Reg. No. : | | | | | | | | | | |

Question Paper Code: 34705

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Fourth Semester

Mechanical Engineering

01UME405 – STRENGTH OF MATERIALS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Define principal planes and principal stresses.
2. State the relationship between Young's modulus and modulus of rigidity.
3. Write the equation for the simple bending theory.
4. Write down relations for maximum shear force and bending moment in case of a cantilever beam subjected to uniformly distributed load running over entire span.
5. Distinguish between closed coil helical spring and open coil helical spring.
6. What kind of stress introduced when an axial load acts on a closed and open coiled spring?
7. State the limitations of Euler's formula.
8. A cantilever beam of spring 2 *m* is carrying a point load of 20 *kN* at its free end. Calculate the slope at the free end. Assume $EI = 12 \times 10^3\ kNm^2$.
9. Find the thickness of the pipe due to an internal pressure of 10 N/mm^2 if the permissible stress is 120 N/mm^2. The diameter of pipe is 750 *mm*.
10. What are types of stress in a thin cylindrical vessel subjected to internal pressure?

PART - B (5 x 16 = 80 Marks)

11. (a) A cast iron flat 300 *mm* long and 30 *mm* (thickness) × 60 *mm* (width) uniform cross section, is acted upon by the following forces : 30 *kN* tensile in the direction of the length 360 *kN* compression in the direction of the width 240 *kN* tensile in the direction of the thickness. Calculate the direct strain, net strain in each direction and change in volume of the flat. Assume the modulus of elasticity and Poisson's ratio for cast iron as 140 kN/mm^2 and 0.25 respectively. (16)

Or

(b) A bar of 30mm dia is subjected to a pull of 60kN.The measured extension on a gauge length of 200mm is 0.09mm and the change in dia 0.0039 mm. calculate the poison, s ratio and the value of elastic constants. (16)

12. (a) A beam of the length 10 *m* is simply supported at its ends carries two concentrated loads of 5 *kN* each at distance of 3 *m* and 7 *m* from the left support and also a uniformly distributed load of 1 k*N/m* between the point loads.

(i) Draw Shear force and bending moment diagrams and

(ii) Calculate the maximum bending moment. (16)

Or

(b) Derive the shear stress equation for a rectangular cross section. (16)

13. (a) Recommend the dimensions of a hollow circular shaft with a diameter ratio 3:4 which is to transmit 60 *kW* at 200 *rpm*. The maximum shear stress in the shaft is limited to 70 *GPa* and the angle of twist is 3.8° in a length of 4*m*. For the shaft material the modulus of rigidity is 80 *GPa*. (16)

Or

(b) A helical spring of circular cross-section wire 18 mm in diameter is loaded by a force of 500N. The determine the maximum shear stress in the material of the spring. What number of coils must mean coil diameter of the spring is 125mm. The modulus of rigidity is 80 kN/mm^2. the spring have for its deflection to be 6 mm. (16)

14. (a) The external and internal diameters of a hollow cast iron column are 50 *mm* and 40 *mm* respectively. If the length of this column is 3 *m* and both of its ends are fixed,

(i) Predict the crippling load using Euler's formula taking $E = 100GPa$

(ii) Also determine the Rankine load for the column assuming $\sigma_c = 550\ MPa$ and $\propto = \frac{1}{1600}$ (16)

Or

(b) A beam *AB* of length 8 *m* is simply supported at its ends and carries two point loads of 50 *kN* and 40 *kN* at a distance of 2 *m* and 5 *m* respectively from left support *A*. Determine, deflection under each load, maximum deflection and the position at which maximum deflection occurs. Take $E = 2 \times 10^5\ N/mm^2$ and $I = 8.5 \times 10^6\ mm^4$. (16)

15. (a) Draw the Mohr's stress circle for direct stresses of 80 MN/m^2 (tensile) and 50 MN/m^2 (compressive) and estimate the magnitude and direction of the resultant stresses on planes making angles of 22° and 64° with the plane of the first principal stress. Find also the normal and tangential stresses on these planes. (16)

Or

(b) At a point within a body subjected to two mutually perpendicular directions, the stresses are 180 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Each of the above stresses is accompanied by a shear stress of 50 N/mm^2. Determine

(i) major and minor principal stresses and its direction

(ii) maximum shear stress (16)