



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech/EE (O)/SEM-3/CS-312/2012-13

2012

NUMERICAL METHODS & 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) The degree of precision of Simpson's $\frac{1}{3}$ rule is

- a) 1 b) 2
c) 3 d) 4.

- ii) The rate of convergence of bisection method is

- a) linear b) quadratic
c) cubic d) none of these.

- iii) If $f(x) = \frac{1}{x^2}$, then divided difference $f(a, b)$ is

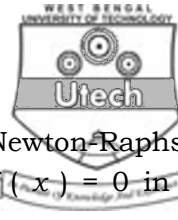
- a) $\frac{a+b}{(ab)^2}$ b) $-\frac{a+b}{(ab)^2}$
c) $\frac{1}{a^2 - b^2}$ d) $\frac{1}{a^2} - \frac{1}{b^2}$.



- iv) If $\frac{5}{3}$ is approximated to 1.6667, then absolute error is
- a) 0.000033 b) 0.000043
 c) 0.000045 d) 0.000051.
- v) If E_a is the absolute error in a quantity whose true and approximate values are given by x_t and x_a , then the relative error is given by
- a) $\left| \frac{E_a}{x_a} \right|$ b) $\left| \frac{E_a}{x_t} \right|$
 c) $\left| \frac{E_a}{x_t - x_a} \right|$ d) $|E_a|$.
- vi) $(\Delta - \nabla) x^2$ is equal to (the notations have their usual meanings)
- a) h^2 b) $-2h^2$
 c) $2h^2$ d) none of these.
- vii) Output of the following programme 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) i.e. number : 0, number : 1 .... up to number : < a large number >  
 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) Which of the following is used in Romberg's integration ?
- a) Forward differences
  - b) Newton's interpolation
  - c) Richardson extrapolation
  - d) Polynomial interpolation.
- x) Output of the following programme code
- ```
void main ( )  
{  
  int i = 0, a, b ;  
  clrscr ( ) ;  
  a = i ++ ; b = ++1 ;  
  printf ( "%d, %d, %d", a, b, i) ;  
  getch ( ) ;  
}
```
- is
- a) 0, 2, 2
 - b) 1, 1, 2
 - c) 1, 2, 2
 - b) 0, 1, 2



- xi) The condition of convergence of Newton-Raphson method when applied to an equation $f(x) = 0$ in an interval is
- $f'(x) \neq 0$
 - $|f'(x)| < 1$
 - $\{f'(x)\}^2 > |f(x) \cdot f''(x)|$
 - $\{f''(x)\}^2 > |f(x) \cdot f'(x)|$
- xii) The predictor-Corrector method is
- Euler's method
 - 4th order Runge-Kutta method
 - Taylor's series method
 - Modified Euler method.
- xiii) Error in the 4th order Runge-Kutta method is of
- $O(h^3)$
 - $O(h^2)$
 - $O(h^4)$
 - $O(h^5)$

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

- Find $y(0.10)$ and $y(0.15)$ by Euler's Method, from the differential equation $\frac{dy}{dx} = x^2 + y^2$ with $y(0) = 0$, correct to four decimal places, taking step length $h = 0.05$.
- Use Lagrange's Interpolation formula to find the value of $f(x)$ for $x = 0$, given the following table :

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



4. Find the value of the integral $\int_0^1 e^x dx$, by Trapezoidal Rule with $h = 0.1$.
5. Prove that $\Delta^m \left(\frac{1}{x} \right) = \frac{(-1)^m n! h^m}{x(x+h)(x+2h)\dots(x+mh)}$.
6. 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. Prove that Newton-Raphson method has a quadratic convergence.

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-Seidel method
 (correct to 3 decimal places) :

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

$$x + 12y + 3z = 39.66$$

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

b) Calculate $f(1.135)$ using suitable formula :

x :	1.140	1.145	1.150	1.155	1.160	1.165
f(x) :	0.13103	0.13541	0.13976	0.14410	0.14842	0.15272

10 + 5



9. a) Construct Lagrange's Interpolation polynomial by using the following data :

$x :$	40	45	50	55
$f(x) :$	15.22	13.99	12.62	11.13

- b) Using Newton's divide difference formula find y (3.4) :

$x :$	2.5	2.8	3.0	3.1	3.6
$y :$	12.1825	16.4446	20.0855	22.1980	36.5982

6 + 9

10. a) Solve the following system of linear equations by Gauss elimination method :

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

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

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

- b) Find the inverse of matrix $\begin{bmatrix} 2 & 1 & 0 \\ 4 & 3 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ by L-U

Factorization method.

- c) Prove that $\Delta \cdot \nabla = \Delta - \nabla$. 6 + 6 + 3

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

i) by value

ii) by reference ?

Give examples.



- b) What will be the output of the following program ?

Main ()

```
{
    int arr [ ] = { 0, 1, 2, 3, 4 } :
    int i, * p ;
    for ( p = arr, i = 0 ; p + 1 <= arr + 4 ; p++, i++ )
        printf ("%d", * (p + i) ) ;
}
```

- c) What is the difference between do loop and do-while loop in C ?
- d) Write a program in C for Simpson's 1/3 rule for any function of your choice. 4 + 3 + 3 + 5

12. a) Find the missing term in the following table :

x :	0	1	2	3	4	5
y :	0	—	8	15	—	35

- b) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by Simpson's $\frac{1}{3}$ rule, taking 6 equal

sub-intervals. What is the geometrical significance of this rule ?

- c) Compute $y(0.2)$ from the equations $\frac{dy}{dx} = x + y$,

$y(0) = 1$, taking step length $h = 0.1$ by 4th order RK method correct to three decimal places. 4 + 5 + 6



13. a) What is the lowest degree polynomial which takes the following values ?

$x :$	0	1	2	3	4	5
$f(x) :$	0	4	9	16	25	36

- b) Find $\Delta^2 (ax^2 + bx + c)$.
- c) Solve the following differential equation for $x = 1$ by taking $h = 0.2$, by Taylor's series method :

$$\frac{dy}{dx} = xy, y(0) = 1 ; \text{correct to three decimal places.}$$
