6311

Unique Paper Code : **2511504**

Name of the Paper : **Numerical Methods**

Name of the Course : **B. Tech. Electronics**

Semester : **V**

F-5

Duration : **3 Hours**

Maximum Marks: 75

Instructions for Candidates

Q. No. 1 is Compulsory

Attempt Five Questions in all

All questions carry equal marks.

Non-programmable scientific calculators are allowed.

1 Attempt ALL.

(a) Find the sum of 0.123×10^3 and 0.456×10^2 and write the result in three digit mantissa form.

(b) Define accuracy, absolute error and relative error.

(c) Compare Newton Raphson and secant in terms of convergence, number of function evaluation per iteration and accuracy.

(d) Find the inverse of the matrix using Gauss Jordan method

$$A=\begin{bmatrix}1 & 3\\ 2 & 7\end{bmatrix}$$

(e) Given $f(0) = -1$, $f(1) = 1$ and $f(2) = 4$, find the Newton's interpolating formula.

5 x 3=15

2(a) Find the root of an equation $x^3 - 5x + 1 = 0$ correct up to 3 significant digits using Regula Falsi in the interval [2, 3]. Also explain its graphical interpretation and specify the number of iterations in which solution is reached. 10

(b) Perform three iterations of the bisection method and obtain the smallest positive root of the equation in the interval [0, 1].

$$x^3 + 2x - 2 = 0$$ 5

3(a). Solve the following system of equations using Gauss elimination method.

$$2x + 6y + 10z = 0$$
$$x + 3y + 3z = 2$$
$$3x + 14y + 28z = -8$$ 7

(b) Solve the following system of equations using the Gauss Seidel method

$$8x_1 - 3x_2 + 2x_3 = 20$$
$$4x_1 + 11x_2 - x_3 = 33$$
$$x_1 + x_2 + 4x_3 = 9$$ 8

4(a) Find the polynomial using Lagrange interpolation of the given tabulated data

x	-2	0	2
$F(x)$	4	2	8

5

(b) In mathematics, functions can often be represented by infinite series. For example, the exponential function can be computed using

$$e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{3!} + \cdots + \frac{x^n}{n!}$$

Calculate the value of $e^{0.5}$ after 4 terms respectively. Also give the percent 4

relative error.

(c) Define the shift operator (E), forward difference operator (Δ), backward difference operator (∇) also derive the following relationships:

i. $\Delta.\nabla=\Delta-\nabla$

ii. $\nabla=\frac{E-1}{E}$

iii. $\Delta=E-1$ 6

5(a) Give two characteristics of Cubic Spline interpolation. Fit the following points by cubic spline interpolation using the initial conditions $M_0=M_3=0$.

X	0	1	2	3
Y	1	2	33	244

Estimate the function at x=2.5. 10

(b) Derive the Trapezoidal rule of Integration for n points. Also explain its limitations. 5

6(a) Find the first and second derivative of $f(x)$ at x=1.5 from the following tabulated values

x	$f(x)$
1	3.23
1.5	3.19
2	3
2.5	2.91
3	2.81

8

(b) Evaluate $\int_0^1 \left(\frac{1}{1+x}\right) dx$ correct up to three decimal place using Simpson's $\frac{1}{3}$ Rule of Integration with n=6.

Also find relative and percentage error w.r.t. true value. 7

7 (a) Using Euler method find the approximate value of y when x=0.4

$$\frac{dy}{dx}= x+y^2$$

when $y(0)$=1 and h=0.1. 6

(b) Using Runge Kutta method of fourth order find $y(0.1)$ and $y(0.2)$; given that $\frac{dy}{dx} = 1 + xy$, with the initial condition of $y(0)$=2. 9