B.E. (Civil Engineering) Third Semester (C.B.S.)

Strength of Materials

P. Pages : 3 **NIR/KW/18/3293**

Time : Three Hours * 1 8 8 1 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
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7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Use of non programmable calculator is permitted.

1. a) A bar of steel is length ' ℓ ' and is uniform thickness 't'. The width of bar varies from 'a' at one end to 'b' at other end. Find the extension of the rod when it carries an axial pull 'P'. **6**

b) A rigid bar ABC hinged at point A & supported by steel & Aluminum rod at B & C as shown in fig. 1 A load of 20 kN is applied at point D. Find the stress induced and the elongation of both rods. **7**

$A_{St} = 1000\,mm^2,\ \ell_{St} = 2000\,mm$

$A_{Al} = 100\,mm^2,\ \ell_{Al} = 500\,mm$

Take, $E_{St} = 2\times10^5\,N/mm^2,\ E_{Al} = 0.8\times10^5\,N/mm^2$

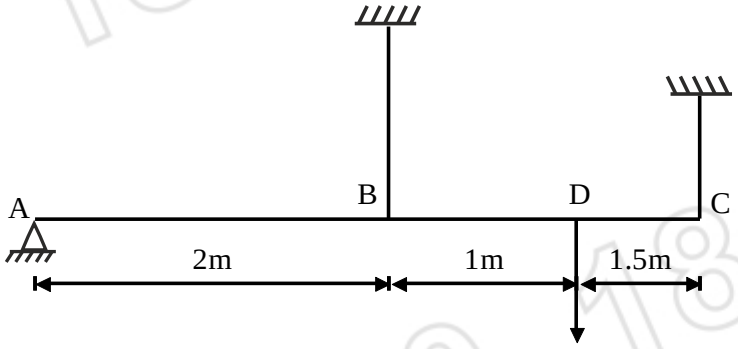

fig. 1

OR

2. a) A flat bar of steel 20 mm wide and 5 mm thick is placed between two aluminum bars each 20 mm wide & 7.5 mm thick to form a composite bar of $20\times20\,mm$. These bars are fastened together at their ends. When the temp. of each is 20ºC, find the stresses in each when temp. of whole assembly is raised to 70ºC. **7**

$\alpha_S = 12\times10^{-5}/^oC,\ E_S = 2.1\times10^5\,N/mm^2,$

$\alpha_Q = 24\times10^{-5}/^oC,\ E_Q = 0.71\times10^5\,N/mm^2$

b) Define Poisson's ratio and state the relation between three elastic constant E, G and K. **6**

3. a) Draw SFD & BMD for simply supported beam subjected to UDL of intensity w kN/m throughout the span. **4**

b) A Simply Supported Beam of 8 m. span is subjected to point load of 20 kN at 2 m. from left end and clockwise moment of 40 kN-m at centre of span. Draw SFD & BMD. **10**

OR

4. Draw SFD and BMD for the loaded beam shown in fig. 2 and also find point of contra flexure if any **14**

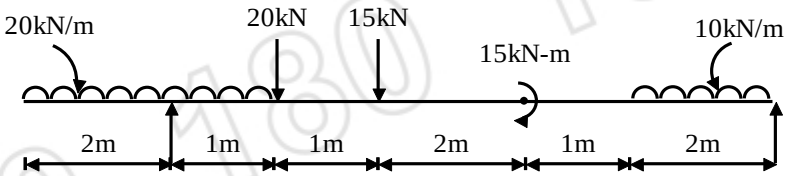

fig. 2

5. a) Derive the bending stress formula for a beam subjected to transverse loading. **7**

b) Prove that in circular section the maximum shear stress intensity is equal to (4/3) of average shear stress. **6**

OR

6. A Simply supported beam having I – cross section as shown in fig. 3 is subjected to UDL of 15 kN/m over entire length of beam i.e. 8 m. Calculate bending stresses in tension & compression zone. Also draw stress distribution diagram. **13**

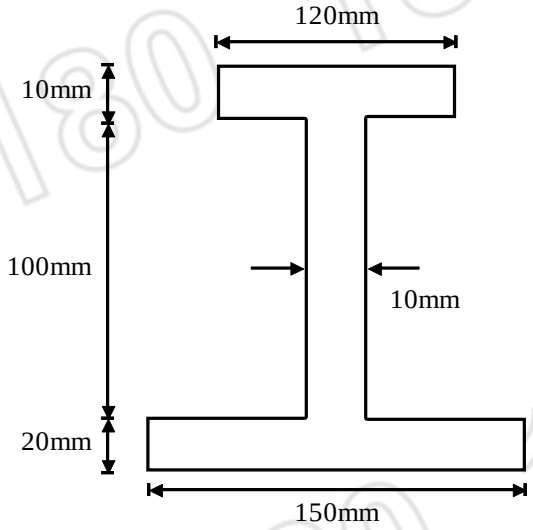

fig. 3

7. a) Draw torsion formula with suitable assumptions for circular cross section. **7**

b) Show that a hollow circular shaft whose internal diameter is half the outer diameter has a torsional strength equal to 15/16 of that of a solid shaft of the same outer diameter. **6**

OR

8. A shaft is required to transmit 245 KW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed $40\,N/mm^2$ & twist 1^o per meter length. Determine the diameter required if (a) The shaft is solid. (b) The shaft is hollow with external diameter twice the internal diameter. Take $G = 80\,kN/mm^2$. **13**

9. a) Derive differential equation of moment curvature relation of beam. **8**

b) Find the deflection of simply supported beam of length L carrying a point load at centre in terms of EI. **6**

OR

10. Calculate slope at A and deflection at B for the beam shown in figure 4 in terms of EI. **14**

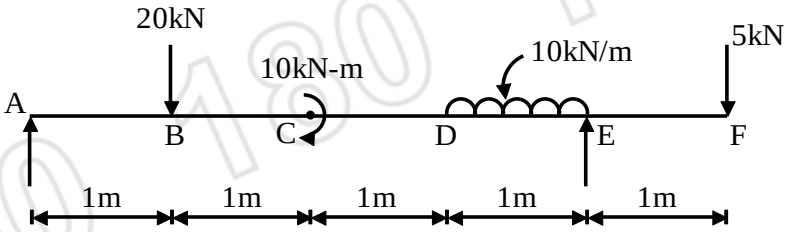

fig. 4

11. A point in strained material is subjected to stress as shown in figures find, **13**

i) Principal stress and it's position.

ii) Maximum shear stress and it's position.

