PURBANCHAL UNIVERSITY

III SEMESTER BACK-PAPER EXAMINATION-2005

LEVEL: B. E. (Electronics & Communication)

SUBJECT: BEG250CI, Mechanics & Properties of Solids.

Full Marks: 80

TIME: 03:00 hrs. **Pass Marks:** 32

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Attempt ALL questions

Q. [1] [a] Explain the term degree of static indeterminacy. Verify your definition with the help of a suitable example of your choice. [6]

[b] Draw the bending moment and shear force diagram for the beam shown in fig. [1b]. [10]

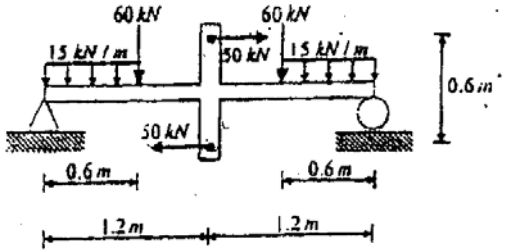


Fig. 1[b]

Q. [2] [a] Locate the Centroid of the plane area shown in fig.2[a.] All dimensions are in mm. The axis of semicircle and circle is same. [8]

[b] Calculate the moment of inertia of a trapezoid having bases a and b (a>b) and altitude h with respect to centroidai axes X parallel to the base.[8]

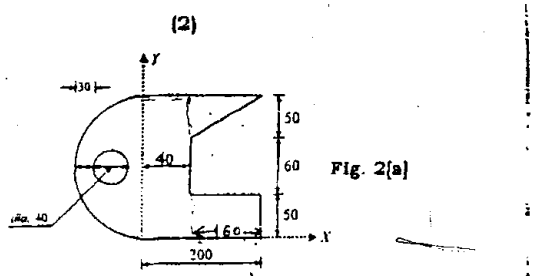


Fig. 2[a]

Q. [3] [a] Explain the term ultimate stress, allowable stress and factor of safety. [6]

[b] A 20 cm long steel tube 10 cm internal diameter and one cm thick is surrounded closely by a brass tube of the same length and thickness. The tubes carry an axial thrust of l00kN. Estimate the load carried by each tube and the amount each tube shortens.Take E_{steel}= 2.1× 10^8kN/m^2 and E_{brass}=1.0× 10^8 kN/m^2. [10]

Q. [4] [a] A square element is subjected to two tensile stresses σ_x and σ_y as shown in the fig. [4a], Show that the locus of the normal and tangential stress on a plane inclined at an angle θ with horizontal is a circle. [8]

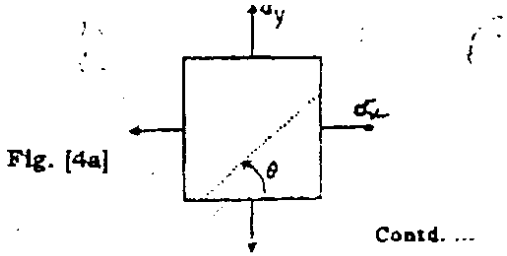
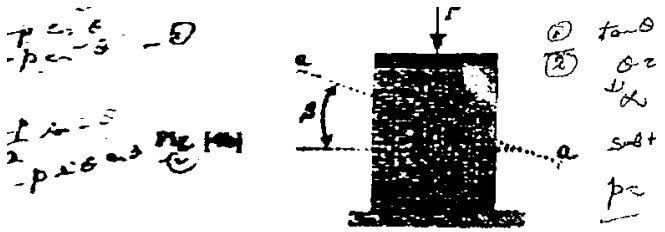


Fig. [4a]

Contd. ...

