Q7.1 Which of the following is the correct expression for shear strain for a shear deformable beam?

1. $\psi$

2. $\psi + 1$

3. $\frac{dw}{dx}$

4. $\psi + \frac{dw}{dx}$
Q7.2 Which of the following statements is not true about Timoshenko beam?

1. The primary variables are displacement and slope.

2. The secondary variables are shear force and bending moment.

3. **Cross-sections which are normal and plane to the longitudinal axis remain normal and plane to it after bending of beam.**

4. None of these.
Q7.3 Choose the correct statement in context of a Timoshenko beam.

1. Cross-sectional planes which are straight will remain straight after bending.

2. Neutral axis will remain normal to the cross-section before and after bending.

3. *Timoshenko beam theory is preferred for short and thick beams.*

4. Shear strain is constant throughout the beam.
Q7.4 Lagrangian approximation functions can be used in Timoshenko beam but not in Euler-Bernoulli beam. Why?

1. Euler-Bernoulli beam has two degree of freedom while Timoshenko beam has one degree of freedom per node.

2. Euler-Bernoulli beam has one degree of freedom while Timoshenko beam has two degree of freedom per node.

3. Both beams have two degree of freedom – the two degrees of freedom for Euler-Bernoulli beam are represented by functions which are dependent on each other.

4. **Both beams have two degree of freedom – the two degrees of freedom for Euler-Bernoulli beam are represented by functions which are independent on each other.**
Q7.5 Primary variables for a Timoshenko beam can be expressed as: $w(x) = \sum_{j=1}^{m} w^e_j \alpha^e_j$ and $\Psi(x) = \sum_{j=1}^{n} s^e_j \beta^e_j$

If $m=n=2$, then which of the following statements is not true?

1. Shear locking will occur.

2. $\frac{d\Psi}{dx}$ will become equal to zero.

3. Bending energy will vanish.

4. *Lagrangian approximation functions cannot be used.*
Q7.6 Primary variables for a Timoshenko beam can be expressed as:
\[ w(x) = \sum_{j=1}^{m} w_j^e \alpha_j^e \] and \[ \Psi(x) = \sum_{j=1}^{n} s_j^e \beta_j^e \]
Which of the following statements is not true regarding shear locking?

1. \( n=m=2 \) will lead to shear locking.

2. Shear stress will become constant for \( m=n=2 \).

3. \textit{It is a numerical issue related to rounding off error.}

4. It is a numerical error related to the order of the approximation polynomial.
Primary variables for a Timoshenko beam can be expressed as:
\[ w(x) = \sum_{j=1}^{m} w_j^e \alpha_j^e \] and
\[ \psi(x) = \sum_{j=1}^{n} s_j^e \beta_j^e \]
Which of the following statements is true if approximation functions are Lagrangian in nature?

1. \( \alpha_1^e = 1 - \bar{x}/h_e, \alpha_2^e = \bar{x}/h_e \)

2. \( \alpha_2^e = 1 - \bar{x}/h_e, \alpha_1^e = \bar{x}/h_e \)

3. \( \alpha_1^e = 1 - \bar{x}_2/h_e, \alpha_2^e = \bar{x}_2^2/h_e \)

4. \( \alpha_2^e = 1 - \bar{x}_2^2/h_e, \alpha_1^e = \bar{x}_2^2/h_e \)
Q7.8 Primary variables for a Timoshenko beam can be expressed as:

\[ w(x) = \sum_{j=1}^{m} w_j e \alpha_j^e \quad \text{and} \quad \Psi(x) = \sum_{j=1}^{n} s_j e \beta_j^e \]

Which of the following methods cannot be used to remove shear locking?

1. Let \( m = n+1 \).

2. Let \( m=n \), and use reduced integration on specific terms.

3. **Let \( m=n \), and use standard integration method for all terms.**

4. None of the above.
Q7.9 For a Timoshenko beam, the stiffness matrix for a linear 1-D element will be:

1. 2X2
2. 3X3
3. 4X4
4. 6X6
Q7.10 Given below are some of the terms which are calculated to compute element stiffness matrices for a Timoshenko beam. Which of these terms requires to be reduced integrated to avoid shear locking?

1. \[ \int_0^{h_e} \frac{d\alpha_i}{dx} \frac{d\alpha_i}{dx} GAK_s \, dx \]

2. \[ \int_0^{h_e} \frac{d\alpha_i}{dx} \beta_j GAK_s \, dx \]

3. \[ \int_0^{h_e} \frac{d\alpha_i}{dx} \beta_i GAK_s \, dx \]

4. \[ \int_0^{h_e} \beta_i \beta_j GAK_s \, dx \]
Q7.11 Which of the following statements is not true about an Eigenvalue problem?

1. Eigenvalues are characteristics of the mathematical mode of the problem.

2. *Eigenvalues change due to changes in externally applied loads.*

3. Eigenvalues are unique to a particular system.

4. None of the above.
Q7.12 Which of the following parameters will not influence Eigenvalues of a system?

1. Boundary conditions.

2. Material density.


4. **External force.**