

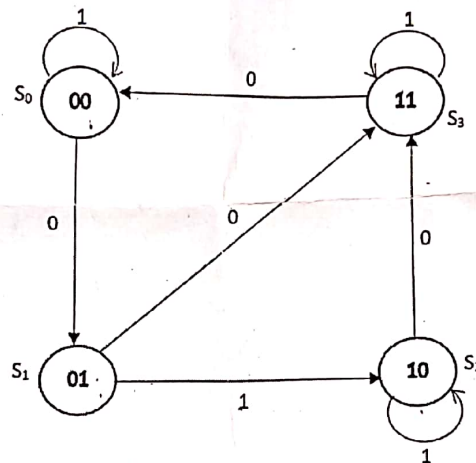
Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Attempt any Two questions:

Section A

(2×10=20)

1. Design the sequential circuit with respect to the following state diagram using T flip flops.



2. Implement $F = \sum (0, 1, 4, 5, 7)$ using
- Multiplexer
 - Decoder
 - PLA

3. Differentiate between combinational circuit and sequential circuit. Design mod-10 synchronous counter using J-K flip flop. Show necessary truth tables and k-maps.

Section B

(8×5=40)

Attempt any Eight questions

4. Provide one example where shift left operation can be used. Explain serial-in-serial-out register.

✓ 5. Carry out the following tasks

- Perform 2's complement subtraction of 010110-100101
- Represent decimal number 10 in its BCD form → 10000

✓ 6. Derive the Boolean expression for sum and carry of half adder. Draw its combinational circuit. Implement it using only NOR gates.

✓ 7. Express $F' = (x + yz)'$ as a sum of min-terms.

✓ 8. Minimize the following Boolean function using K-map

$$F(A, B, C, D) = \sum m(0, 1, 2, 5, 7, 8, 9, 10, 13, 15)$$

✓ 9. What are the practical implications of down counter? Explain BCD ripple counter.

✓ 10. Design a combinational circuit with three inputs and one output. The output is 1 when the binary value of the inputs is an even number.

✓ 11. Differentiate between ROM and PLA. Explain different types of ROM.

✓ 12. Write short notes on (Any two)

- Positive Logic
- I²L
- ASCII

Bachelor Level / First Year/ First Semester/ Science
Computer Science and Information Technology (MTH 112)
(Mathematics I)
(NEW COURSE)

Full Marks: 80
Pass Marks: 32
Time: 3 hours.

*Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.*

Group A ($10 \times 3 = 30$)

Attempt any **THREE** questions.

1. (a) If a function is defined by

[1+1+1+2]

$$f(x) = \begin{cases} 1+x, & \text{if } x \leq -1 \\ x^2, & \text{if } x > -1, \end{cases}$$

evaluate $f(-3)$, $f(-1)$ and $f(0)$ and sketch the graph.

- (b) Prove that $\lim_{x \rightarrow 0} \frac{|x|}{x}$ does not exist. [5]

2. (a) Sketch the curve $y = x^2 + 1$ with the guidelines of sketching [5]

- (b) If $z = xy^2 + y^3$, $x = \sin t$, $y = \cos t$, find $\frac{dz}{dt}$ at $t = 0$. [5]

3. (a) Estimate the area between the curve $y = x^2$ and the lines $x = 0$ and $x = 1$, using rectangle method, with four sub intervals. [5]

- (b) A particle moves along a line so that its velocity v at time t is [5]

$$v = t^2 - 2t + 10$$

- (i) Find the displacement of the particle during the time period $1 \leq t \leq 4$.

- (ii) Find the distance traveled during this time period.

4. (a) Define initial value problem. Solve: [5]

$$y'' + y' - 6y = 0, y(0) = 1, y'(0) = 0$$

- (b) Find the Taylor's series expansion for $\cos x$ at $x = 0$. [5]

Attempt any TEN questions.

5. (a) Dry air is moving upward. If the ground temperature is 20° and the temperature at a height of 2km is 10°C , express the temperature T in $^\circ\text{C}$ as a function of the height h (in kilometers), assuming that a linear model is appropriate. (b) Draw the graph of the function and find the slope. Hence, give the meaning of the slope. (c) What is the temperature at a height of 2km ? [5]

6. Find the equation of tangent at $(1, 3)$ to the curve $y = 2x^2 + 1$.

7. State Rolle's theorem and verify the theorem for $f(x) = x^2 - 9$, $x \in [-3, 3]$.

8. Starting with $x_1 = 1$, find the third approximation x_3 to the root of the equation $x^3 - x - 5 = 0$.

9. Show that the integral

$$\int_0^3 \frac{dx}{x-1},$$

diverges.