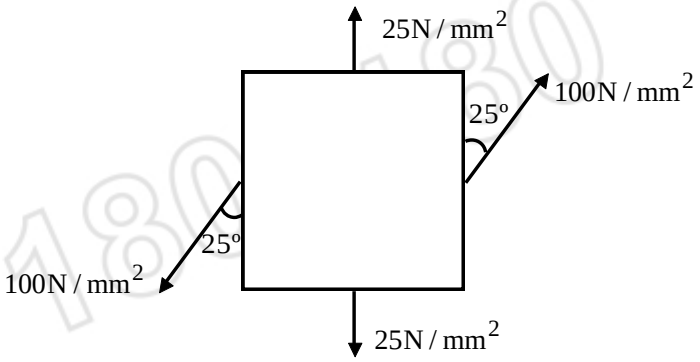

fig. 5

OR

12. At a point in a strained material there are two mutually perpendicular stress of **13**

$500\,N/mm^2(T)$ and $600\,N/mm^2(C)$. They are accompanied by shear stress of $100\,N/mm^2$. Calculate.

a) Principal Stress.

b) Position of principal plane.

c) Maximum Shear Stress.

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B.E. (Civil Engineering) Third Semester (C.B.S.)

Strength of Materials

P. Pages : 3 **NJR/KS/18/4348**

Time : Three Hours * 0 1 0 9 * Max. Marks : 80

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8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Use of non programmable calculator is permitted.

1. a) Define Poisson's ratio and state the relation between three elastic constants E, G and K. **7**

b) A thin cylindrical shell 0.75m in diameter and 2.5m long has a metal thickness 10mm. It is subjected to an internal fluid pressure of 2.5 MPa find the circumferential and longitudinal stresses in the wall. Also determine the changes in length, diameter and volume of the cylinder. Take E = 210 GPa and $\mu = 0.3$. **7**

OR

2. a) With the help of stress-strain curve for mild steel, explain the following terms :- **5**

i) Limit of proportionality. ii) Yield point.
iii) Ultimate stress. iv) Breaking point.

b) The composite bar consisting of steel and aluminium components shown in fig. 1.

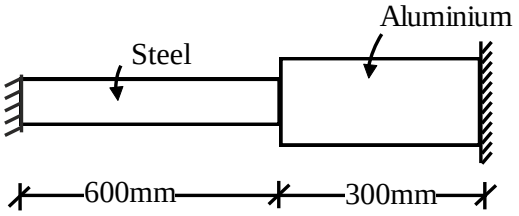

Fig.1

is connected to two grips at the ends at a temperature of 50ºC. Find the stresses in the two rods when the temperature falls to 15ºC.

i) If the ends do not yield. **4**

ii) If the ends yield by 0.20mm. **5**

Take $E_s = 2x10^5 N/mm^2$; $E_a = 0.70x10^5 N/mm^2$

$\alpha_s = 1.17 x10^{-5} per^o/C$, $\alpha_a = 2.34x10^{-5} per^o/C$.

$A_s = 225 mm^2$, $A_a == 350 mm^2$.

3. a) Write properties of shear force diagram. **3**

b) Write properties of bending moment diagram. **3**

c) Derive the relationship between load, shear force and bending moment. **7**

OR

4. Draw shear force and bending moment diagram for the beam shown in fig. 2 and locate the point of contraflexure if any. **13**

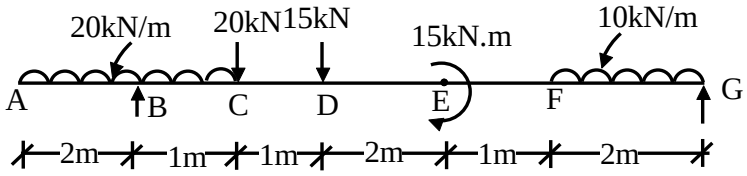

Fig. 2

5. A bar of T section symmetrical about the vertical Centre line has a 160mm wide and 20mm thick flange and a 120mm deep and 20mm thick web. The member is acted upon by a longitudinal pull P which acts on the section at a point on the vertical central line and is 50mm from the bottom edge of the web. Determine the magnitude of the maximum pull which can be applied if the maximum allowable tensile stress on the section is 80 MPa. Also find the minimum stress on the section when the pull P is transmitted. **13**

OR

6. a) Derive the bending formula and give the three assumption in theory of simple bending. **9**

b) Draw a typical shear stress distribution over following beam section subjected to a shear force. **4**

i) I-beam. ii) T-beam.

7. A solid shaft transmits 100kW at 150rpm. Determine the suitable diameter of the shaft if the maximum torque transmitted exceeds the mean by 20% in each revolution. The shear stress is not to exceed 60MPa. Also find the maximum angle of twist in a length of 4m of the shaft. G = 80 GPa. **13**

OR

8. Two solid shafts AC and BC of aluminium and steel are rigidly connected at "C" and attached to rigid supports at A and B. Shaft AC is 75mm in diameter and having length 2m. Shaft BC is 55 mm diameter and having length 1m. A torque of 200N-m was applied at junction "C". Compute the maximum shearing stress in each material. What is the angle of twist at the junction? **13**

$G_{al} = 3\times10^4\ N/mm^2$ and $G_{st} = 9\times10^4\ mm^2$.

