

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTech
BRANCH: MECHANICAL

SEMESTER : II
SESSION : SP/22

SUBJECT: ME532 FRACTURE MECHANICS

TIME: 2 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
-

- Q.1(a) Why does the compliance of a component increase with the crack growth? [2]
- Q.1(b) Why does a brittle material not have stable crack growth? [3]
- Q.1(c) A large plate of 36 mm thickness with an edge of $a=32$ mm length is pulled very slowly under control loading. At the displacement of 7.2 mm, when the recorded load is 2750 N, the crack starts growing. At $a=41.7$ mm, the crack is arrested and the load decreases to 1560 N. Determine the critical energy rate. [5]
- Q.2(a) Stress field is the same for plane strain and plane stress problems. Why is it not so for displacement field? [2]
- Q.2(b) For many problems of practical applications, solutions of infinite plates are applicable. Justify the statement. [3]
- Q.2(c) Displacement near the crack tip is determined by integrating strain components. Why do we equate the integration constants to zero? [5]
- Q.3(a) Draw a neat sketch to show the yield planes of plane stress case. [2]
- Q.3(b) Does fracture mechanics recommend the enhancement of the yield stress of an alloy through a heat treatment? Justify your answer. [3]
- Q.3(b) Determine the plastic zone size through the Dugdale approach for Mode I of an infinite plate. [5]
- Q.4 Determine the J-Integral for the double-cantilever-beam specimen, if each cantilever is pulled by a distributed load P , as shown in Fig. Q.4. [1
0]

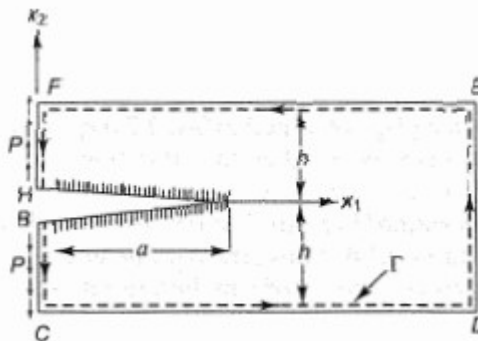


Fig. Q.4

- Q.5(a) Why are results of Charpy or Izod impact tests not useful in predicting loads that would grow an existing crack in a component with known geometry and boundary conditions? [3]
- Q.5(b) What are the shortcomings/limitations of S-N curve approach? [3]
- Q.5(c) Derive the relationship between CTOD and J-Integral. [4]