



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 × 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)  $\frac{|A - T|}{T}$  .

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- 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

$$\frac{dy}{dx} = x^2 + y^2 \quad \text{for } x = 0.25, \text{ given that } y(0) = 1$$

correct up to 3 decimal places.

3. Find out the integration value, correct upto 5 decimal places

$$\int_2^3 \sqrt{2+x^3} \, dx, \text{ taking number of sub-intervals } n = 10 \text{ by Simpson's } \frac{1}{3} \text{ rule.}$$

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.  $3 \times 15 = 45$ 

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 :

<b><i>x :</i></b>	1	2	3	4	5	6	7	8	9
<b><i>y :</i></b>	2	6	7	8	10	11	11	10	9

 $7 + 8$ 

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

<b><i>Class-interval</i></b>	100-110	110-120	120-130	130-140	140-150
<b><i>Frequency</i></b>	4	7	15	?	40

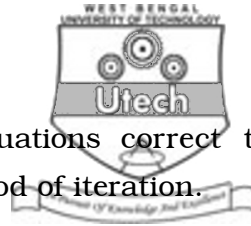
150-160	160-170	170-180	180-190	190-200
?	16	10	6	3

Total number 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 :

<b><math>P :</math></b>	12	15	21	25
<b><math>W :</math></b>	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  $x = 0.5$ , 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  $x = 0.2$ .

$$5 + 5 + 5$$

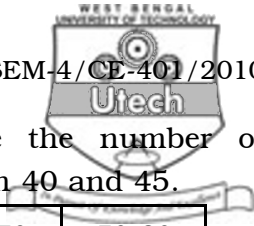
13. a) Using Euler's method solve for  $y$  at  $x = 0.1$  from

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

$$h = 0.05.$$

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

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



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

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

5 + 5 + 5

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