9. Calculate slope at A and deflection at B for the beam shown in fig. 3 in terms of EI. **13**

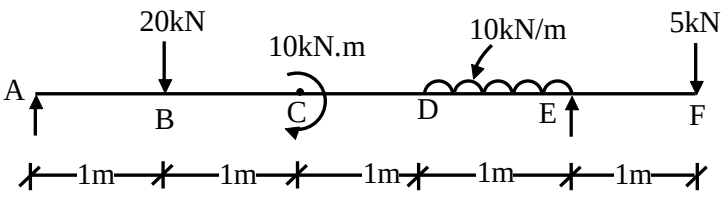

Fig. 3

OR

10. A simply supported beam of 8m length carries two point loads of 60kN and 45kN at 1m and 4m respectively from the left hand end. **13**
Find the deflection under each load and maximum deflection.
E = 210 GPa and I = 180 x 10^{-6} mm^4.

11. A point in strained material is subjected to stress as shown in fig. 4. **14**
Find
i) Principal stress and its position.
ii) Maximum shear stress and its position.

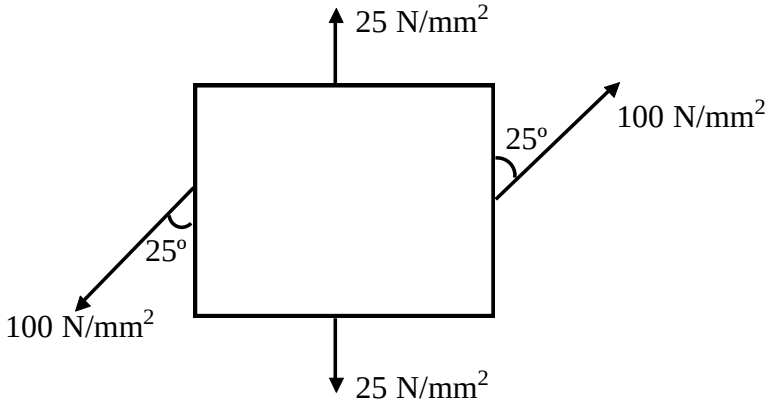

Fig.4

OR

12. For the stressed element as shown in fig. 5 find the following. **14**
i) Normal and tangential stresses on the inclined plane making 30º clockwise with X-axis.
ii) Principal stresses and principal planes location.
iii) Maximum shear stress and its location.

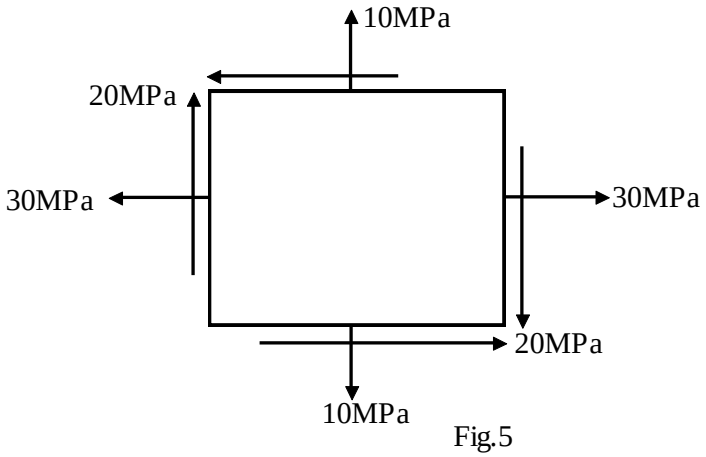

Fig.5

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B.E. (Civil Engineering) Third Semester (C.B.S.)

Strength of Materials

P. Pages : 2 **NRJ/KW/17/4348**

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8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Diagrams and chemical equations should be given whenever necessary.
11. Illustrate your answers whenever necessary with the help of neat sketches.
12. Use of non programmable calculator is permitted.

1. a) Explain with neat sketch about stress-strain behaviour of mild steel under tension. **6**

b) Find the total elongation in steel rod as shown in Fig. 1. **7**

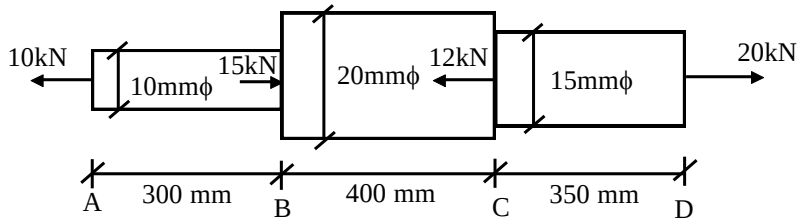

Fig. 1

OR

2. a) A composite section made up of copper rod 200mm diameter enclosed in steel tube of 150mm internal diameter and 12mm thick. Length of assembly is 600mm and fastened at both the ends. If temperature of rod is raised to 60ºC, find the stresses developed in each material. Take **7**

$E_s = 2x10^5\ N/mm^2$; $E_c = 1.05x10^5 N/mm^2$

$\alpha_s = 12x10^{-6}/^oC$; $\alpha_c = 17.5x10^{-6}/^oC$

b) Derive the relation between E; G & μ. **6**

3. A simply supported beam of 8m span is subjected to point load of 20 kN at 2m from left end and a clockwise moment of 40kN m at the centre of span. Calculate the support reaction and draw SFD & BMD. Locate point of contraflexure, if any. **13**

OR

4. Draw shear force & bending moment diagram for the fig. 2. Also locate point of contraflexure. **13**

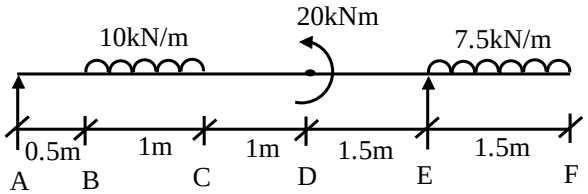

Fig. 2

5. A simply supported beam having I-cross section as shown in fig 3. is subjected to UDL of 15 kN/m over entire length of beam i. e. 8m. Calculate bending stresses in tension and compression zone. Also draw stress distribution diagram. **13**

