(b) A simply supported beam is loaded as shown in figure 2:

(i) Determine the reactions;

(ii) Sketch the shear force diagram indicating critical values;

SF and BM 2013

(iii) Sketch the bending moment diagram indicating critical values

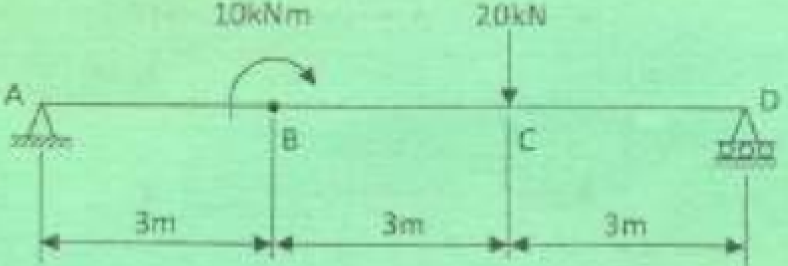
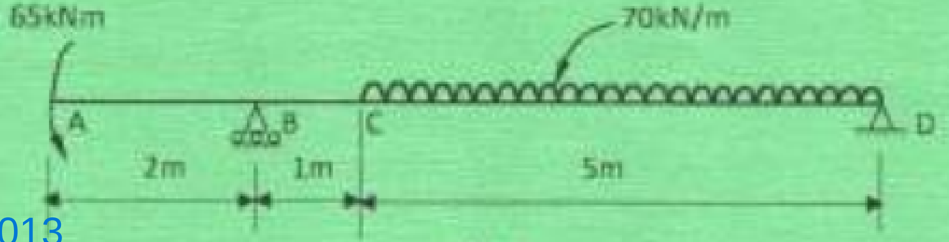


Figure 2

(a) Analyse the beam shown in figure 2 for reactions, shear forces, bending moments and hence sketch the shear forces, bending moments diagrams indicating all the critical values. (10 marks)



SF and BM 2013

Fig. 2

4. Figure 4 shows a simply supported beam with overhanging ends loaded as shown.

(i) Calculate the support reactions at B and E.

(4 marks)

(ii) Draw the shear force and bending moment diagrams.

(16 marks)

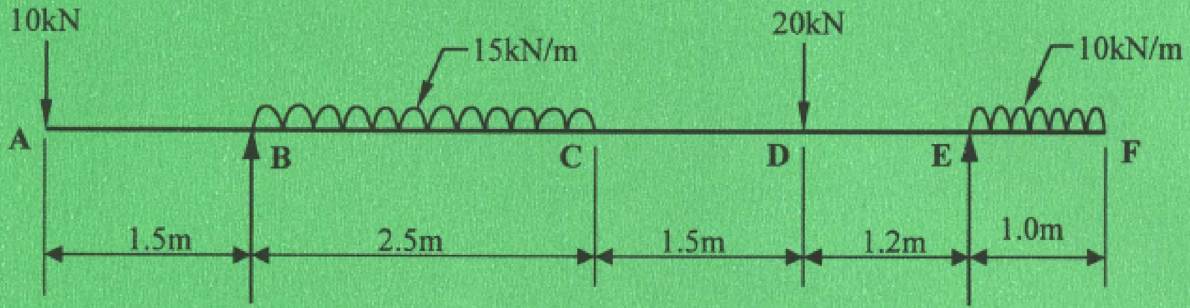


Fig. 4

SF and BM 2015

1. **Figure 1** shows a simply supported beam with an overhanging end loaded as shown.

(i) Calculate the shearforce and bending moments at points A, C, D, E and B.

(16 marks

(ii) Determine the point of contraflexture from support A. (4 marks

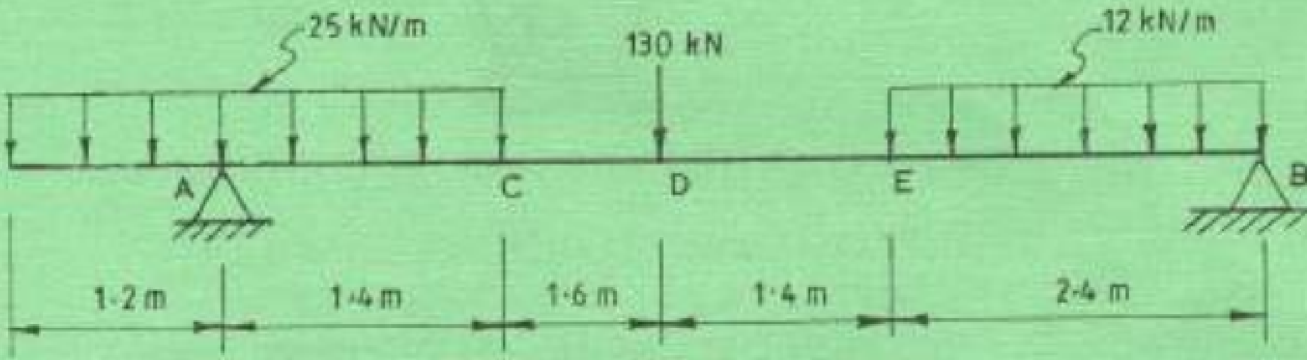


Figure 1

2017

4. **Figure 2** shows a loaded beam:

