



ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER - 2008
NUMERICAL METHODS AND 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) Which of the following relations is true ?

a) $E = 1 + \Delta$

b) $E = 1 - \Delta$

c) $E = 1/\Delta$

d) None of these.

ii) By evaluating $\int_0^1 \frac{dx}{1+x^2}$ by a numerical integration method, we can obtain an approximate value of

a) $\log_e 2$

b) π

c) e

d) $\log_{10} 2$.

iii) If a be the actual value and e be its estimated value, the formula for relative error is

a) $\frac{a}{e}$

b) $\frac{|a - e|}{a}$

c) $\frac{(e - a)}{e}$

d) $\frac{|a - e|}{e}$.

iv) in Trapezoidal rule, the portion of curve is replaced by

a) straight line

b) circular path

c) parabolic path

d) none of these.



v) The error involved in 4th order R-k method is given by

- a) $O(h^2)$
- b) $O(h^4)$
- c) $O(h^3)$
- d) $O(h^5)$.

vi) An $n \times n$ matrix A is said to be diagonally dominant if

- a) $|a_{ii}| \leq \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$
- b) $|a_{ii}| < \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$
- c) $|a_{ii}| > \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$
- d) $|a_{ii}| \geq \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$.

vii) Find the output of the following program :

```
main()  
{  
    char a, b ;  
    a = 'b' ;  
    b = a ;  
    printf( "b = %c\n", b ) ;  
}
```

- a) a
- b) b
- c) garbage value
- d) none of these.



viii) Lagrange's interpolation formula is used for

- a) equispaced arguments only
- b) unequispaced arguments only
- c) both equispaced and unequispaced arguments
- d) none of these.

ix) If $f(3) = 5$ and $f(5) = 3$, then the linear interpolation function $f(x)$ is

- a) $f(x) = 8 - x$
- b) $f(x) = 8 + x$
- c) $f(x) = x^2$
- d) $f(x) = x + x^2 + 8$.

x) If $f(x) = \frac{1}{x}$, the divided difference $[a, b, c]$ is

- a) $\frac{1}{a + b + c}$
- b) $\frac{1}{abc}$
- c) $\frac{1}{a^2 + b^2}$
- d) $\frac{1}{a + b - c}$.

xi) If $\frac{dy}{dx} = x + y$ and $y(1) = 0$, then $y(1.1)$ according to Euler's method is

$[h = 0.1]$

- a) 0.1
- b) 0.3
- c) 0.5
- d) 0.9.

xii) Which one of the following results is correct ?

- a) $\Delta x^n = nx^{n-1}$
- b) $\Delta x^{(n)} = nx^{n-1}$
- c) $\Delta^n e^x = e^x$
- d) $\Delta \cos x = -\sin x$.

xiii) In the method of iteration the function $\phi(x)$ must satisfy

- a) $|\phi'(x)| < 1$
- b) $|\phi'(x)| > 1$
- c) $|\phi'(x)| = 1$
- d) $|\phi'(x)| = 2$.



xiv) The inherent error for Simpson's $\frac{1}{3}$ rd rule of integration is as (the notations have their usual meanings)

- a) $-\frac{nh^5}{180} f''(x_0)$ b) $-\frac{nh^5}{140} f^{iv}(x_0)$
 c) $-\frac{nh^3}{12} f''(x_0)$ d) none of these.

xv) $(\Delta - \nabla) x^2$ is equal to (the notations have their usual meanings)

- a) h^2 b) $-2h^2$
 c) $2h^2$ d) none of these.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. From the following table find the values of $f(12)$ by Newton's divided difference interpolation formula :

x :	11	13	14	18	19	21
f(x) :	1342	2210	2758	5850	6878	9282

3. Solve the following system by Matrix Inversion Method :

$2x + y + z = 10$

$3x + 2y + 3z = 18$

$x + 4y + 9z = 16.$

4. a) Evaluate the missing terms in the following table :

x :	0	1	2	3	4	5
f(x) :	0	—	8	15	—	35

b) What is ternary operator ? Give an example.

5. a) Solve by Taylor's series method $\frac{dy}{dx} = 2x + 3y^2$ given $y = 0$ when $x = 0$ at $x = 0.2.$

b) Using Euler's method obtain the solution of $\frac{dy}{dx} = x - y,$ with $y(0) = 1$ and $h = 0.2$ at $x = 0.4.$



6. Find the first approximation of the root lying between 0 and 1 of the equation $x^3 + 3x - 1 = 0$ by Newton-Raphson formula.
7. Find $y'(x)$, $y''(x)$, given

$x :$	0	1	2	3	4
$f(x) :$	1	1	15	40	85

GROUP - C

(Long Answer Type Questions)

Answer any three of the following questions.

3 × 15 = 45

8. a) From the following table, estimate the number of students who obtained marks between 40 and 45 :

Marks :	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
No. of Students :	31	42	51	35	31

- b) Using Newton divided difference formula, evaluate $f(8)$ and $f(15)$ given :

X :	4	5	7	10	11	13
f(X) :	48	100	294	900	1210	2028

7 + 8

9. a) Find the positive real root of $x^3 = 18$ using the bisection method of 4 iterations.
 b) Find the root of the equation $x^3 + x^2 + x + 7 = 0$ using Regula Falsi method.
 c) A curve passes through the points as given in the following table. Find the area bounded by the curve, x-axis, $x = 1$ and $x = 9$:

X	1	2	3	4	5	6	7	8	9
Y	0.2	0.7	1	1.3	1.5	1.7	1.9	2.1	2.3

5 + 5 + 5

10. a) Write a program in C to solve the equation $x^3 - 3x - 5 = 0$ within (1, 2) by Bisection method correct up to 3 places of decimal.
 b) Write a program in C using recursive function to calculate the sum of all digits of any number.

8 + 7



11. a) Evaluate $\int_0^1 xe^x dx$ by using Trapezoidal rule taking $n = 6$.

b) Use Lagrange's interpolation formula to find the value of $f(x)$ for $x = 0$, given the following :

$x :$	- 1	- 2	2	4
$f(x) :$	- 1	- 9	11	69

c) Prove that Newton-Raphson method has a quadratic convergence. 5 + 5 + 5

12. a) Solve the following system of equations by $L - U$ Factorization Method :

$$x_1 + x_2 - x_3 = 2$$

$$2x_1 + 3x_2 + 5x_3 = - 3$$

$$3x_1 + 2x_2 - 3x_3 = 6.$$

b) Solve the following set of equations by Gauss-Seidel method correct to 2 places of decimal :

$$9x - 2y + z = 50$$

$$x + 5y - 3z = 18$$

$$- 2x + 2y + 7z = 19.$$

c) Write a C program to approximate a real root of the following equation :

$$4 * \sin(x) = e^x \text{ by Bisection method.}$$

5 + 5 + 5

13. a) Write a C program to interpolate a given function at a specified argument by Lagrange's interpolation formula.

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 $n = 4$.

c) Calculate the approximate value of $\int_0^{\pi/2} \sin x dx$ by Composite Trapezoidal Rule

by using 11 ordinates. Also compare it with the actual value of the integral.

5 + 5 + 5

END