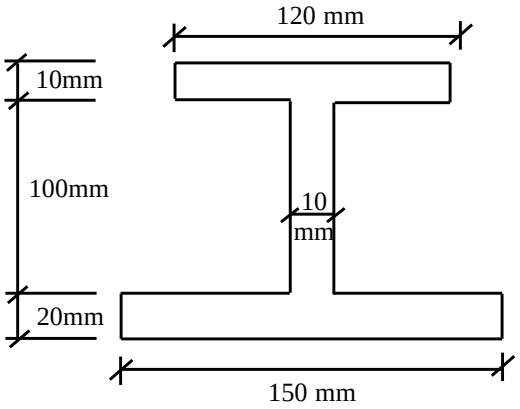

Fig. 3

OR

6. A simply supported beam having rectangular cross section of 230mmx400mm is subjected to udl of 40kN/m over a span of 1.5m. Calculate maximum shear stress for the section of beam. **13**

7. A shaft is required to transmit 200 kW power at 200 rpm. The maximum torque may be 1.2 times mean torque the shear stress in shaft should not exceed 40 N/mm^2 & permissible twist is 1º per meter length. Determine the diameter of shaft taking modulus of rigidity = $80kN/mm^2$. **13**

OR

8. a) Derive to torque equation stating the assumption made in torsional theory. **6**

b) A circular rod of 25mm diameter is applied with a clockwise torque of 200 kNm. Determine maximum shear stress and angle of twist, if G = 8000 MPa. **7**

9. a) Derive differential equation of flexural of beam. **6**

b) Find deflection of simply supported beam carrying a point load at center. **8**

OR

10. Find slope at A and deflection at C for fig. 4. **14**

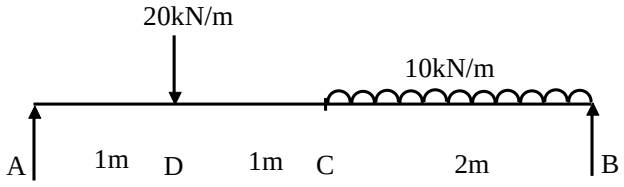

Fig. 4

11. At a point in a strained material there are two mutually perpendicular stress of 500 N/mm^2 (T) and 600 N/mm^2 (C). They are accompanied by shear stress of 100 N/mm^2. **14**
Calculate :-
a) Principal stress. b) Position of principal plane c) Maximum shear stress.

OR

12. Solve Q. 11 by Mohr circle method. **14**

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B.E. Third Semester (Civil Engineering) (C.B.S.)

Strength of Materials

P. Pages : 4 **NKT/KS/17/7208**

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9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Derive the relation between three elastic constant E, G & K. **7**

b) Find the force P acting at C in the bar shown in fig. 1. Find the extension of the bar if **7**
$E = 2 \times 10^5 \text{ MPa}$

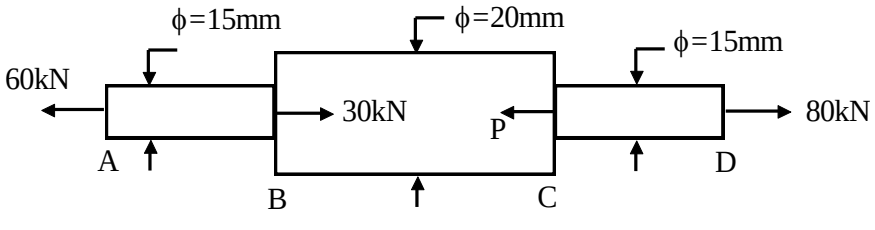

Fig. 1

OR

2. a) A bar of brass 25mm in dia. is enclosed in a steel tube of 50mm external dia. & 25mm internal dia. The bar and the tube are both initially 1.5m long & are rigidly fastened at both ends using 20mm dia. pins. Find the stresses in the two materials when temperature rises from 30ºC to 100ºC. E for steel $= 200 \text{kN/mm}^2$, E for brass $= 100 \text{ kN/mm}^2$, $\alpha_s = 11.6 \times 10^{-6} /^o\text{C}$, $\alpha_b = 18.7 \times 10^{-6} /^o\text{C}$. **10**
Also find the shear stress induced in the pins.

b) With the help of strain-stress curve for mild steel, explain the following terms:- **4**
i) Limit of proportionality.
ii) Yield point.
iii) Ultimate stress.
iv) Breaking point.

3. Shear force diagram in fig. 2 for a beam which rests on two supports, one being on the left hand end Deduce directly form the shear force diagram. **13**

i) The bending moment at 2m interval along the beam

ii) The loading on the beam

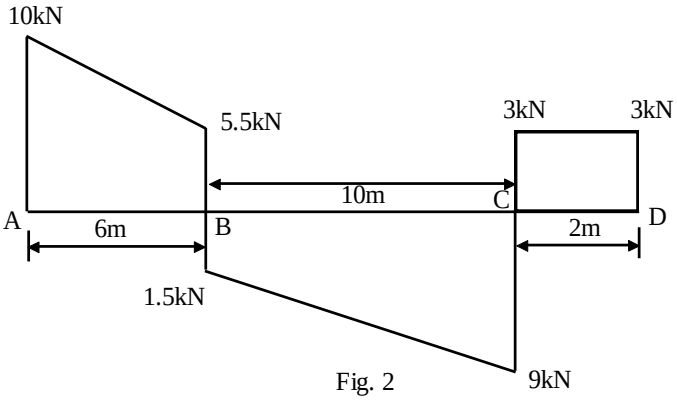

Fig. 2

OR

4. Draw shear force & bending moment diagram for the beam shown in fig. 3. & define point of contra-flexure. **13**

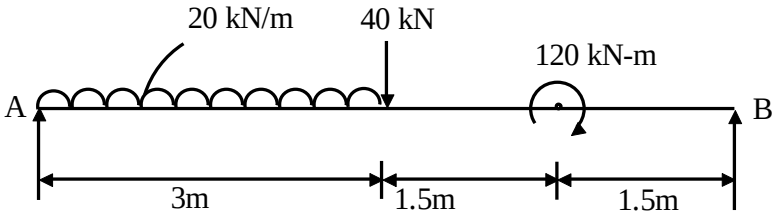

Fig. 3

5. Derive the Bending formula & give the assumptions in theory of simple bending. **13**

OR

6. A simply supported beam carries a udl of 30kN/m over a span of 1.0m. The cross-section of beam is a T section having diamensions as shown in fig. 4. Calculate the maximum shear stress for the section of the beam. **13**