[b] The centric force P is applied to a short post as shown in the figure [4b] knowing that the stress on plane a-a are σ = -100Mpa and τ = 35Mpa , determine [i] the angle β that the plane a-a forms with horizontal and [ii] maximum compressive stress set up in the post. [8]



Q. [5] [a] For the beam and loading shown in the fig. [5a], design the cross-section of the beam, knowing that the grade of timber used has an allowable normal stress of 12MPa. [8]

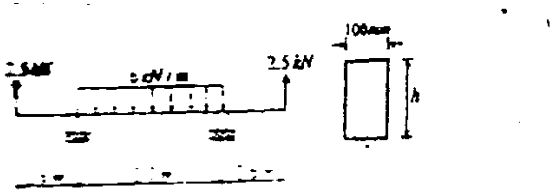


Fig. [5a]

[b] Prove that in the flexural theory, normal stess in proportional to the distance measured on either side of the neutral axis. [8]

Q. [6] [a] A solid circular shaft is to transmit a twisting moment of 45000 kg. cm. If the maximum permissible angle of twist is not to exceed one degree in 20 diameter of length, determine the diameter of the shaft. Take G = 0.8×10^6 kg/cm^2.[8]

[b] Calculate increase in the volume of the boiler shell, 3m long and 1m in diameter, when subjected to an internal pressure of 20kg/cm^2. The wall thickness is such that the maximum tensile stress is not to exceed 300kg/cm^2. Take E = 2.1×10^6kg/cm^2 . [8]

Q. [7] Write a short notes on (any FOUR): [4×4=16]

[a] Crystallography of metals.

[b] Fatigue behavior

[c] Radius of curvature

[d] Hoop stress

[e] Elasticity and hardness

[f] Principle of superposition.

PURBANCHAL UNIVERSITY

III SEMESTER FINAL EXAMINATION-2004

LEVEL: B. E. (Electronics & Communication)

SUBJECT: BEG250CI, Mechanics & Properties of Solids.

Full Marks: 80

TIME: 03:00 hrs. **Pass Marks:** 32

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Attempt any FIVE questions

Q. [1] [a] Find out the degree of static indeterminacy of the beam shown in Fig. 1[a]. [4]

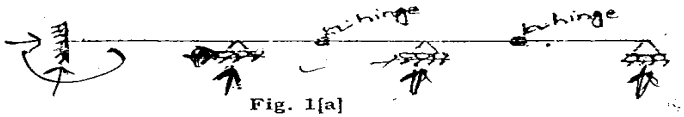


Fig. 1[a]

[b] Draw the shear force and bending moments diagrams for the beam loaded as [12] [12]

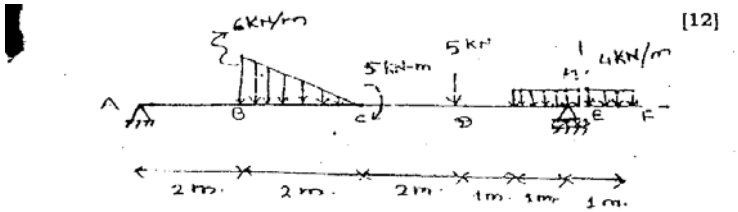


Fig. 1[b]

Q. [2] [a] Determine the amount of inertia of the rectangular section about the X-X axis passing through its C.G. [6]

[b] Determine the moment of ..... [10]

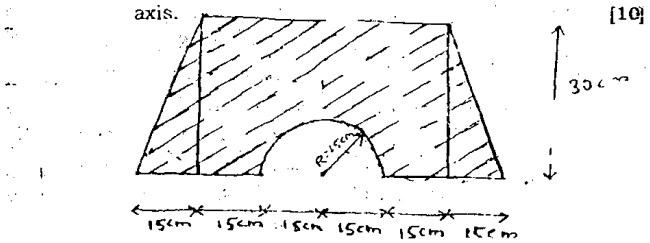


Fig. 2[b]

Q. [3] [a] Explain the terms elasticity, elastic limit, young's modules and modules of rigidity. [8]

[b] A member formed by connecting a steel bar to an aluminum bar is shown in fig. 3[b] of assuming that the bars are prevented form buckling sideways; calculate the magnitude of force p, that will cause the total length of the member to decrease 0.30 mm. The values os elasticity modulus for steel and aluminum are 2×10^5 N/mm^2 and 6.5×10^4 N/mm^2 respectively.

