Ganpat University
M.Tech (II Semester) CAD/CAM
CBSC REGULAR EXAMINATION MAY JUNE - 2014
3ME211 Engineering Analysis and Optimization

Time: 3 hr   **Total Marks: 70**

Instructions:
(1) Attempt all Questions.
(2) Figures to the right of questions indicate full marks of questions.
(3) Assume suitable data if necessary.

SECTION I

1. (a) Derive the shape function of bar element of length L and two nodes. [06]
   (b) Give comparisons between finite element solution and exact solutions. [06]

OR

1. (a) Explain one of the FEM methods to derive stiffness matrix and force matrix of bar [06]
   element. Derive the element stiffness matrix for the bar element.
   (b) Explain the role of finite element analysis in machine design in mechanical [06]
   engineering

2. (a) Explain the temperature effect in the 2D truss element. [04]
   (b) Determine the nodal displacement, element stress and support reaction for the [08]
   problem as shown in figure A. Take E = 200E03 N/mm^2.

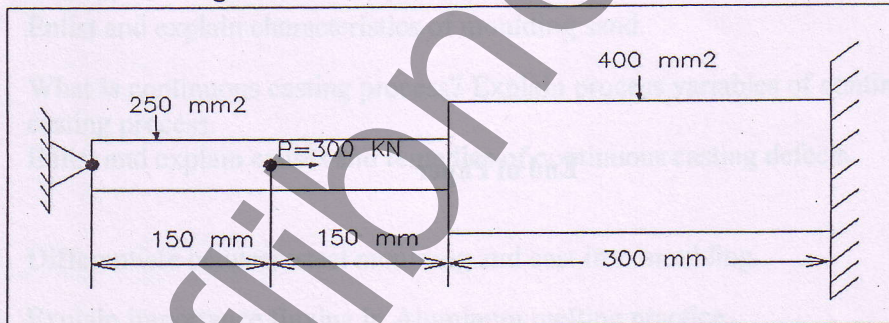Figure A.

OR

2. (a) Write down some important comment s regarding properties of global stiffness [04]
   matrix.
   (b) Derive the relation between strain and displacement matrix. Find the strain [08]
   displacement matrix [B] for CST elements which are used to discritize a rectangle
   plate of 2 cm X 3 cm size.

3. Attempt any two short notes: [11]
   (a) Penalty approach to treat boundary condition
   (b) 3D truss element and its applications.
   (c) Traction force vector for CST element.

SECTION II

4. (a) Determine the maximum and minimum value of the function [06]
   $$f(x) = 12x^5 - 45x^4 + 40x^3 + 5$$
   (b) Find the minimum of the function [06]
   $$f(x) = 10x^6 - 48x^5 + 15x^4 + 200x^3 - 120x^2 - 480x + 100$$

4. (a) Find the minimum of   [12]
$$f(x) = x(x - 1.5)$$
By Interval Halving Method in the interval (0.0, 1.0) to within 10% of the exact value.

5. (a) Compare the ration of intervals of uncertainty (L_n/L_0) obtainable in the following   [06]
methods for n = 2,3,....,10. Exhaustive search Dichotomous search with $\delta = 10^{-4}$
Interval halving method

   (b) Find the number of experiments to be conducted in the following methods to obtain a   [05]
value of $L_n/L_0 = 0.001$. Exhaustive search Dichotomous search with $\delta = 10^{-4}$
Interval halving method

5. (a) Find the minimum of the function   [11]

$$f(x) = 0.65 - \frac{0.75}{1+x^2} - 0.65x \tan^{-1}\frac{1}{x}$$

By exhaustive search in the interval (0, 3) to achieve an accuracy of within 5% of the exact value.

6. Find the minimum of   [12]
$$f(x) = x(x - 1.5)$$
By dichotomous search method in the interval (0.0, 1.0) to within 10% of the exact value.

End of Paper