



Name :

Roll No. :

Invigilator's Signature :

**CS/B.TECH(NEW)BME/ECE/EE/EIE/PWE/ICE/EEE/
SEM-3/M(CS)-301/2012-13**

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) In the problem "Find the area of a circle having radius 2; given $\pi = 3.14$ ", the kind of error of the approximation 3.14 for π is
- a) Truncation error b) Round-off error
- c) Inherent error d) Relative error.
- ii) The number 9.6506531 when round-off to 4 places of decimal will give
- a) 9.6506 b) 9.6507
- c) 9.6505 d) none of these.

3003(N)

[Turn over

- vii) In evaluating $\int_a^b f(x) dx$, the error in Trapezoidal rule



- viii) When Gauss-Elimination method is used to solve $AX = B$, A is transformed to a
- null matrix
 - upper-triangular matrix
 - identity matrix
 - diagonally-dominant matrix.
- ix) If $\frac{dy}{dx} = x^2 + y$ and $y(0) = 1$, then $y(0.02)$ according to Euler's method is $[h = 0.01]$
- 1.02
 - 1.04
 - 1.00
 - 0.99.
- x) The finite difference method is used to solve
- a system of ordinary differential equation
 - a Boundary Value Problem
 - a partial differential equation
 - a system of transcendental equation.
- xi) The local truncation error in Euler's method for the solution of ODE of first order is
- $O(h^2)$
 - $\frac{h^2}{2} y''(x_m + \theta h)$
 - $h^2 y''(x_m + \theta h)$
 - none of these.
- xii) One root of the equation $x^2 + 2x - 2 = 0$ lies between
- 1 and 2
 - 0 and 0.5
 - 0.5 and 1
 - none of these.



GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. Find $f(5)$ from the following data :

| | | | | | | |
|--------|---|----|----|-----|-----|-----|
| x | 0 | 2 | 3 | 4 | 7 | 8 |
| $f(x)$ | 4 | 26 | 58 | 112 | 466 | 668 |

3. Find the value of $\int_0^{\pi/2} \sqrt{1 - 0.162 \sin^2 x} \, dx$ using Simpson's $\frac{1}{3}$ rd rule taking six equal subintervals.

4. Using Newton-Raphson method find $\sqrt[4]{32}$ correct upto 4 places of decimal.

5. Find the inverse of the following matrix using Gauss Elimination method.

$$\begin{pmatrix} 1 & 2 & 6 \\ 2 & 5 & 15 \\ 6 & 15 & 46 \end{pmatrix}$$

6. Use Fourth order Runge-Kutta method to find an approximate value of $y(0.2)$ given that $y(0) = 0$ and $\frac{dy}{dx} = 1 + y^2$.



GROUP – C

(Long Answer Type Questions)

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

7. a) Round off 31. 5218 to one significant figure. 1
- b) What is the percentage error in approximating $\frac{4}{3}$ to 1.3333 ? 2
- c) Prove that $E \equiv e^{hD}$, where E , h and D are the shift operator, the step length and the differential operator respectively. Hence, show that $hD \equiv \sin h^{-1} (\mu\delta)$, where, μ and δ have their usual meanings. 3 + 2
- d) Define interpolation and extrapolation. Deduce the Newton's forward interpolation formula. 2 + 5
8. a) Find by Lagrange's formula, the interpolation polynomial which corresponds to the following data : 5
- | | | | | | |
|----------|---|---|----|----|----|
| $x :$ | 0 | 1 | 2 | 3 | 4 |
| $f(x) :$ | 3 | 6 | 11 | 18 | 27 |
- b) Find a real root of the equation $x^3 - 2x - 5 = 0$ by using Regula-Falsi method. 5
- c) Derive Simpson's one-third rule from Newton-Cote's quadrature formula. 5



9. a) Solve the system of linear equation by LU Factorization

Method :

$$2x - 6y + 8z = 24$$

$$5x + 4y - 3z = 2$$

$$3x + y + 2z = 16$$

- b) Compute $y(0.5)$, by Milne's predictor-corrector method from $\frac{dy}{dx} = 2e^x - y$,

given that $y(0.1) = 2.0100$, $y(0.2) = 2.0401$,

$y(0.3) = 2.0907$, $y(0.4) = 2.1621$. 7

10. a) Find the root of the equation $x \tan x = 1.28$, that lies in the interval $(0, 1)$, correct to 4 decimal places, using Bisection method. 6

- b) Find the solution of the following differential equation by Euler's method for $x = 1$ by taking $h = 0.2$, $dy/dx = x + y$ with $y = 1$ when $x = 0$. 5

- c) Show that $(1 + \Delta)(1 - \nabla) \equiv 1$. 4



11. a) Obtain the Newton's Divide Difference interpolating polynomial, hence find $f(3)$: 8

| | | | | | | |
|----------|---|----|----|---|---|----|
| $x :$ | 0 | 1 | 2 | 4 | 5 | 6 |
| $f(x) :$ | 1 | 14 | 15 | 5 | 6 | 19 |

- b) Solve the following system of equations using Gauss elimination method : 7

$$-x + y + 10z = 35.61$$

$$x + 10y + z = 20.08$$

$$10 + y - x = 11.19$$

=====