



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  $\pi$  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.

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- iii) If  $f(3) = a + \Delta f(1) + \Delta^2 f(1)$  then  $a =$
- a)  $f(0)$                                       b)  $f(1)$
- c)  $f(2)$                                       d)  $f(3)$ .
- iv) Which of the following is true ?
- a)  $E = 1 - \Delta$                                       b)  $E = 1 + \Delta$
- c)  $\Delta = E + 1$                                       d)  $E = \Delta^{-1}$ .
- v) It cannot be recommended to construct an interpolation polynomial for a function  $f(x)$  if
- a)  $f(x)$  is not a polynomial
- b)  $f(x)$  is not derivable somewhere
- c)  $f(x)$  has abrupt changes
- d) graph of  $f(x)$  is unknown.
- vi) The degree of precision of Simpson's  $\frac{1}{3}$ rd rule is
- a) 1    b) 2
- c) 3    d) 4.
- vii) In evaluating  $\int_a^b f(x) dx$ , the error in Trapezoidal rule is of order
- a)  $h^3$     b)  $h^4$
- c)  $h^2$     d)  $h$ .



- 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,  $\mu$  and  $\delta$  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

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

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

$$10 + y - x = 11.19$$

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