Exam Date & Time: 02-Jun-2023 (02:30 PM - 05:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

DEPARTMENT OF CIVIL ENGI NEERING IV SEMESTER B. TECH END SEM EXAM, MAY 2023 SUBJECT:STRENGTH OF MATERIALS Subject Code: CIE 4306 Date:02/06/2023 Time: 2:30 PM TO 5:30 PM MAX. MARKS: 50

STRENGTH OF MATERIALS [CIE 4306]

Duration: 180 mins.

Marks: 50

E

Answer all the questions.

Section Duration: 180 mins

1) Draw SFD and BMD for the single overhanging beam subjected to loading as shown in figure. Mark all salient points and inflection point.



B) Explain failure pattern in long columns and list any 4 assumptions made in Euler's theory for long (4)

1 of 3

columns.

- Draw the shear stress distribution for an inverted T section which carries a shear force of 12 kN. The section details of inverted T section is as follows: overall depth 80mm, width of flange 60mm, thickness of both flange and web 20mm each. The neutral axis is located at 30mm from the bottom. (6)
 - A)
 - B) A simply supported beam of rectangular cross section 100 mm wide and 200 mm deep has a span of 5 m. Find the maximum safe UDL, the beam can carry over the entire span, if the maximum bending stress not to exceed 10 MPa. (4)
- 3) A cantilever beam is subjected to the forces as shown in figure. Determine slope and deflection at the free end. Take moment of inertia = $60 \times 10^{-5} \text{ m}^4$ and E = 210 GPa.



B) Develop the equation for slope and deflection for the beam loaded as shown in figure using Macaulay's method. Determine the slope at support A and deflection at B. Take $EI=15 \times 10^3 \text{ kNm}^2$.

(5)



- 4) Show that a hollow shaft is stronger than a solid shaft of same material, length and weight subjected to pure tortion.
 - (5)

- A)
- B) A solid circular shaft has to transmit 150 kW of power at 200 rpm. If the allowable shear stress is 75 MPa and permissible twist is 1° in a length of 3m, determine the diameter of the shaft. Take G = 82GPa. (5)
- 5) A hollow cast iron column of one end fixed and hinged at other end has 150 mm external diameter and 100 mm internal diameter. The actual length of the column is 10 m. Determine the safe compressive load using Euler's formula with a factor of safety of 3. Take E=95 GPa. (5)
 - A)
 - B) Determine the Rankine's crushing load for a hollow cylindrical cast iron column, 150 mm external diameter and 20 mm thick, if it is 6m long and hinged at both ends. Take Rankine's constants are σ_c = 550 MPa and a =1/1600. (5)

-----End-----