Unit 7 - Week 5

Course outline

Assignment 5

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-09-04, 23:59 IST.

Instructions for answering numerical questions

1. 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.

2. 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/m^2,deflection – mm,

1) Let $w = u(x,y) + iv(x,y)$. For derivative of w to exist, what are the necessary as well as sufficient conditions? *1 point*

- $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}; \frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$
- $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}; \frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$
- $\frac{\partial u}{\partial x} = -\frac{\partial v}{\partial y}; \frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$
- $\frac{\partial u}{\partial x} = -\frac{\partial v}{\partial y}; \frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}; \frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$

2) For a given Airy's stress function ϕ , the stress component τ_{xy} can be obtained by *1 point*

- $\frac{\partial^2 \phi}{\partial x^2}$
- $\frac{\partial^2 \phi}{\partial y^2}$
- $\frac{\partial^2 \phi}{\partial x \partial y}$
- $-\frac{\partial^2 \phi}{\partial x \partial y}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$-\frac{\partial^2 \phi}{\partial x \partial y}$

3) The bi-harmonic equation in expanded form in a Cartesian coordinate system is given by *1 point*

- $\frac{\partial^4 \phi}{\partial x^4} - 2\frac{\partial^4 \phi}{\partial x^2 y^2} - \frac{\partial^4 \phi}{\partial y^4} = 0$
- $\frac{\partial^4 \phi}{\partial x^4} - \frac{\partial^4 \phi}{\partial x^2 y^2} + \frac{\partial^4 \phi}{\partial y^4} = 0$
- $\frac{\partial^4 \phi}{\partial x^4} + 2\frac{\partial^4 \phi}{\partial x^2 y^2} + \frac{\partial^4 \phi}{\partial y^4} = 0$
- $\frac{\partial^4 \phi}{\partial x^4} + \frac{\partial^4 \phi}{\partial y^4} = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\partial^4 \phi}{\partial x^4} + 2\frac{\partial^4 \phi}{\partial x^2 y^2} + \frac{\partial^4 \phi}{\partial y^4} = 0$

4) Laplace operator in two dimensions in polar form is given by *1 point*

- $\frac{\partial^2}{\partial r^2} + \frac{1}{r}\frac{\partial^2}{\partial r^2} + \frac{1}{r^2}\frac{\partial^2}{\partial \theta^2}$
- $\frac{\partial^2}{\partial r^2} + \frac{1}{r}\frac{\partial}{\partial \theta} + \frac{1}{r^2}\frac{\partial^2}{\partial \theta^2}$
- $\frac{\partial^2}{\partial r^2} + \frac{1}{r^2}\frac{\partial^2}{\partial r^2} + \frac{1}{r^2}\frac{\partial^2}{\partial \theta^2}$
- $\frac{\partial^2}{\partial r^2} + \frac{1}{r}\frac{\partial}{\partial r} + \frac{1}{r^2}\frac{\partial^2}{\partial \theta^2}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\partial^2}{\partial r^2} + \frac{1}{r}\frac{\partial}{\partial r} + \frac{1}{r^2}\frac{\partial^2}{\partial \theta^2}$

5) A plate with a hole subjected to tension is a *1 point*

- Simply connected problem
- Multiply connected problem
- Disconnected problem
- None of these

No, the answer is incorrect.
Score: 0
Accepted Answers:
Multiply connected problem

6) To evaluate the displacement field from the stress field, compatibility conditions has to be satisfied. *1 point*

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
True

7) For a plane stress problem *1 point*

- $\varepsilon_{zz} = 0 \ and \ \sigma_{zz} = 0$
- $\varepsilon_{zz} \neq 0 \ and \ \sigma_{zz} = 0$
- $\varepsilon_{zz} \neq 0 \ and \ \sigma_{zz} \neq 0$
- $\varepsilon_{zz} = 0 \ and \ \sigma_{zz} \neq 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\varepsilon_{zz} \neq 0 \ and \ \sigma_{zz} = 0$

8) What is the Airy's stress function for a problem of crack under Mode-I loading, with the centre of crack as the origin? *1 point*

