END SEMESTER / RETEST EXAMINATION, 2020

Semester: 4TH semester

Subject code: Me - 405

Subject: STRENGTH OF MATERIALS

Full Marks: 70 (part A-25 + part B-45)

Duration: 3 hours

Questions on Part A are compulsory.
Answer any five questions from Part B.

PART- A MARK- 25		
Question no.	**Questions**	**Marks**
Question 1		1 x 10= 10
1a	The ratio of lateral strain to linear strain is called _____.	
1b	The total strain energy stored in a body up to elastic limit is _____.	
1c	The bending moment at the free end of a cantilever carrying any type of load is _____.	
1d	The term deformation per unit length is called _____.	
1e	The stiffness of a closely coiled helical spring is _____ proportional to the number of turns.	
1f	A column that fails due to direct stress is called _____.	
1g	The distance between the centre of a rivet hole to the nearest edge of the plate is called _____.	
1h	When the shear force at a point is zero, the the bending moment is _____ at that point.	
1i	The stress induced in a body if suddenly loaded is _____ the stress induced when the same load is applied gradually.	
1j	The neutral axis of a section is an axis at which the bending stress is _____.	
Question no. 2	**State true or false**	1 x 10= 10
2a	The columns whose slenderness ratio is less than 80 are called long columns.	
2b	The rivets are temporary fastenings.	
2c	In leaf spring, the lengths of all the leaves are equal.	
2d	The torsional rigidity of a shaft is given by $\frac{T}{J}$.	

2e	The maximum bending moment of a simply supported beam with central load lies at the point of loading.	
2f	At the neutral axis of a beam, the shear stress is maximum.	
2g	Modulus of resilience is the proof resilience per unit volume of a material.	
2h	The unit of stain is N/mm.	
2i	Thermal stress is caused when the temperature of a body remains constant.	
2j	The factor of safety is always more than unity.	

Question no. 3		1 x 5= 5
3a	Euler's formula holds good only for	
i)short column iii)both short and long columns	ii)long column iv)weak columns	
3b	In the torsion equation, $\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{l}$, the term $\frac{J}{R}$ is called	
i)shear modulus iii)bulk modulus	ii)polar modulus iv)none of these	
3c	The product of Youngs's modulus (E) and moment of inertia (I) is called	
i)modulus of rigidity iii)flexural rigidity	ii)bulk modulus iv)torsional rigidity	
3d	Hooke's law holds good upto	
i)yield point iii)plastic limit	ii)elastic limit iv)breaking point	
3e	The strain energy stored in a body when the load is gradually applied is	
i)$\frac{\sigma E}{V}$ iii)$\frac{\sigma^2 E}{2V}$	ii)$\frac{\sigma V}{E}$ iv)$\frac{\sigma^2 V}{2E}$	

PART- B, MARK- 45		
Question no.	**Questions**	**Marks**
Question no. 4		
4a	Define the terms: toughness, hardness, proof resilience, ductility and strength.	5
4b	A hollow cylinder 2m long has an outside diameter of 50mm and inside diameter of 30 mm. if the cylinder is carrying a load of 25kN, find the stress in the cylinder. Also find the deformation of the cylinder, if modulus of elasticity for the cylinder material is 100 GPa.	4
4c		
Question no. 5		

5a	Define factor of safety.	1
5b	The ultimate strength of a steel column in a building is 10KN and the allowable load is 2KN, calculate factor of safety for steel column.	2
5c	A reinforced concrete column 500mm×500mm in section is reinforced with 4 steel bars of 25 mm diameter, one in each corner. The column is carrying a load of 1000 kN. Find the stresses in the concrete and steel bars. Take E for steel = 210 GPa and E for concrete = 14GPa.	6
Question no. 6		
6a	An alloy specimen has a modulus of elasticity of 120 GPa and modulus of rigidity of 45 GPa. Determine the poisson's ratio.	3
6b	Two parallel walls 6m apart are stayed together by a steel rod 25 mm diameter passing through metal plates and nuts at each end. The nuts are tightened when the rod is at a temperature of 100^0C. determine the stress in the rod when the temperature falls down to 60^0C, if i)the ends do not yield. ii)the ends yield by 1mm. Take E = 200 GPa and $\alpha = 12\times10^{-6}/^0$C	6
Question no. 7		
7a	What is point of contraflexure?	1
7b	A simply supported beam 6m long is carrying a uniformly distributed load of 5 kN/m over a length of 3m from the right end. Draw the SFD and BMD for the beam and also calculate the maximum bending moment on the section.	8
Question no. 8		
8a	Calculate the maximum torque that a solid circular shaft of 125 mm diameter can transmit, if the maximum angle of twist is 1^0 in a length of 1.5m. Take C = 70 GPa.	4
8b	A closely coiled helical spring is made of 6mm diameter wire. The maximum shear stress and deflection under a 200N load is not to exceed 80 MPa and 11 mm respectively. Determine the number of coils and their mean diameter. Take C = 84 MPa.	5
Question no.9		
9a	A cantilever beam of 2 m span is 15 cm wide and. It carries a uniformly distributed load of 5 kN/m over its entire span. Find the slope and deflection of the cantilever beam at its free end. Take EI = 2.5×10^{12} N-mm^2.	4
9b	A rectangular beam 300 mm deep is simply supported over a span of 4m. What uniformly distributed load the beam may carry, if the bending stress is not to exceed 120 MPa. Take I = 225×10^6 mm^4.	5

Question no. 10		
10a	Define long column, short column and slenderness ratio.	3
10b	Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. The length of the column is 2.3 m and is hinged at its both ends. Take E = 205 GPa. Also determine the crippling load by Rankine's formula. Take σ_c = 335 MPa and Rankine's constant as $\frac{1}{7500}$.	6
Question no. 11		
11a	Two plates 15 mm thick are joined by a double riveted lap joint. The pitch in each row of rivets is 60 mm and rivet diameter is 20 mm. the permissible stresses are: Tension in plates = 150 N/mm^2 Shear in rivets = 94.5 N/mm^2 Bearing in rivets = 212.5 N/mm^2 Find the efficiency of the joint.	5
11b	What are the causes of failure of a riveted joint?	4

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