Roll No. ....

22221

M.Tech 1st Semester Mechanical Engg. (Machine Design)

Examination–May, 2014

NUMERICAL ANALYSIS AND OPTIMIZATION

Paper-M-801-A

Time : 3 hours ***Max. Marks : 100***

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard will be entertained after the examination.

Note : Attempt any **five** questions. All questions carry equal marks.

1. Transform the matrix to tri-diagonal form by using Householder's method.

$$A = \begin{bmatrix} 2 & -1 & -1 \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{bmatrix}$$

Also find the Eigen values and corresponding eigen vectors.

2. (a) Find the cubic splines to fit the data and evaluate y (1.5) and y' (3)

x :	1	2	3	4
y :	1	2	5	11

(b) Find the cubic polynomial which takes the following values :

x :	0	1	2	3
f(x) :	1	2	1	10

Hence, or otherwise evaluate f(4).

3. Derive the derivatives formulae using forward difference formula and hence, find the first and second derivatives of f(x) at 1.1 if :

X :	1.0	1.2	1.4	1.6	1.8	2.0
f(x) :	0	0.128	0.544	1.296	2.432	4.00

4. (a) Use Romberg's method to compute $\int_0^1 \frac{dx}{1+x}$. Hence, evaluate $\log_e 2$ correct to four decimal places.

(b) Using Runge-Kutta method of order 4, find y for x = 0.1 and 0.2.

Give that $\frac{dy}{dx} = xy + y^2, y(0) = 1.$

5. Apply Milne's method to find a solution of the differential equation $\frac{dy}{dx} = x - y^2$, in the range $0 \le x \le 1$ for the boundary condition y = 0 at x = 0, taking h = 0.2. Starting solutions required are to be obtained by using Taylor's series methods.

6. Write short notes on any **four** of the following :

(a) Householder's methods for symmetric matrices

(b) Gradient Method

(c) Quadratic programming

(d) Kuhn Tucker conditions

(e) Eigen Values and Eigen vectors

(f) Application of Dynamic Programming

7. (a) Discuss direct search method. Also write the characteristics of direct search method.

(b) State the necessary and sufficient conditions for the unconstrained minimum of the function.

8. (a) What is the use of Lagrange's multiplier Method ? What is their practical significance ?

(b) Find the minimum value of the function $f(x_1, x_2) = x_1^2 + x_2^2 - 10x_1 - 10x_2$

$$\text{Subject to} \quad \begin{aligned} & x_1 + x_2 \leq 9 \\ & x_1 - x_2 \geq 6, \\ & x_1, x_2 \geq 0. \end{aligned}$$