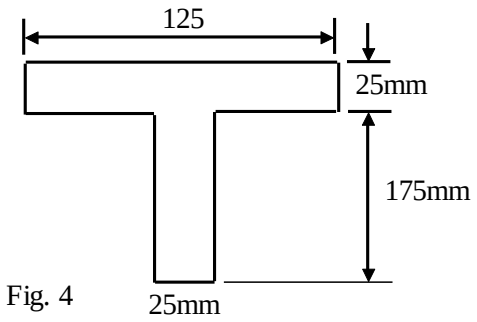

Fig. 4

7. A shaft is required to transmit 245 kw power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40N/mm^2 & the twist 1^o per meter length. Determine the diameter required if **13**

a) The shaft is solid.

b) The shaft is hollow with external diameter twice the internal diameter

Take modulus of rigidity = 80 kN/mm^2.

OR

8. a) A hollow shaft of circular cross section is to have an inside dia. one half of outside dia. shaft is to be designed to transmit 60kw at 500 rpm. The allowable shear stress is $35N/mm^2$ for this shaft calculate **10**

i) External diameter
ii) Angle of relative twist in degrees between two sections 2m apart.
iii) Percentage difference in the weight of hollow shaft as compared with the weight of solid shaft designed for the same condition

$G = 8.4 \times 10^4 \text{ N/mm}^2$.

b) Explain Assumptions in the theory of pure torsion. **3**

9. Beam AB simply supported at both ends carries load as shown in figure 5 **13**
Calculate :

a) Slope at pt 'A'
b) Deflection at pt 'D'
c) Maximum deflection.

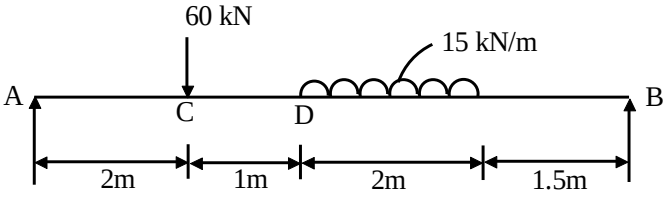

Fig. 5

OR

10. Calculate the deflection under point load for the beam shown in fig 6. by Macauley's method in terms of EI. **13**

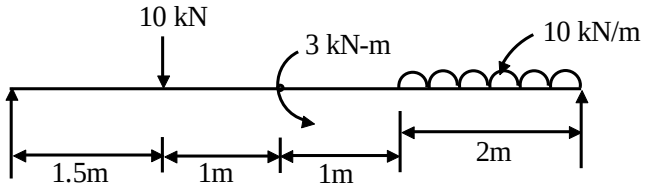

Fig. 6

11. A mild steel plate is stressed as shown in fig. 7 Before stressing, a circle of 300mm dia. is drawn on the plate. Determine the lengths & directions of the major & minor axes of the ellipse into which the circle deforms after stressing. Poisson's ratio = 0.3, modulus of elasticity $= 200 \text{ kN/mm}^2$. **14**

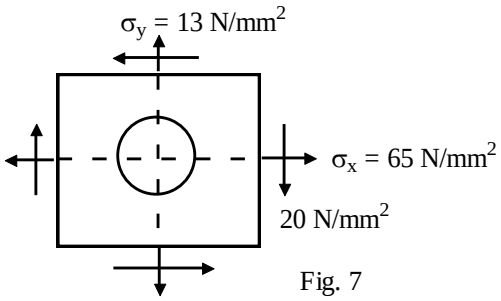

Fig. 7

OR

12. A point in strained material is subjected to stress as shown find **14**

i) Principal stress & its position

ii) Maximum shear stress & its position

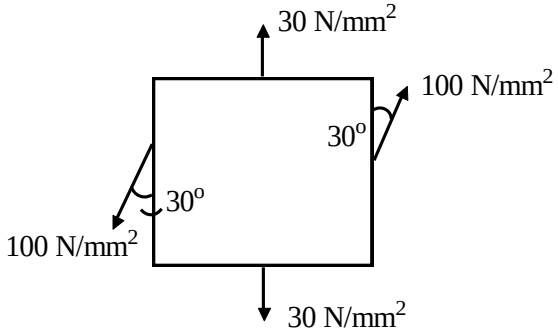

Fig. 8

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B.E.(Civil Engineering) Semester Third (C.B.S.)

Strength of Materials

P. Pages : 3 **KNT/KW/16/7208**

Time : Three Hours * 0 8 9 8 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Draw stress strain curve for mild steel under tension and explain the salient points. **6**

b) A thin cylindrical shell 1 m in diameter and 3 m long has a metal thickness 10 mm. It is subjected to an internal fluid pressure of 3 MPa. Find the circumferential and longitudinal stresses in the wall. Also Determine the changes in length, diameter and volume of the cylinder. Take E = 210 GPa and = μ 0.3. **7**

OR

2. a) Derive the equation relating E, G and μ. **6**

b) A composite section madeup of copper rod 150 mm diameter enclosed in steel tube of 150 mm internal diamater and 10 mm thickness. Length of the assembly is 500 mm and fastened at both the ends. If the temperature of the is raised to 60ºC, find the stresses developed in each material. **7**

