## BME Final Year 2nd Semester Examination, 2018

## Subject: Fracture Mechanics

Time: 3 hrs Full Marks: 100

## Answer question no. 1 and any five from the rests.

- 1. Answer any ten 10 X 3 = 30
- (a) What do you mean by fictitious crack length?
- (b) What are the relationships between critical stress intensity factor and critical strain energy release rate under plane stress and plane strain conditions?
- (c) What do you mean by Orwan's correction?
- (d) What is CTOD? What is its significance?
- (e) What do you mean by Dugdale's plastic strip model?
- (f) What is significance of etch pit experiment?
- (g) Draw three modes of crack propagation.
- (h) Write down names of the mechanisms of crack formation in solid materials.
- (i) What is J-integral?
- (i) What is meant by stress concentration factor?
- (k) What is the criterion for relating specimen thickness with plane strain condition?
- 2. (a) Deduce the expression for theoretical cohesive strength.
- (b) How can we show that presence of crack makes the fracture strength of Steel roughly one thousandth of its Young's modulus?
- (c) Write down Griffith's criterion of fracture and mention its, limitation.

6+5+3

- 3. (a) How can you deduce the expression of stress intensity factor from the equations of theory of elasticity?
- (b) Write down a short note of crack tip plasticity.
- (c) Why do we consider plane strain fracture toughness as a design parameter?

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(d) How can plane strain condition prevail in case of a thin specimen?	4+4+3+3
4. (a) A specimen of a 4340 steel alloy having a plane strain fracture toughness of 45 MPa.m <sup>0.5</sup> is exposed to a stress of 1000 MPa. Will this specimen experience fracture if it is known that the largest surface crack is 0.75 mm long? why or why not? Assume geometry factor, Y=1	
(b) What do you mean by critical strain energy release rate?	
(c) What do you mean by crack arrest?	8+3+3
5 (a) Write a brief note on micro void coalescence.	
(b) How can you explain the typical shape of cup and cone fracture?	
(c) For few materials we can readily get critical stress intensity factor from CVN- Explain why.	
(d) How does DBT vary with specimen thickness in case of charpy test and why?	5+3+3+3
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6. (a) Draw mirror, mist and hackle zone for brittle fracture.	
(b) How can you find out toughness from the fracto-graph of brittle fracture?	
(c) What do you mean by Paris Equation? What is its significance?	
(d) Why do we prefer large grained materials to prevent creep?	5+3+3+3
7. Write short notes on any four	3.5 X 4 =14
(a) Indentation toughness	
(b) Hydrogen embrittlement	
(c) Stress corrosion cracking	
(d) Transformation toughening	
(e) Persistent slip band	