CBCS Scheme

USN | | | | | | | | | | |

15MR34

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define Hooke's law and explain stress-strain diagram for mild steel with characteristic points. **(06 Marks)**

b. A member is subjected to point loads and total elongation in the member. Assume $E = 2.1 \times 10^5 \frac{N}{mm^2}$. Find load P_2 and stresses in each part. **(10 Marks)**

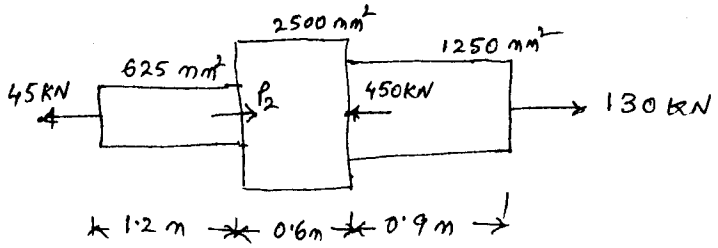


Fig.Q.1(b)

OR

2 a. Define thermal stress and thermal strain in a material. **(04 Marks)**

b. Obtain relation for Bulk modulus and modulus of elasticity. **(04 Marks)**

c. A circular rod of 0.10 meter diameter and 0.5 meter long is subjected to axial tensile load of 1000kN. Determine the modulus of rigidity, bulk modulus and the change in volume if the Poission's ratio $\mu = 0.3$, $E = 2 \times 10^5 \frac{N}{mm^2}$. **(08 Marks)**

Module-2

3 a. Define the principal stresses and principal planes. **(04 Marks)**

b. Obtain relation for longitudinal stress in thin cylinder with internal fluid pressure 'p' and thickness 't'. **(04 Marks)**

c. The state of stress at a point in a strained material is shown in Fig.Q.3(c). Determine:
   i) Direction of the principal planes.
   ii) Magnitude of principal stresses.
   iii) Maximum shear stress. **(08 Marks)**

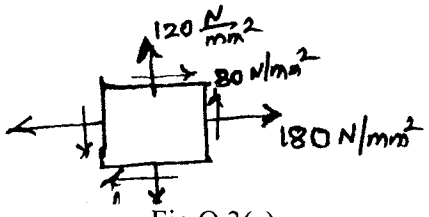


Fig.Q.3(c)

OR

4 a. Differentiate between thick and thin cylinders. **(06 Marks)**

b. Explain construction of Mohr's circle for stresses. **(06 Marks)**

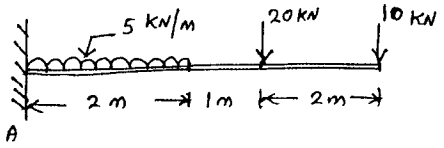
c. A thick cylinder of internal diameter 160mm is subjected to internal pressure of 40MPa. If the allowable stress in the material is 120 N/mm^2, find the external diameter of cylinder and thickness required. **(04 Marks)**

Module-3

5 a. Derive relation for maximum bending moment for simply supported beam with point load. **(06 Marks)**

b. Find maximum shear force and bending moment for given cantilever with loading, as shown. **(10 Marks)**

Fig.Q.5(b)

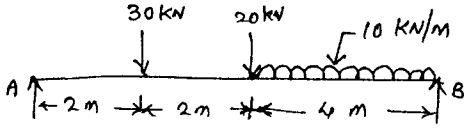


OR

6 a. Explain sign conventions for shear force and bending moment. **(06 Marks)**

b. Sketch shear force and bending moment diagrams for given beam, with point loads and udl. **(10 Marks)**

Fig.Q.6(b)



Module-4

7 a. What are the assumptions made in the bending theory? **(04 Marks)**

b. Prove that $\frac{M}{I} = \frac{E}{R}$ with usual notations. **(04 Marks)**

c. A simply supported beam of span 5m has a cross section 150mm × 250mm. If the permissible stress is 10 N/mm^2, find the maximum intensity of uniformly distributed load, the beam can carry. **(08 Marks)**

OR

8 a. Show that for a simply supported beam with point load W at mid span, the maximum deflection is $\frac{WL^3}{48EI}$. **(08 Marks)**

b. A simply supported beam of 6m span is subjected to point load of 18kN at 4m from left support. Find maximum deflection using Meculay's method. Assume E = 200GPa and I = 15 × 10^6 mm^4. **(08 Marks)**

Module-5

9 a. Obtain Torsional rigidity relation and state the assumptions made. **(08 Marks)**

b. A solid steel shaft transmits 100kW at 150rpm. Determine suitable diameter of the shaft, if the maximum shear stress is 60MPa. Find the maximum angle of twist, if the length of shaft is 4m. Assume modulus of rigidity is 80 GPa. **(08 Marks)**

OR

10 a. State assumptions made in Euler's theory for elastic long columns and derive relation for crippling load for column with one end fixed and other end free. **(08 Marks)**

b. A 2 meters long pin ended column of square cross section is made of material with E = 12GPa and allowable stress 12MPa. Determine the size of the column for supporting a load of 95 kN, with factor of safety of 3. **(08 Marks)**

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