PART – C (1×15=15 Marks)

16. a) A steel tube of 300 mm external diameter is to be shrunk on to another steel tube of 90 mm internal diameter. After shrinking the diameter at the junction is 180 mm. Before shrinking on the difference of diameter at the junction is 0.12 mm. Find : i) The radial pressure at the junction ; ii) The circumferential stresses developed in the two tubes after shrinking on. Take E = 200 $GN/m^2$.

(OR)

b) Using Castigliano's theorem determine the horizontal and vertical displacements of the free end D in the frame shown in Fig.Q.No. 16 (b). Take EI = $12 \times 10^{13}$ $Nmm^2$.

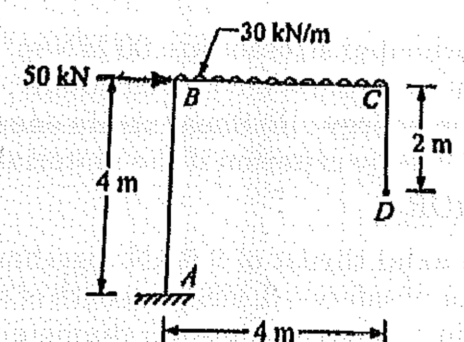


Fig.Q.No. 16 (b)

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Reg. No. :

# Question Paper Code : 90121

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Civil Engineering

CE 8402 : STRENGTH OF MATERIALS – II

(Regulations 2017)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. Recall Castigliano's first theorem.
2. List the causes of lack of fit in plane frames.
3. The right support of a fixed beam of 6m span sinks by 15 mm. Calculate the moment caused due to sinking of support. Take E = $2 \times 10^5$ $N/mm^2$ and I = $40 \times 10^5$ $mm^4$.
4. Determine the fixed end moments at the ends of a beam 4m long carrying a clockwise couple 'M' at the midspan.
5. Categorize loaded columns based on their end conditions.
6. Determine the Modulus of Rigidity of a thick cylinder made of a material having a Young's Modulus of 203$GN/m^2$ and Poisson's ratio of 0.287.
7. Recall Maximum Principal Strain Theory.
8. Comment on the failure criteria based on Maximum Principal Stress Theory.
9. Outline the two reasons of unsymmetrical bending of beams.
10. Mention the assumptions made in the analysis of curved beams using Winkler-Bach Theory.

PART – B **(5×13=65 Marks)**

11. a) A uniform metal bar has a cross-sectional area of 7 $cm^2$ and a length of 1.5 m. With an elastic limit of 160$MN/m^2$, what will be its proof resilience ? Determine also the maximum value of an applied load which may be suddenly applied without exceeding the elastic limit. Calculate the value of gradually applied load which will produce the same extension as that produced by the suddenly applied load above. Take E = 200 $GN/m^2$.

(OR)

b) A crane structure attached to a vertical wall and carrying a vertical load of 20 kN at C as shown in Figure Q.No. 11 (b). All tension members are stressed to 80$N/mm^2$ and all compression members to 50$N/mm^2$. Determine horizontal and vertical deflection of end C using unit load method. Take $E = 2 \times 10^5$ $N/mm^2$. All members, except CD, have a length of 2m.

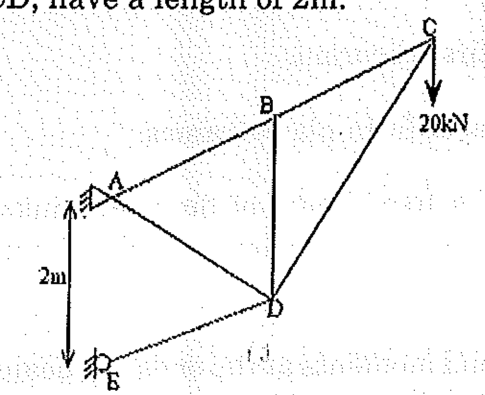


Fig. Q.No. 11 (b)

12. a) A simply supported continuous beam ABCD covers three spans, AB = 1.5 L, BC = 3L and CD = L. It carries uniformly distributed loads of 2w, w and 3w per meter run on AB, BC and CD respectively. If the girder is of the same cross-section throughout, find the bending moment and shear force at supports. Also plot bending moment and shear force diagrams using the theorem of three moments.

(OR)

b) A beam ABCD with simply supported ends, 16m long is continuous over three spans ; AB = 6m, BC = 5m and CD = 5m, the supports being at the same level. There is a uniformly distributed load of 20 kN/m over BC. On AB, there is a point load of 80kN at 2m span from A. On CD, there is a point load of 60 kN at 3m from D. Using theorem of three moments calculate the moments and reactions at the supports and draw bending moment and shear force diagrams.



13. a) A simply supported built-up beam of symmetrical I section has the following dimension. Flanges 30cm × 5cm and web 100cm × 2cm. Compute its length, given that when it is subjected to a load of 40 kN per metre length, it deflects by 1 cm. Find out the safe load, if this beam is used as a column with both ends fixed. Assume a factor of safety of 4. Use Euler's formula. E = 210$GN/m^2$.

(OR)

b) A cylindrical shell 3m long which is closed at the ends has an internal diameter of 1 m and a wall thickness of 15mm. Calculate the circumferential and longitudinal stresses induced and also change in dimensions of the shell if it is subjected to an internal pressure of 1.5$MN/m^2$. Take E = 200$GN/m^2$ and 1/m = 0.3.

14. a) In a material the principal stresses are 60 $MN/m^2$, 48$MN/m^2$ and -36$MN/m^2$. Take E = 200$GN/m^2$ and 1/m = 0.3 and calculate : i) Total strain energy ; ii) Volumetric strain energy ; iii) Shear strain energy ; and iv) Factor of safety on the total strain energy criterion if the material yields at 120 $MN/m^2$.

(OR)

b) A bolt is under an axial thrust of 9.6 kN together with a transverse force of 4.8 kN. Given factor of safety = 3, yield strength of material of bolt = 270 $N/mm^2$ and Poisson's ratio = 0.3, calculate its diameter according to i) Maximum principal stress theory; ii) Maximum shear stress theory ; and iii) Strain Energy Theory.

15. a) A simply supported beam of T-section (flange : 100 mm × 20 mm ; web : 150 mm × 10 mm) is 2.5 m in length. It carries a load of 3.2 kN inclined at 20° to the vertical passes through the centroid of the section. If E = 200 $GN/m^2$ calculate : i) Maximum tensile stress ; ii) Maximum compressive stress ; iii) Deflection due to the load ; and iv) Position of the neutral axis.

(OR)

b) A curved frame shown in Figure Q. 15(b) is subjected to a load of 2.4 kN. Determine the resultant stresses at points 1 and 2 and also the position of the neutral axis.

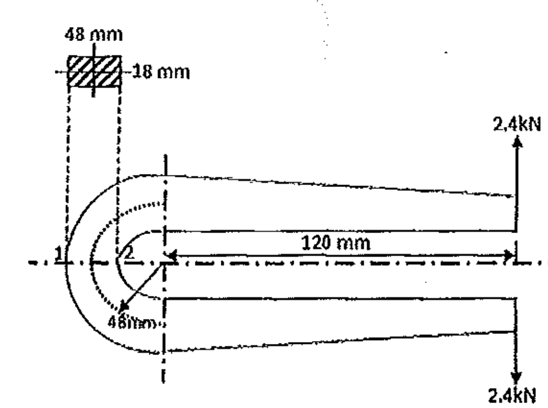


Fig. Q.No. 15 (b)