Register Number……

B.E. DEGREE EXAMINATIONS: APRIL/MAY 2012

Eighth Semester

AERONAUTICAL ENGINEERING

U07ARE11: Fatigue and Fracture

Time: Three Hours **Maximum Marks: 100**

Answer All Questions:-

PART A (10 x 1 = 10 Marks)

1. S-N curves are derived from _____ tests on samples of the material to be characterized.
   a. Cyclic stress b. Shear Stress c. Sinusoidal stress d. Fatigue Stress
2. Notch sensitivity q is defined by the equation
   a. $q = (K_t - 1) / (K_f - 1)$ b. $q = (K_f - 1) / (K_t - 1)$
   c. $q = (1 - K_f) / (1 - K_t)$ d. $q = (1 - K_t) / (1 - K_f)$
3. Low cycle fatigue is controlled by
   a. Strain b. Stress c. Load d. Force
4. High cycle fatigue generally has _____ cycles
   a. More than 10000 b. Less than 1000 c. More than 1000 d. Less than 10000
5. Fatigue life has _____
   a. 3 phases b. 1 phase c. 4 phases d. 2 phases
6. Fatigue life is defined as the number of _____ cycles that a specimen sustains, before failure occurs.
   a. Stress b. Strain c. Load d. Force
7. When new free surfaces are created at the crack, front, the _____of the system is increased.
   a. Potential Energy b. Potential Strain c. Surface Strain d. Surface Energy
8. Which of the following modes is called Mode- II crack?
   a. Closing mode b. Tearing mode c. Sliding mode d. Opening mode
9. The Safe-life design technique is employed generally in _____
   a. Normal System b. Uneconomical System c. Sub systems d. critical systems
10. A _____ design of a system secures that system in the event of failure of a component.
    a. Safe-Life b. Fail-safe c. Life-safe d. critical-design

PART B (10 x 2 = 20 Marks)

11. What is a SN Curve?
12. What are the effects of notches in the loaded structures?
13. Write down the Manson's relation?
14. What is transition life?
15. What do you mean by dislocations?
16. What is final fracture?
17. Write a brief note on Griffith's theory?
18. What is fracture toughness?
19. Define safe life and fail safe design.
20. List down the factors that are to be considered while designing the components to avoid fatigue failure.

PART C (5 x 14 = 70 Marks)

21. a) (i) What do you understand by fluctuating stresses, repeated stresses and alternating stresses?

(ii) Explain what is Neuber's stress concentration factor?

(OR)

b) (i) What is the need for using factor of safety in the design of components?

(ii) Using Soderberg method,' determine the required diameter of a solid circular rod of a ductile material having endurance strength as 250 MPa and a tensile yield strength as 300 MPa. The rod is subjected to a varying axial load from 200 KN compression to 600 KN tension. The stress concentration factor is 1.8 and factor of safety is 2.0.

22. a) (i) What do you understand by cyclic strain hardening? How does that change the mechanical properties of a material?

(ii) Explain Miner's theory to estimate the life of a component.

(OR)

b) (i) What is cycle counting techniques – explain?

(ii) Explain the relevance of coffin - Manson theory in the study of fatigue behavior of materials.

23. a) (i) with neat sketches, explain different modes of crack growth.

(ii) Explain in detail the dislocations happening in a material.

(OR)

b) (i) Explain the informations you may get about the materials from the fatigue fracture surfaces?

(ii) Explain in detail about crack initiation and growth?

24. a) (i) Explain the effect of thickness on fracture toughness.

(ii) Explain the Irwin – Orwin extension of Griffith's theory.

(OR)

b) (i) Explain the Griffith's theory for obtaining the failure stress

(ii) What is stress- intensity factor? Discuss the theoretical and experimental values of the factors for different geometries

25. a) (i) What is the need for Fracture Mechanics study in design of aircraft components?

(ii) Explain safe life and fail safe design philosophies in detail.

(OR)

b) Give suitable examples of aircraft structural components mode of composite materials and discuss their fatigue behavior.

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