



Name :
Roll No. :
Invigilator's Signature :

**CS/B.TECH(NEW)(APM/CSE/IT/AUE/CHE/BT/ME
/PE/CE/CT/LT/TT/FT/SEM-4/M(CS)-401/2012**

2012

NUMERICAL METHODS

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) If $\frac{5}{3}$ is approximated to 1.6667, then absolute error is

- a) 0.000033 b) 0.000043
c) 0.000034 d) none of these.

ii) If $f(x) = \frac{1}{x^2}$ then the divided difference $f(a, b)$ is

- a) $\frac{(a + b)}{(ab)^2}$ b) $\frac{(a - b)}{(ab)^2}$
c) $\frac{1}{a^2} - \frac{1}{b^2}$ d) $\frac{1}{a^2 - b^2}$.



- iii) The value of $\frac{\Delta^2}{E}(x^3)$ is
- a) x b) $6x$
- c) $3x$ d) x^2 .
- iv) If $\frac{dy}{dx} = x + y$ and $y(1) = 0$, then $y(1.1)$ according to Euler's method is, $h = 0.1$ (say),
- a) 0.1 b) 0.3
- c) 0.5 d) 0.9 .
- v) If $y_0 = 2$, $y_1 = 4$, $y_2 = 8$, $y_4 = 32$ then y_3 is equal to
- a) 5 b) 15
- c) 6 d) 16.5 .
- vi) The order of h in the error expression of Trapezoidal rule is
- a) 1 b) 2
- c) 3 d) 4 .
- vii) Regula-Falsi method is
- a) conditionally convergent
- b) linearly convergent
- c) divergent
- d) none of these.



viii) Pivoting is very much essential because

- a) determinant of the coefficient matrix should be greater than zero
- b) pivot element should not have very large value compared to the elements of the matrix
- c) it reduces the possibility of division by zero
- d) change of convergence is higher.

ix) Which of the following is true ?

- a) $\Delta^n x^n = (n + 1)!$
- b) $\Delta^n x^n = n!$
- c) $\Delta^n x^n = 0$
- d) $\Delta^n x^n = n.$

x) An $n \times n$ matrix A is said to be diagonally dominant if

- a) $|a_{ii}| \geq \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$
- b) $|a_{ii}| \leq \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$
- c) $|a_{ii}| > \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$
- d) $|a_{ii}| < \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|.$



xi) The condition of convergence of Newton Raphson's method is

- a) $|f(x).f'(x)| < \{f''(x)\}^2$
- b) $|f(x).f''(x)| < \{f'(x)\}^2$
- c) $|f(x).f'(x)| > \{f''(x)\}^2$
- d) $|f(x).f''(x)| > \{f'(x)\}^2$.

xii) For $\frac{dy}{dx} = xy$ and $y(0) = 2$, the value of k_2 according to

Runge-Kutta method of 2nd order is ($h = 0.2$)

- a) 0.1
- b) 0.01
- c) 0.4
- d) 0.04.

GROUP - B

(Short Answer Type Questions)

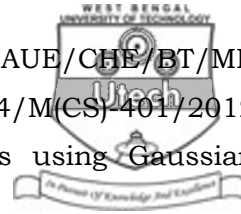
Answer any *three* of the following. $3 \times 5 = 15$

2. Given $u_0 + u_6 = 3$, $u_1 + u_5 = 5$, $u_2 + u_4 = 7$. Find u_3 , where v_x

is a function of x .

3. Using the following table find $\frac{dy}{dx}$ at $x = 0$ & 1.5 .

x :	0	1	2	3
y :	1	2	11	34



4. Solve the following system of equations using Gaussian elimination method :

$$\begin{aligned}x + y + z &= 9 \\2x - 3y + 4z &= 13 \\3x + 4y + 5z &= 40\end{aligned}$$

5. Find the value of $(19)^{\frac{1}{3}}$ correct to four decimal points by Newton-Raphson method.
6. Find the cubic polynomial by Lagrange's interpolation formula which takes the following value :

x	:	0	4	5	8
$f(x)$:	1	2	1	10

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Find a root of the equation $x^4 - x - 10 = 0$ that lies between 1 & 2 using Newton-Raphson method correct to 3 places of decimal.
- b) Solve the system of equations

$$\begin{aligned}x + y + 54z &= 110 \\27x + 6y - z &= 85 \\6x + 15y + 2z &= 72\end{aligned}$$

by Gauss-Seidel method.

7 + 8



8. a) Solve the following system of equations by LU-factorization method :

$$3x + 2y + 7z = 4$$

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

$$3x + 4y + z = 7$$

- b) Using Runge-Kutta method of order 4, find $y(0.2)$

given that $\frac{dy}{dx} = 3e^x + 2y$, $y(0) = 0$, taking $h = 0.1$.

7 + 8

9. a) Find the root of the equation $3x - \cos x - 1 = 0$ by Regula-falsi method, correct to three decimal places.

- b) Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{\cos x} dx$ by using (i) Trapezoidal and

(ii) Simpson's $\frac{1}{3}$ rd rule, where $h = 15^\circ$. 7 + 8

10. a) Compute $y(1.4)$ by Milne's predictor & corrector's

method from $\frac{dy}{dx} = \frac{1}{2}(x + y)$ where $y(1) = 3.595$,

$y(1.1) = 3.833$, $y(1.2) = 4.088$, $y(1.3) = 4.362$.

- b) Derive Newton's divided difference formula.



c) Given that $\frac{dy}{dx} = \log_{10}(x+y)$ with the initial condition that $y = 1$ when $x = 0$. Find y for $x = 0.2$ and $x = 0.5$ using Euler's modified formula. 5 + 5 + 5

11. a) If $y = f(x)$ is a polynomial degree 5 with $y_0 = f(0) = 0$, $y_1 = f(1) = 3$, $y_2 = f(2) = 14$, $y_3 = f(3) = 45$, $y_4 = f(4) = 84$, $y_5 = f(5) = 170$, $y_6 = f(6) = 258$. It is found that there is one error in the value of y_3 . Find the correct value of y_3 .

b) Why implicit method is preferred over explicit method though it requires more computations ?

c) Show that the rate of convergence in Newton-Raphson method is quadratic. 8 + 3 + 4

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