Total No. of printed pages = 4

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Roll No. of candidate | | | | | | | | | | |

B.Tech. 5th Semester End-Term Examination

CE

COMPUTER ORIENTED NUMERICAL METHODS

(New Regulation & New Syllabus)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the correct answer : (10 × 1 = 10)

(i) $\left(\frac{xy}{z}\right)$ to be evaluated such that x and z are small. Then the expression should be evaluated to minimize errors as

(a) $\left(\frac{xy}{z}\right)$ (b) $\left(\frac{x}{z} \times y\right)$

(c) $\left(\frac{y}{z} \times x\right)$ (d) any of the above

(ii) In general the ratio of truncation error to that of round-off error to r is

(a) 1 : 1 (b) 2 : 1

(c) 1 : 2 (d) 1 : 3

(iii) Match the following

(A)	Newton-Raphson	1.	Integration
(B)	Runge-Kutta	2.	Root finding
(C)	Gauss Seidel	3.	Ordinary differential equation
(D)	Simpson's rule	4.	Solution of system of linear equations

(a) A2-B3-C4-D1 (b) A3-B2-C1-D4

(c) A1-B4-C2-D3 (d) A4-B1-C2-D3

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(iv) The method of successive approximation is known as

(a) Iteration method (b) Convergent method

(c) None of these (d) Secant method

(v) Errors may occur in performing numerical computation on the computer due to

(a) Rounding off errors (b) Power fluctuation

(c) Error in data entry (d) All of these

(vi) Newton-Raphson method to solve equation having formula

(a) $x_{n+1} = x_n + \frac{f(x_n)}{f'(x_n)}$ (b) $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$

(c) $x_{n+1} = x_n + \frac{f'(x_n)}{f(x_n)}$ (d) $x_{n+1} = x_n - \frac{f'(x_n)}{f(x_n)}$

(vii) The smallest +ve root of $x^3 - 5x + 3 = 0$ lies between

(a) 0 and 1 (b) None of these

(c) 2 and 3 (d) 1 and 2

(viii) Every square matrix can be expressed as product of lower triangular and unit upper triangular matrix ———— method based on this fact

(a) Choleski method (b) LU decomposition method

(c) Crout's method (d) All of these

(ix) Newton-Raphson method is applicable to the solution of

(a) Both algebraic and transcendental Equations

(b) Both algebraic and transcendental and also used when the roots are complex

(c) Algebraic equations only

(d) Transcendental equations only

(x) Consider the following data:

x	0	1	2
$f(x)$	2	3	12

The value of $\int_0^1 f(x)\,dx$ by Trapezoidal rule would be

(a) 2 (b) 12

(c) 10 (d) 17

(xi) Round off the following numbers into 3 decimal places $(4 \times \frac{1}{2} = 2)$

(a) 2.2755 (b) 22.3745

(c) 0.38599 (d) 12.3748

(xii) Rewrite the following numbers retaining 4 significant digit $(4 \times \frac{1}{2} = 2)$

(a) 1.30012 (b) 0.09789

(c) 0.500012 (d) 5.309100

(xiii) Convert the following numbers to the other 3 number system $(2 \times 2 = 4)$

(a) 45.25 (b) 10010111.1011

(xiv) Give very short answer (1+1+2=4)

(a) What is algorithm?

(b) What is the significance of rank of a matrix?

(c) What do you mean by Trade-off between accuracy and speed of iterative solution?

2. Find the smallest positive root of the following equation correct up to 4 decimal places using

(a) bisection method

(b) Regula-Falsi method $x^3 - 2x = 5$. (6+6=12)

3. Find the L-U factor of the coefficient matrix of the following simultaneous equation (12)

$4x + 8y + 3z = 0.1$

$2x - 3y - z = 1.4$

$x - y + 2z = 0.3$

4. Use G-S iterative method to solve the following set of linear equations (12)

$x - 2y + 5z = 12$

$5x + 2y - z = 6$

$2x + 6y - 3z = 5$

5. (a) Find the inverse of the following matrix [A] using Gauss-Jordan method (6)

$$\begin{bmatrix} 3 & 2 & 4 \\ 2 & 1 & 1 \\ 1 & 3 & 5 \end{bmatrix}$$

(b) Write the algorithm of Newton Raphson method to solve single variable equation (6)

6. (a) The population of a town in the census is given as follows. Estimate the population in the year 1996 using Newton's backward difference interpolation formula. (6)

Year (x)	1961	1971	1981	1991	2001
Population (y) (in 1000s)	46	66	81	93	101

(b) Mention the specific uses of Newton's forward difference interpolation formula, Newton's backward difference interpolation formula and Gauss interpolation formula to find the polynomial for a given set of data points. (6)

7. Values of x (in degrees) and $\cos x$ are given in the following table

x	$\cos x$
15	0.9659
20	0.9397
25	0.9063
30	0.8660
35	0.8192
40	0.7660

Obtain the value of cos 13° (12)

8. Using Euler's method and Modified Euler's method find the solution of the differential equation $\frac{dy}{dx}=xy^{1/2}$ with the initial condition $y(1) = 0$ and obtain value of y for $x=1.3$ with step size 0.1. (12)

9. (a) A rocket is projected vertically upward and the velocity is measured and recorded as follows. Find the location of the rocket above ground after 30 seconds from its take off. (6)

Time (sec)	0	2	4	6	8	10	12	14	16
Vel (Km/s)	0	2.8	2.9	3.2	3.5	3.8	4.0	4.1	4.1

(b) Find the value of the following definite integral using Trapezoidal rule and Simpson's 1/3rd rule. Take $h=0.1$ $I=\int_0^1 \sqrt{1-x^2}\,dx$. (6)

10. (a) Given that $\frac{dy}{dx}=3x+y^2$ where $y(1) = 1.2$. Using 2nd order Runge-Kutta method find $y(1.1)$ correct to four decimal places. (6)

(b) From the following data table find $y(5)$ using Langrange's interpolation polynomial (6)

x	0	3	7	10
y	1	31	351	1011

11. (a) Describe how round-off errors can be minimized in numerical computations. (6)

(b) The following table gives the angular displacements θ (radians at different interval of time t seconds

θ	0.052	0.105	0.168	0.424	0.327
t	0	0.02	0.04	0.06	0.08

Calculate the angular velocity at $t = 0.07$ sec. (6)

12. Write very short notes on :

(a) Absolute, relative and percentage errors in computations

(b) Interpolation

(c) Eigen Value and Eigen vector

(d) Partial and complete pivoting. (3+3+3+3=12)