$Es = 2 x 10^5 N/mm^2$; $Ec = 1.05 x 10^5 N/mm^2$

$\alpha S = 12X10^{-6}/^oC$; $\alpha c = 17.5 x 10^{-6}/^oC$

3. Draw SFD and BMD for the loaded beam shown in Fig. 1 and also find the point of contra flexure if any. **13**

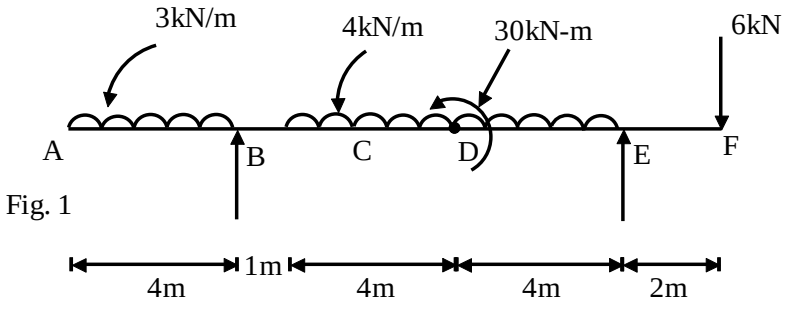

Fig. 1

4. Draw SFD and BMD for the loaded beam shown in Fig. 2 and also find the point of contra flexure if any. **13**

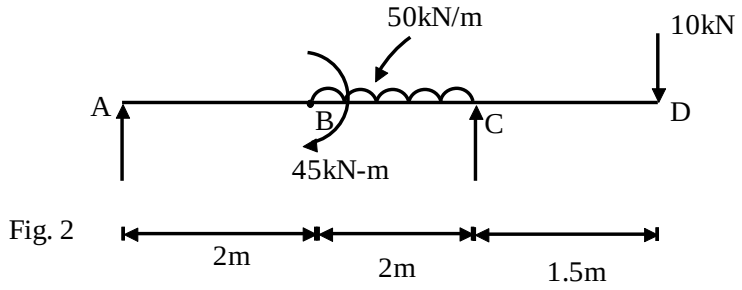

Fig. 2

5. a) Derive with suitable assumptions flexure formula. **7**

b) A simply supported beam of length 4 m carrying a UDL of 20 kN/m over it entire span. The beam is of I section with following data. Top flange 60 mm x 10 mm; web 10 mm x 100 mm and bottom flange 120 mm x 10 mm. Calculate bending stresses and draw the distribution diagram. **7**

OR

6. a) Find the dimension of the strongest beam that can be cut from the cylindrical log of wood with diameter 'D'. **6**

b) Prove in circular section the maximum shear stress intensity is equal to $\left(\frac{4}{3}\right)$ of average shear stress. **8**

7. a) A solid circular shaft is to transmit 300 kW at 100 rpm. If the shear stress in not to exceed 80 N/mm^2. find the diameter of the shaft. What % of saving in weight would be obtained if this shaft is replaced with hollow one whose internal diameter is 0.6 times of external diameter? The length, material and maximum shear stress being same. **13**

OR

8. Two solid shafts AC and BC of aluminum and steel are rigidly connected at 'C' and attached to rigid supports at A and B. Shaft AC is 75 mm in diameter and having length 2m. Shaft BC is 55 mm diameter and having length 1m. A torque of 200 Nm was applied at junction 'C'. Compute the maximum shearing stress in each material. What is the angle of twist at the junction? **13**

$G_{al} = 3x10^4\,N/mm^2$ and $G_{st} = 9x10^4\,N/mm^2$.

9. For the beam shown in Fig. 3, Calculate slope at point A, E and F. Also calculate deflection at point B and maximum deflection. **13**

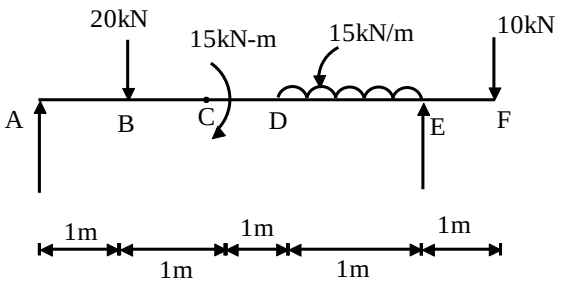

Fig:3

OR

10. For the beam shown in Fig. 4, Calculate slope at A and D. Also calculate deflection at B, C and maximum deflection. **13**

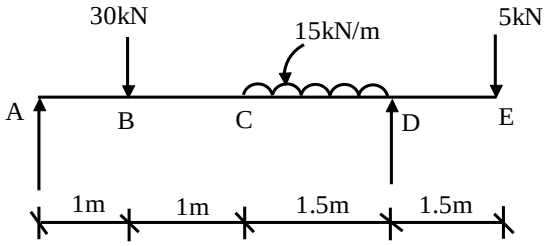

Fig:4

11. a) A circle of 400 mm diameter is scribed on a mild steel plate before it is subjected to stresses as shown in Fig. 5. Calculate the lengths of major and minor axis of the ellipse and also find their direction $\mu = 0.3; E = 205\ kN/mm^2$. **8**

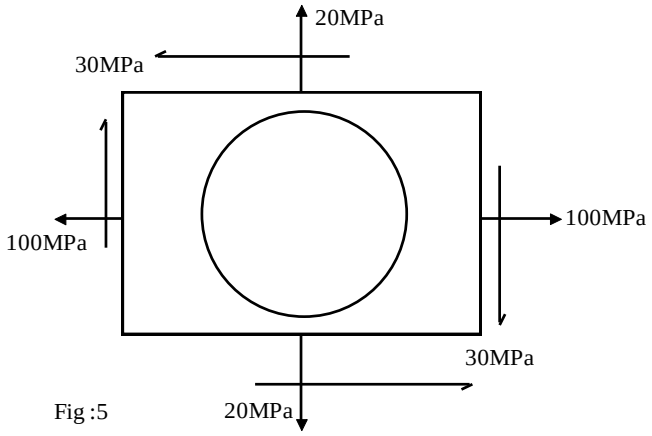

Fig :5

b) Principal stresses at a point in a material are p_1 and p_2 respectively. Calculate the resultant stress on the plane carrying maximum shear stress. **6**

OR

12. For the stressed element as shown in Fig. 6 find the following. **14**

i) Normal and tangential stresses on the inclined plane making 30º clockwise with X axis.

ii) Principal stresses and principal planes location.

iii) Maximum shear stress and its location.