(a) Determine the reactions on both supports; (2 marks)

(b) Plot the shear force and bending moment diagrams to show values at critical points. (14 marks)

(c) Determine the point of centraflexture from support B. (4 marks)

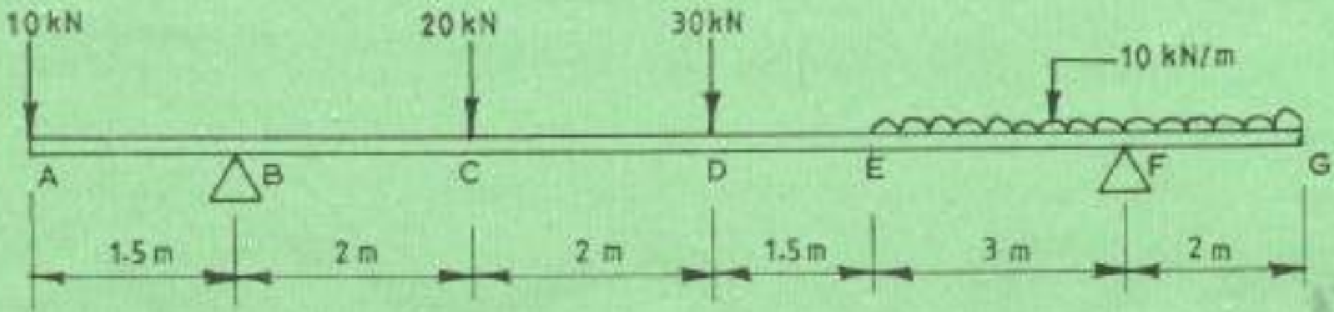


Fig. 2

2018

1. (a) Show that the maximum uniformly distributed load for a simply supported beam is given by $WC^2/8$. (3 marks)

(b) **Figure 1** shows a loaded beam:

(i) plot the shear force diagram and bending moment diagram;

(ii) calculate the point of contraflecture from left hand end. (17 marks)

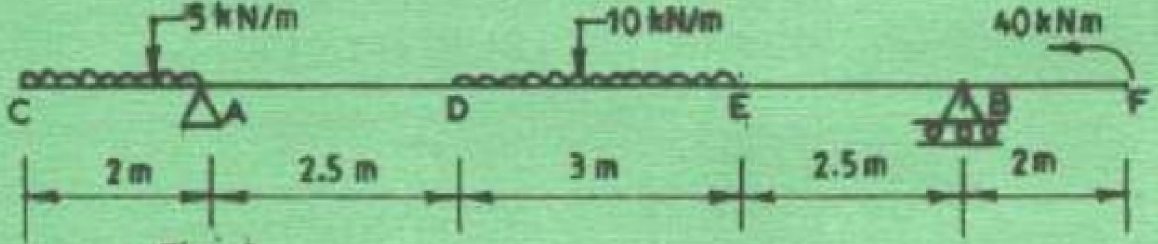


Fig. 1

2017

4. (a) Differentiate between imposed load and dead load on a building. (4 marks)

(b) **Figure 5** shows a loaded beam which is simply supported.

(i) sketch the shear force diagram indicating values at critical points;

(ii) sketch the bending moment diagram indicating values at critical points.

(11 marks)

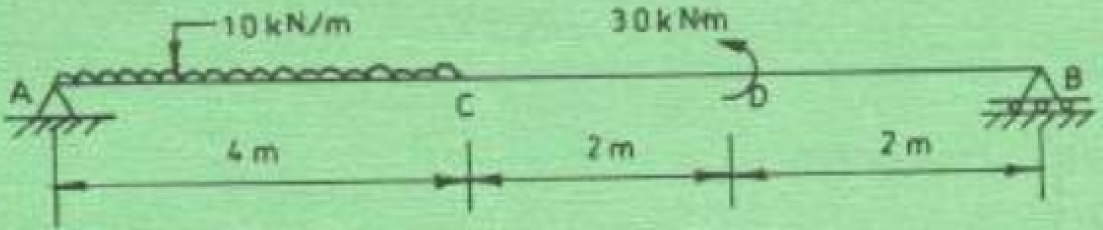


Fig. 5

SF and BM 2019

1. Figure 1 shows a loaded simply supported beam with a couple of 120 kNm at point C. Draw the shear force and bending moment diagrams for the beam, indicating values at all critical points. (20 marks)

