QUESTION BANK

UNIT- I (STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS)
PART-A

1. Define: "Design"
2. What is 'Adaptive design '? Where is it used? Give examples.
3. What are the various phase of design process?
4. List some factors that influence machine design.
5. Define: "Optimization"
6. Define Principal plane, principal stress
7. Give examples for curved beams
8. Why normal stress theory is not suitable for ductile materials?
9. Define stress concentration and stress concentration factor. ,
10 Define: "Factor of safety"
11. How is factor of safety defined for brittle and ductile materials?
12. What are the various factors to be considered in deciding the factor of safety?
13. What are the factors to be considered in the selection of materials for a machine element?
14· Differentiate between static and variable stresses.
15. Define amplitude stress and stress ratio. What is the value of stress ratio for a cyclic stress?
16. What are various theories of failure?
17. What is the use of Goodman & Soderberg diagrams?
18. Differentiate between Endurance limit and Endurance strength.
19. Define endurance limit. What are the factors affecting endurance strength.
20. What is an S-N Curve?

UNIT- I (STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS)
PART -B

1. (a) A piston of a reciprocating compressor has a diameter of 60mm. The maximum pressure on the
piston fall is 1.25MN/m_2.Assuming the gudgeon pin passing through the small end of the connecting
rod can be safely loaded in shear up to 10MN/m_2, Calculate the minimum diameter of the gudgeon pin.
(8)
(b) Explain with mathematical expressions.
Maximum principal stress theory and Von-Mises-Henky theory (8)

2. (a) Determine the diameter of the steel bar, which is a ductile in a nature subjected to an axial load of
60KN and torsional moment of 1600N-m.Use the factor of safety 2.5.E=200GPa. (8)
(b) Explain with mathematical expressions.
Maximum shear theory and Venant's theory (8)
3. A steel member is subjected to a 3-D stress system and resulting principal stress are 120N/mm^2
tension, 80N/mm^{2}and 40N/mm^2 compression. If the proportional limit of the material in simple tension
is 280N/mm^2 and its poison's ratio is O.3.Determine the factor of safety according to (a) Maximum
principal stress theory (b) Maximum principal strain theory (c) Maximum shear stress theory.
(16)
4. A bolt is subjected to a tensile load of 25KN and a shear load of 10KN. Determine the diameter of
the bolt according to (a) Maximum principal stress theory (b) Maximum principal strain theory (c)
Maximum shear stress theory. Assume factor of safety 2.5, Yield point stress in simple tension
300N/mm^2, Poisson's ratio is 0.25. (16)
5. Taking stress concentration in to account find the maximum stress induced when a tensile load of
20KN is applied to (i) A rectangular plate 80mm wide and 12mm thick with a transverse hole of 16mm
diameter.(ii)A stepped shaft of diameters 60mm and 30mm width a fillet radius of 6mm. (16)
6. A circular bar is simply supported with a span of 0.5mand is subjected to a concentrated cyclic load
at its midspan. The load varies from a minimum value of20KN to maximum value of 45 KN. The load
3
direction is transverse to the shaft axis. Decide upon the diameter of the bar taking a factor of safety of
1.5 and factor of 0.85 and 0.89 respectively for size effect and surface finish. Take often following
values for material properties.
Ultimate strength = 650N/mm^2 ,Yield strength = 450N/mm^2
Endurance strength =350N/mm^2 (16)
7. The bending stress in a machine part fluctuates between a tensile stress of 280N/mm^2 and a
compressive stress of 140N/mm2• What should be the minimum ultimate tensile strength of this part to
carry this fluctuation indefinitely according to (i) Goodman's formula (ii) Soderberg formula Factor of
safety is 1. 75. Assume that the yield point is never likely to be less than 55% of the

Ultimate tensile strength or greater than 93 % of it. (16)

8. Determine the thickness of a 120mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 1000N.The properties of the plate materials are as follows. Endurance limit stress is 225MPa and yield point stress is 300MPa. The factor of safety based on yield point may be taken as 1.5. (16)

9. A hot rolled bar of steel is subjected to a torsional load varying from-150N-m to 450N-m. Determine the required diameter of the bar using a factor of safety of 1.7. Properties of the material may be assumed as follow.
Ultimate tensile stress = 450MPa
Yield stress = 300MPa (16)

10.A transmission of shaft made C45 steel subjected to a fluctuating torque varying from -100N-m to +500N-m.Also a fluctuating bending moment acts on the shaft which varies from +500N-m to -500Nm.
Let the stress concentration factor be 2. The shaft is machined for a factor of safety 1.5.Determine the required diameter of the shaft. (16)