Roll No. ....

22221

M. Tech. 1st Sem. (Mech. Engg.)

(Machine Design)

Examination – December, 2014

NUMERICAL ANALYSIS AND OPTIMIZATION

Paper : M-801-A

Time : Three hours] *[Maximum 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 examination.

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

1. (a) Solve the system

$$2x + 2y + z = 12$$
$$3x + 2y + 2z = 8$$
$$5x + 10y - 8z = 10$$

by using Gauss elimination method

(b) Determine Eigen value and the corresponding Eigen vector of the matrix. by Jacobi Method

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$

2. Given the values

x	:	300	304	305	307
$\log_{10} x$	:	2.4771	2.4829	2.4843	2.4871

Evaluate $\log_{10} 310$ by using

(i) Lagrange's formula

(ii) Newton's divided difference formula

3. (a) Find f '(10) from the following data :

x	:	3	5	11	27	34
f(x)	:	–13	23	899	17315	35606

(b) Given that;

x	:	4.0	4.2	4.4	4.6	4.8	5.0	5.2
logx	:	1.3863	1.4351	1.4816	1.5261	1.5686	1.6094	1.6487

Evaluate $\int_{4.0}^{5.2} \log x \, dx$ using

(i) Trapezoidal rule

(ii) Simpson's rule

4. Using Runge-Kutta Method of order 4, find y for x = 0.1, 0.2, 0.3

Given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$. Continue the solution at x = 0.4 using Adam's Method.

5. (a) Transform the matrix to tri-diagonal form by using Householder's method

$$A = \begin{bmatrix} 1 & 4 & 3 \\ 4 & 1 & 2 \\ 3 & 2 & 1 \end{bmatrix}$$

(b) Fit a parabola, by the method of least squares, to the following data :

x	:	1	2	3	4	5
y	:	5	12	26	60	97

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

(i) Optimization and Engg application of Optimization

(ii) Types of multistage decision problem

(iii) Gradient Method

(iv) Application of Dynamic Programming

(v) Non Linear programming problems

(vi) Difference between constrained and unconstrained Optimization techniques

7. Consider the problem

Minimize $F(X_1, X_2) = (X_1 - 1)^2 + X_2^2$

Subject to $G_1(X_1, X_2) = X_1^3 - 2X_2 \leq 0$

$G_2(X_1, X_2) = X_1^3 + 2X_2 \leq 0$

Determine whether the constraint qualifications and the Kuhn Tucker conditions are satisfied at the optimum point. Also state the Kuhn Tucker condition.