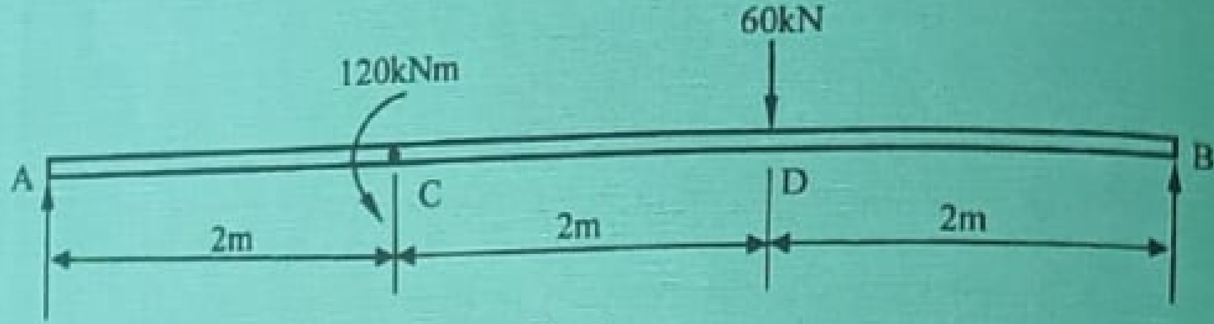


Fig. 1

2019

(b) A simply supported beam is loaded as shown in **figure 1**. (4 marks)

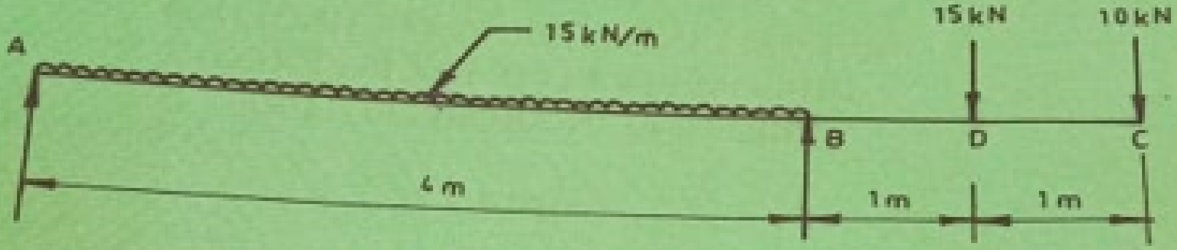


Fig. 1

(i) determine reactions at supports A and B.

(ii) sketch the shear force and bending moment diagram indicating critical values.

2021 (iii) Determine the position at the point of contraflexure. (16 marks)

3. Figure 3, shows a section of a purlin:

(i) Determine the position of the centroid;

(ii) Calculate the second moments of area about both principal axes.

(iii) Calculate the radius of gyration about both principal axes.

(iv) Calculate the section modulus at point A.

(20 marks)

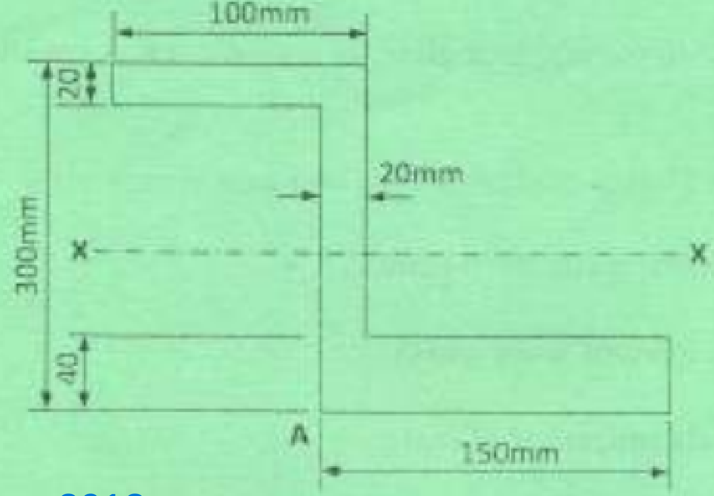


Figure 3

Properties of a Section 2013

(b) For the section shown in figure 1, determine:

(i) I_{yy};

(ii) r_{yy};

(iii) Z_{yyB}

(9 marks)

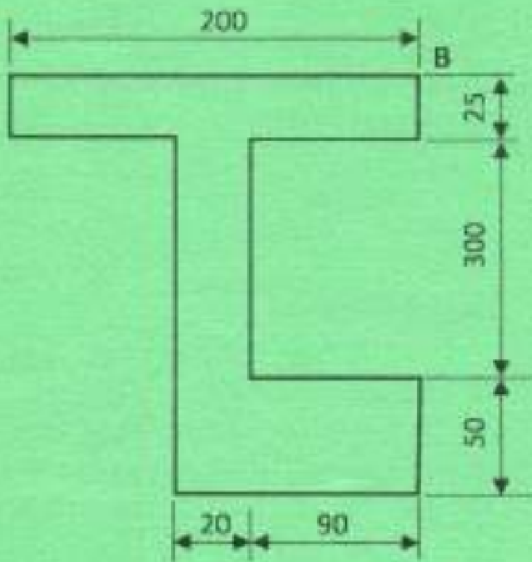


Fig. 1

3. (a) A beam of an I-section shown in **figure 3** is simply supported over a span of 4.3 m. Determine the load that the beam can carry per meter length if the allowable stress in tension is 100 N/mm^2. (12 marks)

