M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023
Third Semester
M.E. – CAD/CAM
20PCDEL313 – ENGINEERING FRACTURE MECHANICS
(Regulations 2020)

Duration: 3 Hours   Max. Marks: 100

PART - A (10 × 2 = 20 Marks)
Answer ALL Questions

		Marks, K-Level, CO
1.	State the three modes of fracture.	2,K1,CO1
2.	Why does a brittle material not have stable crack growth?	2,K1,CO1
3.	What is the purpose of evaluating J-integral?	2,K1,CO2
4.	Show the yield planes of plane stress cases through a clear diagram.	2,K2,CO2
5.	List any two crack arrest mechanism.	2,K1,CO3
6.	Draw R Curves for ductile and brittle materials	2,K2,CO3
7.	Why is mixed mode crack study needed?	2,K2,CO4
8.	What does 5% secant line assure in K_{Ic} test?	2,K2,CO4
9.	Define crack instability.	2,K1,CO5
10.	Define Singular element method.	2,K1,CO5

PART - B (5 × 13 = 65 Marks)
Answer ALL Questions

11. a) Mode I (Westergaard's Approach) case has been solved for a biaxial case and its stress and displacement fields are taken to be approximately the same as of an uniaxial case. Justify.   13,K2,CO1

OR

b) Explain Airy's stress function and complex stress function.   13,K2,CO1

12. a) Discuss about the Plastic Zone Size through the Dugdale Approach.   13,K2,CO2

OR

b) Path independence of the J integral is not valid for elastic plastic materials. Why?   13,K2,CO2

13. a) Explain plain strain fracture toughness K_{IC} test methods as per the guide lines given in ASTM standard E399 procedure with more emphasize on precracking.   13,K2,CO3

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **12247**

OR

b) Discuss the crack arrest mechanism for at least two materials. *13,K2,CO3*

14. a) Explain the effects of changing the load spectrum. *13,K2,CO4*

OR

b) An edge crack, detected on a large plate, is of length 3.1 mm under a *13,K2,CO4* constant amplitude cyclic load having σ_{max} = 310 MPa and σ_{min} = 172 MPa. If the plate is made of a ferrite pearlite steel and K_{Ic} = 165 MPa $\sqrt{m}$, determine (a) propagation life up to failure and (b) propagation life if the crack length a is not allowed to exceed 25 mm.

15. a) Explain mixed mode crack propagation criteria. *13,K2,CO5*

OR

b) Explain indirect methods to determine fracture parameters in FEM. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Explain the Plastic Zone Shape for Plane Stress and Plane Strain with *15,K3,CO6* neat sketch.

OR

b) Fluctuating load on a critical component of an offshore structure is *15,K3,CO6* shown by a histogram in Fig. During a routine check-up, an edge crack of length 1.5 mm is detected. If the crack length is not allowed to exceed 25 mm, determine the remaining life of the component. Use Paris law with material constants as C = 6.0 x 10^{-12} $(MPa)^{3.2}$ and m = 3.2.