



ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER - 2008
NUMERICAL METHODS & PROGRAMMING
SEMESTER - 3

Time : 3 Hours]

[Full Marks : 70

GROUP - A**(Multiple Choice Type Questions)**

1. Choose the correct alternatives for any ten of the following : 10 × 1 = 10

i) In Newton's forward interpolation, the intervals should be

- a) equally spaced
- b) not equally spaced
- c) may be equally spaced
- d) both (a) and (b).

ii) Which of the following is not true (the notations have their usual meanings) ?

- a) $\Delta = E - 1$
- b) $\Delta \cdot \nabla = \Delta - \nabla$
- c) $\frac{\Delta}{\nabla} = \Delta + \nabla$
- d) $\nabla = 1 - E^{-1}$.

iii) The $(n + 1)^{\text{th}}$ order forward difference of the n^{th} degree polynomial is

- a) $n!$
- b) $(n + 1)!$
- c) 0
- d) none of these.

iv) The inherent error for Weddle's rule of integration is as (the notations have their usual meanings)

- a) $-\frac{nh^5}{180} f^{iv} (x_0)$
- b) $-\frac{nh^7}{180} f^{vi} (x_0)$
- c) $-\frac{nh^7}{140} f^{vi} (x_0)$
- d) none of these.

```
main( )  
  
    {  
  
        int x, y ;  
  
        y = 4 ;  
  
        x = y << 4 ;  
  
        printf( "%d", x ) ;  
  
    }
```

a) 63 b) 60
c) 64 d) 65.

a) 0.0064 b) 0.0063

c) 0.006395 d) 0.006394.

a) $|f(x) \cdot f'(x)| < \{f''(x)\}^2$
 b) $|f(x) \cdot f''(x)| < \{f'(x)\}^2$
 c) $|f(x) \cdot f'(x)| > \{f''(x)\}^2$
 d) $|f(x) \cdot f''(x)| > \{f'(x)\}^2$.

a) h^2

b) h^3

c) h^4

d) h

where h is the width of each sub-interval of $[a, b]$.



ix) Simpson's one-third rule is applicable only if the number of subintervals is even.

a) True

b) False.

☐

x) Lagrange's interpolation formula deals with

a) Equispaced arguments only

b) Unequispaced arguments only

c) both (a) and (b)

d) none of these.

☐

xi) $\Delta^3 (Y_0)$ may be expressed as which of the following terms ?

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) Both (a) and (c).

☐

xii) Output of the following Program Code :

```
Void main()
```

```
{
```

```
int i = 0 ;
```

```
clrscr( ) ;
```

```
void main( ) ;
```

```
printf( "number : %d", i ) ;
```

```
i ++ ;
```

```
getch( ) ;
```

```
}
```

is

a) number : 0

b) number : 1

c) continue printing like (b) j.e. 0,

number : ... upto number : <a large number >

d) none of these.

☐



xiii) Relative Error is measured by which of the following expressions ?

a) $\text{Mod} \left[\frac{\text{Absolute Error}}{\text{Approximate Error}} \right]$

b) $\text{Mod} \left[\frac{\text{Absolute Error}}{\text{Exact Error}} \right]$

c) $\text{Mod} (\text{Exact value} - \text{Approximate value})$

d) None of these.

xiv) In Gauss elimination method, the given system of equations represented by $AX = B$ is converted to another system $UX = Y$ where U is

a) diagonal matrix

b) null matrix

c) identify matrix

d) upper triangular matrix.

xv) The minimum number of functions in any C program is

a) 1

b) 2

c) 3

d) 4.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following.

$3 \times 5 = 15$

2. a) Prove that

$$f(4) = f(3) + \Delta f(2) + \Delta^2 f(1) + \Delta^3 f(1).$$

3

b) Evaluate $\Delta^2 \cos 2x$.

2

3. a) What is the difference between interpolation and extrapolation ? Give suitable examples.

2

b) Find the polynomial $f(x)$ and hence calculate $f(5.5)$ for the given data :

3

$x :$	0	2	3	5	7
$f(x) :$	1	47	97	251	477



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

b) Calculate the area of the function $f(x) = \sin x$ with limits $(0 - 90^\circ)$ by Simpson's $\frac{1}{3}$ rd rule using 11 ordinates. 3

5. Compute the values of $f(3.5)$ and $f(7.5)$ using Newton's interpolation from the following table : 3 + 2

$x :$	3	4	5	6	7	8
$f(x) :$	27	64	125	216	343	512

6. Show that $\Delta \log f(x) = \log \left[1 + \frac{\Delta f(x)}{f(x)} \right]$, where Δ is the forward difference operator.

7. Solve by using Euler's Method the following Differential equation for $x = 1$ by taking $h = 0.2$.

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

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following questions.

3 × 15 = 45

8. a) Given the following table of function $F(x) = \frac{1}{x}$, find $\frac{1}{2.72}$ using the suitable Interpolation Formulae. Find an estimate of the error. 8

$x :$	2.7	2.8	2.9
$F(x) :$	0.3704	0.3571	0.3448

b) Solve the system of linear equations by Gauss-Elimination method :

$$x - 2y + 9z = 8$$

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

$$2x - 8y + z = -5.$$

7



9. a) Find Lagrange's interpolation polynomial passing through the set of points :

x	0	1	2
y	4	3	6

Use it to find y at $x = 1.5$, $\frac{dy}{dx}$ at $x = 0.5$ and evaluate $\int_0^3 y \, dx$. 8

- b) Find the value of $\log 2^{1/3}$ from $\int_0^1 \frac{x^2}{1+x^3} \, dx$ using Simpson's $\frac{1}{3}$ rd rule with $h = 0.25$. 7

10. a) Find the real root of $x^3 + x^2 - 1 = 0$ by Iteration method. 5

- b) Solve the equation by $L-U$ factorization method :

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

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

$$x + y + 4z = -6.$$

5

- c) Deduce the Newton's Backward Interpolation Formula. 5

11. a) What do you mean by recursion and calling a function

i) by reference

ii) by value ?

Explain with examples.

iii) What is the difference between do loop and do-while loop in C ? Give examples. 8

- b) Write a program in C for Trapezoidal Rule, taking any function of your choice. 7

12. a) Solve the following differential equations for $x = 1$ by taking $h = 0.2$ using Taylor's series method :

$$\frac{dy}{dx} = x^3 + y^4, y(0) = 1 ; \text{ correct to the three decimal places. } 8$$

- b) Find A^{-1} , if $A = \begin{bmatrix} 8 & -4 & 0 \\ -4 & 8 & -4 \\ 0 & -4 & 8 \end{bmatrix}$ by Gauss-Jordan method. 7



13. a) Find out the root of the following equation using Regula Falsi method :

$3x - \cos(x) - 1 = 0$ that lies between 0 and 1 (correct to four decimal places).

7

- b) Solve the system of equations by Gauss-Seidel method :

$$3x + 4y + 15z = 54.8$$

$$x + 12y + z = 39.66$$

$$10x + y - 2z = 7.74.$$

8

END