

Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (AUE)/SEM-4/AUE-401/2011

2011

**ENGINEERING ANALYSIS & 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 the following : $10 \times 1 = 10$

i) Which of the following is not true (the notations have their usual meaning) ?

a) $\Delta = E - 1$

b) $\Delta \cdot \nabla = \Delta - \nabla$

c) $\frac{\Delta}{\nabla} = \Delta + \nabla$

d) $\nabla = 1 - E^{-1}$.

ii) If the interval of differencing is unity and $f(x) = ax^2$ (a is a constant), find which one of the following is wrong ?

a) $\Delta f(x) = a(2x + 1)$

b) $\Delta^2 f(x) = 2a$

c) $\Delta^3 f(x) = 2$

d) $\Delta^4 f(x) = 0$.

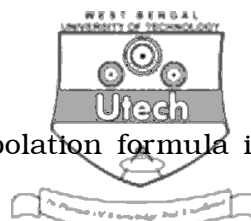
iii) The value of $\Delta^{n+1} x^{(n)}$ is

a) $n!$

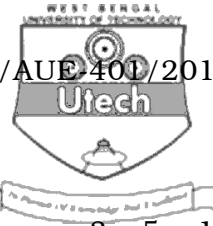
b) 0

c) n

d) none of these.



- iv) Newton's forward or backward interpolation formula is used for
- equal intervals
 - unequal intervals
 - both (a) and (b)
 - none of these.
- v) In the Simpson's $\frac{1}{3}$ rule, the no of equal sub-intervals is
- even
 - odd
 - both (a) and (b)
 - none of these.
- vi) The error in the composite trapezoidal rule is of order
- h
 - h^2
 - h^3
 - h^4 .
- vii) The area in Simpson's $\frac{1}{3}$ rule is approximated by the area of
- rectangle
 - parabola
 - ellipse
 - none of these.
- viii) The error in 4th order Runge-Kutta method is
- $O(h^2)$
 - $O(h^3)$
 - $O(h^4)$
 - $O(h^5)$.
- ix) In the method of interaction the function $\phi(x)$ must satisfy
- $|\phi'(x)| < 1$
 - $|\phi'(x)| > 1$
 - $|\phi'(x)| = 1$
 - $|\phi'(x)| = 2$.
- x) Gauss-elimination method fails when any one of the pivotal elements is
- 0
 - 1
 - 2
 - 1.



GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following.

$$3 \times 5 = 15$$

2. Show that $\Delta^2 \left(\frac{5x+12}{x^2+5x+6} \right) = \frac{2(5x+16)}{(x+2)(x+3)(x+4)(x+5)}$ with $h = 1$.
3. Obtain the Newton-Raphson formula for finding the m th root of positive no. a and hence show that for the cube root of $a (> 0)$ is $x_{n+1} = \frac{2x_n^3 + a}{3 \cdot x_n^2}$.
4. Solve by Gauss-elimination method

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

$$x + z = 2$$

$$2y + z = 3.$$
5. Solve $\frac{dy}{dx} = x + y$ with $y(0) = 1$, $x \in [0, 1]$ by Taylor's series method to obtain y for $x = 0.1$.
6. Evaluate $\int_0^1 x.e^x dx$, using Trapezoidal rule taking $n = 6$.

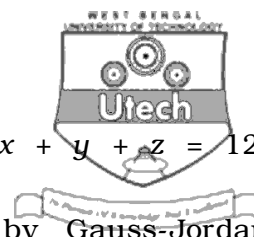
GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following.

$$3 \times 15 = 45$$

7. a) Solve $x^2 + y^2 = 11$ and $y^2 + x = 7$, near $x = 3$ and $y = -2$ by Newton-Raphson method, correct to 3 decimal places.
- b) Find a positive root of $x^3 + x^2 - 1 = 0$ by the iterative method, correct to 4 decimal places.

$$8 + 7$$



8. a) Solve by Gauss-Jordan method $10x + y + z = 12$,
 $x + 10y + z = 12$, $x + y + 10z = 12$.
 b) Find the inverse of the matrix by Gauss-Jordan method :

$$\begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$$

8 + 7

9. a) Find the largest eigenvalue and corresponding eigenvector of the matrix by power method.

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

- b) Find a cubic polynomial which takes the following data, by Newton's forward interpolation. Hence find $f(0.5)$:

$x :$	0	1	2	3
$f(x) :$	1	0	1	10

8 + 7

10. a) Compute $f'(1.1)$ and $f''(1.1)$ from the following table :

$x :$	1.1	1.2	1.3	1.4	1.5
$f(x) :$	2.0091	2.0333	2.0692	2.1143	2.1667

- b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's $\frac{1}{3}$ rule, taking $h = \frac{1}{6}$. Hence calculate the value of λ .

8 + 7

11. a) Use 4th order Runge-Kutta method to find $y(0.1)$ and $y(0.2)$, correct to 4 decimal places when $\frac{dy}{dx} = y - x$, $y(0) = 2$.

- b) Using Lagrange's polynomial find $y(10)$ if

$x :$	5	6	9	11
$y :$	12	13	14	16

8 + 7