

4E1208

Roll No.:

Total No of Pages: 7

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B. Tech. IV - Sem. (Main) Exam., May - 2019

PCC Civil Engineering

4CE4 – 05 Strength of Materials

Time: 3 Hours

Maximum Marks: 120

*Instructions to Candidates:*

*Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.*

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination. (Mentioned in form No. 205)*

1. NIL

2. NIL

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**PART - A**

**(Answer should be given up to 25 words only)**

**[10×2=20]**

**All questions are compulsory**

- Q.1 Express the term Proof stress & yield point.
- Q.2 Give the difference between deformation & strain.
- Q.3 Write the application of Mohr's Circle.
- Q.4 State the point of contra-flexure & point of inflection.

- Q.5 Write the principle of simple bending.
- Q.6 Write the assumption of Euler's theory for columns.
- Q.7 Write the modes of failure of a column by crushing & buckling.
- Q.8 Describe Torque & application of Torsion. Also write the torsion formula.
- Q.9 Which method is effective method for finding out the deflection & why?
- Q.10 Write the Mohr's second theorem. <http://rtuonline.com>

## PART - B

(Analytical/Problem solving questions)

[5×8=40]

Attempt any five questions

Q.1 An overhanging beam ABC, supported at A and B is loaded as shown in figure (1).

Determine by double integration method.

- (i) Deflection at free end C
- (ii) Maximum deflection between A & B

Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $I = 450 \text{ cm}^4$

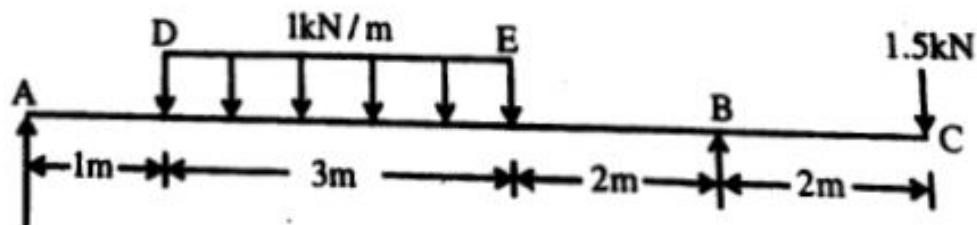


Figure (1)

Q.2 A simple beam AB is acted upon by couples  $\mu$  and  $2\mu$  at the ends, as shown in figure (2). Determine by Area moment method:

- (i) Slopes at A and B
- (ii) Deflection at the mid-span

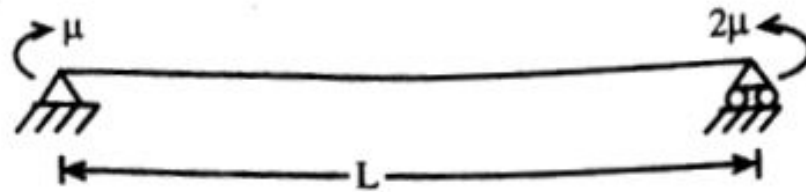


Figure (2)

Q.3 A shaft is transmitting 100 kW at 180 r.p.m. If the allowable stress in the material is  $60 \text{ N/mm}^2$ , determine the suitable diameter for the shaft. The shaft is not to twist more than  $1^\circ$  in a length of 3 metres. Take  $N = 80 \text{ N/mm}^2$ .

Q.4 Derive the equation of critical load, when one end is fixed and the other end is hinged.

Q.5 Construct the S.F. and B.M. diagrams for the beam shown in figure (3) and mark the values of the important ordinates.

