Code No: R1922036 **R19** SET - 1

II B. Tech II Semester Supplementary Examinations, February - 2022
DESIGN OF MACHINE MEMBERS-I
(Mechanical Engineering)

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)	Write the general considerations in the design of engineering materials and their properties?	[8M]
	b)	Discuss the concept of stiffness in tension and bending?	[7M]

Or

2		A machine element is loaded so that $\sigma_1 = 120\ Mpa$, $\sigma_2 = 70Mpa$, $\sigma_3 = -90Mpa$ the material has a maximum yield strength in tension and compression of 360Mpa. Find the factor of safety for each of the following theories. i) Maximum Normal stress theory ii) Maximum Shear stress theory iii) Distortion energy theory.	[15M]
3	a)	Determine the size of a piston rod subjected to a total load of having cyclic fluctuations from 150 *kN* in compression to 25 *kN* in tension. The endurance limit is 360 MPa and yield strength is 400 MPa. Take impact factor = 1.25, factor of safety = 1.5, surface finish factor = 0.88 and stress concentration factor = 2.25.	[9M]
	b)	Explain Goodman's method to calculate the safe values of fluctuating stress. For what materials it is applicable?	[6M]

Or

4	a)	A shaft made of steel having ultimate tensile strength of 700 MPa and yield point 420 MPa is subjected to a torque of 2000 *N m* clockwise to 600 *N m* anti-clockwise. Calculate the diameter of the shaft if the factor of safety is 2 and it is based on the yield point and the endurance strength in shear.	[10M]
	b)	Explain theoretical stress concentration factor.	[5M]
5		A bearing is fastened to the frame by 6 bolts spaced equally on a 250 mm bolt circle. The bearing flange diameter is 300 mm. A load of 45 KN is applied at 280 mm from the frame. Determine the size of bolts when i) two bolts are located in the vertical plane of symmetry of the bearing ii) two bolts are located in the horizontal plane of symmetry of the bearing. Assume allowable tensile stress in the bolt material to be 90MPa.	[15M]

Or

6	a)	Explain the design of keys and stresses in keys.	[6M]
	b)	Design a cotter joint to withstand an axial load varying from 50kN in tension to 50kN in compression. The allowable for the steel used in the joint are 60Mpa in tension; 70Mpa in crushing; 45Mpa in shear.	[9M]
7		Design a hollow steel shaft to transmit 18 kW at 300 rpm. The loading is such that the maximum bending moment is 100kNm, the maximum torsional moment is 50kNm and axial compressive load is 15kN. The shaft is supported on rigid bearings 1.5 m apart. The maximum permissible shear stress on the shaft is 40 N/mm^2. The inside diameter is 0.8 times the outside diameter.	[15M]

Or
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8 a) Design a solid muff coupling made of cast iron to connect two shafts transmitting 35KW at 150rpm with a capability of 25% maximum torque greater than the mean torque. The shaft and key are made of mild steel for which permissible shear and crushing stress are 30MN/m^2 and 80MN/m^2 respectively. Permissible shear stress in CI is 15MN/m^2. [10M]

b) Discuss the design of shafts for combined bending? [5M]

9 a) A close coiled helical compression spring of 16 active coils has a spring stiffness of 10 N/mm. It is cut into two springs having 7 and 9 turns. Determine the spring stiffness of resulting springs. [9M]

b) Explain springs for fatigue loading in detail. [6M]

Or

10 a) A bus is provided with four leaf springs each having 9 leaves and supports are 2m a part and section of leaf is 50 mm x 6mm. The full capacity load for springs amounts to 10000N. The rear axle takes 80% of load, breaking strength 12,000. Check the dimensions. [10M]

b) Write about stresses of helical springs? [5M]