**II B. Tech I Semester Supplementary Examinations, September - 2021**
**MECHANICS OF SOLIDS**
(Com to ME, AME)

Time: 3 hours　　　　　　　　　　　　　　　　　　　　　　　　Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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| | | | |
|---|---|---|---|
| 1 | a) | An axial pulls of 40 kN is acting on a bar consisting of three sections of length 30 cm, 25 cm and 20 cm and diameters 2 cm, 4 cm, 5 cm respectively, if E = 2 X $10^5$ N/mm$^2$. Determine (i) Stress in each section (ii) Total extension of the bar. | [8M] |
| | b) | When do temperature stresses develop in members? Derive expressions for temperature strain and stress. | [7M] |

Or

| | | | |
|---|---|---|---|
| 2 | | Explain the graphical method to determine principal stress, principal angles and normal and shear stresses on any inclined planes with respect to given references plane. | [15M] |
| 3 | | A simply supported beam of length 8 m rests on supports 6 m apart, the right hand end is overhanging by 2 m. The beam carries a uniformly distributed load of 1500 N/m over the entire length. Draw S.F. and B.M. diagram and find point of contra flexure, if any. | [15M] |

Or

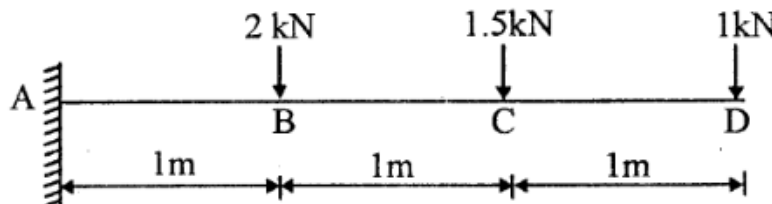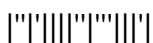| | | | |
|---|---|---|---|
| 4 | a) | A cantilever beam of length 3m carries the point loads as shown in fig.1. Draw the shear force and bending moment diagrams. | [10M] |



Fig.1

| | | | |
|---|---|---|---|
| | b) | Sketch and explain the various types of beams? | [5M] |
| 5 | a) | Starting from the fundamentals, derive the equation from the theory of simple bending | [8M] |

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

| | | | |
|---|---|---|---|
| | b) | A beam is simply supported and carries a uniformly distributed load of 40 kN/m run over the whole span. The section of the beam is rectangular having width and depth as 500 mm and 200 mm. If the maximums stress in the material of the beam is 120 N/mm$^2$, find the span of the beam. | [7M] |

Or

| | | | |
|---|---|---|---|
| 6 | a) | An I-section beam 350 mm x 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I-section. Also sketch the shear stress distribution across the section | [10M] |
| | b) | Draw the shear stress distributions for following cross sections. (i) Rectangular Section　　　(ii) T-Section | [5M] |

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7    A beam is loaded as shown in fig. 2 determine the deflection of the points C and    [15M]
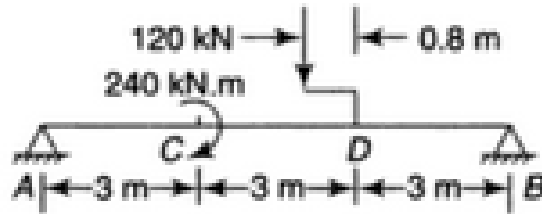D. Take EI= 90,000 kN-m$^2$.



Fig.2

Or

8   a)   What are the advantages of Macaulay's method over double integration method?    [7M]

   b)   A hollow shaft is to transmit 300kW power at 80rpm. If the shear stress is not to    [8M]
exceed 60N/mm$^2$ and the internal diameter is 0.6 times the external diameter,
find the external and internal diameters assuming that the maximum torque is 1.4
times the mean torque.

9   a)   Derive lame's equations with suitable assumptions    [8M]

   b)   A vessel in the shape of a spherical shell of 1.4m internal diameter and 4.5mm    [7M]
thickness is subjected to a pressure of 1.8 N/mm$^2$. Determine the stress induced
in the material of the vessel.

Or

10 a)   Derive an expression for the Euler' crippling load for a long column with one end    [7M]
fixed and other end free.

   b)   A hollow cast iron column 200 mm outside and 150 mm inside diameter, 8m    [8M]
long has both ends fixed. It is subjected to an axial compressive load. Taking the
factor of safety as 6, $\sigma_c$=560N/mm$^2$ and a=1/1600 for pinned ends, determine the
safe Rankine's load.

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