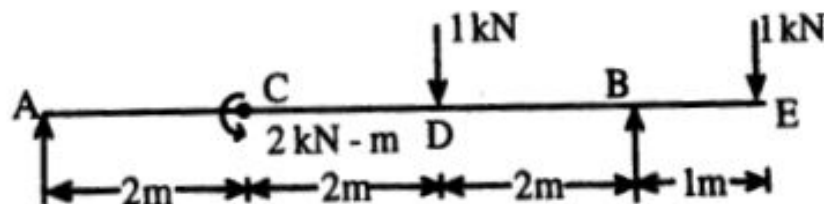
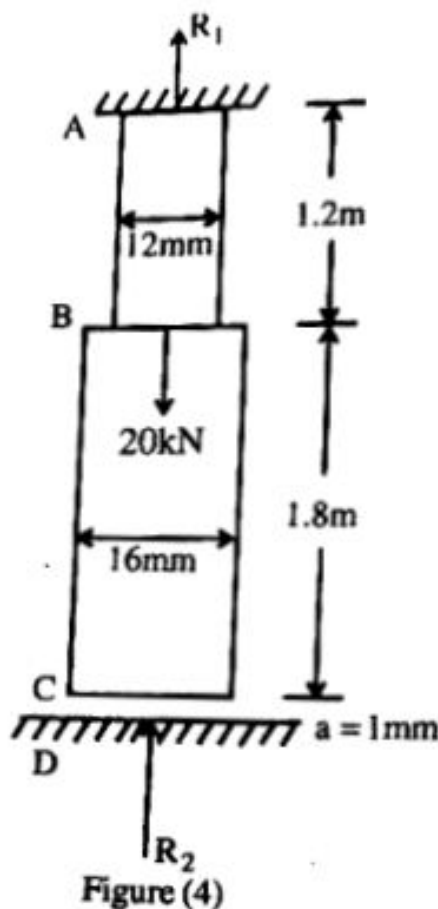


Figure (3)

Q.6 A composite bar ABC, rigidly fixed at upper support at A and hanging 1mm above the lower support D, is loaded as shown in Fig (4). Determine the reaction at the two supports and stresses in two sections.

Take  $E = 2 \times 10^5 \text{ N/mm}^2$ . The diameter of upper portion AB is 12mm and that of lower portion BC is 16mm. <http://rtuonline.com>



Q.7 At a point in a loaded specimen, the principle stresses acting on two mutually perpendicular planes are  $90 \text{ N/mm}^2$  and  $60 \text{ N/mm}^2$  both being compressive. Determine the resulting stress acting on a plane inclined at  $60^\circ$  measured clockwise to the plane on which the larger normal stress is acting.

## PART - C

(Descriptive/Analytical/Problem Solving/Design Questions)

[4×15=60]

Attempt any four questions

Q.1 Derive the secant formula by theoretical approach for columns.

Q.2 A beam, simply supported at the ends, is subjected to a point load  $\frac{W}{2}$ , eccentrically placed as shown in figure (5). Determine:

- (a) Slopes at the ends
- (b) Deflection under the load
- (c) Central deflection
- (d) Maximum deflection and its location

Solve this problem by using conjugate beam method & draw bending moment diagram in each case.

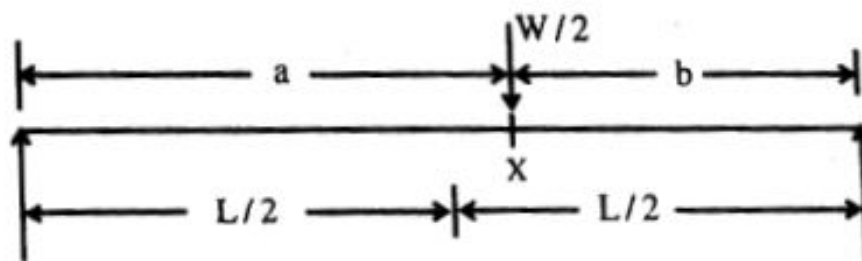


Figure (5)

Q.3 A beam ABCD is supported at A, C and D, has an internal hinge at B and is loaded as shown in figure (6). Draw the Bending moment and shear force diagrams, showing clearly the position and magnitude of maximum B.M. in the beam.

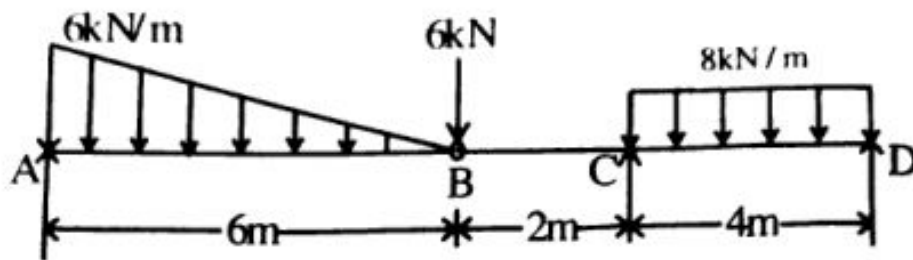


Figure (6)

Q.4 A rigid bar ABC is hinged at A and attached to brass bar BF (length 0.35m, area  $400\text{mm}^2$ ) and steel bar CD (length 0.3m and area  $250\text{mm}^2$ ). The temperature of brass bar BF is lowered by 30K and that of bar CD is raised by 30K. Neglecting any possibility of lateral buckling, find the normal stresses in the brass and steel. Take  $E = 0.9 \times 10^5 \text{ N/mm}^2$  and  $\alpha = 20 \times 10^{-6}$  per K for brass, and  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $\alpha = 12 \times 10^{-6}$  per K for steel. Refer figure (7).

