BE Sem VII CAD (R)

CAD/CAM Finite Elements Analysis.

Con. 2987-09. **VR-4674**

(REVISED COURSE)

(4 Hours) **[Total Marks : 100**

MASTER

N.B.: (1) Question Nos. **1** and **6** are **compulsory**.
(2) Attempt any **two** out of **four** questions from **Section I**.
(3) Attempt any **two** out of **four** questions from **Section II**.
(4) Attempt to the **two** sections must be written in **separate** answer books.
(5) Assume any **suitable data** if **necessary**.

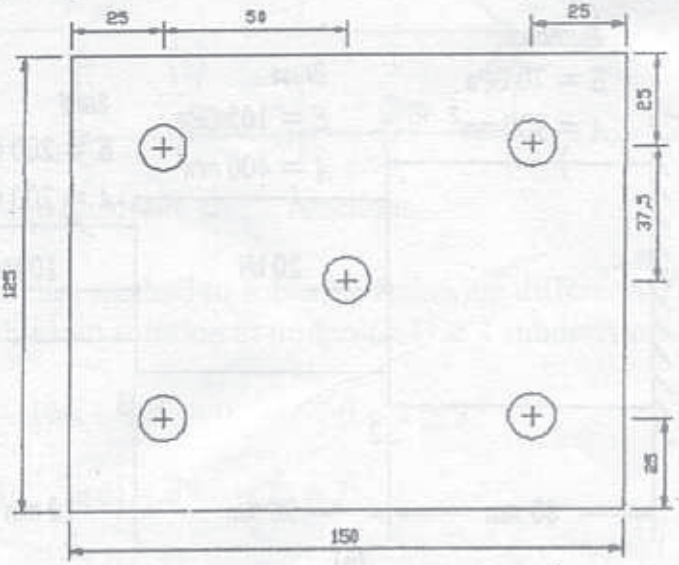
Section-I

1. (a) Describe the transformation used in the magnification and reduction with respect to the origin. Find the new coordinates of the triangle A(0, 0), B(1, 1), C(5, 2) after it has been (i) magnified to twice its size and (ii) reduced to half its size. 5
   (b) Reflect the diamond shaped polygon whose vertices are A(– 1, 0), B(0, – 2), C (1, 0), D(0, 2) about the vertical line x = 2. 5
   (c) Find a transformation A_v which aligns a given vector V with the vector K along the positive z axis. 8

2. (a) Explain Design Process models according to Ohsuga and Pahl & Beitz. 8
   (b) Derive parametric equations of line, circle, ellipse and parabola. 8

3. (a) Explain characteristics of a Bezier Curve. 8
   (b) Explain Cohen Sutherland algorithm. 8

4. (a) The part drawing of component is shown in the **fig.** Five holes of 12.5 mm diameter are to be drilled at five places. The speed and feed rate are 592 rpm and 100 mm/min respectively. The machine has floating zero feature and absolute positioning. The thickness of a plate is 10 mm. Write manual part program. 8



   (b) Explain feed drives used in CNC machine tools. 8

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5. Write short notes on any **four** :— 16

(a) Standardization in Graphics

(b) Geometric Construction Methods

(c) Knowledge base Engineering

(d) Object Orientation in CAD

(e) Subroutines and do-loops in part programming.

Section-II

6. (a) Solve the following governing differential equation :— 15

$$\frac{d^2y}{dx^2} - 10x^2 = 5, \quad 0 \le x \le 1$$

B.C.S. $y(0) = y(1) = 0$

Using Following methods—

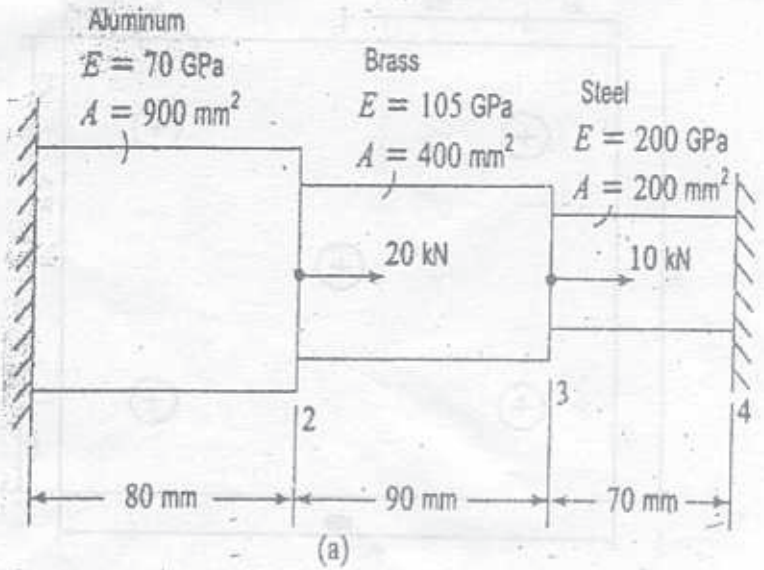
(1) Galerkin method, using cubic polynomial for approximate function

(2) Exact Method.

