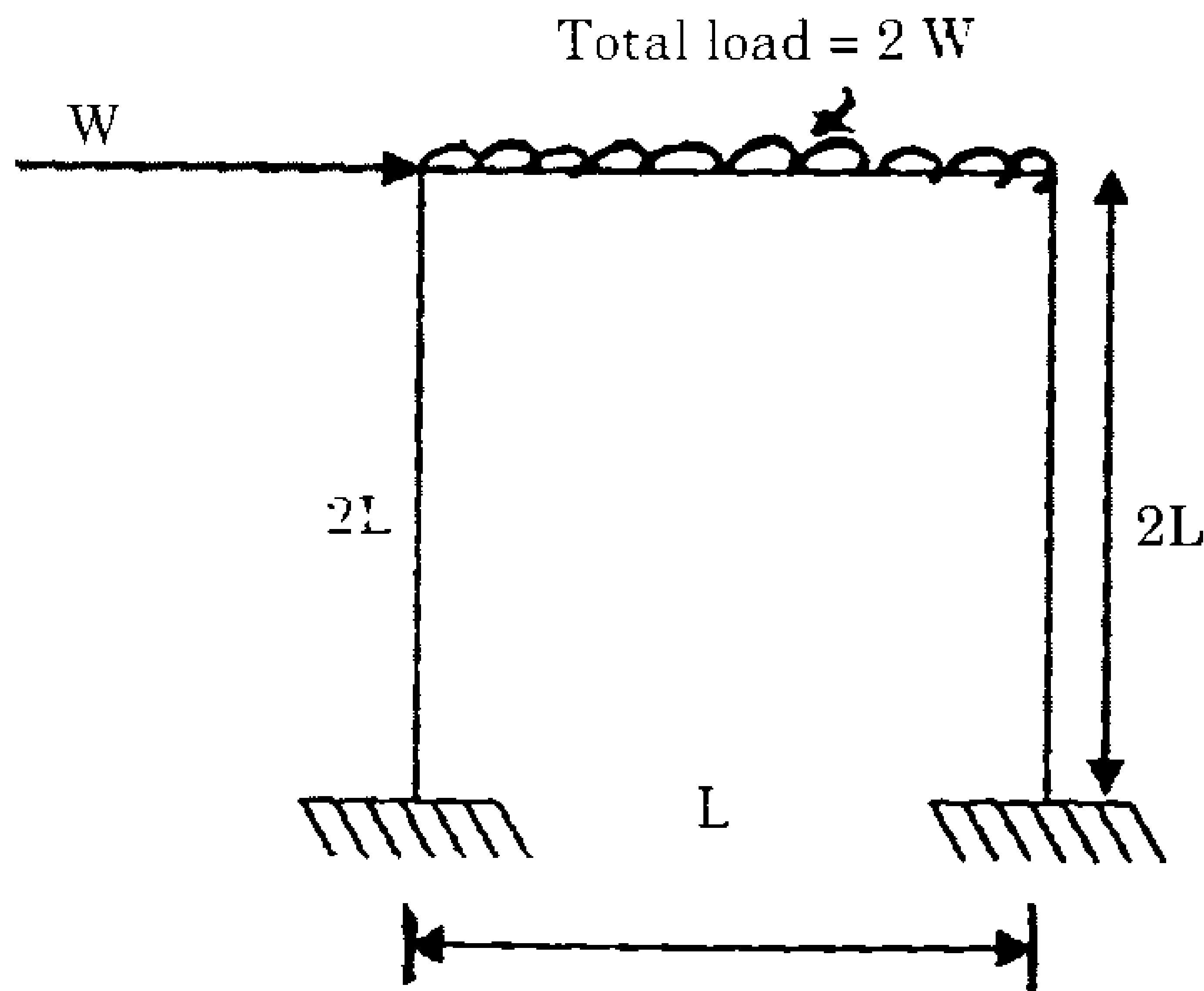


Fig. 6

- (b) Design the joint of a truss shown in Fig. 7. The members are connected by Power driven rivets of 20 mm diameter in gusset plate 12 mm thick. 30

