Q. Code: 212344

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

B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019

Third Semester

ME16304 – MECHANICS OF SOLIDS

(Common to ME and AE)

(Regulation 2016)

Time: Three Hours **Maximum : 100 Marks**

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	What do you mean by Strain Energy?	1	U
2.	State the principle of Superposition?	1	U
3.	List the various types of support.	2	AP
4.	What are all the various assumptions made in the theory of simple bending?	2	AP
5.	Why hollow circular shafts are preferred when compared to solid circular shafts?	3	AN
6.	What is the type of stress induced in a structural member subjected to torsional loading?	3	AN
7.	What is a laminated Spring?	2	U
8.	Give some examples for Torsion spring?	2	U
9.	What are major classifications of a pressure vessel?	4	U
10.	What are the types of stresses induced in a pressure vessel due to its internal pressure?	4	AP

PART B - (5 X16 = 80 Marks)

11.	(a)	A solid steel bar 500 mm long and 70 mm diameter is placed inside an aluminium tube having 75 mm inside diameter and 100 mm outside diameter. The aluminium cylinder is 0.15 mm longer than the steel bar. An axial load of 600 kN is applied to the bar and the cylinder through rigid cover plates. Find the stresses developed in the steel bar and aluminium tube. Take Young's modulus as 2.2×10^5 N/mm^2 and 0.7×10^5 N/mm^2 for steel and aluminium respectively.	**(16)**	1	AP

(OR)

(b) A 400 mm long bar has rectangular cross-section 10 mm × 30 mm. This bar is subjected to (i) 15 kN tensile force on 10 mm × 30 mm faces, (ii) 80 kN compressive force on 10 mm × 400 mm faces, and (iii) 180 kN tensile force on 30 mm × 400 mm faces. Find the change in volume if $E = 2 \times 10^5$ N/mm^2 and $\mu = 0.3$. **(16) 1 AP**

12. (a) Draw the Shear force and Bending moment diagrams for the simply supported beam shown in Figure 12 a **(16) 2 AP**

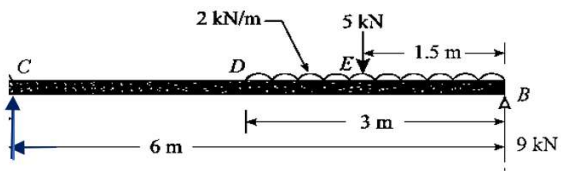

Figure 12a

(OR)

(b) A beam is simply supported and carries a UDL of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120N/mm^2 and the moment of Inertia is 7×10^8 mm^4. Find the span of the beam. **(16) 2 AP**

13. (a) A shaft has to transmit a torque of 30 kNm. The maximum shear stress is not to exceed 100 MPa and the angle of twist is not to exceed 1°/meter length. G = 80 GPa. Design the shaft according to the given specifications if it is a (i) solid circular shaft and (ii) hollow circular shaft of internal diameter 90% of the external diameter. **(16) 3 AP**

(OR)

(b) In a close coiled helical spring, the diameter of each coil is to be 10 times that of diameter of wire of the spring and the maximum shear stress is not to exceed 80 N/mm^2. Maximum permissible deflection under a load of 200 N is 11 mm. Take rigidity modulus as 80×10^3 N/mm^2. Determine the number of coils, the diameter of the coil and the spring rate. **(16) 3 AP**

14. (a) Determine the deflection under each load, E =210GPa and $I = 180 \times 10^6\ mm^4$ **(16)** **2** **AP**

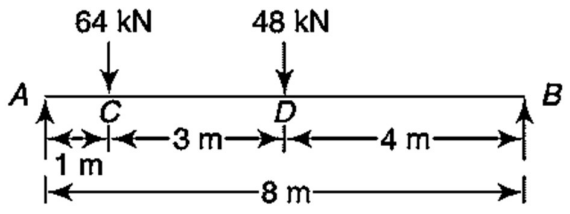

Figure 14a

(OR)

(b) A simply supported beam of length 7 m is subjected to a load of 120 kN at a point 4 m from the left end. Calculate the slopes at the ends and the deflection at the point of application of load. EI is constant. **(16)** **2** **AP**

15. (a) A cylindrical pressure vessel, of diameter 1 m and length 2 m, is subjected to an internal pressure of 2 MPa. If the hoop stress is limited to 42 MPa and the longitudinal stress to 28MPa, find the minimum thickness required. What will be the change in volume of the cylinder under this pressure? E = 200 GPa and $\mu = 0.3$. **(16)** **4** **AP**

(OR)

(b) The stresses at appoint of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55° with the axis of major tensile stress. Also find the magnitude of the maximum shear stresses in the component. **(16)** **4** **AP**