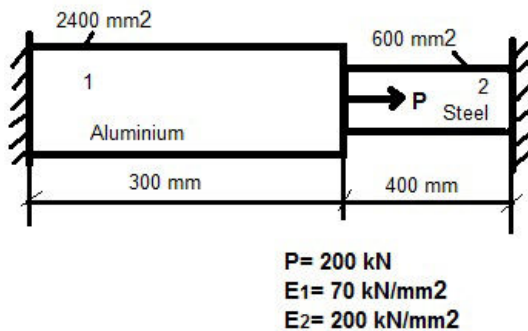


1. a. Explain the step by step procedure involved in FEA. (15)
b. Discuss in detail about Finite Element Method and Boundary Element Method. Write the various steps involved. (5)

OR

2. A stepped bar is subjected to an axial load of 200 kN at the place of change of cross section and material as in the fig. Find i. Nodal displacement, ii. Reaction forces, iii. Induced stresses in each material. (20)



3. Derive the shape function for 1-D Beam element. Check the shape functions for unity. (20)

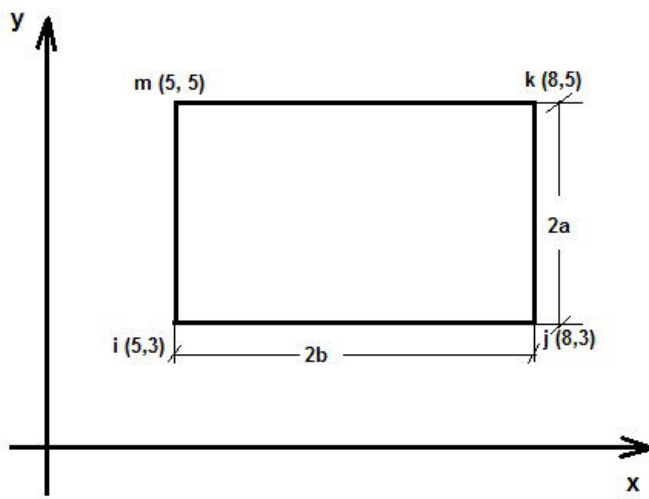
OR

4. Find the deflection at the centre of the simply supported beam of span 'l', subjected to an UDL w/unit length throughout its entire length using i. Galerkin method, ii. Least square method, iii. Point collocation method, iv. Subdomain method. The governing differential equation for the beam subjected to UDL is given by

$$EI \frac{d^4 y}{dx^4} - w = 0, \quad 0 \leq x \leq l$$

Use trigonometric trial function. (20)

5. a. What is the purpose of Pascal's triangle (2)
b. Write short notes on the properties of the shape function. (3)
c. Determine three points on the 50 °C contour line for the rectangular element shown in the figure. The nodal values are $\Phi_i = 42 \text{ °C}$, $\Phi_j = 54 \text{ °C}$, $\Phi_k = 56 \text{ °C}$ and $\Phi_m = 46 \text{ °C}$. Use local coordinate system. (15)

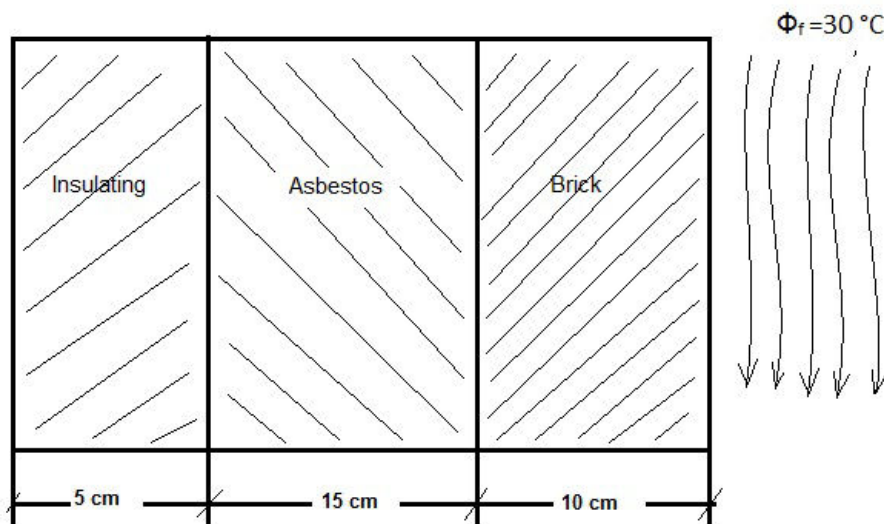


OR

6. Derive the shape function for a 2-D Triangular element. (20)
7.
 - a. What is higher order element? Discuss in detail with an example. Also list the purpose and advantages of higher order elements. (16)
 - b. Write the Shape function for the 1-D cubic element and check for unity. (4)

OR

8. Derive the shape function for a 1-D quadratic element. Use local coordinate system (20)
9.
 - a. State Darcy law. What does the negative sign indicate? (2)
 - b. A wall of cylindrical oven consists of 3 different layers of materials. First layer is composed of 5 cm of insulating material with thermal conductivity 0.08 W/mk. The second layer is made of 15 cm thickness of asbestos with thermal conductivity 0.04 W/mk. The outer layer consists of 10 cm thick brick wall with thermal conductivity 0.72 W/mK. The inside wall temperature of oven is 250°C and outer layer is 30 °C with convective heat transfer coefficient 40 W/m²K. Determine the temperature distribution along the composite wall. (Convective heat loss occurs at the right end). (18)



Wishing you All the Best