Assignment 08

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

**Due on 2018-09-26, 23:59 IST.**

1) Select the correct option for non-symmetric but specially orthotropic laminate.  

- $A_{16} = A_{26} = D_{16} = D_{26} = 0$
- $A_{16} = A_{26} = B_{16} = B_{26} = D_{16} = D_{26} = 0$
- $A_{16} = A_{26} = B_{ij} = D_{16} = D_{26} = 0$
- None of these

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
$A_{16} = A_{26} = B_{16} = B_{26} = D_{16} = D_{26} = 0$

2) Estimate the coefficients of thermal expansion for a unidirectional glass-polyester composite in the transverse direction. The fiber volume fraction in the composite is 60%. Assume the following constituent properties.  

Coefficient of thermal expansion for fiber ($\alpha_f$) = $0.5 \times 10^{-5}$/°C  
Coefficient of thermal expansion for matrix ($\alpha_m$) = $9.0 \times 10^{-5}$/°C  
Young's modulus of fiber (E_f) = 70 GPa; Young's modulus of matrix (E_m) = 3.5 GPa  
Poisson's ratio of fiber ($\nu_f$) = 0.2; Poisson's ratio of matrix ($\nu_m$) = 0.35

No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
- $9.82 \times 10^{-5}$
- $7.49 \times 10^{-5}$
- $5.16 \times 10^{-5}$
- $6.56 \times 10^{-5}$
The laminate is subjected to a normal axial stress of 15 MPa and a shear stress of 1.0 MPa. Calculate extensional stiffness matrix \([A]\) and coupling stiffness matrix \([B]\) for the given laminate.

\[
\begin{bmatrix}
11.67 & 3.33 & 0 \\
3.33 & 6.66 & 0 \\
0 & 0 & 31
\end{bmatrix} \text{ GN/m and } \begin{bmatrix}
11.67 & 0 & 0 \\
0 & 6.66 & 0 \\
0 & 0 & 31
\end{bmatrix} \text{ GN}
\]

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

\[
\begin{bmatrix}
46.68 & 13.32 & 0 \\
13.32 & 46.68 & 0 \\
0 & 0 & 12
\end{bmatrix} \text{ GN/m and } \begin{bmatrix}
46.68 & 0 & 0 \\
0 & 6.66 & 0 \\
0 & 0 & 6
\end{bmatrix} \text{ GN}
\]

4) A semi-infinite composite plate as shown in the figure is loaded by \(q\) N/m and length of the plate is \(a\) m. Find out the expression for displacement \(u_0\) in x-direction. The composite plate having \([0/2/90_2]\) lamination sequence with a unit thickness of each lamina.

\[
(\text{Where } A_{11} = \frac{D_{11}}{A_{11}} - \frac{D_{12}^2}{A_{11}})
\]

\[
\frac{B_{11}q \cdot a^3}{24A_{11}D_{11}} \left[4 \left(\frac{x}{a}\right)^3 + 1\right] \left(\frac{x}{a}\right)
\]

\[
\frac{B_{11}q \cdot a^3}{24A_{11}D_{11}} \left[4 \left(\frac{x}{a}\right)^4 - 1\right] \left(\frac{x}{a}\right)
\]

\[
\frac{B_{11}q \cdot a^3}{24A_{11}D_{11}} \left[4 \left(\frac{x}{a}\right)^4 + 1\right] \left(\frac{x}{a}\right)
\]

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

\[
\frac{B_{11}q \cdot a^3}{24A_{11}D_{11}} \left[4 \left(\frac{x}{a}\right)^2 - 1\right] \left(\frac{x}{a}\right)
\]

5) Consider a symmetrically laminated finite rectangular plate which is simply supported on all four edges. The plate is loaded as shown in figure with load intensity of \(q(x,y)\). For such a plate, the out-of-plane
boundary conditions are………. (Note: Laminate is specially orthotropic.)

\[
\begin{align*}
\text{Problem 5 can be solved for out-of-plane displacement } w^0(x,y) \text{ by representing Fourier series as follows:} \\
\quad w^0(x,y) = \sum \sum w_{mn} \sin \left( \frac{m\pi x}{a} \right) \sin \left( \frac{n\pi y}{b} \right)
\end{align*}
\]

Match the lists I and II to select the correct rate of convergence for different mechanical quantities as given in the list I.

<table>
<thead>
<tr>
<th>List I</th>
<th>List II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Out-of-plane shear</td>
<td>a. (m^{-5})</td>
</tr>
<tr>
<td>2. Load</td>
<td>b. (m^{-3})</td>
</tr>
<tr>
<td>3. Displacement (w)</td>
<td>c. (m^{-4})</td>
</tr>
<tr>
<td>4. Curvature</td>
<td>d. (m^{-2})</td>
</tr>
</tbody>
</table>

No, the answer is incorrect.
Score: 0

Accepted Answers:
1-b; 2-d; 3-a; 4-c

7) (Note: question 7 to 10 have same data as follow) 1 point

A semi-infinite plate is simply supported and pinned at one end, while simply supported on
The plate is subjected to a uniformly distributed load \( q \) N/m. The plate is made up of a symmetric laminate composite as shown in the figure.

**Assertion (A):** Even though the beam is free to move in \( x \) direction at \( x = +a/2 \), the solution for displacement at this end \( u^0 \) is zero.

**Reason (R):** The presence of symmetric laminate ensures that there is no coupling between the \( u(x) \) and \( M(x) \). And \( u(x) \) will be non-zero only in presence of non-zero \( N_x \).

Both A and R are true and R is the correct explanation of A.

No, the answer is incorrect.

Score: 0

**Accepted Answers:**

- Both A and R are true and R is the correct explanation of A.

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8) The vertical load acting on the plate (\( q \)) is predominantly balanced by \( \ldots \ldots \) \( \ldots \ldots\) (dA-infinitesimally small area).

- \( M_x \)
- \( M_y \)
- \( M_z \)
- \( M_{yz} \) and \( M_{xz} \)

No, the answer is incorrect.

Score: 0

**Accepted Answers:**

- \( M_x \)

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9) Which of the following statements are the correct?

1. For mid-plane ABCD, line AB and CD which were straight prior to deformation, will remain straight after deformation as well.

2. Presence of non-zero \( M_y \) ensure that these line segment remain straight.
3. My is non-zero because D12 is non-zero.

- 1 and 3
- 1 and 2
- only 3
- all 1, 2 and 3

No, the answer is incorrect.
Score: 0
Accepted Answers:
all 1, 2 and 3

10 Presence of My is demonstration of the …………

- Symmetry of laminate composite.
- Semi-infinite nature of the plate.
- Poisson’s effect.
- Both A and B

No, the answer is incorrect.
Score: 0
Accepted Answers:
Poisson’s effect.