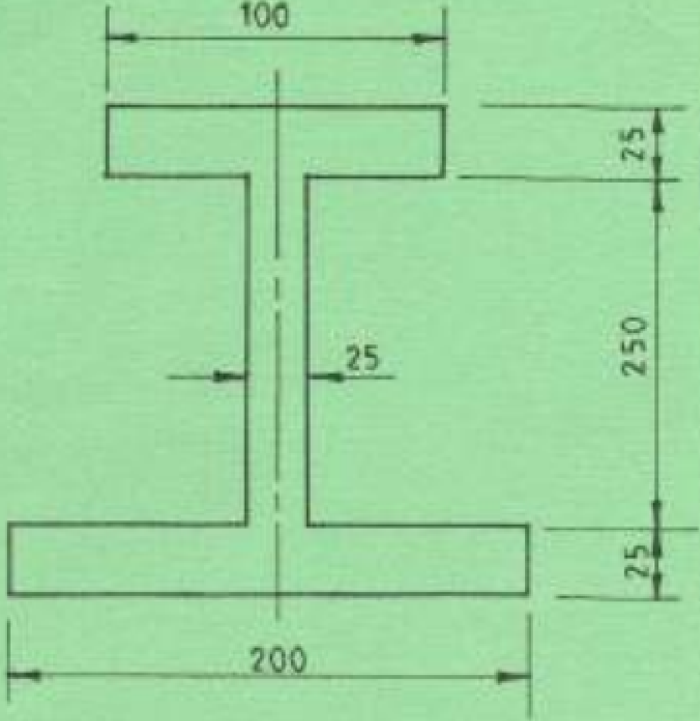


Figure 3

2017

(c) Calculate the section modulus about the X-X axis for the beam section shown in **figure 6**. (9 marks)

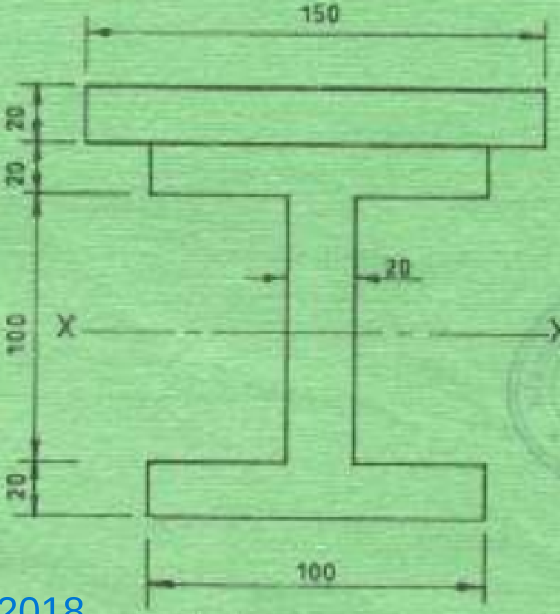
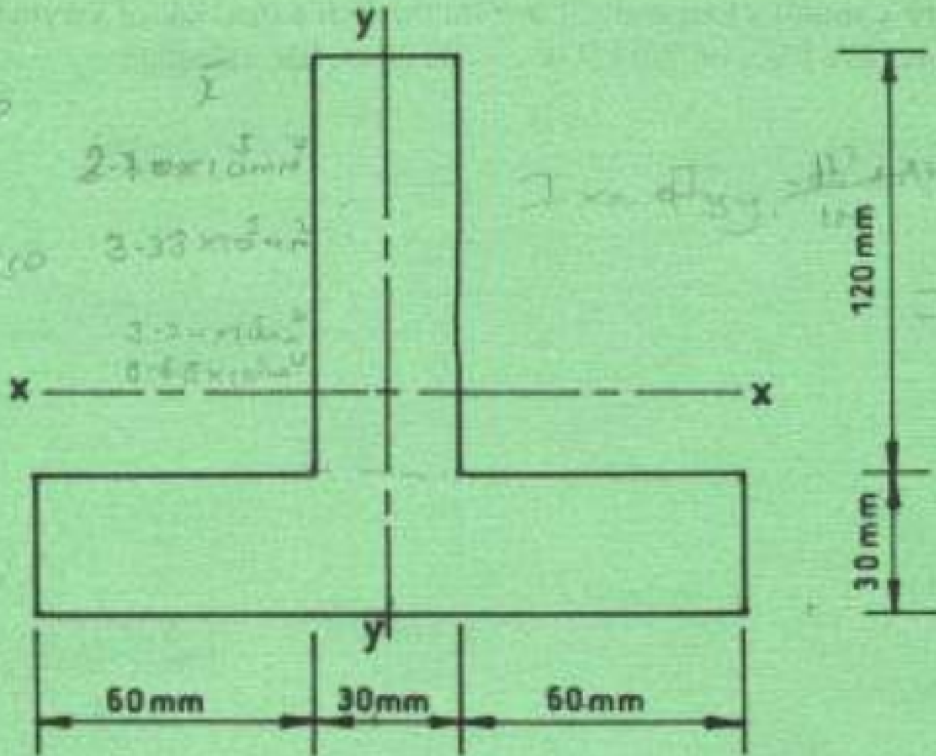


Fig. 6

Properties of a Section 2018

(a) **Figure 2** shows a cross section of a beam. Calculate second moment of area about both centroidal axes. (12 marks)

