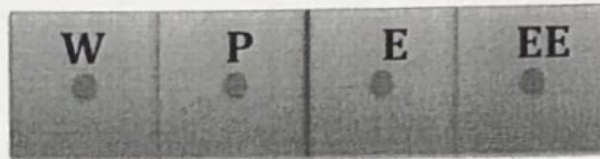


## CLL-768 Minor-2, Marks: 20

Q1. The diffusion flux at the face centroid (e) of a cell is often approximated as

$$\left. \frac{d\phi}{dx} \right|_e = \frac{\phi_E - \phi_P}{\Delta x}$$



- A. Will this discretization be always **second-order accurate**?-  
Explain
- B. Making use of the W and EE nodes also, find a **symmetric fourth-order-accurate scheme** for the derivative on the cell face. **MARKS: 1+7**

Q2. For unsteady state 1-D diffusion with zero sources:

- A. Show with the help of **von-Neumann** stability criteria that the **Crank Nicholson scheme** is always unconditionally stable.
- B. Does **Scarborough criteria** demand the same? If not what is the time step limit imposed? **MARKS: 6+2**

Q3. If following are examples of source terms (S) as a function of temperature (T), if **A and B are both positive constants** what will you take as  $S_c$  and  $S_p$  to make **Scarborough criteria** work?

- 1)  $S = A + B \cdot T$
- 2)  $S = A - B \cdot T$
- 3)  $S = A - B \cdot T^3$
- 4)  $S = A + B \cdot T^3$

**MARKS: 4**