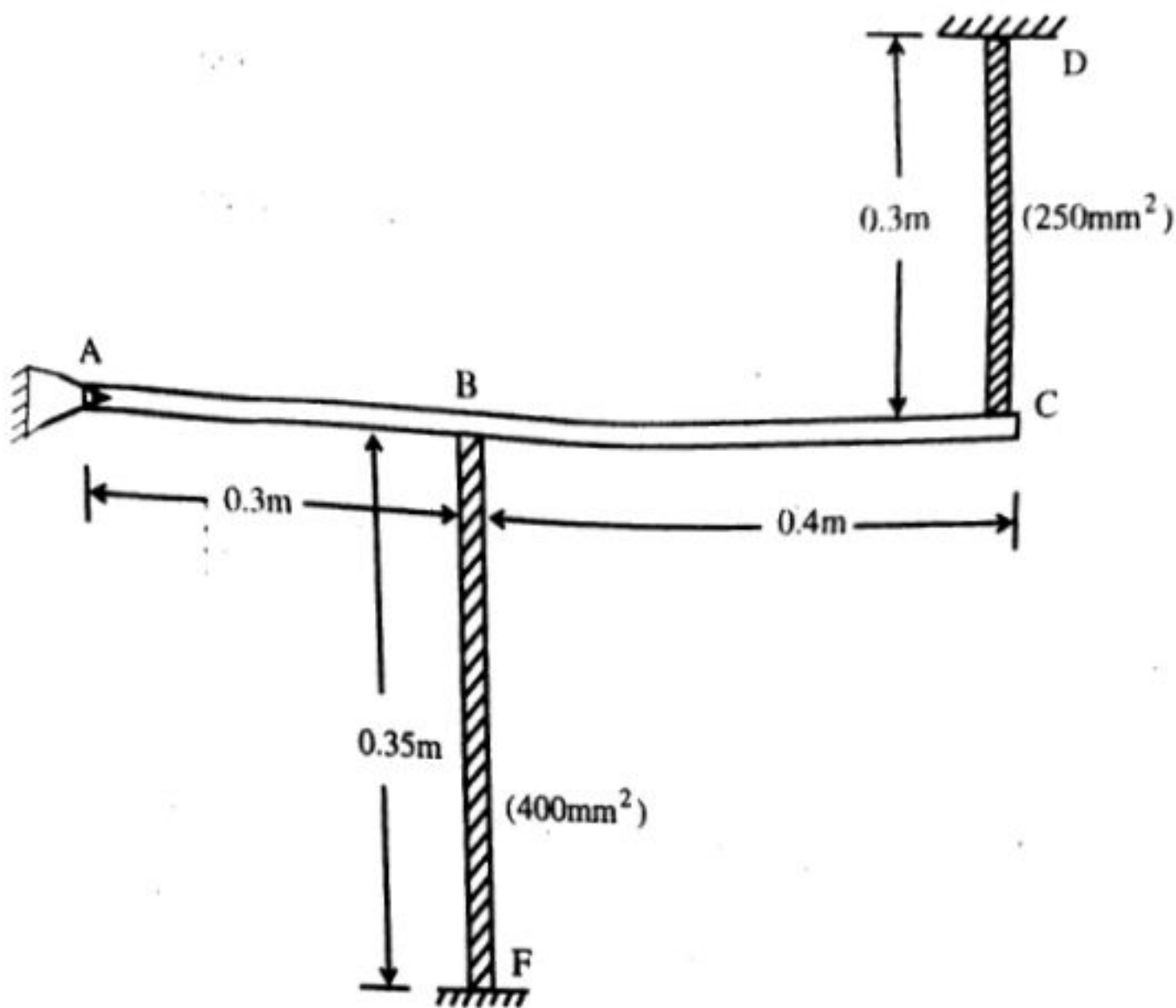


Figure (7)

Q.5 Compute the normal, shear and resultant stresses on any inclined plane by graphical method. Also write the procedure for construction of Mohr's circle and draw it.

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