CBCS Scheme

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16CAE421

Fourth Semester M.Tech. Degree Examination, June/July 2018
Fracture Mechanics

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1 a. Derive an expression for fracture strength of a brittle solid containing a crack using Grifths energy balance. **(08 Marks)**

b. Define fracture. List the use of fracture mechanics in modern engineering design. **(04 Marks)**

c. What is surface energy? Explain. **(04 Marks)**

OR

2 a. Explain 3 basic mode of crack displacement. Explain in detail of mode – I. **(06 Marks)**

b. A plate containing the hole is applied uniform stress σ of a value 100MPa. Estimate the magnitude of stress at a point p as shown in Fig Q2(b) for the condition :

i) a = b ii) $a = \frac{1}{10}b$ iii) a = 10b

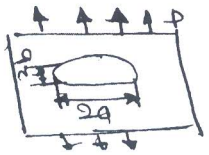

Fig Q2(b) **(06 Marks)**

c. List various method of NDT. Explain any one. **(04 Marks)**

Module-2

3 a. Explain Dugdale's plastic strip model and show that internal stress must be equal the yield strength of material. **(08 Marks)**

b. Explain plastic zone shape for plane stress according to Vonmises criteria. **(08 Marks)**

OR

4 a. A thick center cracked plate of high strength A1 Alloy is 20mm void and contain crack of length 80mm. if it feel IS at applied stress of 100MPa. What is the fracture toughness of alloy? What values of applied stress could the produced fracture for the sample length of crack in a i) Infinite body ii) 120mm wide plate. **(06 Marks)**

b. Explain General test procedure for stress intensities fracture K_{IC}. **(10 Marks)**

Module-3

5 a. Determine the energy release rate for double cantilever beam specimen. **(08 Marks)**

b. Define J. integral. Show that J integral is path dependent. **(08 Marks)**

OR

6 a. Define CTOD and explain. **(05 Marks)**

b. Derive the relation for non-linear energy release rate for Elastic mode – I loading. **(06 Marks)**

c. Explain R-Curve Analysis. **(05 Marks)**

Module-4

7 a. Explain Dynamic fracture toughness and crack arrest toughness. **(05 Marks)**

b. Explain briefly crack branching. **(06 Marks)**

c. Write the principle of crack arrest. **(05 Marks)**

OR

8 a. A 3mm thick crack panel 10cm wide containing edge crack of 1mm yield at a load of 150kN however at a load of 120kN another panel of same material cracked into 2 pieces when crack was 5mm fracture. Calculate yield stress and fracture toughness of material. **(08 Marks)**

b. Explain different type of crack arrest. **(04 Marks)**

c. Write a short note on Dynamic energy release rate. **(04 Marks)**

Module-5

9 a. An edge crack, detected on a large plate is of length 3.1mm under a constant amplitude cyclic load having σ_{max} = 310MPa. And σ_{min} = 172MPa. If plat is made of a ferrite, paralite steel and K_{IC} = 165 MPa $\sqrt{M}$. Determine:

i) Propagation life up to failure

ii) Propagation life the crack length a is not allowed to exceed 25mm

Use $C = 6.8\times10^{-2}$ M = 3, f = 1.12. **(10 Marks)**

b. Explain factor affecting fatigue performance. **(06 Marks)**

OR

10 Write short note on the following (Four)

a. Variabel amplitude loading.

b. Carack Growth behavior

c. Life estimation

d. Crack closure

e. Mixed mode loading **(16 Marks)**

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