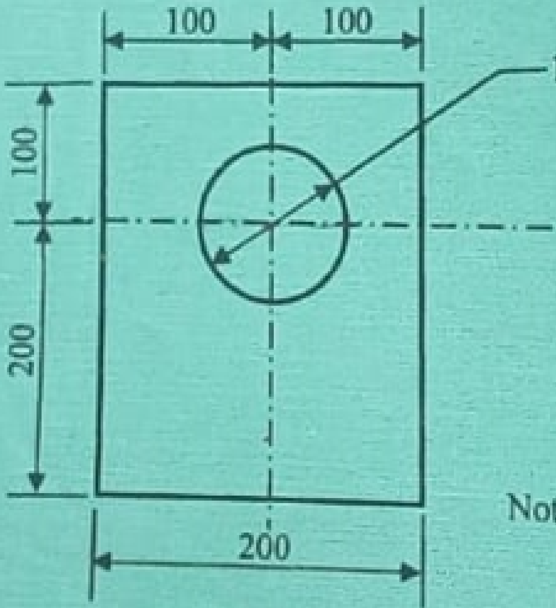


2019

Fig. 2

2. (a) **Figure 2** shows a section of a beam. Find the moment of inertia of the section about the X-X axis.

(14 mark



Note: Dimensions are in mm

Fig. 2

2019

(b) Calculate the second moments of area of the section shown in **figure 5** about the centroided axis; x - x and y - y. (6 marks)