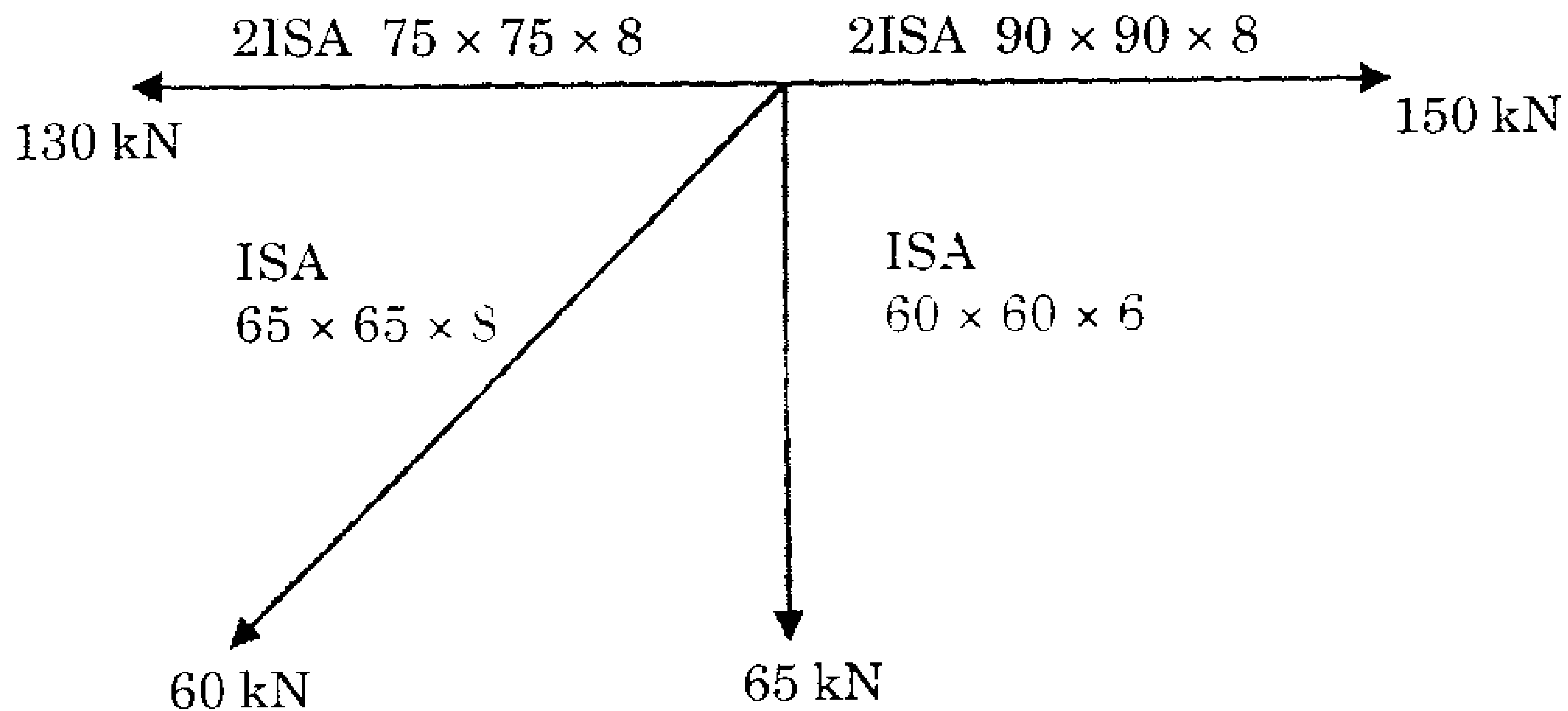


Fig. 7

Or

- (a) A column ISHB 350@ 674 N/m carries an axial load of 1200 kN. Design suitable gusset base using M20 Concrete mix. 30
- (b) A plate girder has a simple supported span of 20 m. It carries a superimposed UDL of 150 kN/m. The section of plate girder at supports

is shown in Fig. 8. Design the horizontal, vertical and intermediate stiffeners along with their connections. 30

