

**POST-GRADUATE COURSE**  
**Term End Examination — June, 2023/December, 2023**  
**MATHEMATICS**  
**Paper-4B : COMPUTER PROGRAMMING & ITS APPLICATION TO**  
**NUMERICAL ANALYSIS**

Time : 2 hours ]

[ Full Marks : 50

Weightage of Marks : 80%

**Special credit will be given for accuracy and relevance in the answer. Marks will be deducted for incorrect spelling, untidy work and illegible handwriting. The marks for each question has been indicated in the margin.**

***Use of scientific calculator is strictly prohibited.***

Answer Question No. 1 and any *four* from the rest :

1. Answer any *five* questions : 2 × 5 = 10
- a) Assuming  $m$  and  $n$  are integers, determine the values of  $m$  and  $n$  after executing following C statements.
- ```
m = 8, n = 11;
if( 2 * m == n ) goto L50;
n++;
goto L20;
L50 : n=m;
L20 : n+=5;
```
- b) Evaluate the following postfix expression :
- |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 3 | + | 2 | * | 6 | 9 | 7 | - | / | - |
|---|---|---|---|---|---|---|---|---|---|---|
- c) Given that  $i = 1$ ,  $j = 2$ ,  $k = 3$  are three integer variables in C. Determine the value of the expression.
- $(i > j) || !(j > k) \&\& (k > 3)$
- The operators are listed below in descending order ( high to low ) of priority.
- !, &&, ||
- d) Explain 'continue' statement with an example.
- e) A two-dimensional integer array A is declared as follows :
- ```
int A[ 3 ][ 4 ] = [ { 1, 2, - 1 }, { 2, 3, 4, 5 } ];
```
- Determine the value of  $A[0][3]$  and  $A[1][3]$ .

- f) What is the output of the following program segment ?

```
int i = 1;
while (i<128){
    printf ("%d\t",i);
    i = i*2;
}
```

- g) A statement in C is given as follows :

```
printf("%d",i>=0?i:-i);
```

Determine what value will be printed by the above statement after initializing  $i$  by 17. Determine also the output of printf statement when  $i$  is initialized by  $-17$ .

- h) Give an example of multi-alternative if statement.
2. a) Write an algorithm to add all the digits of a given integer  $n$ .  
 b) What are Structure and Union in C language ? Explain with examples. What is the difference between them ?  $5 + (3 + 2)$
3. a) What is the purpose of 'typedef' keyword ? How is this keyword used in conjunction with structure ?  
 b) What output the following for statement produce ?  

```
for(i=10;i>=1; i/=2)
    printf("%d\n",i++);
```
- c) Why is the 'break' statement used in C program ? Explain with example.  $3 + 4 + 3$
4. a) Three different types of loops are given below  
 Loop1 : while ( i < 10) { ..... }  
 Loop 2 : for ( ; i < 10; ) { ..... }  
 Loop 3 : do { ..... } while ( i < 10);  
 Which of the above loops are equivalent ? Justify your answer.  
 b) Give an example of nested for loop in C.  
 c) Write a recursive function to calculate factorial of an integer  $n$ .

$4 + 3 + 3$

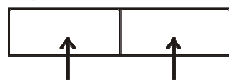
5. a) The lengths  $a$ ,  $b$ ,  $c$  of three sides of a triangle are given. A triangle is valid if it satisfies following conditions.
- Each side's lengths ( $a$ ,  $b$ ,  $c$ ) must be greater than zero
  - Sum of the length of any two sides is greater than the length of the third side.

Write a C program to determine whether the triangle is valid or not. If valid, then also determine whether the triangle is equilateral ( three sides equal ) or isosceles ( two sides equal ) or scalene ( sides unequal ).

- b) Write a short note on 'while' and 'do-while' loop. 6 + 4
6. a) Suppose that  $x$  is a one-dimensional array and  $p$  is a pointer variable. Assuming that the assignment  $p = x$  has just been performed. Based on the above information determine which of the following expressions are true ? Justify your answer.

- $p == x[0];$
- $p == \&x[0];$
- $*p == x[0];$

- b) Suppose  $T$  be the pointer to the first node to a non-empty linked list and  $x$  be the pointer to some arbitrary node in  $T$ , where every node has following structure :



Data (int) next ( pointer to next node )

Write an algorithm to insert a node with data field as 5 after node  $x$ . You can use function `getnode ( )` which returns a pointer to a free node.

- c) Suppose a floating point variable  $x$  has been initialized to 18.23. Determine the output of the following two `printf` statements in C.

```
printf ("%1.1f\n", x); 4 + 4 + 2
printf ("% - 8.3f", x);
```

7. a) Write a program to find out the value of  $\sqrt[3]{a}$  (accurate up to 3 decimal places) using Newton-Raphson method. The method uses the expression

$$x_{n+1} = x_n - f(x_n) / f'(x_n)$$

to generate the sequence of approximate root.

- b) Write a function check (  $x, y, n$  ) that returns 1 if both  $x$  and  $y$  fall between 0 and  $n-1$  inclusive. The function should return 0 otherwise. Assume  $x, y$  and  $n$  all are integers. 6 + 4