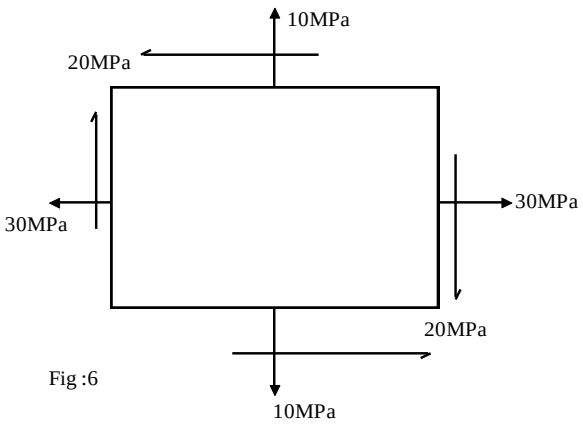

Fig :6

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B.E. (Civil Engineering) Third Semester (C.B.S.)

Strength of Materials

P. Pages : 3 **TKN/KS/16/7296**

Time : Three Hours * 0 9 2 2 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Assume suitable data whenever necessary.
3. Illustrate your answers whenever necessary with the help of neat sketches.
4. Use of non programmable calculator is permitted.

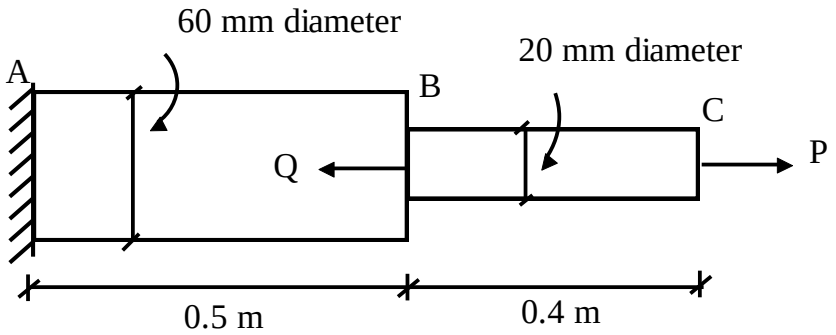
1. a) Define Poisson's ratio and state the relation between three elastic constants E, G and K. **8**

b) A 9 kN tensile load will be applied to a 50m length of steel wire with E = 200 GPa. Determine the smallest diameter of wire which can be used, knowing that the normal stress must not exceed 150 MPa and that the increase in the length of the wire should be at most 25 mm. **6**

OR

2. a) Draw stress – strain curve for mild steel under tension and explain the salient points. **6**

b) The rod ABC is made of an aluminium for which E = 70 GPa knowing that P = 6 kN, Q = 42 kN. Determine the deflection of (i) Point A (ii) Point B. **8**



3. a) Write properties of shear force diagram. **3**

b) Write properties of Bending Moment diagram. **3**

c) Derive the relationship between load, shear force and bending moment. **7**

OR

4. A beam 10m long has supports at its end A & B. It carries a point load of 2.5 kN at 3m from A and a point load of 2.5 kN at 7m from A and UDL of 0.5 kN/m between the point loads. Draw SFD and BMD. Locate the maximum B.M. Value. **13**

5. a) Derive the bending formula and give the three assumption in theory of simple bending. **7**

b) A hollow circular bar having outside diameter twice the inside diameter is used as a beam. From the bending moment diagram of the beam, it is found that the bar is subjected to a bending moment of 40 kN.m. If the allowable bending stress in the beam in to be limited to 100 MN/m^2. Find the inside diameter of the bar. **6**

OR

6. a) A beam of square section is used as a beam with one diagonal horizontal. Find the magnitude and location of maximum shear stress in beam. Sketch the shear stress distribution across the section. **9**

b) Draw a typical shear stress distribution over following beam section subjected to a shear force. **4**

i) I – Beam

ii) T – Beam

7. a) Determine the torque which may be applied to a solid shaft of 90mm outer diameter without exceeding an allowable shearing stress 75 MPa. **6**

b) Solve part (a) assuming that the solid shaft is replaced by a hollow shaft of the same mass and of 90 mm inner diameter. **7**

OR

8. a) A bar of rectangular section 50 mm x 25 mm in section is 600 mm long and is subjected to a torque of 275 N – m. **6**

Find the maximum shear stress induced and the angle of twist Take $C = 8 \times 10^4 \ N/mm^2$.

b) A hollow shaft is to transmit 300 kN at 80 r.p.m. If the shear stress is not to exceed $60\,N/mm^2$ and the internal diameter is 0.6 of the external diameter. Find the external and internal diameter assuming the maximum torque is 1.4 times the mean torque. **7**

9. a) Derive the differential equation of flexural of beam. **8**

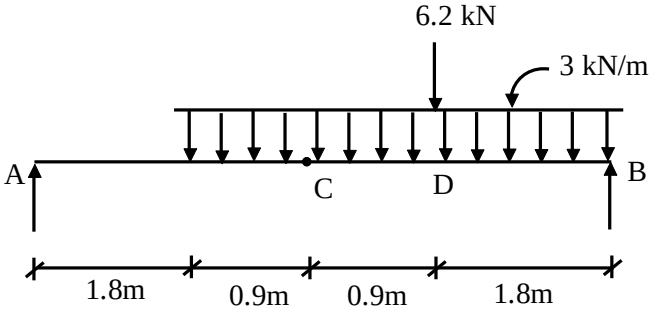
b) Find the deflection of cantilever beam loaded with concentrated load at free end. **6**

OR

10. For the beam shown in figure **14**
Determine :

a) Slope at the end A

b) Deflection at the mid point C.



11. a) Derive the differential equation of equilibrium under the body forces for state of stress in a two dimension for a strained material. **7**

b) Define the following terms. **6**

i) Principal Plane

ii) Principal Stresses

iii) Angle of Obliquity

OR

12. At a point in a strained material there are two mutually perpendicular stresses of $600\,N/mm^2$ and $400\,N/mm^2$ both tensile. They are accompanied by a shear stress of $100\,N/mm^2$. **13**

Find :

i) Principal stresses

ii) Position of principal planes.

iii) Maximum shear stress.

Compare the values using Mohr circle method.

