Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH (CE)/SEM-4/CE-401/2010

2010

MATHEMATICS – II

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) The Newton-Raphson method fails when

a) $f'(x)$ is negative b) $f'(x)$ is too large

c) $f'(x)$ is zero d) never fails.

ii) If A be the actual value and T be its estimated value, the formula for relative error is

a) $\frac{A}{T}$ b) $\frac{(A - T)}{T}$

c) $\frac{|A - T|}{A}$ d) $\frac{|A - T|}{T}$.

iii) The truncation error to compute the integration in trapezoidal rule is of order

a) h b) h^2

c) h^3 d) h^4.

iv) The order of convergence in Regula-falsi method is

a) 2 b) 3

c) 0 d) none of these.

v) Simpson's $\frac{1}{3}$ rule gives exact value when the degree of the polynomial is

a) three b) less than three

c) two d) less than two.

vi) Select the correct answer :

a) $\delta = E^{1/2} + E^{-1/2}$

b) $\delta = E^{1/2} - E^{-1/2}$

c) $\delta = \frac{1}{2}(E^{1/2} + E^{-1/2})$

d) None of these.

vii) A matrix $[x_{ij}]$ in which $x_{ij} = 0$ for $i \neq j$, is called

a) upper triangular matrix

b) lower triangular matrix

c) diagonal matrix

d) none of these.

viii) Runge Kutta method has a truncation error, which is of the order

a) h^2 b) h^3

c) h^4 d) none of these.

ix) Power method is used to find the ..... eigenvalue of a matrix.

a) largest b) smallest

c) both d) none of these.

x) Simpson's one-third formula for the integration $\int_a^b f(x)\,dx$, the curve $y = f(x)$ is approximated as

a) hyperbola b) circle

c) parabola d) none of these.

xi) Gauss-Jacobi method is used to

a) integrate a definite integral numerically

b) solve a system of linear equations numerically

c) differentiate a function numerically

d) solve an initial value problem numerically.

xii) The rate of convergence of the fixed point iteration method for solving $f(x) = 0$ is

a) quadratic b) biquadratic

c) cubic d) linear.

xiii) The degree of precision of trapezoidal rule is

a) 1 b) 2

c) 3 d) 4.

xiv) If a number be rounded to m decimal places, then for the absolute error (E_A),

a) $E_A > \frac{1}{2} \times 10^{-m}$ b) $E_A \leq \frac{1}{2} \times 10^{-m}$

c) $E_A = 10^{-m}$ d) $E_A \geq \frac{1}{2} \times 10^{-m}$.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Use Taylor's series method to solve the equation

$\frac{dy}{dx} = x^2 + y^2$ for $x = 0{\cdot}25$, given that $y(0) = 1$ correct up to 3 decimal places.

3. Find out the integration value, correct upto 5 decimal places of the integration $\int_2^3 \sqrt{2 + x^3}\, dx$, taking number of sub-intervals $n = 10$ by Simpson's $\frac{1}{3}$ rule.

4. Solve the following system by relaxation method :

$$10x + 2y + z = 9$$

$$2x + 20y - 2z = -44$$

$$-2x + 3y + 10z = 22$$

5. Solve the following equation by Gauss elimination method :

$$2x_1 + 4x_2 + x_3 = 15$$

$$3x_1 + 6x_2 + 2x_3 = 22$$

$$5x_1 + 2x_2 + x_3 = 15$$

6. Find the moment generating function of the Poisson distribution and from it determine its mean and variance.

7. Evaluate $\sqrt{12}$ to three places of decimals by Newton-Raphson method.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. a) Find one root of $x^x + 2x - 6 = 0$ by the method of bisection up to three significant figures.

   b) Find a root of the equation $x^3 - x - 1 = 0$ by Newton-Raphson method. 7 + 8

9. a) Find a root of $x^3 + 2x - 2 = 0$, by Regula-falsi method correct to three significant figures.

   b) Fit the parabola $y = a + bx + cx^2$ to the following data and also the goodness of fit, by least squares method :

x :	1	2	3	4	5	6	7	8	9
y :	2	6	7	8	10	11	11	10	9

7 + 8

10. a) In the following data two class frequencies are missing :

Class-interval	100-110	110-120	120-130	130-140	140-150
Frequency	4	7	15	?	40

150-160	160-170	170-180	180-190	190-200
?	16	10	6	3

Total numbeer of frequencies is 150 and the median is 146·25. Find out the missing frequencies.

   b) Using Power method determine the largest eigenvalue and the corresponding vector of the matrix :

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

7 + 8

11. Solve the following system of linear equations correct to 3 significant figures by Gauss-Seidel method of iteration.

$2x + 10y + z = 13$

$10x + y + z = 12$

$2x + 2y + 10z = 14.$

12. a) If P is the pull required to lift a load W by means of a pulley block, find a linear law of the form $P = mW + c$ connecting P and W, using the following data :

P :	12	15	21	25
W :	50	70	100	120

b) Find $y'(x)$ given

x	=	0	1	2	3	4
$y(x)$	=	1	1	15	40	85

Hence, find $y'(x)$ at $x = 0{\cdot}5$, here $y'(x)$ is $\frac{dy}{dx}$.

c) Solve the differential equation by Euler's method :

$$\frac{dy}{dx} = (x^2 + y^2), \; y(0) = 0.$$

Find y at $x = 0{\cdot}2$. 5 + 5 + 5

13. a) Using Euler's method solve for y at $x = 0{\cdot}1$ from

$\frac{dy}{dx} = x + y + xy$, $y(0) = 1$, taking step size

$h = 0{\cdot}05$.

b) Calculate the mean and standard deviation for the following table giving the age distribution of 542 numbers :

Age	20-30	30-40	40-50	50-60	60-70	70-80	80-90
No. of members	3	61	132	153	140	51	2

c) From the following table, estimate the number of students who obtained marks between 40 and 45.

Marks :	30-40	40-50	50-60	60-70	70-80
No. of Students :	31	42	51	35	31

5 + 5 + 5