Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (IT,ECE,EEE,ICE)/SEM-3/M(CS)-312/2010-11

2010-11

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) The ratio of absolute error of the true value is called

      a) relative error b) absolute error

      c) truncation error d) inherent error.

   ii) The significant digit of 0·0001234 is

      a) 7 b) 4

      c) 8 d) 6.

   iii) The percentage error in approximating 4/3 to 1·3333 is

      a) 0·0025% b) 25%

      c) 0·00025% d) 0·25%

iv) Given a pointer, **ptr** to a structure **stru** containing a member name. Which of the following correctly references **name** ?

a) ptr → stru → name b) ptr.name

c) ptr → stru.name d) ptr.str.name

v) With every use of a memory allocation function, what function should be used to release allocated memory which is no longer needed ?

a) unalloc( ) b) free( )

c) dealloc( ) d) dropmem( ).

vi) Which operator cannot be overloaded ?

a) cout b) cin

c) ++ d) ::

vii) Which one of the following will read a character from the keyboard and will store in the variable *c* ?

a) c=getc( ); b) getc(&c);

c) getchar(&c); d) c=getchar( );

viii) If the interval of differencing in unity and $f(x)=ax^2$ (a is constant), which one 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) $\Delta^4 f(x)=0$.

ix) In Simpson's 1/3 rule of finding $\int_a^b f(x)\,dx$, $f(x)$ is approximated by

a) line segment b) parabola

c) circular sector d) part of ellipse.

x) If $f(0)=12$, $f(3)=6$ and $f(4)=8$, then the linear interpolation function $f(x)$ is

a) $x^2-3x+12$ b) x^2-5x

c) x^3-x^2-5x d) $x^2-5x+12$.

xi) Runge-Kutta formula has a truncation error which is of the order of

a) h^2 b) h^3

c) h^4 d) h^5.

xii) If $f(x)=\frac{1}{x^2}$, then the dividend 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) $\frac{1}{a^2}-\frac{1}{b^2}$.

GROUP – B

(Short Answer Type Questions)

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

2. Values of x (in degrees) and sin x are given in the following table :

x (in degree)	15	20	25	30	35	40
$f(x)$	0·2588190	0·3420201	0·4226183	0·5	0·5735764	0·6427876

Determine the value of sin 38° by Newton's backward difference interpolation formula.

3. Find the positive real root of $x^3 - x^2 - 1 = 0$ using the bisection method of 4 iterations.

4. Estimate the value of the integral by Simpson's 1/3 rule, taking 4 strips.

$$\int_1^3 \frac{1}{x}\,dx$$

5. Solve by Taylor's series method $dy/dx = 1/(x^2 + y)$ where $y(4) = 4$. Compute the values of y (4.1).

6. Solve the system of linear equations by Gauss-Jordan method :

$2x + y + z = 0$

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

$x + 4y + 9z = 16$

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Write a *C* program to multiply two matrices of order 3 × 3 by using pointer method. What do you mean by recursive function ? Explain with the help of example.

   b) Using matrix factorization method solve the following system of equations :

   $x + 3y + z = 9$

   $x + 4y + 2z = 3$

   $x + 2y - 3z = 6$. 7 + 8

8. a) Write a program in *C* to copy the contents of a text file to another text file. Suppose the source file is named as "input.txt" and destination file is named as "output.txt".

   b) How does an append mode differ from a write mode ? What are the common uses of rewind ( ) and ftell ( ) functions ?

c) Find from the following table, the area bounded by the curve and the x-axis from $x = 7{\cdot}47$ to $x = 7{\cdot}52$.

x	7·47	7·48	7·49	7·50	7·51	7·52
$f(x)$	1·93	1·95	1·98	2·01	2·03	2·06

8 + 3 + 4

9. a) Write a program in *C* using recursive function to calculate the sum of all digits of any number.

b) Write a *C* program to integrate $\int (4x - 3x^2)\,dx$, where lower and upper limits are 0 and 1 respectively, taking $h = 0{\cdot}25$. 7 + 8

10. a) Use the fourth order Runge-Kutta method to find the value of y when $x = 0{\cdot}2$ given that $y = 0$ when $x = 0$ and $dy/dx = 1 + y^2$.

b) Apply Lagrange's interpolation formula to find $f(x)$ if

$f(1) = 2$, $f(2) = 4$, $f(3) = 8$, $f(4) = 16$ and $f(7) = 128$.

c) Write a *C* program to solve the equation $x^3 - 3x - 5 = 0$ within (1, 2) by bisection method correct to 3 decimal places. 5 + 5 + 5

11. a) Solve the given system of equations :

$10x + 2y + z = 9$

$2x + 20y - 2z = -44$

$-2x + 3y + 10z = 22$

by Gauss-Seidel method.

b) Using Taylor's method, obtain an approximate value of y at $x = 0{\cdot}2$ for the differential equation $\frac{dy}{dx} = 2y + 3e^x, y(0) = 0$. 8 + 7