

II B. Tech II Semester Regular Examinations, August/September - 2021
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

- 1 a) A rectangular bar 40 mm x 20 mm cross section is subjected to a tensile load of 200 kN. Find the factor of safety, if yield strength of the material is 500 MPa. [5M]
b) Compare rectangular box section, hollow circular section, elliptical section subjected to bending moment in terms of economy of material [7M]
c) What are the basic modes of failure of a mechanical component? [3M]

Or

- 2 a) Two flat bars with different configurations are shown in figure 1. Each carries a steady load of 4 kN. The material is gray cast iron. Determine the maximum stress induced for each of the conditions shown. The stress concentration factor in both the cases is 1.7. Which component is more critical? [6M]

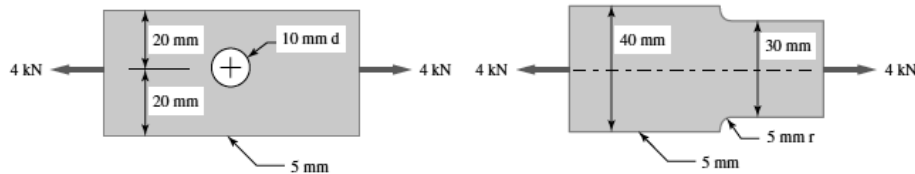


Figure 1

- b) Compare the theories of failure by drawing the boundaries of their application for biaxial stress condition. [9M]
3 a) Draw and explain S-N Curve? What is the difference between S-N Curve for ferrous and non-ferrous components? [8M]
b) A machine part is operated for a period 78 hours at the service load. The service load is then removed and the part is operated at a heavier load. Failure at this load occurs after 79 hours. The life of the part at heavy load is 80 hours. Find its life at the service load. [7M]

Or

- 4 a) Describe the method of designing part subjected to fatigue loading for definite life. [7M]
b) A steel alloy has an ultimate tensile strength of 600 MPa, yield strength of 400 MPa and an endurance limit of 200 MPa under reversed bending. Sketch a modified Goodman diagram. Indicate on the sketch and give the magnitude of the endurance stress for released loading. [8M]
5 a) Compare permanent connections of riveted joints, welded joints and bonded joints. [7M]
b) A circular shaft, 75 mm in diameter is welded to the support by means of a circumferential fillet weld. It is subjected to a torsional moment of 3 kN-m. Determine the size of the weld if the maximum shear stress in the weld is not to exceed 70 MPa [8M]

Or

- 6 Design a gib and cotter joint to connect square rods with a side of the square as 25 mm. Consider $\sigma_t = 60$ MPa, $\sigma_c = 90$ MPa and $\tau = 40$ MPa. The joint has to carry a load of 35 kN. Draw the sketch of the assembly. [15M]



- 7 Design a 900 mm long simply supported shaft between bearings used to transmit 20 kW power at 600 rpm. Two pulleys are mounted in such a way that they divide the shaft in three equal parts. If the pull in the belt is 10 kN vertically downwards in left pulley and same horizontal pull on the right pulley. Combined shock and fatigue factor applied to bending moment and torsional moment are 1.5 and 1.25 respectively. The allowable shear stress is 40 MPa [15M]

Or

- 8 Design a bushed-pin type flexible coupling for connecting a motor shaft to a pump shaft for the following service conditions : [15M]

Power to be transmitted = 40 kW; Speed of the motor shaft = 1000 rpm;

Diameter of the motor shaft = 50 mm; Diameter of the pump shaft = 45 mm.

The bearing pressure in the rubber bush and allowable stress in the pins are to be limited to 0.45 MPa and 25 MPa respectively. Draw the diagram of coupling.

- 9 a) What factors affect the strength, rigidity and stability of a spring? [3M]
b) Design a helical compression spring with a mean diameter of 18mm. The spring deflects 5 mm when the applied load varies from 150N to 250N. Loading is essentially static. The spring end is closed but not ground and both ends are fixed. [12M]

Or

- 10 a) What is concentric spring? What are the applications advantages of concentric spring? [5M]
b) A semi-elliptic leaf spring consists of two extra full-length leaves and six graduated - length leaves, including the master leaf. Each leaf is 7.5 mm thick and 50 mm wide. The centre-to-centre distance between the two eyes is 1 m. The leaves are pre-stressed in such a way that when the load is maximum, stresses induced in all the leaves are equal to 350 MPa. Determine the maximum force that the spring can withstand. [10M]