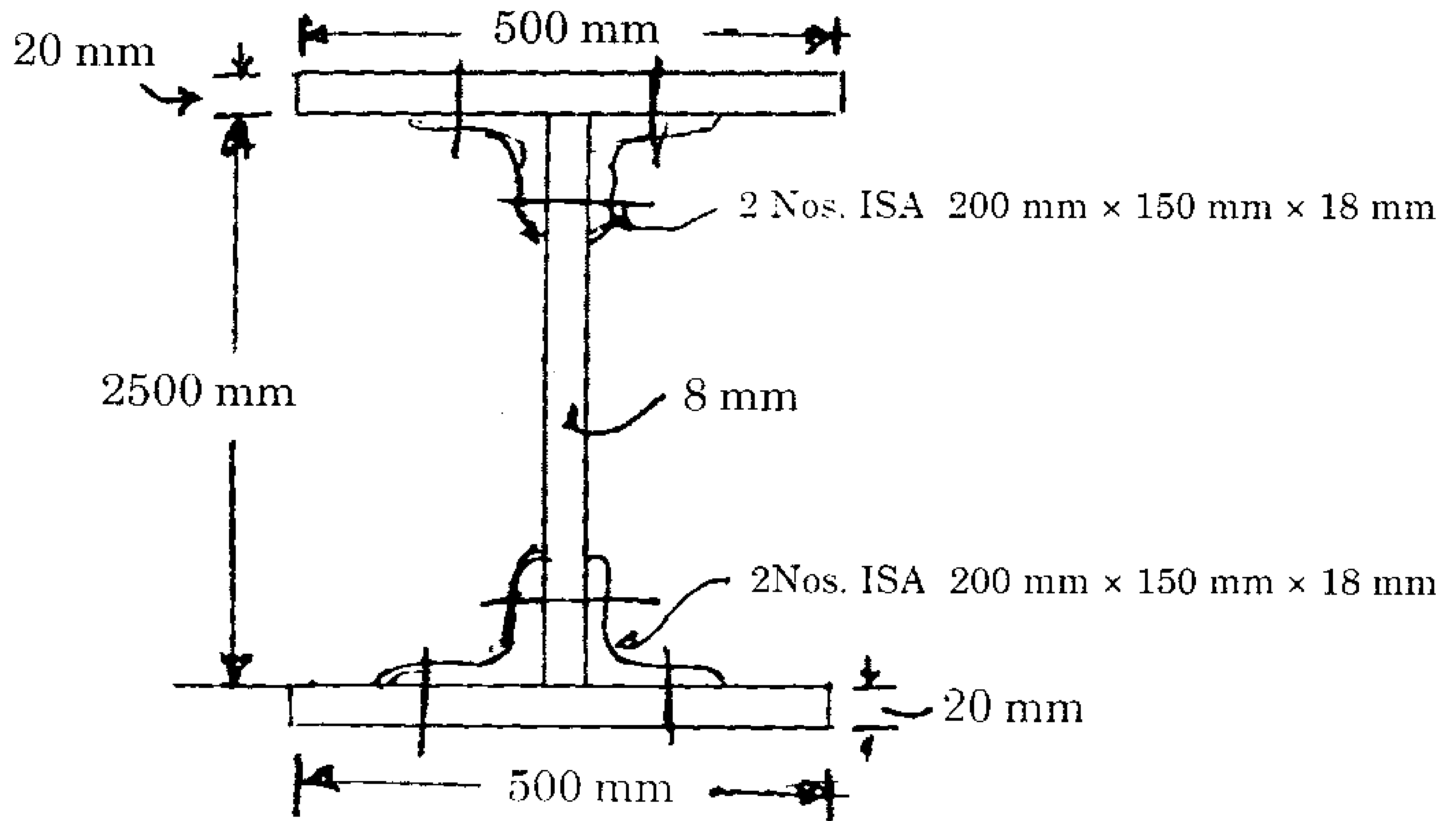


Fig. 8

5. Solve any four from the following questions : 15×4=60
- (a) Compare the advantages and disadvantages of aerobic and anaerobic systems of wastewater treatment taking at least *two* examples from each.
- (b) Draw a schematic diagram of a treatment plant to purify deep well water with excess dissolved iron and organics. Explain the process of

purification in each unit. Identify the chemicals to be used, show also the points of chemical addition.

- (c) Describe the different systems of distribution layout in water supply. State their merits and demerits.
- (d) Why is Noise considered as pollution ? Discuss the physiological effect of Noise pollution. What are the various control measures of Noise pollution ?
- (e) Explain the graphically the relationship between optimum duration and optimum cost of construction project.
- (f) Differentiate between :
- (i) PERT and CPM
 - (ii) Earliest expected time and earliest event time
 - (iii) Slack and float
 - (iv) Earnest money deposit and security deposit
 - (v) Administrative approval and technical sanction.

Roll No.

