1. What are the causes of stress concentration in a mechanical component?

a) Uniform loading
b) Smooth surfaces
c) Geometric irregularities and defects
d) Large cross-sectional area

Answer: c) Geometric irregularities and defects

Explanation: Stress concentration occurs due to geometric features like notches, holes, and sharp changes in shape, which induce localized stress concentrations, leading to potential failure under load.

2. In which type of loading does stress concentration typically occur in tension?

a) Static loading
b) Dynamic loading
c) Cyclic loading
d) Impact loading

Answer: c) Cyclic loading

Explanation: Stress concentration in tension often occurs under cyclic loading conditions where repeated stress cycles cause fatigue failure, especially near areas of geometric irregularities.

3. Which factor can help in reducing stress concentration in a mechanical component?

a) Increasing the load
b) Polishing the surface
c) Introducing sharp corners
d) Reducing the size of geometric irregularities

Answer: d) Reducing the size of geometric irregularities

Explanation: Smoothing surfaces, avoiding sharp corners, and minimizing geometric irregularities help in reducing stress concentration by distributing stress more evenly throughout the component.

4. What is the theoretical stress concentration factor?

a) The actual stress in the component
b) The maximum stress in the component
c) The ratio of maximum stress to nominal stress
d) The ratio of maximum stress to theoretical stress

Answer: c) The ratio of maximum stress to nominal stress

Explanation: The theoretical stress concentration factor represents the ratio of maximum stress at the stress concentration point to the nominal or average stress in the component.

5. What is notch sensitivity related to in fatigue analysis?

a) The sensitivity of a material to notches
b) The sensitivity of a material to cyclic loading
c) The sensitivity of a material to stress concentration

d) The sensitivity of a material to tensile stress

Answer: c) The sensitivity of a material to stress concentration

Explanation: Notch sensitivity refers to how susceptible a material is to stress concentration effects, especially in fatigue situations, where small geometric irregularities can significantly reduce the fatigue life of a component.

6. Which diagram is used for fatigue analysis considering both mean and alternating stresses?

a) Mohr’s circle
b) Goodman diagram
c) S-N Curve
d) Gerber parabola

Answer: b) Goodman diagram

Explanation: The Goodman diagram is used for fatigue analysis, plotting both mean and alternating stresses to determine the potential for fatigue failure under cyclic loading conditions.

7. What does the S-N Curve represent in fatigue analysis?

a) Stress-strain relationship
b) Stress-time relationship
c) Stress-fatigue life relationship
d) Stress-temperature relationship

Answer: c) Stress-fatigue life relationship

Explanation: The S-N Curve, also known as the fatigue curve, represents the relationship between stress amplitude and the number of cycles to failure, providing valuable data for fatigue analysis and component design.

8. Which equation is used to determine the combined effect of alternating and mean stresses in fatigue analysis?

a) Soderberg equation
b) Goodman equation
c) Gerber equation
d) Modified Goodman equation

Answer: d) Modified Goodman equation

Explanation: The Modified Goodman equation is used to calculate the combined effect of alternating and mean stresses in fatigue analysis, taking into account the endurance limit and ultimate tensile strength of the material.

9. What does the cumulative fatigue damage factor account for in fatigue design?

a) The total number of cycles
b) The combined effect of stress concentrations
c) The influence of surface roughness
d) The accumulated damage from repeated loading

Answer: d) The accumulated damage from repeated loading

Explanation: The cumulative fatigue damage factor considers the accumulated damage caused by repeated loading cycles over the component's lifetime, aiding in predicting fatigue failure and designing for finite life.

10. Which factor accounts for the influence of component size on fatigue life?

a) Loading factor
b) Size factor
c) Surface factor
d) Material factor

Answer: b) Size factor

Explanation: The size factor accounts for the influence of component size on fatigue life, recognizing that larger components tend to have shorter fatigue lives due to increased stress concentrations and higher stress levels.

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