Compare the answers at x = 0.25, 0.5, 0.75.

(b) Explain errors encountered in FEA. 3

7. (a) For the three -stepped bar shown in **figure** determine the displacements at node 2 and 3, stresses in the three sections and reactions at the ends. 8



(a)

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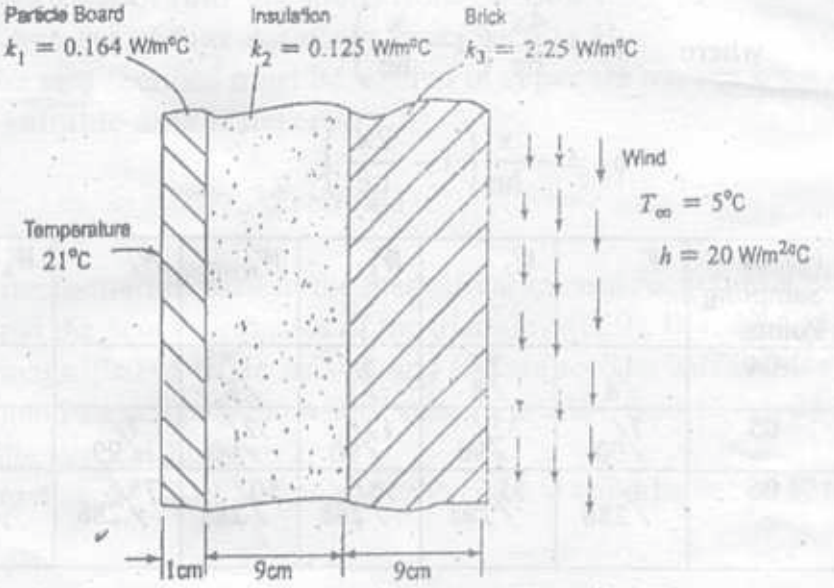
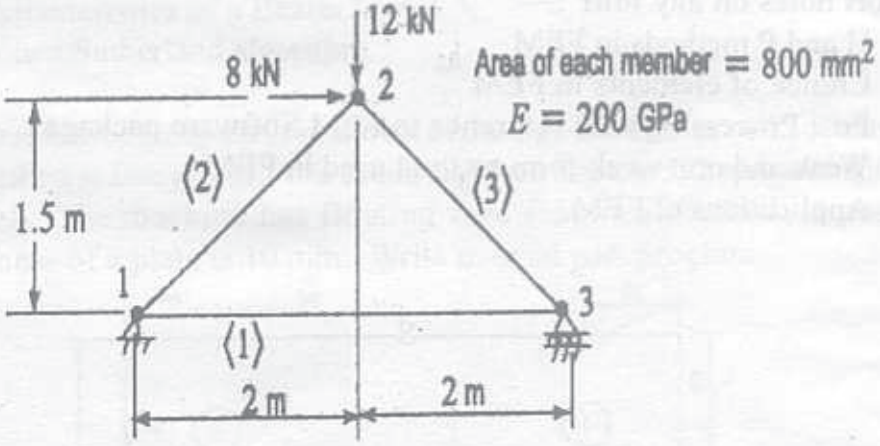
(b) The interior wall of a room is maintained at a temperature of 21°C. The wall is built using particle board, insulation and brick as shown in **figure**. On a mild day the outside air temperature has convection coefficient of 20 W/m² °C. Determine the temperatures at wall interfaces and the rate of heat loss from the room per m².



8. (a) Determine the nodal deflections, stresses in members, and the reactions at supports for the three bar truss shown in **figure**. 10



(b) Explain linear and quadratic shape functions. 6

9. (a) Use finite difference method to solve the following differential equation. Compare the answer with exact solution at midpoint. Use 4 subdivisions. 8

$$\frac{d^2u}{dx^2} - 16u + 5x^2 = 0 \qquad 0 \le x \le 2$$

B.C.S. $u(0) = 0$ $u(2) = 2$

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(b) Solve the following integration numerically using Newton-Cotes Method.

$$K_{23} = \int_0^{he} x^2 \frac{d\phi_2}{dx} \frac{d\phi_3}{dx} dx$$

where $\phi_2 = \frac{4x}{he}\left(1 - \frac{x}{he}\right)$

$$\phi_3 = -\frac{x}{he}\left(1 - \frac{2x}{he}\right)$$

No. of Sampling Points	W_1	W_2	W_3	W_4	W_5	W_6
04	$1/8$	$3/8$	$3/8$	$1/8$	-	-
05	$7/90$	$32/90$	$12/90$	$32/90$	$7/90$	-
06	$19/288$	$75/288$	$50/288$	$50/288$	$75/288$	$19/288$

Compare the answer with exact. What will be the effect of inadequate number of sampling points ? Actually try and conclude.

10. Write short notes on any **four** :— 16

(a) H and P methods in FEM
(b) Choice of elements in FEM
(c) Post Processing with reference to FEM Software package.
(d) Weak and non weak form method used in FEM
(e) Applications of FEM.

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