

Unit 11 - Week 9

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Assignment 9

The due date for submitting this assignment has passed. **Due on 2019-10-02, 23:59 IST.**
 As per our records you have not submitted this assignment.

Instructions for answering numerical questions

- In all numerical type questions, you are expected to round off the answers to two decimal places accuracy unless otherwise specified.
 Examples: 1. Ans: 9.825, you report as 9.83
 2. Ans: 9.8, you report as 9.80
 3. Ans: 9, you report as 9.00
- This style of reporting is essential for computer based automated correction of your answers.
- The answers for various quantities asked are to be reported in the following units unless otherwise specified, Stress- MPa, Stress intensity Factor- MPa/m, Strain energy- Nmm, Energy release rate- J/m², deflection – mm

1) For convenient analysis of fracture in thicker specimen, the states of stress considered are 1 point

plane strain at the surface and plane stress at the interior of the specimen
 plane stress at both the surface and interior of the specimen
 plane stress at the surface and plane strain at the interior of the specimen
 plane strain at both the surface and interior of the specimen

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 plane stress at the surface and plane strain at the interior of the specimen

2) With regard to evaluating Plastic zone, which of the following statements are true: 1 point

A) In all materials, to simplify the analysis, usually the material is assumed to be elastic-perfectly plastic
 B) In the plastic zone at the crack tip, the compliance of the component decreases
 C) To incorporate the effect of plasticity in fracture analysis, the crack is mathematically modeled to be longer than the actual length

- A, C
 only A
 only B
 B, C

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 A, C

3) The plastic zone length r_p in Irwin's model for Plane strain condition is given by the expression 1 point

- $\frac{1}{2\pi} \left(\frac{K_I}{\sigma_{ys}} \right)^2$
 $\frac{1}{6\pi} \left(\frac{K_I}{\sigma_{ys}} \right)^2$
 $\frac{3}{\pi} \left(\frac{K_I}{\sigma_{ys}} \right)^2$
 $\frac{1}{3\pi} \left(\frac{K_I}{\sigma_{ys}} \right)^2$

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 $\frac{1}{3\pi} \left(\frac{K_I}{\sigma_{ys}} \right)^2$

4) Dugdale's Plastic zone model is based on 1 point

- molecular adhesion
 macroscopic plasticity
 molecular cohesion
 macroscopic elasticity

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 macroscopic plasticity

5) The assumption that plastic deformation concentrates in a line is pertinent to: 1 point

- Simplistic approach
 Irwin's model
 Dugdale's model
 None of these

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 Dugdale's model

6) A material having a crack of length 8 mm has got the length of plastic zone as 4mm. What is the ratio of effective crack length according to Dugdale model and Irwin's model 2 points

