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KUMARAGURU
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B.E/B.TECH DEGREE EXAMINATIONS: APRIL /MAY 2024

(Regulation 2018)

Fourth Semester

CIVIL ENGINEERING

U18CET4004**:** Strength of Materials

COURSE OUTCOMES

CO1: Understand the deformation and strains under different load action and response in terms of forces and moments.

CO2: Apply engineering principles to calculate the reactions, forces and moments.

CO3: Analyze the state of stress in three dimension and structural members using various theories of failure.

CO4: Analyse the long and short columns and determine the design loads

CO5: Analyse the unsymmetrical sections and curved beams.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)

1.	Define strain energy.	CO1	[K_1]
2.	State Castigliano's first theorem.	CO1	[K_1]
3.	Find the reaction at prop for a propped cantilever subjected to concentrated load at centre.	CO2	[K_3]
4.	Mention the advantages of fixed beam over simply supported beam.	CO2	[K_1]
5.	Enlist the different theories of failure.	CO3	[K_1]
6.	Define principle stresses and principle plane.	CO3	[K_1]
7.	Write the expression for crippling load when both ends of the column are fixed.	CO4	[K_1]
8.	Compare column and strut.	CO4	[K_2]
9.	Outline the reasons for unsymmetrical bending.	CO5	[K_2]
10.	Identify the nature of stress in the inside section of a crane hook.	CO5	[K_2]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)

11.	Using Castigliano's theorem, determine the deflection under single concentrated load applied to a simply supported beam as shown in Figure.1. Take EI as 2.2 MN/m^2.	16	CO1	[K_3]

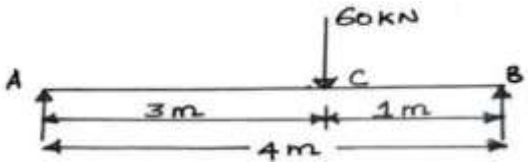

Figure.1

12.	A continuous beam ABC covers two consecutive span AB and BC of lengths 4 m and 6 m, carrying an UDL of 6 kN/m and 10 kN/m throughout the span respectively. If the ends A and C are simply supported, find the support moments at A, B and C. Draw shear force diagram and bending moment diagram.	16	CO2	[K_4]
13.	A mild steel shaft 120 mm diameter is subjected to a maximum torque of 20 kNm and a maximum bending moment of 12 kNm at a particular section. Determine the factor of safety according to the maximum shear stress theory if the elastic limit in simple tension is 220 MN/m^2.	16	CO3	[K_3]
14.	A solid round bar 3 m long and 5 cm in diameter is used as a column. Determine the crippling load when the column is used with following end conditions. i. Both ends are fixed. ii. One end fixed and other end hinged. iii. Both ends are hinged. iv. One end fixed and other end free.	16	CO4	[K_3]
15.	A 1.5 m long cast iron column has a circular cross section of 5 cm diameter. One end of the column is fixed in direction and position and the other end is free. Taking factor of safety as 3, calculate the safe load using i. Rankine-Gordon formula; take yield stress 560 MN/m^2 and a=1/1600 ii. Euler's formula; Young's modulus of cast iron=120 GN/m^2	16	CO4	[K_3]
16.	Find the resultant stresses at a point 1 and 2 for the frame subjected to a load of 2.4 kN as shown in figure.3. Also locate the position of neutral axis.	16	CO5	[K_3]

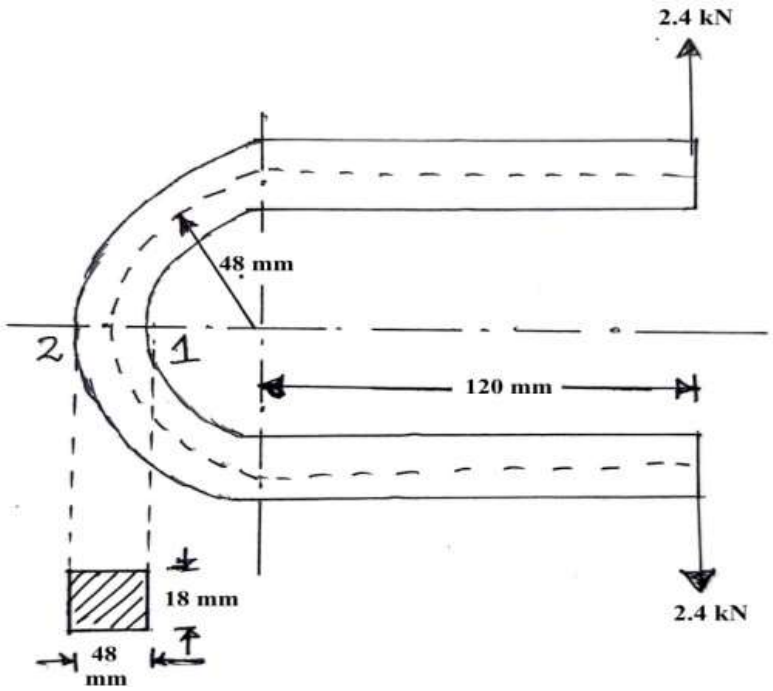

Figure.2

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