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Total No. of Questions : 5

No. of Printed Pages : 7

M0922010

CIVIL ENGINEERING

Second Paper

Time : 3 Hours]

[Total Marks : 300

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1. Answer the following questions in *one* or *two* lines each : 20×3=60
- (A) How plasticity chart is useful in classification of fine-grained soils ?
 - (B) Illustrate compaction curve and draw zero air void line typically.
 - (C) Draw Mohr-Coulomb envelop curve for a cohesive soil mass.
 - (D) Define Active Earth Pressure.
 - (E) How stability number is calculated ?
 - (F) State different types of settlements considered in the design of a shallow foundation.
 - (G) Define undisturbed soil samples.
 - (H) What is a Multipurpose Scheme ?
 - (I) Name different systems of irrigation.
 - (J) What are different forms of precipitation ?
 - (K) Define U_n confined aquifer.
 - (L) Write assumptions of Dupuit's theory.

- (M) What are different modes of failure in an earthen dam ?
- (N) Draw a typical X-section of a ogee shaped spillways.
- (O) Write the function of distributory head regulator.
- (P) Give characteristic features of CI sleepers.
- (Q) Write importance of Traffic signals.
- (R) Write the purpose of sub-base below cement concrete road.
- (S) What is a flexible pavement in highways ?
- (T) Illustrate Diamond crossing in Railways.

2. (a) Explain the network of Air Traffic control. 30
- (b) What is a transition curve ? Derive an expression for the length of a transient curve. Highlight its necessity. 30

Or

- (a) Discuss various aspects, considered in hydraulic design of a Bridge. Discuss the criteria for deciding scour depth for bridge foundation. 30

- (b) Describe Marshall method of bituminous mix design. How stability and flow value is decided w.r.t. Marshall test ? 30
3. (a) Discuss all the methods of irrigation with neat sketches. 20
- (b) The catchment area of a basin is in the shape of a regular hexagon of side 40 km, 7 rain gauges located one at each end of the hexagon and one at the centre recorded precipitation of 10, 20, 30, 40, 50, 60 and 70 cm respectively. Using Thiessen polygon method, compute the average precipitation over the basin. 20
- (c) Discuss the design principles of Head and Cross-regulators. 20

Or

- (a) How estimation of run-off and maximum flood is done by Unit Hydrograph method ? Also discuss unit hydrograph theory in detail. 20
- (b) Discuss various steps, involved in the design of an ogee spillway. 20

(c) Design an unlined channel in alluvial soil by Tractive force approach for a discharge of $50 \text{ m}^3/\text{sec}$. Take the following data :

- (i) Bed slope = 1 in 5000
- (ii) Side slope = $\frac{1}{2}$ in 1
- (iii) Mannings roughness coefficient = 0.0225
- (iv) Permissible tractive force = 0.0025 kN/m^2 .

Also design the same channel using Lacey's theory given by $f = 1.1$. 20

4. (a) Explain the Indian Soil classification system. How do you determine the various properties of the soil for the soil classification ? 20

(b) While excavation for a wall footing, it was observed that water level lowered down to a depth of 4.5 m from initial depth of 1.2 m. The water content of soil mass at saturation is 25%. Compute effective stress at a depth of 4 m and also find increase in effective stress at a depth of 5 m. Take $\sigma = 2.67$ and consider the soil is saturated by capillary action above the water table. 20

- (c) A 3 m thick soil stratum has coefficient of permeability of 3×10^{-7} m/sec. A separate test gave porosity as 90% and bulk unit weight 21 kN/m^3 at a moisture content of 31%. Determine the head at which upward seepage will cause quick sand condition. 20

Or

- (a) Define various factors of safety, used in the analysis of stability of slopes. Discuss the Swedish Circle method and Bishop's method for stability analysis and compare. 20
- (b) Determine ultimate bearing capacity of a 1.5 m wide strip footing, with its base at a depth of 1.2 m, resting on a dry cohesionless sand stratum.

Take : $\gamma = 17.5 \text{ kN/m}^3$

$$\phi' = 38^\circ$$

$$N_q = 60$$

$$N_r = 75$$

Also determine the ultimate bearing capacity if the soil properties are $\gamma = 18 \text{ kN/m}^3$; $c = 30 \text{ kN/m}^2$ and $\phi = 20^\circ$ for the same footing. 20

- (c) A vertical excavation was made in a clay deposit having unit weight 19 kN/m^3 . It caved in after the depth of digging reached 5 m. Taking the angle of internal friction to be zero, compute the value of cohesion. If this clay is used as backfill against a retaining wall upto a height of 10 m then what will be active and passive earth pressure on the wall. 20

5. Write short notes on any *four* of the following : 15×4=60

- (a) Flow Nets. in seepage analysis
- (b) Foundation treatment in Dam
- (c) Syphon spillways
- (d) Ground Improvement Techniques
- (e) Earth Pressure
- (f) Slip circle method.