- 1.5
 1.2
 0.84
 0.96

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 1.2

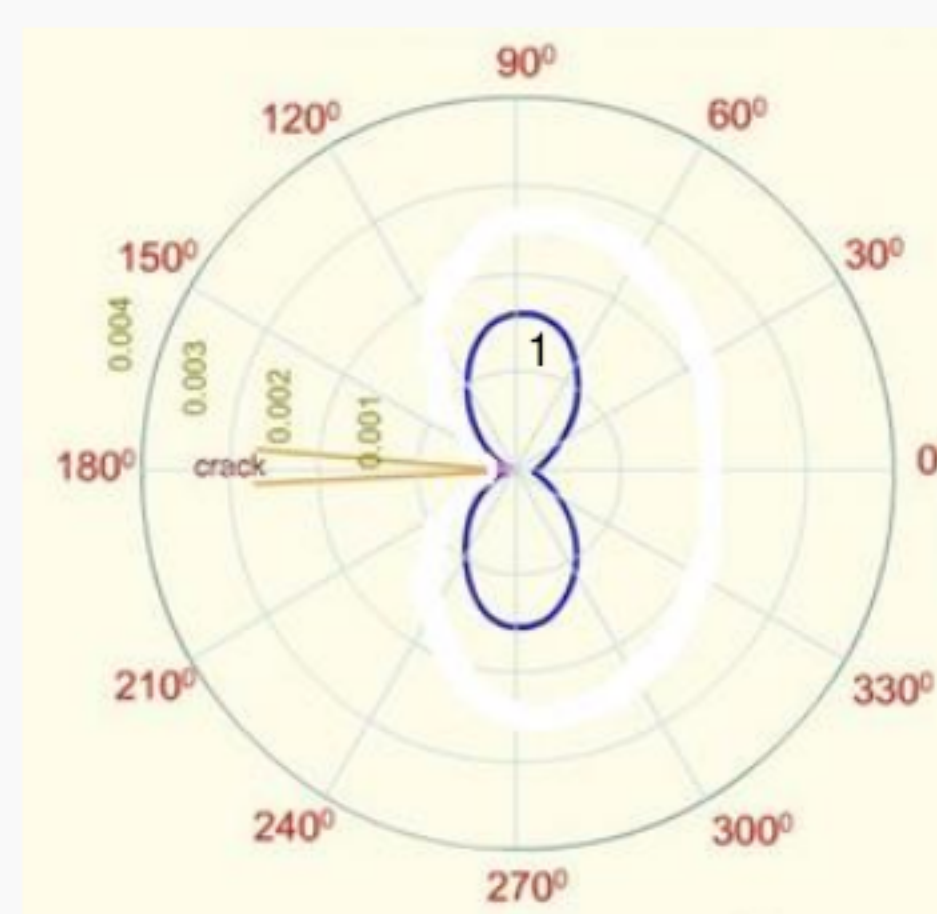
7) Which of the following statements are correct regarding the plastic zone shape in a Fracture mechanics problem 2 points

- A. The shape of the plastic zone varies across the thickness of the specimen
 B. Butterfly shape plastic zone which closely resembles mode I isochromatics occur at the interior of the specimen
 C. If redistribution of loading is considered, then the plastic zone in the inner region will be slightly larger and the outer ones on the surface would be smaller
- A, C
 B,D
 all are correct
 None are correct

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 all are correct

8) 2 points



In the figure given above, which of the following attributes matches the Plastic zone shape indicated by 1

- A) Plane Stress Condition
 B) Plane strain Condition
 C) Tresca yield Criteria
 D) von Mises yield Criteria
 E) Mode I loading
 F) Mode II loading
- A, D, E
 B, C, F
 B, D, E
 A, C, F

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 B, D, E

9) Which of the following statements are true regarding the findings of Irwin about Plastic zone for plane strain condition in a material having Poisson ratio as 1/3 2 points

- A) The failure stress is greater than $3\sigma_{ys}$ due to crack tip blunting
 B) σ_{xx} is zero at the crack tip since it acts as a free surface due to blunting
 C) The effect of release of σ_{xx} is felt for some distance on x-axis beyond the crack tip
 D) The failure stress is closer to $2\sigma_{ys}$

- All are true
 B, C, D
 A, B, D
 B, C

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 B, C

10) For a thin infinite plate with center crack having a length of 12 mm, if the applied stress is 400 MPa and the yield stress is 600 MPa , using Dugdale's model calculate the mode I stress intensity factor K_I (in $\text{MPa}\sqrt{\text{m}}$) considering the plastic zone size

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 (Type: Range) 78.00,85.00

2 points

A beam subjected to three point bending has an edge crack of length 20 mm. The beam has a length of 1.5 m, depth of 120 mm and thickness of 40 mm. Take $K_{IC} = 120\text{ MPa}(\text{m})^{1/2}$ and $\sigma_{ys} = 680\text{ MPa}$

11) What is the critical load that can be applied to the beam in kN(kilo Newtons)?

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 (Type: Range) 120.00,128.00

2 points

12) What is the adjusted crack length (in mm) to accommodate the effect of yielding according to Irwin's model:

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 (Type: Range) 21.00,27.00

1 point

13) Determine the new critical load considering the corrected crack length in kN.

No, the answer is incorrect.
 Score: 0

Accepted Answers:
 (Type: Range) 105.00,115.00

2 points