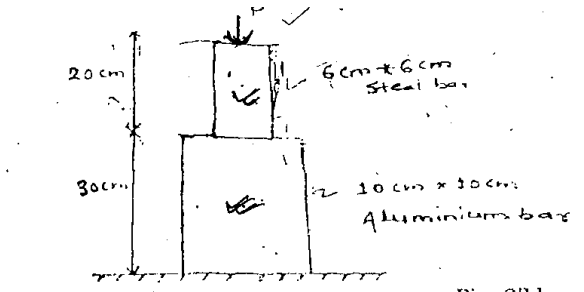


Fig. 3[b]

Contd

Q. [4] [a] .....constructing Mohr's circle in .....the analysis of principle stresses? [6]

[b] A rectangular clock of material is subjected to a tensile stress of 110N/mm^2 on one plane and a tensile stress of 4 N/mm^2 on the plane at right angles to the former. Each of the above stress is accompanied by a shear stress of 63N/mm^2 and that associated with the former tensile stress tends to rotate the block anticlockwise. Find [i] the direction and magnitude of each of the principal stress and [ii] magnitude of greatest shear stress. [10]

Q. [5] [a] Prove that in simple in bending of beam, the neutral axis passing through the centre of gravity (C.G) of the section. [8]

[b] A flectched beam consists of a wooden joist 150mm wide and 300mm deep strengthened by a steel plate 12mm thich and 300mm deep on either side of the joist. If the maximum stress in the wooden joist is 7 N/mm^2, find the corresponding maximum stess attained in steel. Find also the moment of resistance of the composite section. [Take E for steel = 2×10^5 N/mm^2 and for wood = 1×10^4 N/mm^2] [8]

Q. [6] [a] Two shafts of same material and of same lengths are subjected to the same torque, if the first shaft is of a solid circular-section and the second shaft is of hollow circular section, whose internal diameter is 2/3 of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the shaft. [8]

[b] A thin cylindrical shell of 120 cm diameter 1.5cm thick and 6m long is subjected to internal fluid pressure of 2.5N/mm^2. If the value of E=2×10^5N/mm^2 and poisson's ratio=0.3, calculate [i] change in diameter [ii] change in length and [iii] change in volume. [8]

Q. [7] Write short notes on (any FOUR): [4x4= 16]

[a] Elasticity and hardness

[b] Fatigue and fracture

[c] Thermal conductivity.

[d] Section module.

[e] Hoop stress.

PURBANCHAL UNIVERSITY

III SEMESTER FINAL EXAMINATION-2003

LEVEL: B. E. (Electronics & Communication)

SUBJECT: BEG250CI, Mechanics & Properties of Solids.

Full Marks: 80

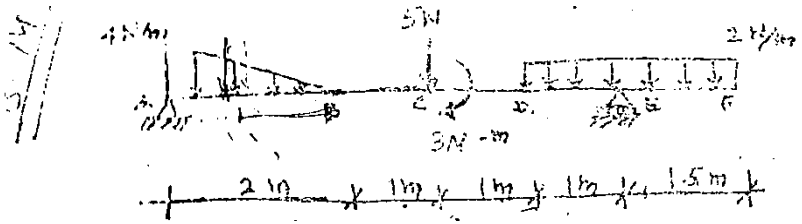
TIME: 03:00 hrs. **Pass Marks:** 32

Candidates are required to give their answers in their own words as far as practicable.

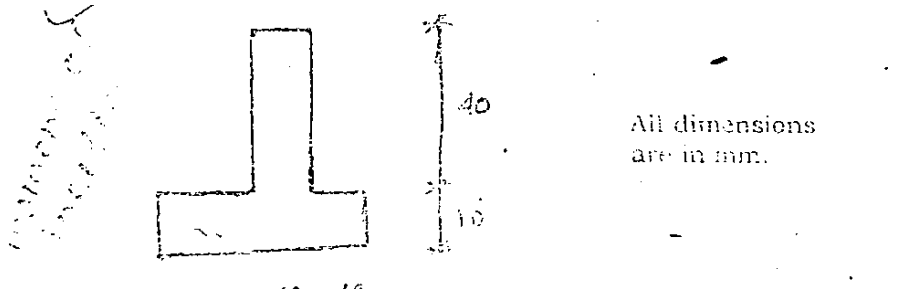
All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Attempt any FIVE questions

Q. [1] Draw a shear force and bending moment diagrams for the beam loaded as shown in Fig. [1]. Also locate salient point with values. [16]