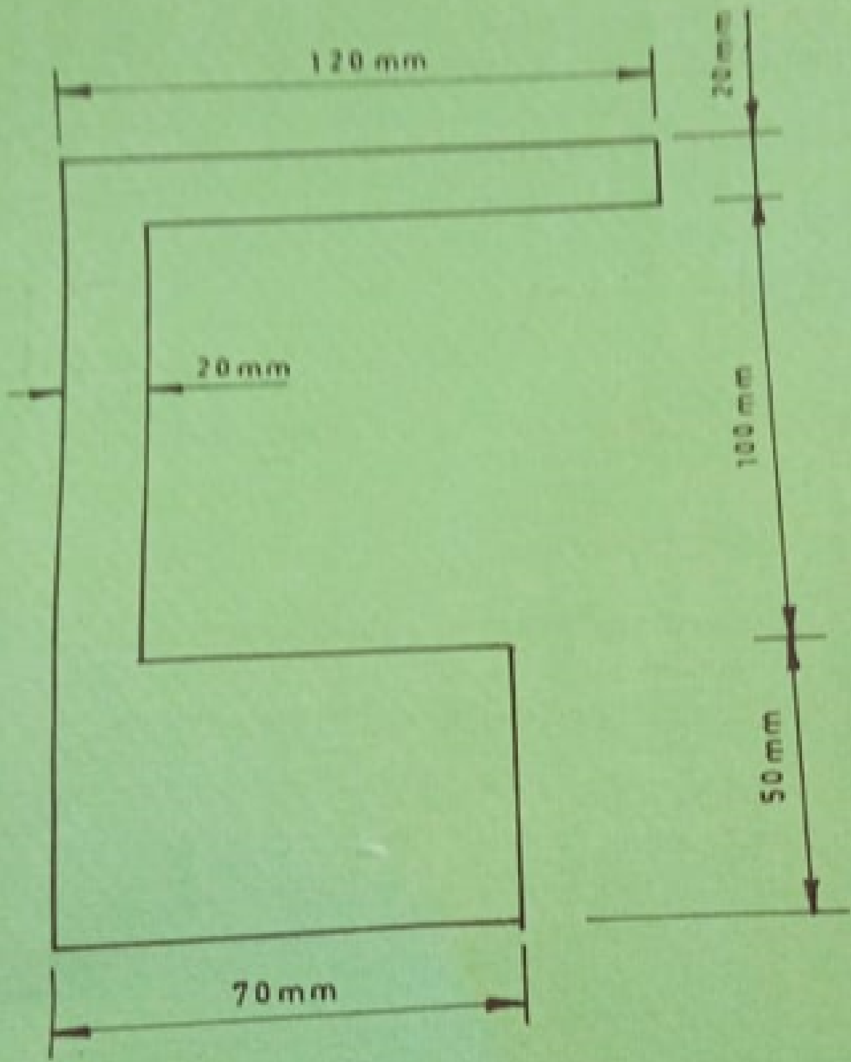


Fig. 5

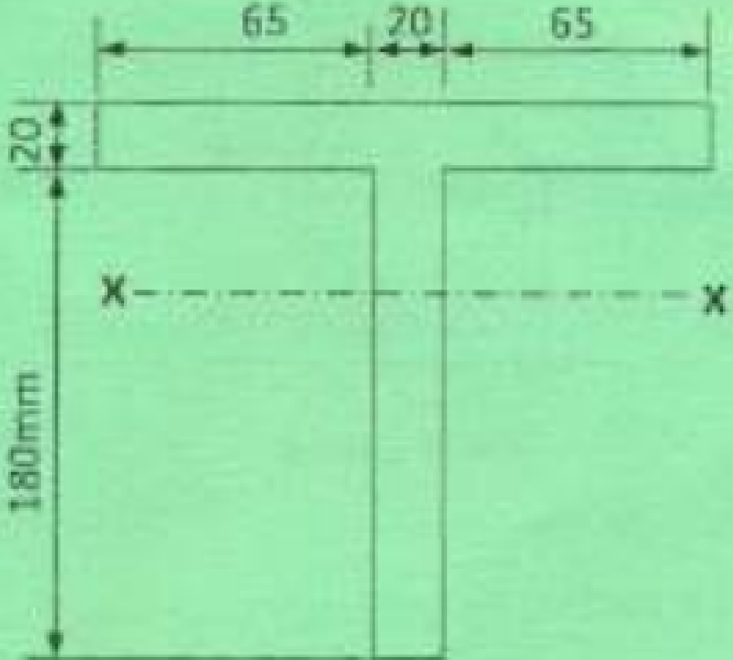
Properties of a Section 2021

(b) A horizontal centilever beam 3m long has a cross section as shown in figure 4. If the beam carries a uniformly distributed load of 10 KN/m along its entire length, calculate:

(i) The maximum tensile stress.

(ii) The maximum compressive stress.

Theory of Simple Bending 2013



2013

4. (a) (i) Define the term 'bending stress'.

(ii) Determine the value of the maximum bending stress and the radius of currature at the point of maximum bending moment for a rectangular cantilever beam of width 120 mm, depth 400 mm and span 2.6 m. The beam carries a uniformly distributed load (UDL) of 30 kN/m together with a point load of 75 kN at the free end.

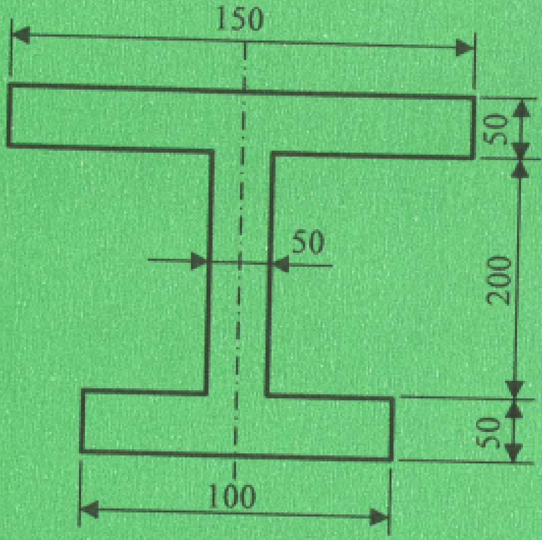
Take $E = 185\ kN/mm^2$

2014

($6\frac{1}{2}$ marks)

(a) Calculate the moment of resistance of the beam section shown in figure 1 if the stresses in the upper and lower flanges are limited to 25 N/mm² and 40 N/mm² respectively.

(12 marks)



Dimensions in mm

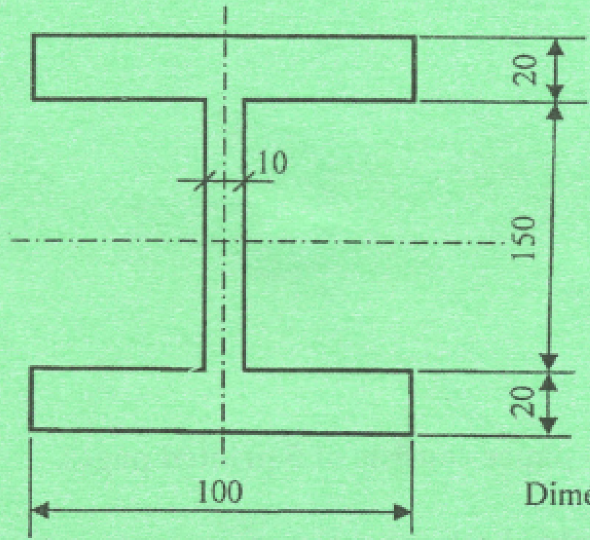
Fig. 1

Fig. 1

(b) Figure 2 shows a section of a beam which is simply supported over a span of 3.8 m and carries a uniformly distributed load of 5.5 kN/m over the entire span. Calculate:

(i) maximum bending moment of the beam;
(ii) moment of resistance of the beam at a bending stress of 100 N/mm^2;
(iii) radius of curvature at the point of maximum bending moment.

