B.E. MECHANICAL ENGINEERING FINAL YEAR SECOND SEMESTER EXAM 2022

ELEMENTS OF FRACTURE MECHANICS

Time: **Four hours**   Full Marks: **70**

1. Answer any ten (10×2=20)

a. What is critical stress intensity factor?
b. What do you mean by chain scission in polymers?
c. What is meant by ductile brittle transition temperature?
d. What is effect of strain rate on ductile brittle transition temperature of high yield point materials?
e. What are the three modes of crack propagation?
f. What is the relevance of Orwan's correction to Griffiths criteria?
g. What is crack wedging?
h. What do you mean by intergranular crack propagation?
i. What is indentation toughness?
j. What is meant by critical strain energy release rate?
k. What is meant by persistent slip band?
l. What is the role of Mn in steel making in terms of fracture toughness?

2. Write short notes on any six (6×5=30)

a. Transformation toughnening
b. Crack arrest
c. Importance of mirror-mist-hackle zone in brittle fracture
d. Crack tip plasticity
e. Long crack toughness and short crack toughness
f. Hydrogen embrittlement
g. Stress corrosion cracking
h. Crack branching and crack meandering.

3. Answer any four (4×5=20)

a. Fracture stress of steel is roughly E/1000. Deduce this relationship mentioning all relevant assumptions.
b. What do you mean by MVC? discuss all the steps.
c. Mention Westergaard equations and discuss how the concept of stress intensity factor emerges out of those equations.
d. How can you use Paris law for life prediction of Engg. components, subjected to fatigue loading?
e. Some aircraft component is fabricated from some alloy having critical stress intensity factor of $35 MPam^{1/2}$. It been determined that fracture results at a stress 250MPa when the internal crack length is 3 mm. For the same component, will fracture occur at a stress of 320MPa with a maximum internal crack of length 2 mm? What will be the result if maximum surface crack is of length 2 mm?