# Unit 9 - Week 7

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## Assignment 7

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

**Due on 2019-09-18, 23:59 IST.**

1) The Airy's stress function $\phi$ for Mode II loading is given by: *1 point*

- $\phi = yReZ_{II}$
- $\phi = -yRe\bar{Z}_{II}$
- $\phi = ReZ_{II}$
- $\phi = -Re\bar{Z}_{II}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\phi = -yRe\bar{Z}_{II}$

2) Westergaard stress function $Z_{II}$ for Mode II loading with crack center as the origin is given by: *1 point*

- $\frac{\tau}{\sqrt{z^2-a^2}}$
- $\frac{\tau a}{\sqrt{z^2-a^2}}$
- $\frac{\tau z}{\sqrt{z^2-a^2}}$
- $\frac{\tau a}{\sqrt{a^2-z^2}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\tau z}{\sqrt{z^2-a^2}}$

3) As per Atluri-Kobayashi equation, which of the following is/are correct? *2 points*

- $A_{I1} = -K_I/\sqrt{2\pi}$
- $A_{I1} = K_I/\sqrt{2\pi}$
- $A_{II1} = K_I/\sqrt{2\pi}$
- $A_{II1} = -K_I/\sqrt{2\pi}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$A_{I1} = K_I/\sqrt{2\pi}$

4) After shifting the origin to the crack tip and making the approximation for near tip field,Westergaard stress function $Z_{II}$ for Mode II loading becomes: *2 points*

- $\frac{K_{II}}{\sqrt{2\pi z_0}}$
- $\frac{K_{II}}{\sqrt{2\pi}}\left(\cos\frac{\theta}{2} + i\sin\frac{\theta}{2}\right)$
- $\frac{K_{II}}{\sqrt{2\pi r}}\left(\cos\frac{\theta}{2} + i\sin\frac{\theta}{2}\right)$
- $\frac{K_{II}}{\sqrt{2\pi r}}\left(\cos\frac{\theta}{2} - i\sin\frac{\theta}{2}\right)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{K_{II}}{\sqrt{2\pi z_0}}$
$\frac{K_{II}}{\sqrt{2\pi r}}\left(\cos\frac{\theta}{2} - i\sin\frac{\theta}{2}\right)$

5) To satisfy the boundary condition on $\tau_{xy}$, different cases are possible. With respect to the value of stress function Y(z), match the pairs *2 points*

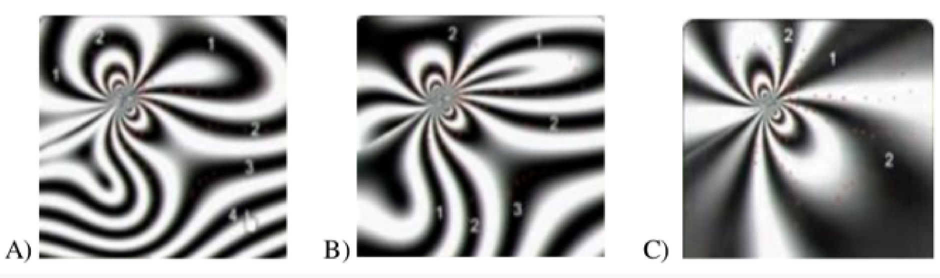
| | |
|---|---|
| A. Y = 0 | I. Irwin's solution |
| B. Y is real constant | II. Generalized Westergaard solution |
| C. Y with imaginary part as zero | III. Conventional Westergaard Solution |

- A-III, B-I, C-II
- A-I, B-II, C-III
- A-III, B-II, C-I
- A-II, B-I, C-III

No, the answer is incorrect.
Score: 0
Accepted Answers:
*A-III, B-I, C-II*

6) Experimental fringe pattern for gear tooth is as shown in the figure. For this, theoretical fringes are plotted with different number of parameters. Choose the correct number of parameters for each fringe pattern (taking into account the geometry of fringe patterns) *2 points*

Fig. Experimental fringe pattern of gear tooth




- A-6, B-2, C-5
- A-2, B-5, C-6
- A-6, B-5, C-2

No, the answer is incorrect.
Score: 0
Accepted Answers:
*A-6, B-5, C-2*

The terms used in the expression are denoted using the alphabets as follows:
$A = \cos\frac{\theta}{2}; B = \sin\frac{\theta}{2}; C = \cos\frac{3\theta}{2}; D = \sin\frac{3\theta}{2}; E = \frac{K_I}{\sqrt{2\pi r}}; F = \frac{K_{II}}{\sqrt{2\pi r}}.$
In the Westergaard stress function for Mode II loading, after shifting the origin and making the approximation for near tip field, the stress field is obtained as ____. Express $\sigma_x, \sigma_y$ and $\sigma_{xy}$ using the letters given. The letters have to be written in the order given above separated by a comma without any spacing. (example: AB(1+C),AB(1-C)) The terms representing final expression of stress components should be in the same sequence as discussed in the lecture. Keeping this in mind write the answer suitably. Please note AB is not equal to BA; while correcting the sequence matters.

