Student Exam No._____

GANPAT UNIVERSITY

M. TECH. II SEM. (CAD/CAM) MECHANICAL ENGINEERING

CBCS REGULAR EXAMINATION APRIL-JUNE 2016

3ME211 ENGINEERING ANALYSIS & OPTIMIZATION

Time: 3 Hours **Total Marks: 60**

Instruction: 1 **Attempt all questions.**
2 **Make suitable assumptions wherever necessary.**
3 **Figures to the right indicate full marks.**

Section I

Q-1

(a) Discuss shape function with respect to one dimensional problem 3

(b) State the principle of minimum (stationary) potential energy and apply the same to determine nodal displacement of the spring system shown in Figure 1. 7

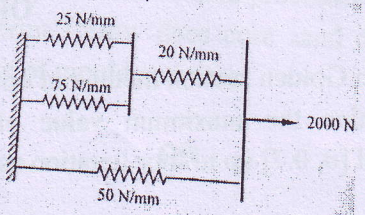

Figure 1

OR

Q-1

(a) A two member truss is shown in Figure 2. The cross-sectional area of each member of the truss is 100 mm^2 and the modulus of elasticity is 200 GPa. Determine the deflections, reactions and stresses in each of the members. 7

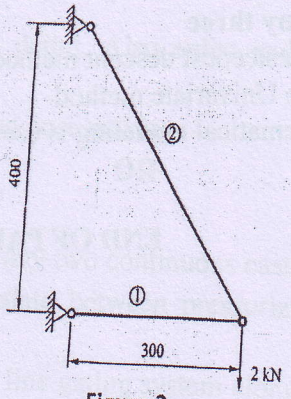

Figure 2

(b) What is FEM? What are the advantages and limitations of the method? 3

Q-2

(a) Explain the properties of stiffness matrix K. 5

(b) What is FEM? Sketch the different types of elements used in finite element analysis (1D, 2D and 3D). 5

OR

Q-2

(a) Explain the temperature effect in one dimensional problem. 5

(b) Explain the elimination approach of imposing boundary conditions. 5

Q-3

(a) Consider a brick wall of thickness L = 30 cm, k = 0.7 W/m·^{0}C. The inner surface is at 28^{0}C and the outer surface is exposed to cold air at -15^{0}C. The heat-transfer coefficient associated with the outside surface is h = 40 W/m^2·^{0}C. Determine the steady state temperature distribution within the wall. 6

(b) Explain how the model and apply boundary conditions to following types of problem: 4

1. Hollow cylinder under internal pressure, with one end closed.
2. Belleville Spring.

Section II

Q-4

(a) Explain Fibonacci method of optimization. 5

(b) Find the minimum of the function 5

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

using the secant method with an initial step size of t0 = 0.1, λ1 = 0.0, and ε = 0.01.

OR

Q-4

(a) Explain Golden section method of optimization. 5

(b) Determine the maximum value of the function $f(x) = x\cos\pi x^2$ in interval [0, 0.7] up to four iteration using Fibonacci method. 5

Q-5

(a) What is the secant method? Explain it. 5

(b) What are the limitations of classical methods in solving a one-dimensional minimization problem? 5

OR

Q-5

(a) Write the engineering applications of optimization. 5

(b) What is optimization? Explain processor for optimization of problem? 5

Q-6 **Attempt any three** 10

(a) Explain the steepest descent method.

(b) Explain the Univariate method.

(c) How mathematical modeling is use full in engineering optimization?

END OF PAPER