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Third Semester B. E. (Civil Engineering) (CBS) Examination

STRENGTH OF MATERIAL

Time : Three Hours] [Max. Marks : 80

N. B. : (1) All questions are compulsory and carry marks as indicated.
(2) Due credit will be given to neatness and adequate dimensions.
(3) Assume suitable data wherever necessary.
(4) Use of Non–programmable pocket calculator is permitted.

1. (a) Derive the equation for elongation of bar of uniformaly tapering section. 4

(b) A bar show in fig. 1 is subjected to tensile force of 200 KN at each end.

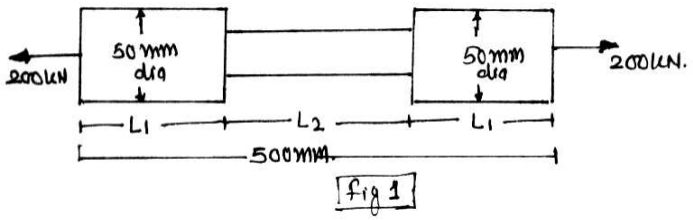


fig 1

Find :

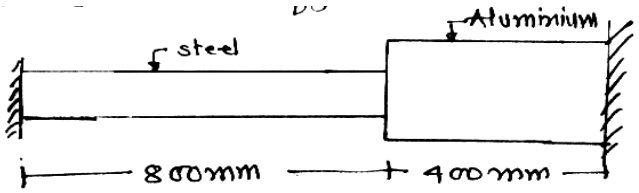
(i) The diameter of middle portion if the stress in the middle portion is limited to 150 N/mm^2 5

(ii) The length of the individual portion if the total elongation of the bar is limited to 0.30 mm
Take E = 200 kN/mm^2 5

OR

2. (a) A thin cylindrical pressure vessel of diameter 2.5 m and thickness 18 mm is subjected to an internal pressure of 1.2 N/mm^2. Find principal stresses. 4

(b) The composite bar consisting of steel and aluminium components shown in fig. 2



is connected to two grips at the ends at a temperature of 60^0C. Find the stresses in the two rods when the temperature falls to 20^0C.

(1) If the ends do not yield. 5

(2) If the ends yield by 0.25 mm

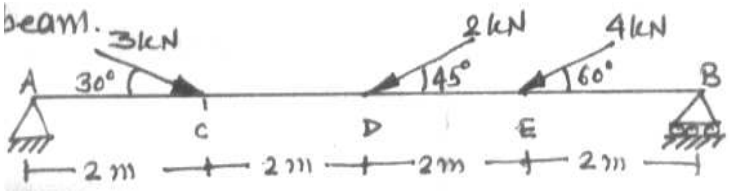
Take $E_s = 2 \times 10^5$ N/mm^2: $E_a = 0.70 \times 10^5$ N/mm^2

$\alpha_s = 1.17 \times 10^{-5}$ per^0/C: $\alpha_a = 2.34 \times 10^{-5}$ per^0/C

$A_s = 250$ mm^2 : $A_0 = 375$ mm^2 5

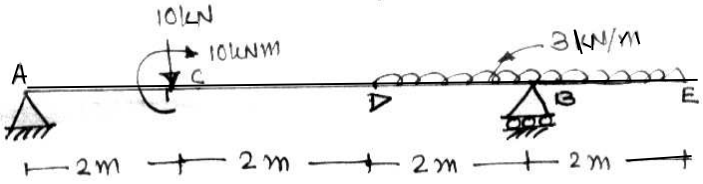
3. (a) Draw SFD and BMD for simply supported beam subjected to uniformly distributed Load of intensity w in kn/m through out the span. 4

(b) Construct the axial thrust and SF diagram for the Loaded beam.



OR

4. Construct the SF and BM diagram for the Loaded beam



13

5. A bar of T section symmetrical about the vertical centre line has a 160 mm wide and 20 mm thick flange and a 120 mm deep and 20 mm thick web. The member is acted upon by a longitudinal pull P which acts on the section at a point on the vertical central line and is 50 mm from the bottom edge of the web. Determine the magnitude of the max^{m} pull which can be applied if the maximum allowable tensile stress on the section is 80 MPa. Also find the minium stress on the section when the pull P is transmitted. 13

OR

6. Derive bending stress formulae for a beam subjected to transverse loading with suitable assumption. 13

7. Derive torsional formulae with suitable assumption for circular cross section. 13

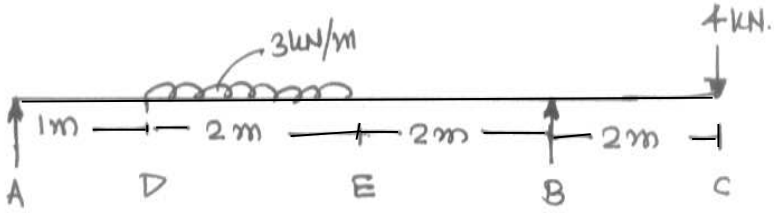
OR

8. A solid shaft transmits 100 kW at 150 rpm. Determine the suitable diameter of the shaft if the maximum torque transmitted exceeds. the mean by 20% in each revolution. The shear stress is not to exceed 60 MPa. Also find the maximum angle of twist in a length of 4m of the shaft. G=80 GPa. 13

9. A simply supported beam of 8 m length carries two point Loads of 64 kN and 48 kN at 1 m and 4 m respectively from the left hand end.
Find the deflection under each Load and the maximum deflection $E = 210$ GPa and $I = 180 \times 10^{-6}$ mm^4. 13

OR

10. An overhanging beam ABC. Supported at A and B is Loaded as shown in fig.



Determine the deflection at the free end and maximum deflection between A and B. Take $I = 600$ cm^4 and $E = 210$ GPa. 13

11. The principal stresses at a point in a bar are 200N/mm^2 (Tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60^0 to the axis of the major principal stress. Also determine. The maximum intensity of shear stress in the material at the point. 14

OR

12. At a point in a piece of elastic material the normal stresses on two mutually perpendicular planes are 80 N/mm^2 (Tensile) and 60 N/mm^2 (compressive). These planes also carry shear stress of 65 N/mm^2. Determine the principal plane, principal stress and maximum shear stress. 14