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**CS/B.Tech (IT, ECE, EEE, ICE)/SEM-3/M(CS)-312/2009-10**

**2009**

**NUMERICAL METHODS AND PROGRAMMING**

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 the interval of differencing is unity and  $f(x) = ax^2$  ( 'a' is a constant ) which of the following choices is wrong ?

- a)  $\Delta f(x) = a(2x+1)$       b)  $\Delta^2 f(x) = 2a$   
c)  $\Delta^3 f(x) = 2$       d)  $\Delta^4 f(x) = 0$ .

ii) The number of significant figures in 6,00,000 is

- a) 1      b) 7  
c) 0      d) 6.

iii) 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)  $\Delta^n x^n = n$ .

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- iv) When Gauss elimination method is used to solve  $AX = B$ ,  $A$  is transformed to a
- a) unit matrix
  - b) lower triangular matrix
  - c) diagonally dominant matrix
  - d) upper triangular matrix.
- v) The method of iteration formula  $\phi(x)$  must satisfy
- a)  $|\phi'(x)| < 1$
  - b)  $|\phi'(x)| > 1$
  - c)  $|\phi'(x)| = 1$
  - d)  $|\phi'(x)| = 2$ .
- vi) Regula-Falsi method is
- a) conditionally convergent
  - b) linearly convergent
  - c) divergent
  - d) none of these.
- vii) Which of the following is true ?
- a)  $E = 1 - \Delta$
  - b)  $E = 1 + \Delta$
  - c)  $\Delta = 1 + E$
  - d)  $E = 1/\Delta$ .
- viii) The order of  $h$  in the error expression of Trapezoidal rule is
- a) 6
  - b) 3
  - c) 5
  - d) 2.
- ix) The degree of precision of Simpson's one third rule is
- a) 1
  - b) 2
  - c) 3
  - d) 5.

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x) Which of the following methods is an iterative method ?

- a) Gauss Elimination method
- b) Gauss-Jordan method
- c) Gauss-Seidel method
- d) Crout's method.

xi) main ( )

```
{  
    print("%x",-1<<4);  
}
```

- a) 0
- b) FO
- c) FFFF
- d) FFF0.

xii) main ( )

```
{  
    char s[] = {'a','b','c','\n','c','\0'};  
    char *p, *str,*str1;  
    p=&s[3];  
    str=p;  
    str1=s;  
    printf("%d",++*p + ++*str1-32);  
}
```

- a) 177
- b) 122
- c) 77
- d) 277.

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xiii) main ( )

```
{
    int a=2, *f1, *f2;
    f1=f2=&a;
    *f2+= *f2+=a+=2*5;
    printf("\n%d %d %d", a, *f1, *f2);
}
```

- a) 16 15 14                      b) 16 16 16  
c) 16 15 16                      d) 24 24 24.

xiv) main ( )

```
{
    printf("\nab");
    printf("\bsl");
    printf("\rha");
}
```

What will be the output for the above code ?

- a) hal\_                              b) ha  
c) h                                  d) ab

**GROUP - B****( Short Answer Type Questions )**Answer any *three* of the following.                      3 × 5 = 15

2. a) What is the difference between interpolation and extrapolation ? Give suitable examples.                      2
- b) If  $y(10) = 35.3$ ,  $y(15) = 32.4$ ,  $y(20) = 29.2$ ,  $y(25) = 26.1$ ,  $y(30) = 23.2$  and  $y(35) = 20.5$ , find  $y(12)$  using Newton's forward interpolation formula.                      3

3. a) Use Newton's divided difference formula to find  $f(5)$  from the following data : 3

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

- b) What do you mean by geometrical interpretation of Simpson's  $\frac{1}{3}$ rd rule ? 2

4. a) Find the values of  $y'(x)$  and  $y''(x)$  at  $x = 1.1$  from the following data, using Newton's forward interpolation formula : 3

X	1.0	1.2	1.4	1.6	1.8	2.0
Y	0	0.128	0.544	1.296	2.432	4

- b) What is ternary operator ? Give examples. 2

5. a) Find the approximate value of  $I = \int dx/(1+x)$  when the interval is  $(0, 1)$  and  $h = \frac{1}{2}$ . Use trapezoidal rule. 3

- b) Show that  $\Delta \log f(x) = \log [1 + \Delta f(x) / f(x)]$ , where  $\Delta$  is the forward difference operator. 2

6. Solve by using Euler's method the following differential equation for  $x = 1$  by taking  $h = 0.2$  :

$$dy/dx = xy, y = 1 \text{ when } x = 0. \quad 5$$

7. Find the smallest positive root of the equation  $3x^3 - 9x^2 + 8 = 0$  correct to 4 places of decimals, using Newton-Raphson method.

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**GROUP - C****( Long Answer Type Questions )**Answer any *three* of the following. $3 \times 15 = 45$ 

8. a) Solve the system of linear equations by Gauss Elimination method :

$$5x_1 - x_2 = 9$$

$$-x_1 + 5x_2 - x_3 = 4$$

$$-x_2 + 5x_3 = -6.$$

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- b) Find the Newton-Raphson iterative formula to find the  $p$ th root of positive number  $N$  and hence find the cube-root of 17.

5

- c) Evaluate the following :

3

$$\Delta^2 \left\{ (5x+12)/(x^2+5x+6) \right\}, \text{ taking } h = 1$$

9. a) Write a C program to interpolate a given function as specified argument by divided difference formula.

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- b) Compute  $I = \int x/\sin x \, dx$ , where the interval is  $(0, 1/2)$  using Simpson's rule with  $h = 1/4$ .

5

- c) Deduce trapezoidal rule for Newton-Cote's quadrature formula.

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10. a) Find the inverse of the following matrix. 5

$$\begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$$

- b) Solve the following system of equations by LU factorization method : 5

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

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

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

- c) Evaluate  $\int x e^x dx$  where the interval is ( 0, -1 ) by using Trapezoidal rule taking  $n = 6$ . 5

11. a) Write a C program to solve the equation  $x^3 - 3x - 5 = 0$  within ( 1, 2 ) by Bisection method correct upto 3 places of decimal. 8

- b) Write a program in C using recursive function to calculate the GCD of any two given numbers. 7

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12. a) Find the root of the equation  $3x - \cos x - 1 = 0$  that lies between 0 and 1, correct to four places of decimal, using bisection method. 7

b) Find the root of the equation  $x^3 - 5x - 7 = 0$ , that lies between 2 and 3, correct to 4 places of decimals, using the method of false position. 7

c) State the condition of convergence of Newton-Raphson method. 1

13. a) Solve the following system of equations, correct to four places of decimals, by Gauss-Seidel iteration method : 8

$$x + y + 54z = 110$$

$$27x + 6y - z = 85$$

$$6x + 15y + 2z = 72$$

b) Find the values of  $y(0.1)$ ,  $y(0.2)$  and  $y(0.3)$  using Runge-Kutta method of the fourth order, given that

$$dy/dx = xy + y^2, y(0) = 1.$$

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