Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

Back End (Odd) Semester Examination July 2025

Roll no...........................

Name of the Course and semester: B.Tech. First Semester
Name of the Paper: Fundamentals of computers and introduction to programming
Paper Code: TCS101

Time: 3 hours   Maximum Marks: 100

Note:
(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1.   (2X10=20 Marks)
a. What are the characteristics of general-purpose computers? Imagine you need to purchase a general-purpose computer for a small business that involves light computing tasks. What specifications would you prioritize to ensure cost-effectiveness and functionality? Provide suitable reasons for your choices.   (CO1)

b. Define a computer network and explain its key components, which help facilitate communication and data transfer. Additionally, explain the characteristics and applications of networks based on local, metropolitan, and wide-area coverage, providing examples for each.   (CO1)

c. Design an algorithm and draw a flowchart to calculate sum of following series:
$1-2^2/2!+3^3/3!-4^4/4!+......n^n/n!$ (CO1,CO3)

Q2.   (2X10=20 Marks)
a. Differentiate the following: (CO2)
   1. Operator precedence and Operator Associativity
   2. Performance comparison between pre and post increment/decrement operators
   3. Compiler and Interpreter
   4. C tokens and identifiers

b. Predict the Output of given code snippet: (CO2, CO3, CO4, CO5)
   (i)
```c
#include <stdio.h>
int main() {
int a = 3, b = 7, c = 5;
printf("%d %d %d",
    (a > b) ? (a > c ? a : c) : (b > c ? b : c),
    (a < b) ? (a < c ? a : c) : (b < c ? b : c),
    (a == b) ? (b == c ? a : b) : (c == a ? c : a));
return 0;
}
```
   (ii)
```c
#include <stdio.h>
int main() {
    int i, j;
    for (i = 0; i < 3; i++) {
       for (j = 0; j < 3; j++) {
          if (i == j) {
             break;
          }
          printf("%d%d ", i, j);
       }
}
```

Back End (Odd) Semester Examination July 2025

```
    }
    return 0;
}
```

(iii)
```
#include <stdio.h>
int main()
    {
        unsigned int x = 8;
        int result = x << 2;
        printf("%d ", result);
        result = x >> 1;
        printf("%d", result);
        return 0;
    }
```

(iv)
```
#include <stdio.h>
void func() {
    static int x;
    printf("%d ", x);
    x++;
}

int main() {
    func();
    func();
    func();
    return 0;
}
```

c. Compare a compiler and an interpreter, outlining the stages involved in each process. Describe the roles of source code and object code in the program development lifecycle. Also, contrast syntax errors and logical errors, providing examples of each and examining their effects on program execution. CO2

Q3. (2X10=20 Marks)

a. (i) Differentiate between entry-controlled loops and exit-controlled loops. Illustrate with examples when each type of loop is most appropriate for use in programming (CO3)
(ii) Write a C program to draw following pattern (CO3)

```
        *
      * * *
    * * * * *
  * * * * * * *
* * * * * * * * *
```

b. (i) Illustrate the concept of short-circuit evaluation in C, describing how it works with the logical operators && and ||. Give suitable example also. (5 Marks) (CO3)
(ii) Write a C program to print the binary equivalent of a decimal number entered by the user (5 Marks) (CO3)

c. Draw a flowchart and write a C program to generate the water bill charges by the municipal authority as follows:
Base price of water consumption per month is charged at 35 paisa per liter.

Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

Back End (Odd) Semester Examination July 2025

There will be surcharge on consumption of water as per below rules:

    i) Water consumption up to 400 liters has no surcharge.

    ii) Water consumption greater than 400 liters up to 800 liters has a surcharge of 10 paisa per liter.

    iii) Water consumption greater than 800 liters has a surcharge of 18 paisa per liter.

An additional amount of 5 % GST is added to final bill.

Example:

    Input: Water consumption = 1000 liters

    Per Liter Cost: 35 paisa

    Base Charge = 1000 liters × 35 paisa = 35000 paisa (Rs. 350)

    For Surcharge:

    For 0–400 liters: No surcharge.

    For 401–800 liters: (800 - 400) liters × 10 paisa = 4000 paisa (Rs. 40)

    For 801–1000 liters: (1000 - 800) liters × 18 paisa = 3600 paisa (Rs. 36)

    Total Surcharge = 4000 + 3600 = 7600 paisa (Rs. 76)

    Total Bill (Before GST) = Base Charge + Surcharge = 35000 + 7600 = 42600 paisa (Rs. 426)

    GST (5%) = 42600 × 5% = 2130 paisa (Rs. 21.30)

    Final Bill = Total Bill + GST = 42600 + 2130 = 44730 paisa (Rs. 447.30)

    Output: Final Bill = Rs. 447.30

(CO3)

Q4. (2X10=20 Marks)

a. Explain the concept of a single-dimensional array in C, and demonstrate with an example how to declare, initialize, and access elements within the array. What is the significance of **segmentation faults** and **bound checking** when working with arrays in C? Does C provide automatic bound checking mechanism? (CO4)

b. Write a menu-driven C program to perform sorting, searching (with user input for the number to be searched), and reversing of an array using separate functions for each operation, with repeated menu options until the user chooses to exit.

    Sample Menu:
    1. Sort the Array
    2. Search an Element
    3. Reverse the Array
    4. Exit
    Enter your choice: (CO4)

c. Design a flowchart and write a C program to find the second smallest and second largest elements in a given one-dimensional array. Ensure that your program handles cases where there are fewer than two elements in the array. (CO4)

Q5. (2X10=20 Marks)

a. Differentiate between the following: (CO5)
    1. Call by Value and Call by Reference
    2. Actual arguments and Formal Arguments

Back End (Odd) Semester Examination July 2025

3. Function Prototype declaration and Function definition
4. Static and External Storage class

b. Describe the memory layout of a C program, detailing where variables of different types (local, global, static, dynamic) are stored, and include a neat and clean diagram to represent the different memory areas.   (CO5)

c. Write a C program to determine whether the inputted number is a Armstrong number or not using recursion.
(CO5)