Question Paper

Exam Date & Time: 07-May-2018 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
THIRD SEMESTER B.S (ENGG)
END-SEMESTER THEORY EXAMINATIONS APRIL - 2018
DATE : 7 MAY 2018
TIME : 9:30AM TO 12:30PM
STRENGTH OF MATERIALS [CE 232A]

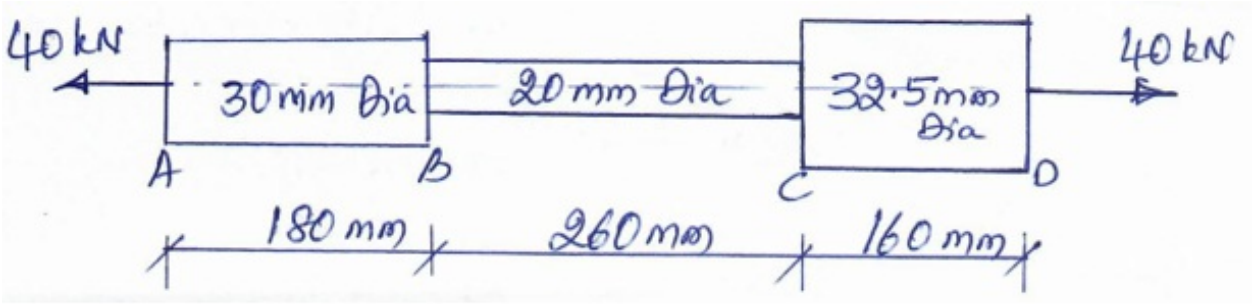
Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

Missing data if any may be assumed suitably.

1) A) Derive an expression for the elongation of a tapering rod having length 'L' and diameter 'D' at one end and 'd' at the other end when subjected to an axial tensile load of 'P' (8)

B) Find the stresses in the three parts of the bar shown in figure and total extension of the bar for an axial pull of 40 kN. Take E = 2 x 10^5 N/mm^2. (12)



2) A) With usual notations define the FOUR elastic constants. (8)

B) A reinforced concrete column is 300 mm x 300 mm in section. The column is provided with 08 steel bars of 20mm diameter. The column carries a load of 360 kN. Find the stresses in concrete and steel bars. (12)

Take E_{st} = 2.1 x 10^5 N/mm^2 and E_c = 0.14 x 10^5 N/mm^2.

3) A) Define Bending moment and Shear forces in beams. Give their relationships. (6)

B) A steel tube of 50 mm in external diameter and 3 mm thick encloses centrally a solid copper bar of 35 mm diameter. (14)

The bar and the tube are rigidly connected together at the ends at a temperature of 20^{o}C. Find the stress in each metal when heated to 170^{o}C. Also find the increase in length, if the original length of the assembly is 350 mm. Take E_{st} = 2 x 10^{5} MPa, E_{cu} = 1 x 10^{5} MPa, α_{st} = 1.08 x 10^{-5} per ^{o} C and α_{cu} = 1.7 x 10^{-5} per ^{o} C

4) Explain with examples (i) Section Modulus (Z) (ii) Simple or Pure bending (6)

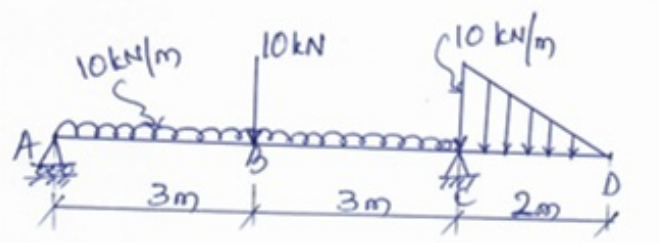
A)

B) A hollow cylindrical column of length 4.2m fixed at both ends carries an axial load of 250 kN. Design the column by Rankine's formula. Adopt a factor of safety of 5. The internal diameter may be taken as 0.8 times the external diameter. Take σ_c= 550 MPa and a = 1/1600 in the Rankine's formula. (14)

5) Define temperature stresses. Give its nature and mathematical relationship. (6)

A)

B) Draw BMD and SFD for the beam loaded as shown in the figure. Show the values at the salient points. (14)



6) Explain (i) Effective length of a column (ii) Short Column and Long Column. (6)

A)

B) A cast iron beam 2.75m long has one support at the left end and the other support at 0.75 m from the right end. The beam is of T section consisting of a top flange 150 mm x 20 mm and a web 20 mm wide and 80 mm deep. If the tensile and compressive stresses are not to exceed 40 MPa and 70 MPa respectively, find the safe concentrated load W that can be applied at the right end of the beam. (14)

7) Explain (i) Principal Stresses and Principal Planes (ii) Shear stress distribution across rectangular cross section. (6)

A)

B) A steel beam having uniform section is 14 m long and is simply supported at its ends. It carries concentrated loads of 120 kN and 80 kN at two points 3 m and 4.5 m from the (14)

two ends respectively. Moment of inertia for the section is 16×10^8 mm^4 and E = 210 kN/mm^2. Calculate the deflections under the two loads.

8) With usual notations obtain the maximum deflection for the cantilever beam carrying uniformly distributed load throughout the span. (6)

A) A hollow shaft with diameter ratio 3/5 is required to transmit 450 kW at 120 rpm. If the shear stress in shaft must not exceed 60 MPa and twist in a length of 2.5 m must not exceed one degree, calculate the required minimum external diameter for the shaft. Take the modulus of rigidity as 8×10^4 MPa (14)

B)

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