DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular End Semester Examination – Summer 2022

Course: B. Tech. **Branch : Mechanical Engineering** **Semester : IV**

Subject Name: Strength of Materials **Subject Code: BTMES404**

Max Marks: 60 **Date:24/08/2022** **Duration: 3.45 Hr.**

Instructions to the Students:

1. *All the questions are compulsory*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question*
3. *Use of non-programmable scientific calculators is allowed*
4. *Assume suitable data wherever necessary and mention it clearly*

		(Level/CO)	Marks
Q. 1	**Attempt Any Two**		
A)	Derive an expression for deformation of uniformly tapering circular cross-sectional body	(CO1)	**6**
B)	A composite bar made of copper, steel and brass is rigidly attached to the end supports as shown in figure 01. Determine the stresses in the three portions of the bar when the temperature of the composite system is raised by 70^0C when i) The supports are rigid ii) the supports yield by 0.6 mm. E_c = 100 GPa, E_s = 205 GPa, E_b = 95 GPa $\alpha_c = 18 \times 10^{-6} / {}^0C$, $\alpha_s = 11 \times 10^{-6} / {}^0C$, $\alpha_b = 19 \times 10^{-6} / {}^0C$	(CO2)	**6**

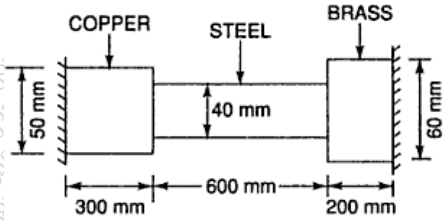

Figure 01

C)	A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 150 MPa on the other at right angle. Each of the above stresses is accomplished by a shear stress of 100 MPa such that when associated with the minor stress tends to rotate the element in anticlockwise direction. Find; i. Principal stresses and their direction ii. Maximum shear stress	(CO3)	**6**
Q.2	**Attempt Any Two**		
A)	A wagon weighing 20 kN is attached to a wire rope and is moving at the speed of 5.4 kmph. The rope suddenly jams and wagon is brought to rest. If length of rope is 50 m and diameter is 36 mm, find maximum instantaneous stress and elongation of rope. Take E = 200 GPa.	(CO2)	**6**
B)	A rectangular pier is subjected to a compressive load of 450 kN as shown in figure 02. Find stress intensities on all the four corners of the pier.	(CO3)	**6**

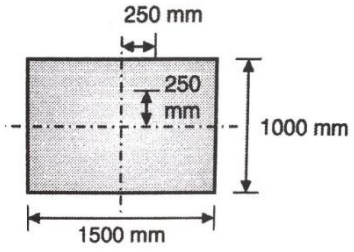

Figure 02

C) Interpret a relationship between rate of loading, shear force and bending moment (CO4) **6**

Q. 3 Attempt Any Two

A) An I-section beam 350 mm X 150 mm has a web thickness 10 mm & flange thickness 20 mm. If the shear force acting on the section is 40 kN, then find; (CO3) **6**

a) Maximum shear stress developed in the section
b) Sketch the shear stress distribution diagram
c) Total shear force carried by web

B) Derive an expression for Flexural equation along with assumptions (CO2) **6**

C) A beam of T-section, 4 m long carries a uniformly distributed load 'w' per meter run throughout its length. The beam is simply supported at its ends. The T-section has web 18.8 cm X 1.2 cm and flange is 10 cm X 1.2 cm. What is the maximum value of 'w', so that the stress in the section does not exceed 60 MPa? (CO3) **6**

Q.4 Attempt Any Two

A) Derive an expression for Torsional formula along with assumptions (Understand) **6**

B) A Hollow shaft with diameter ratio of 3/8 is required to transmit 500 kW at 100 rpm, the maximum torque being 20% greater than mean. The maximum shear stress is not to exceed 60 N/mm^2 and the twist in the length of 3 m is not to exceed 1.4°. Calculate the minimum diameter required for the shaft. (Apply) **6**
Take G = 84 N/mm^2.

C) A hollow CI column of external diameter 200 mm, length 4 meter with both the ends fixed, supports an axial load of 800 kN. Determine the thickness of the column required by using Rankine's formula taking constant of 1/6400 & working stress at 80 MN/m^2 (Apply) **6**

Q. 5 Attempt Any Two

A) Draw shear force and bending moment diagrams for the beam loaded as shown in figure 03

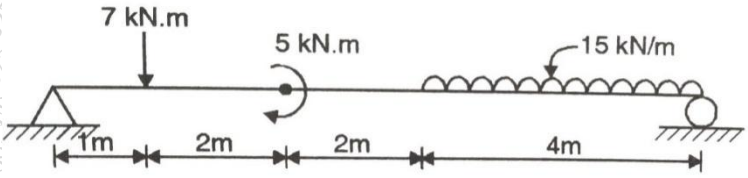

Figure 03 (CO4) **6**

B) Draw shear force and bending moment diagrams for the cantilever beam as shown in figure 04

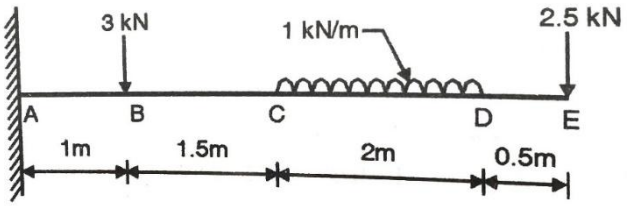

Figure 04 (CO4) **6**

C) A beam ABCD has an internal hinge at B and is loaded shown in figure 05. Plot shear force and bending moment diagrams and locate point of contra flexure. (CO4) **6**

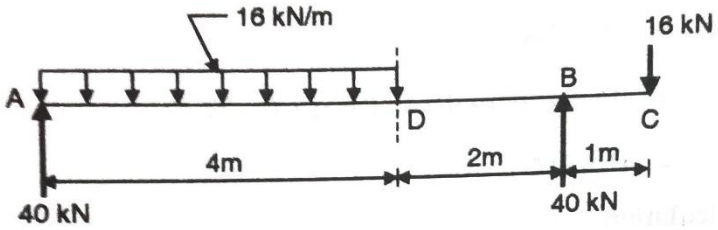

Figure 05

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