Q. [2] Find the principle axis and principle moments of inertia for the fig. [2] [16]



Q. [3] [a] Define the terms stress, strain, ultimate stress, allowable stress and factor of safety. [8]

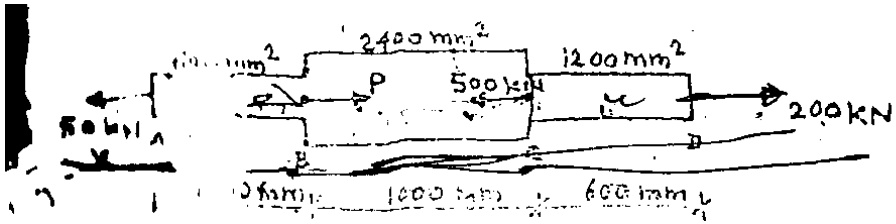
[b] A member ABCD is subjected to point loads as shown in fig. 3[b].

Calculate:

[i] Force P necessary for equilibrium.

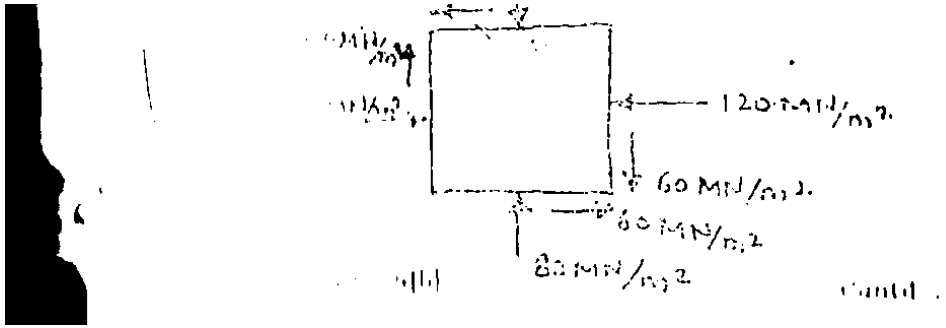
[ii] Total elongation of bar.

[Take E = 210 GN/m^2]



Q. [4] [a] Describe the method using Mohr's circle to determine principle planes and principle stresses. [8]

[b] The fig 4[b] shows the state of stress of a point in a two-dimensional stress body. Determine the magnitude and directions of the principle stress. [8]



[c] Thermal conductivity.

Q. [5] [a] A penstock pipe is 4.8m in diameter and stands 30m high. If the allowable working stress in tension is 120N/mm^2. What is the required wall thickness of the pipe? Assume the pipe is filled with water of specific weight 10KN/m^3 . [8]

[b] A hollow shaft has out side diameter 'd' and inside diameter 'd/2'. Calculate the value of 'd' if the shaft has to transmit 300KW at 120 rpm with working stress of 42N/mm^2. [8]

Q. [6] [a] Show the relationship between slope, deflection and radius of curvature. [8]

[b] Determine the dimensions of a joist of a timber for a span 8m to carry a brick wall 200 mm thick and 5m high, if the density of brick work is 1850kg/m^3 and the permissible stress is limited to 7.5 MN/m^2. Given that the depth of joist is twice the width.

Q. [7] Write short notes on (any TWO): [8×2=16]

[a] Yield point and strain hardening

[b] Heat treatment

PURBANCHAL UNIVERSITY

III SEMESTER BACK-PAPER EXAMINATION-2003

LEVEL: B. E. (Electronics & Communication)

SUBJECT: BEG250CI, Mechanics & Properties of Solids.

Full Marks: 80

TIME: 03:00 hrs. **Pass Marks:** 32

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Attempt any FIVE questions

Q. [1] [a] Draw the shear force diagram and bending moment diagram for the beam loaded as shown in Fig. [1]. Also, show the salient points. [6+8+2]

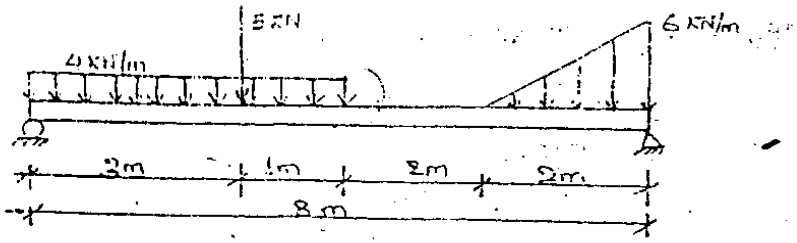


Fig. [1]

