8.1 To solve time dependent problems using FEA method, first step we need to do in element level is:

I. Temporal approximation

II. **Spatial approximation**

III. Apply initial and boundary conditions

IV. None of the above.
8.2 Temporal approximation for parabolic time dependent problems uses:

1. **Alpha family of approximations.**
2. **Beta family of approximations.**
3. **Gamma family of approximations.**
4. **Newmark family of approximations.**
8.3 Euler method in alpha family of approximation for parabolic time dependent problems have order of accuracy to be:

1. $\Delta t$
2. $(2\Delta t)^2$
3. $(3\Delta t)^3$
4. $(\Delta t)^{1/2}$

Where $\Delta t$ is difference of time step
8.4 Diagonalize the following mass matrix using proportional lumping method and select the correct options from given below.

\[
[M] = \rho h_e / 37 \begin{bmatrix}
5 & 2 & 4 \\
-4 & 10 & 1 \\
3 & -6 & 15 \\
\end{bmatrix}
\]

\[
i) [M]_i = \rho h_i / 37 \begin{bmatrix}
5 & 0 & 0 \\
0 & 10 & 0 \\
0 & 0 & 15 \\
\end{bmatrix}
\]

\[
ii) [M]_i = \rho h_i / 37 \begin{bmatrix}
10 & 0 & 0 \\
0 & 5 & 0 \\
0 & 0 & 15 \\
\end{bmatrix}
\]

\[
iii) [M]_i = \rho h_i / 37 \begin{bmatrix}
15 & 0 & 0 \\
0 & 10 & 0 \\
0 & 0 & 25 \\
\end{bmatrix}
\]

\[
iv) [M]_i = \rho h_i / 37 \begin{bmatrix}
10 & 0 & 0 \\
0 & 15 & 0 \\
0 & 0 & 25 \\
\end{bmatrix}
\]

(i) Is correct option
8.5 Diagonalize the following mass matrix using row sum lumping method and select the correct options from given below.

\[
[M] = \rho h_e / 37 \begin{bmatrix}
5 & 2 & 4 \\
-4 & 10 & 1 \\
3 & -6 & 15
\end{bmatrix}
\]

(i) \([M]_d = \rho h_e / 37 \begin{bmatrix}
11 & 0 & 0 \\
0 & 7 & 0 \\
0 & 0 & 12
\end{bmatrix}
\]

(ii) \([M]_d = \rho h_e / 37 \begin{bmatrix}
7 & 0 & 0 \\
0 & 11 & 0 \\
0 & 0 & 12
\end{bmatrix}
\]

(iii) \([M]_d = \rho h_e / 37 \begin{bmatrix}
22 & 0 & 0 \\
0 & 7 & 0 \\
0 & 0 & 12
\end{bmatrix}
\]

(iv) \([M]_d = \rho h_e / 37 \begin{bmatrix}
7 & 0 & 0 \\
0 & 22 & 0 \\
0 & 0 & 12
\end{bmatrix}
\]

(i) Is correct option
8.6 Which of the following statements is true regarding time-dependent problems?

1. They must be linear in both time as well as the primary variable.

2. They do not require boundary conditions to be solved.

3. They require initial conditions along with boundary conditions knowledge.

4. They cannot be ordinary differential equation.
Given the following time-dependent partial equation –

\[- \frac{\partial}{\partial x} \left( a \frac{\partial u}{\partial x} \right) + \frac{\partial^2}{\partial x^2} \left[ b \frac{\partial^2 u}{\partial x^2} \right] + c_0 u + c_1 \frac{\partial u}{\partial t} + c_2 \frac{\partial^2 u}{\partial t^2} = f(x,t) ; \quad 0<x<L\]

which of the following statements is not true while solving the PDE?

1. Given equation needs to be integrated twice with respect to time.

2. Given equation needs to be integrated four times with respect to x.

3. This equation cannot be solved without initial conditions.

4. **None of the above.**
8.8 What does the term “Spatial approximation” in context of a space-time PDE mean?

1. Conversion of a space-time partial differential equation into an ordinary differential equation in space.

2. *Conversion of a space-time partial differential equation into an ordinary differential equation in time.*

3. Conversion of a space-time partial differential equation into a partial differential equation in space.

4. Conversion of a space-time partial differential equation into a partial differential equation in time.
3.3 Given the time-dependent partial equation
\[- \frac{\partial}{\partial x}\left( a \frac{\partial u}{\partial x} \right) + \frac{\partial^2}{\partial x^2}[b \frac{\partial^2 u}{\partial x^2}] + c_0 u + c_1 \frac{\partial u}{\partial t} + c_2 \frac{\partial^2 u}{\partial t^2} = f(x, t) ; \quad 0 < x < L\]
The primary variable \(u\) is assumed to be equal to \(\sum_{j=1}^{n} c_j \Phi_j(x)\). Which of the following statements is true?

1. \(C_j\) is a constant.

2. \(C_j\) is time dependent.

3. Since \(\Phi_j\) depends on \(x\), then \(c_j\) has to be dependent on time only.

4. None of the above.
8.10 $\int w. \text{Residue } = 0$ represents the expression for weighted residue method. Which of the following is true?

1. $w$ represents the primary variable.

2. Residue is the same as the governing differential equation, therefore it will always be zero.

3. $w$ represents the physical weight of the material.

4. $w \text{ represents user-defined functions.}$
8.11 Assembly level equations can be written in the matrix form as:

\[
[K] \{u\} = \{f\} + \{Q\} = \{F\}
\]

Which of the following is true about \(\{F\}\)?

1. \(\{F\}\) represents the terms related to point loads.

2. \(\{F\}\) represents the terms related to distributed load.

3. \(\{F\}\) represents the terms related to external load – both point and distributed loads.

4. \(\{F\}\) will represent external force for any type of governing differential equation.
8.12 Which of the following statements is true regarding backward difference method?