Take $E = 210\ kN/mm^2$. (8 marks)



Dimensions in mm

$M = \frac{wl^2}{8}$

$\frac{M}{I} = \frac{E}{R}$

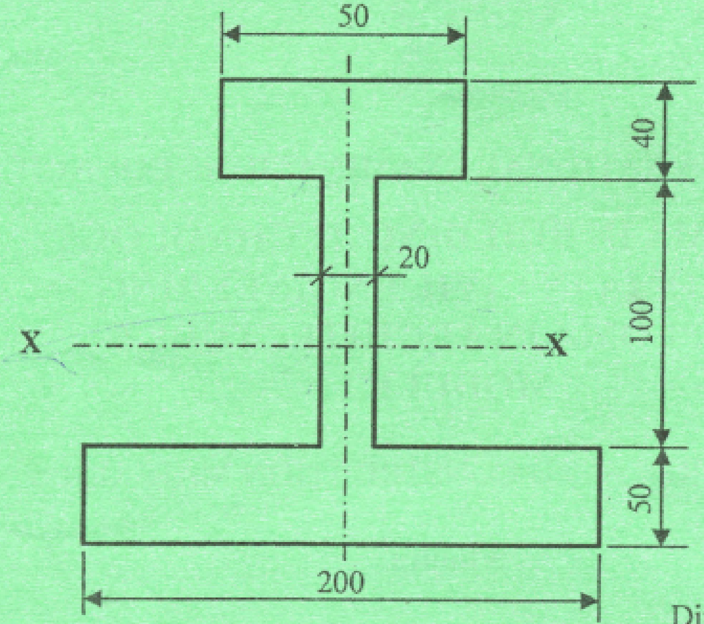
$\frac{E}{R} = \frac{\sigma}{y}$

$R =$

$\sigma = \frac{E}{r}$

2015

1\. (a) Figure 1 shows a section of a beam. Calculate the maximum moment that the beam can carry about the X-X axis if the tensile and compressive stresses are limited to 1.2 N/mm² and 16 N/mm² respectively. (12 marks)



$\frac{M}{I} = \frac{\sigma}{y}$

Dimensions in mm

Fig. 1

2016

(b) Calculate the moment of resistance of the beam section if the stresses in upper and lower sections are limited to 10 N/mm^2 and 25 N/mm^2 respectively. (5 marks)

103

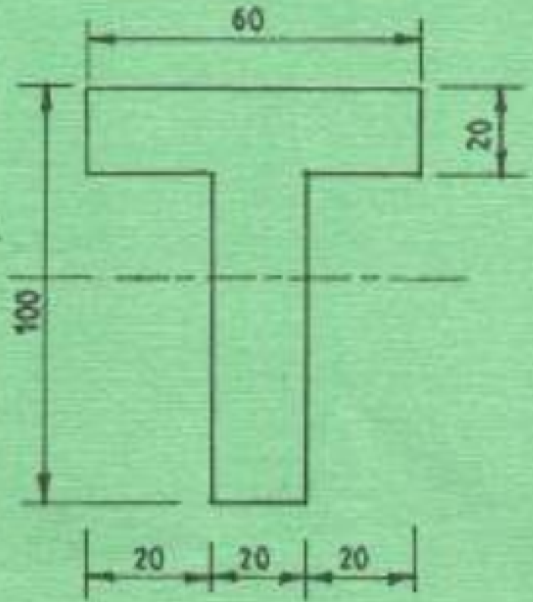
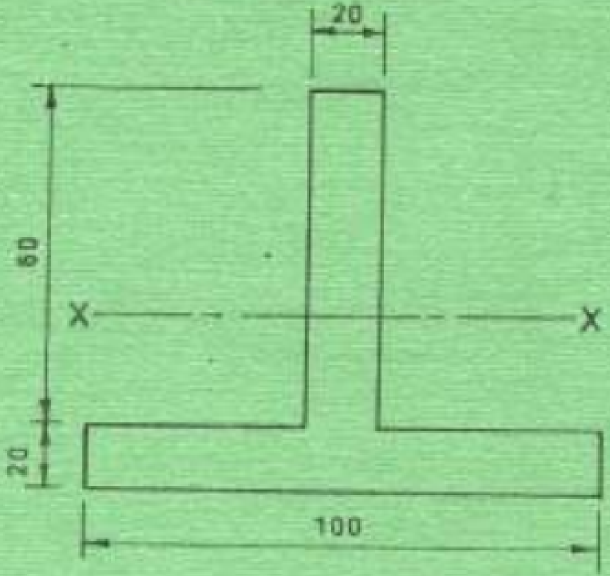


Fig. 2

4. (a) State **two** assumptions in the theory of simple bending. (2 marks)

(b) **Figure 5** shows a loaded beam and its cross section. Calculate the maximum tensile and compressive stresses. (9 marks)



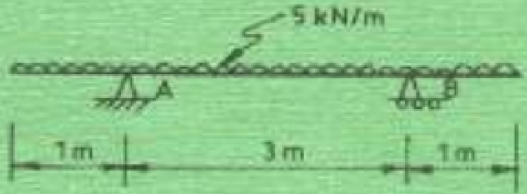


Fig. 5

2018

A cross-section of a beam is shown in **figure 3**. The beam is 4 m long and is simply supported at the left end and at a point 1 m from the right end. If it carries a uniformly distributed load of 15 kN/m over the entire length, calculate the maximum hogging and sagging moments and hence find the maximum tensile and compressive stresses occurring in the beam.