- $\phi = Re\bar{\bar{Z}} + yIm\bar{Z}$
- $\phi = Re\bar{Z} + yIm\bar{\bar{Z}}$
- $\phi = Re\bar{\bar{Z}} - yIm\bar{Z}$
- $\phi = yRe\bar{\bar{Z}} + Im\bar{Z}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\phi = Re\bar{\bar{Z}} + yIm\bar{Z}$

9) In the absence of body forces, for plane stress and plane strain problems, the compatibility condition reduces to *1 point*

- $\nabla^4(\sigma_x + \sigma_y) = 0$
- $\nabla^2(\sigma_x + \sigma_y) = 0$
- $\nabla^2(\sigma_x) = 0$
- $\nabla^2(\sigma_y) = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\nabla^2(\sigma_x + \sigma_y) = 0$

10) Airy's stress function for a problem of beam with uniformly distributed load is given by $\varphi = \frac{A}{6}x^2 + \frac{B}{2}x^2 y + \frac{C}{2}xy^2 + \frac{D}{2}y^2$. Determine σ_x *2 points*

- $\sigma_x = Cx + D$
- $\sigma_x = 2Cx + 2D$
- $\sigma_x = Ax + By$
- $\sigma_x = 2Ax + 2By$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\sigma_x = Cx + D$

11) For a body, the Airy's stress function is defined by $\phi = Bxy$ .The body is under *2 points*

- a state of uniaxial tension
- a state of pure shear
- a superposition of uniaxial tension and pure shear
- None of these

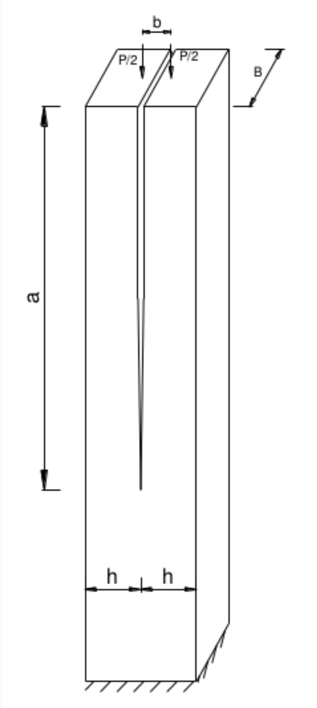
No, the answer is incorrect.
Score: 0
Accepted Answers:
a state of pure shear

12) Which of the following gives boundary conditions for Mode-I crack problem, with the centre of crack as the origin? The x axis is along the crack length while y axis is perpendicular to crack length. *2 points*

- For -a<x<a and y=0, $\sigma_y = 0; \tau_{xy} = 0$
- For $z \to \infty, \sigma_x = \sigma_y = \sigma; \tau_{xy} = 0$
- For any $x, \ and \ y = 0, \ \tau_{xy} = 0$
- For -a<x<a and y=0,$\sigma_x = 0; \tau_{xy} = 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
For -a<x<a and y=0, $\sigma_y = 0; \tau_{xy} = 0$
For $z \to \infty, \sigma_x = \sigma_y = \sigma; \tau_{xy} = 0$
For any $x, \ and \ y = 0, \ \tau_{xy} = 0$

A rectangular elastic strut has a thickness B and a slit of length a starting from the top. Assuming h << a, calculate the following values.



13) The total strain energy of the system in terms of compliance is *2 points*

- $U = \frac{1}{EI}M^2 dC$
- $U = \frac{1}{2}M dC$
- $U = \frac{1}{4}M^2 dC$
- $U = M^2 dC$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$U = M^2 dC$

14) What is the energy release rate of the strut? *2 points*

- $G_1 = \frac{P^2(h-b)^2}{32BEI}$
- $G_1 = \frac{P(h-b)}{32BEI}$
- $G_1 = \frac{P^2(h-b)^2}{16B}$
- $G_1 = \frac{P^2(h-b)^2}{16BEI}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$G_1 = \frac{P^2(h-b)^2}{16BEI}$

15) What is the total compliance? *1 point*

- $C = 2a/EI$
- $C = a/EI$
- $C = 4a/EI$
- $C = a/4EI$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$C = 2a/EI$