7) The expression for $\sigma_x$ is given as *1 point*

- - FB (2 □+ AC )
- FB (1 + AC )
- FB ( AC )
- FB((A/B)(1-BD))

No, the answer is incorrect.
Score: 0
Accepted Answers:
*- FB (2 □+ AC )*

8) The expression for $\sigma_y$ is given as *2 points*

- - FB (2 □+ AC )
- FB (1 + AC )
- FB ( AC )
- FB((A/B)(1-BD))

No, the answer is incorrect.
Score: 0
Accepted Answers:
*FB ( AC )*

9) The expression for $\tau_{xy}$ is given as *2 points*

- - FB (2 □+ AC )
- FB (1 + AC )
- FB ( AC )
- FB((A/B)(1-BD))

No, the answer is incorrect.
Score: 0
Accepted Answers:
*FB((A/B)(1-BD))*

Using Westergaard's displacement function, calculate the following quantities. The displacement field for a Mode-III problem is given as
$u_x = 0; u_y = 0; u_z = w(x,y)$

10) The strain tensor is given by: *2 points*

- $\{\varepsilon\} = \begin{bmatrix} 0 & 0 & \frac{\partial w}{\partial x} \\ 0 & 0 & \frac{\partial w}{\partial y} \\ \frac{\partial w}{\partial x} & \frac{\partial w}{\partial y} & 0 \end{bmatrix}$
- $\{\varepsilon\} = \begin{bmatrix} 0 & 0 & \frac{1}{2}\frac{\partial w}{\partial x} \\ 0 & 0 & \frac{1}{2}\frac{\partial w}{\partial y} \\ \frac{1}{2}\frac{\partial w}{\partial x} & \frac{1}{2}\frac{\partial w}{\partial y} & 0 \end{bmatrix}$
- $\{\varepsilon\} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & \frac{1}{2}\frac{\partial w}{\partial y} \\ 0 & \frac{1}{2}\frac{\partial w}{\partial y} & 0 \end{bmatrix}$
- $\{\varepsilon\} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & \frac{\partial w}{\partial y} \\ 0 & \frac{\partial w}{\partial y} & 0 \end{bmatrix}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\{\varepsilon\} = \begin{bmatrix} 0 & 0 & \frac{1}{2}\frac{\partial w}{\partial x} \\ 0 & 0 & \frac{1}{2}\frac{\partial w}{\partial y} \\ \frac{1}{2}\frac{\partial w}{\partial x} & \frac{1}{2}\frac{\partial w}{\partial y} & 0 \end{bmatrix}$

11) The stress tensor is given by: *2 points*

- $\{\sigma\} = \begin{bmatrix} 0 & 0 & G\frac{\partial w}{\partial x} \\ 0 & 0 & G\frac{\partial w}{\partial y} \\ G\frac{\partial w}{\partial x} & G\frac{\partial w}{\partial y} & 0 \end{bmatrix}$
- $\{\sigma\} = \begin{bmatrix} G\frac{\partial w}{\partial x} & G\frac{\partial w}{\partial x} & 0 \\ G\frac{\partial w}{\partial x} & G\frac{\partial w}{\partial x} & 0 \\ 0 & 0 & 0 \end{bmatrix}$
- $\{\sigma\} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & G\frac{\partial w}{\partial y} \\ 0 & G\frac{\partial w}{\partial y} & 0 \end{bmatrix}$
- $\{\sigma\} = \begin{bmatrix} 0 & 0 & G\frac{\partial w}{\partial x} \\ 0 & 0 & G\frac{\partial w}{\partial y} \\ 0 & G\frac{\partial w}{\partial y} & 0 \end{bmatrix}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\{\sigma\} = \begin{bmatrix} 0 & 0 & G\frac{\partial w}{\partial x} \\ 0 & 0 & G\frac{\partial w}{\partial y} \\ G\frac{\partial w}{\partial x} & G\frac{\partial w}{\partial y} & 0 \end{bmatrix}$

12) Functions, w and $Z_{III}$ , for the mode III, given by Westergaard are: *1 point*

- $w = \frac{1}{G}ImZ_{III}; Z'_{III} = \frac{\tau}{\sqrt{z^2-a^2}}$
- $w = \frac{1}{G}ImZ'_{III}; Z_{III} = \frac{\tau z}{\sqrt{a^2-z^2}}$
- $w = \frac{1}{G}ImZ_{III}; Z'_{III} = \frac{\tau z}{\sqrt{z^2-a^2}}$
- $w = \frac{1}{G}ImZ_{III}; \bar{\bar{Z}}_{III}\frac{\sigma(z-a)}{\sqrt{z^2-a^2}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$w = \frac{1}{G}ImZ_{III}; Z'_{III} = \frac{\tau z}{\sqrt{z^2-a^2}}$