(20 marks)

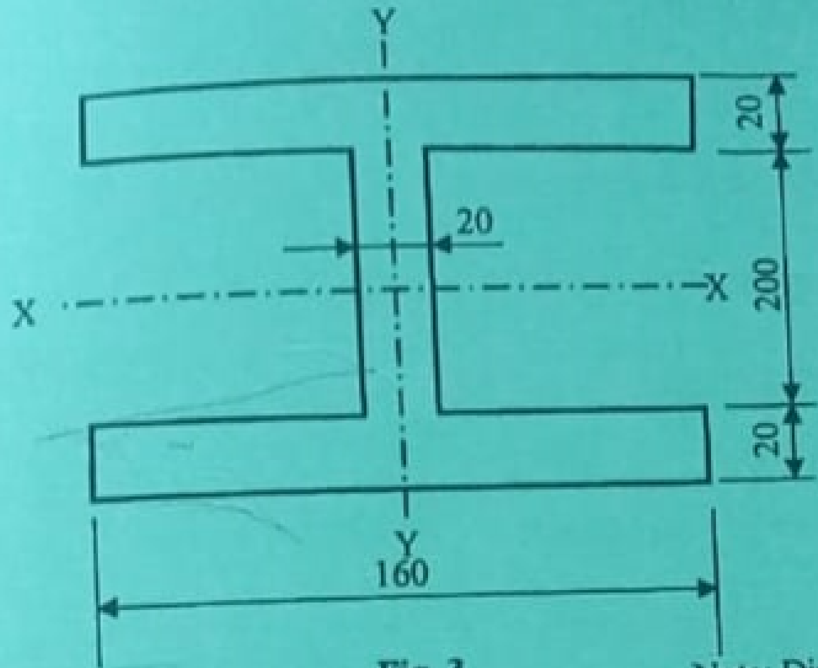


Fig. 3

Note: Dimensions are in mm

2019

4. (a) A horizontal beam shown in **figure 4** is 4 m long, has a uniform thickness of 20 mm, and it is simply supported at its ends. Calculate the maximum uniform distributed load it can carry, if the tensile and compressive stresses must not exceed 32 kN/mm^2 and 56 N/mm^2 respectively. (14 marks)

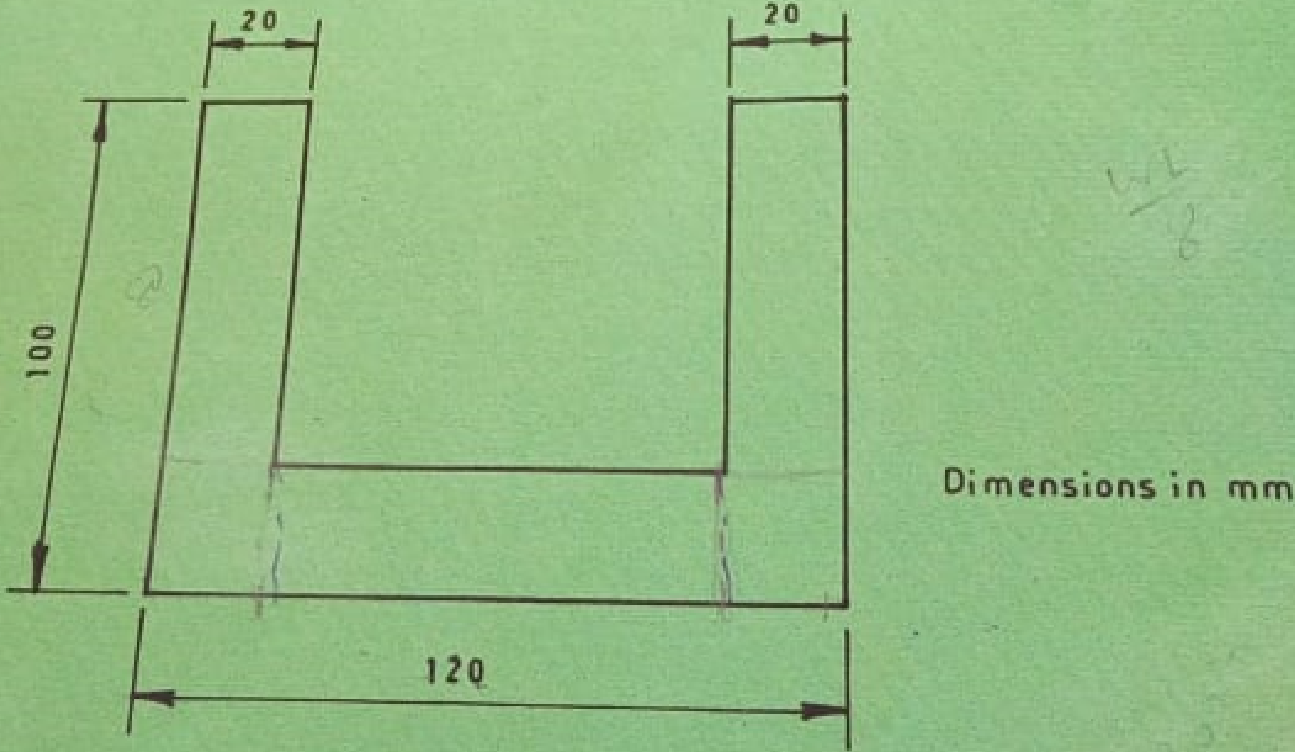


Fig. 4

2021