Roll No. ....

22221

M. Tech. 1st Sem. Mechanical Engg. (Machine Design) Examination–May, 2015

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. (a) Solve the system :

$2x + 4y + z = 3$

$3x + 2y - 2z = -2$

$x - y + z = 6$

by using Gauss Jordan method

(b) Solve the equations :

$2x + y + z = 10;$

$3x + 2y + 3z = 18;$

$X + 4y + 9z = 16$

by Gauss elimination method.

2. (a) Given that

x :	150	152	154	156
$y = \sqrt{x}$:	12.247	12.329	12.410	12.490

Evaluate $\sqrt{155}$ using Lagrange's interpolation.

(b) Fit a straight line, by the method of least square, to the following data :

x:	1	2	3	4	5
y:	14	27	40	55	68

3. Describe Newton's cotes formula. Also drive Trapezoidal rule and Simpson's rule and hence evaluate

$\int_0^4 e^x dx$ by Simpson's Rule.

4. (a) Using modified Euler's method, obtain a solution of the equation

$$\frac{dy}{dx} = 2 + \sqrt{xy}$$ with initial conditions y = 1 when x = 1 at x = 2 in steps of 0.2.

(b) Using Runge-Kutta method, compute y(0.2) and y(0.4) from

$$\frac{dy}{dx} = 3x + \frac{1}{2}y,\ y(0) = 1$$

5. (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) Given that

x :	1.96	1.98	2.00	2.02	2.04
f(x) :	0.7825	0.7739	0.7651	0.7563	0.7473

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 2.04

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

(i) Householder's methods for symmetric matrices

(ii) Gradient Method

(iii) Quadratic programming

(iv) Kuhn Tucker conditions

(v) Eigen Values and Eigen vectors

(vi) Applications of Dynamic Programming

7. Find the maximum of the function $f(x) = 2x_1 + x_2 + 10$ subject to $g(x) = x_1 + 2x_2^2 = 3$ using the Lagrange's multiplier method. Also find the effect of changing the right hand side of the constraint on the optimum value of f.

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

(b) Solve the quadratic programming problem

Maximize $z = 2x_1 + 3x_2 - 2x_1^2$

Subject to $x_1 + 4x_2 \leq 4$

$x_1 + x_2 \leq 2$

$x_1, x_2 \geq 0$