[b] Define principle moment of inertia. Find out the moment of inertia about the centroidal axes of the Fig. [2] [2+14]

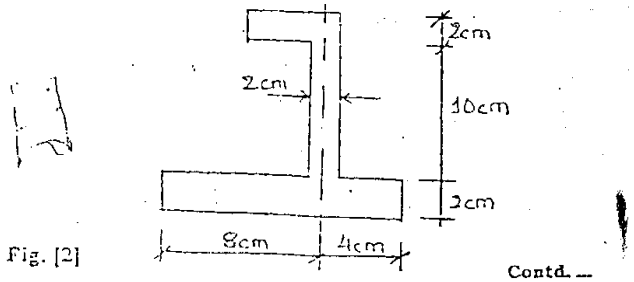
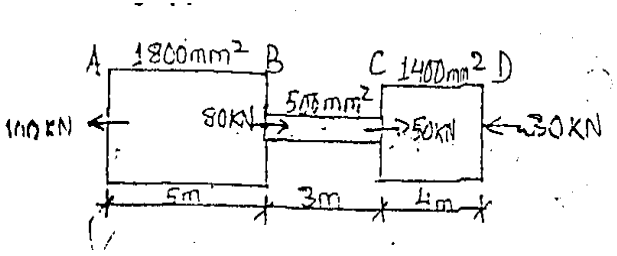


Fig. [2]

Contd....

Q. [3] [a] Explain Hooke's law of elasticity. Discuss,in brief, about the modulus of elasticity. Poisson's ratio and factor of safety. [6]

[b] A brass bar is subjected to the Axial forces as shown in fig. 3[b].



Determine the tensile and compressive forces in the different sections and also the total elongation of the bar. [Take E =80 GPa]

Q. [4] [a] What do you understand by principal stress, normal stress and shear stress? Explain, briefly, the effect of temperature on the stresses. [6+2]

[b] Determine the magnitude and directions of the principle stresses in the two dimensional stressed body as shown-in Fig. 4[b]. [8]

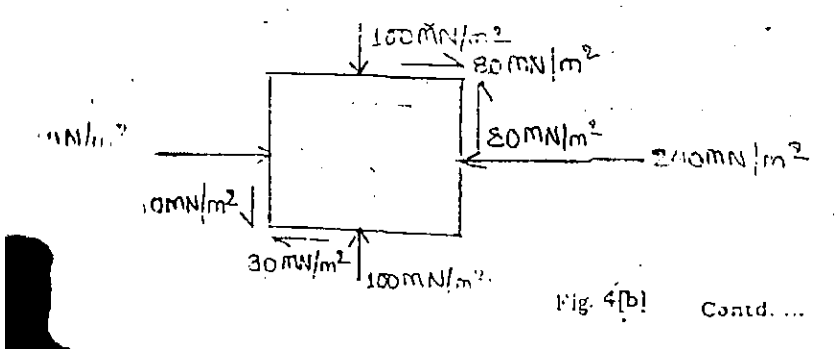


Fig. 4[b]

Contd. ...

Q. [5] [a] What do you understand by the deflection of beam? Show the relationship between the ..... deflection and radius of curvature.

[b] A wooden beam 140 mm wide and 240 mm deep a span of 4m. Determine the load that can be placed at its center to cause a deflection of 10 mm. [Take ..... 6GPa]

Q. [6] [a] A hollow shaft has to transmit 200 kw at 80 rpm the shear stress in the shaft is not to exceed 60 and internal diameter is 0.6 times the external diameter, find the diameters of the shaft.

[b] A thin cylindrical shell of a boiler of diameter is made up of 18 mm chick plates. Find circumferential and longitudinal stresses in plates, if the boiler is subjected to an in pressure of 2.4 MPa [Take efficiency of the join 70%]

Q. [7] ' Write short notes on (any FOUR):

[a] Elastic limit
[b] Composite beams
[c] Heat treatment
[d] Fatigue on loading.
[e] Radius of gyration.
[f] Ultimate stress.

PURBANCHAL UNIVERSITY

III SEMESTER FINAL EXAMINATION-2002

LEVEL: B. E. (Electronics & Communication)

SUBJECT: BEG250CI, Mechanics & Properties of Solids.

