



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)-401/2013  
2013**

**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 :

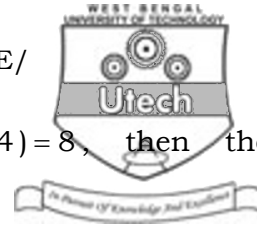
$$10 \times 1 = 10$$

i) The number of significant figures in 0.03409 is

- |          |          |
|----------|----------|
| a) five  | b) six   |
| c) seven | d) four. |

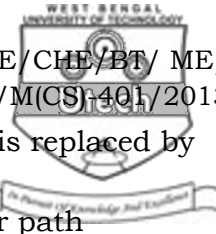
ii) The kind of error occurs when  $\pi$  approximated by 3.14 is

- |                     |                    |
|---------------------|--------------------|
| a) truncation error | b) round-off error |
| c) inherent error   | d) relative error. |



iii) If  $f(0) = 12$ ,  $f(3) = 6$  and  $f(4) = 8$ , then the interpolation function  $f(x)$  is

- a)  $x^2 - 3x + 12$                       b)  $x^2 - 5x$   
c)  $x^3 - x^2 - 5x$                       d)  $x^2 - 5x + 12$ .
- iv) Newton-Raphson method for solution of the equation  $f(x) = 0$  fails when
- a)  $f'(x) = 1$                       b)  $f'(x) = 0$   
c)  $f'(x) = -1$                       d) none of these.
- v) In Gaussian elimination method, the given system of equation represented by  $Ax = B$  is converted to another system  $Ux = Y$  where  $U$  is
- a) diagonal matrix  
b) null matrix  
c) identity matrix  
d) upper triangular matrix.
- vi) Error in Weddle method of integration is
- a) 0                      b)  $-\frac{h^4}{180}(b-a)M_4$   
c)  $-\frac{h^2}{12}(b-a)M_2$                       d)  $-\frac{h^6}{840}(b-a)M_6$ .



vii) In Trapezoidal rule, the portion of curve is replaced by

- a) straight line                      b) circular path
- c) parabolic path                      d) none of these.

viii) Which of the following is an iterative method ?

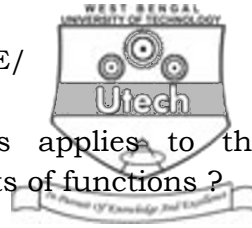
- a) Gauss Elimination Method
- b) Gauss Jordan Method
- c) LU decomposition Method
- d) Gauss-Seidel Method.

ix) The number 9.6506531 when rounded-off to 4 places of decimal will give

- a) 9.6506                      b) 9.6507
- c) 9.6505                      d) none of these.

x)  $\Delta^3 y_0$  may be expressed as

- a)  $y_3 - 3y_2 + 3y_1 - y_0$                       b)  $y_2 - 2y_1 + y_0$
- c)  $y_3 - 3y_2 + 3y_1 + y_0$                       d) none of these.



- xi) Which of the following statements applies to the bisection method used for finding roots of functions ?
- a) Convergence within a few iteration
  - b) Guaranteed to work for all continuous functions
  - c) Is faster than the Newton-Raphson method
  - d) Requires that there be no error in determining the sign of the function.
- xii) Runge-Kutta formula has a truncation error, which is of the order
- a)  $h^2$
  - b)  $h^4$
  - c)  $h^5$
  - d) none of these.
- xiii) In finite difference method,  $\frac{d^2y}{dx^2}$  is replaced by
- a)  $\frac{y_{n+1} - 2y_{n-1} + y_n}{2h^2}$
  - b)  $\frac{y_{n+1} - 2y_n + y_{n-1}}{h^2}$
  - c)  $\frac{y_{n+1} - 2y_{n-1} + y_n}{2h}$
  - d)  $\frac{y_{n+1} - 2y_{n-1} + y_n}{4h^2}$ .

**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.

$3 \times 5 = 15$

2. a) Show that  $\Delta \log f(x) = \log \left[ 1 + \frac{\Delta f(x)}{f(x)} \right]$ .
- b) Define forward difference operator  $\Delta$  and shift operator  $E$ . Prove that  $E \cdot \Delta = \Delta \cdot E$ .



3. Find the missing terms in the following table :

$x$	0	5	10	15	20	25
$y$	6	10	?	17	?	31

4. Evaluate  $\int_0^1 \frac{dx}{1+x^2}$  using Simpson's  $\frac{1}{3}$ rd rule taking  $n = 6$ .

Hence find the value of  $\pi$ .

5. Using Runge-Kutta method of 4th order solve  $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$

with  $y(0) = 1$  at  $x = 0.2$ .

6. Solve the following system of linear equations by Gaussian Elimination method :

$$3x + 4y + 5z = 18, \quad 2x - y + 8z = 13, \quad 5x - 2y + 7z = 20.$$

### GROUP - C

#### ( Long Answer Type Questions )

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

7. a) What do you mean by interpolation ? Derive Newton's backward interpolation formula. Can you apply this formula for unequispaced interpolating points ? 7

- b) Using Trapezoidal and Simpson's  $\frac{1}{3}$ rd rule compute

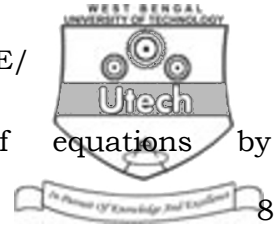
$$\int_4^{5.2} \log_e x \, dx \text{ by taking seven ordinates correct up to four}$$

decimal places. 8

8. a) Find the value of  $\sqrt{2}$  from the following table : 7

$x$	1.9	2.1	2.3	2.5	2.7
$f(x) = \sqrt{x}$	1.3784	1.4491	1.5166	1.5811	1.6432

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- b) Solve the following system of equations by LU-factorization method :

$$3x + 4y + 2z = 15$$

$$5x + 2y + z = 18$$

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

9. a) Find a root of the equation  $x \log_{10} x = 1.2$  by the method of false position correct to three decimal places.

7

- b) Find the inverse of the matrix  $A = \begin{bmatrix} 3 & 2 & 1 \\ 2 & 3 & 2 \\ 1 & 2 & 2 \end{bmatrix}$  by using

Gaussian elimination method.

8

10. a) Apply Milne's method to find  $y(0.8)$  for the equation

$$\frac{dy}{dx} = x + y^2, \quad \text{given that } y(0) = 0, \quad y(0.2) = 0.02,$$

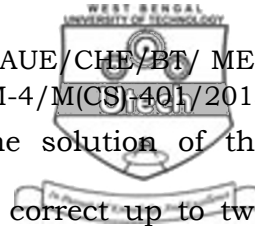
$$y(0.4) = 0.0805, \quad y(0.6) = 0.1839.$$

8

- b) Evaluate  $\int_0^{0.6} \frac{dx}{\sqrt{1-x^2}}$ , using Weddle's rule taking

12 equal subintervals.

7



11. a) Using Gauss-Seidel method find the solution of the following system of linear equations correct up to two decimal places :

$$3x + y + 5z = 13$$

$$5x - 2y + z = 4$$

$$x + 6y - 2z = -1 \quad 7$$

- b) Using finite difference method solve the boundary value problem :

$$\frac{d^2y}{dx^2} + y + 1 = 0 \text{ with } y(0) = 0, y(1) = 0. \quad 8$$

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