Full Marks: 80

TIME: 03:00 hrs. **Pass Marks:** 32

Candidates are required to give their answers in their own words as far as practicable.

All questions carry equal marks. The marks allotted for each sub-question is specified along its side.

Attempt any FIVE questions

Q. [1] [a] Define moment of intertia and Radius of gyration. [4]

[b] Draw the shearforce and bending moment diagrams for the beam loaded-as shown in Fig.-1[b]. [12]

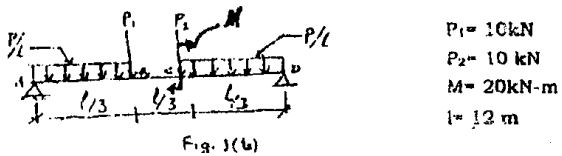


Fig. 1(b)

P_1 = 10kN
P_2 = 10 kN
M = 20kN-m
l = 12 m

Q. [2] [a] Given a beam section as shown in Fig.-2[a] for the loading condition of Fig.-1[b]. The allowable tensile a compressire are 150 MPa. Both. Calculate whether the beam is safe under bending. [10]

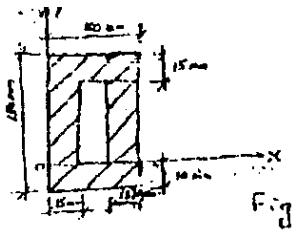


Fig. 2(a)

Contd. ...

[b] Explain in brief about ultimate stress, allowable stress, safety factor and stress concentration [6]

Q. [3] [a] Calculate moment of Inertia of the Fig.-3(a) with respect to X1 and Y1 axes. [10]

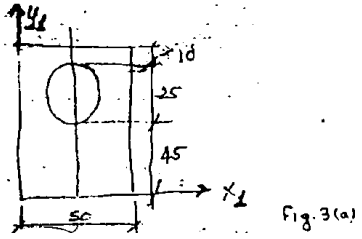


Fig. 3(a)

[b] Explain Thin Welled vessels and their stress characteristics. [10]

Q. [4] [a] Explain the Fatigue behaviour and Fracture in materials. [8]

[b] Determine δ_n and τ analytically and graphically if δ_x =150 MPa and ϕ=30° or ϕ=120° .By using the angle 30° and 120° isolate an element as shown in fig. 4(b) and show by arrows the directions of the stresses acting on the elements. [10]

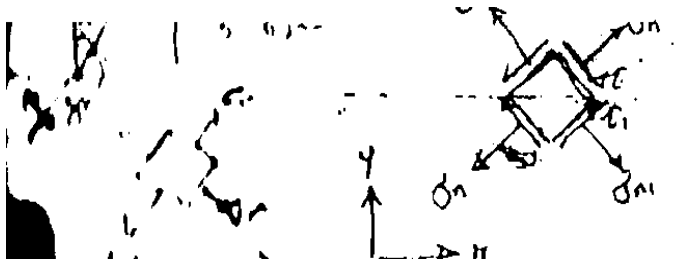


Fig. 4(b)

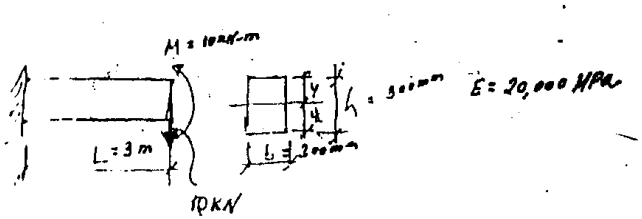


Fig. 7(a) Fig. 7(b)

(b) Explain Hooke's law in shear. [4]

Q. [5] [a] Explain the conception of strain energy in the example of an axially loaded bar. [8]

[b] Prove that the total torque.

If D=outer diameter of the shaft

d = inner diameter of the shaft.

τ = Maximum shear stress developed in the outer most layer of the shaft material. [8]

Q. [6] [a] Explain plastic bending conception. [6]

[b] steel plate is bent into a circular arc of radius 15 meters. If the plate selection be 100 mm wide and 15 mm thick, find the maximum stress induced and the bending moment which can produce this stress. Take $E=2*10^5$ N/mm^2 [10]

Q. [7] [a] Find the deflection at the end of the cantilever beam under loading as shown in Fig-7 . Assume necessary data if required. [12]