10. Use Trapezoidal rule to approximate the integral $\int_1^2 \frac{dx}{x}$, with $n = 5$.

11. Find the derivative of $\mathbf{r}(t) = t^2\mathbf{i} - te^{-t}\mathbf{j} + \sin 2t\mathbf{k}$ and find the unit tangent vector at $t = 0$.

12. What is a sequence? Is the sequence

$$a_n = \frac{n}{5+n}$$

convergent?

13. Find the angle between the vectors $\mathbf{a} = (2, 2, -1)$ and $\mathbf{b} = (1, 3, 2)$.

14. Find the partial derivative f_{xx} and f_{yy} of $f(x, y) = x^2 + x^3y^2 - y^2 + xy$, at $(1, 2)$.

15. Evaluate

(a) $\int_0^3 \int_1^2 x^2 y \, dx \, dy$

(b) $\int_0^\pi \int_1^2 y \sin(xy) \, dx \, dy$

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2079
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Bachelor Level / First Year/ First Semester/ Science
Computer Science and Information Technology (CSc. 109)
(Introduction to Information Technology)
(NEW COURSE)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Section A

Attempt any Two question

(2×10 = 20)

1. What is computer memory? Describe memory hierarchy with suitable examples. [2+8]
2. Why software is needed in computer system? Mention the role of system software. Discuss the functionalities of operating system. [2+2+6]
3. Define computer network. Discuss the types of network topologies with their pros and cons. [2+8]

Section B

Attempt any Eight questions

(8 × 5 = 40)

4. Briefly describe the generations of computer. [5]
5. Define instruction set. How a CPU instruction cycle works? [2+3]
6. Discuss different types of printers with examples. [5]
7. Define decimal to binary conversion. Convert $(12.45)_{10}$ to binary. [1+4]
8. What is communication protocol? Why it is used in computer networks? List few examples of communication protocols. [3+1+1]
9. What is multimedia? Describe the elements of multimedia. [1+4]
10. What is firewall? How firewall is used to secure computer systems? [2+3]
11. Define the terms data warehousing, data mining and big data. [5]
12. Write short notes on: [2.5+2.5]
 - a. Cloud Computing
 - b. IoT

Bachelor Level / First Year/ First Semester/ Science
Computer Science and Information Technology (PHY. 113)
(Physics)
(NEW COURSE)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

Candidates are required to give their answers in their own words as far as practicable.
The questions are of equal value.

Section A

Long Answer Questions:

(2x10=20)

Attempt any TWO questions

1. Explain the meaning of 'fabrication of integrated circuits'. Describe following processes involved in the fabrication of integrated circuits: epitaxial growth, oxidation, oxide removal and pattern definition, doping and interconnection of components. [10]
2. Explain the effect of external magnetic field on current carrying loops. Describe torque on a current-carrying rectangular loop of wire on a pivot rod when placed in a magnetic field. Give alternative way of increasing the torque on the coil. [10]
3. What do you mean by the wavefunction? Discuss its physical significance. Set up time-independent and time-dependent Schrodinger wave equation. What are the implications of this equation? Discuss. [10]

Section B

(8x5=40)

Short Answer Questions:

Attempt any EIGHT questions:

4. Derive expression for electrical conductivity of semiconductor in terms of impurity ionization energy. [5]
5. Describe behavior of mobile negative charges in the Hall effect experiment. [5]
6. Set up differential equation for an oscillation of a spring using Hooke's and Newton's second law. [5]
7. What are (a) the energy, (b) the momentum, and (c) the wavelength of the photon that is emitted when a hydrogen atom undergoes a transition from the state $n = 4$ to $n = 2$? [5]
8. An oscillating block of mass 250 g takes 0.15 sec to move between the endpoints of the motion, which are 40 cm apart. Find (a) frequency and (b) amplitude of the motion, and (c) force constant of the spring. [5]

9. A potential difference of 100 V is established between the two plates one being the high potential plate (say A). A proton of charge $q = 1.6 \times 10^{-19}$ C is released from plate B, the another plate. What will be the velocity of the proton when it reaches plate A? The mass of the proton is 1.67×10^{-27} kg. [5]
10. An α -particle is emitted from a radioactive nuclei with an energy of 6.8 MeV. Calculate its wavelength and compare it with the size of the emitting nucleus that has a radius of 8×10^{-15} m. [5]
11. (a) Calculate the Fermi energy aluminum that have density 2.73 g/cm^3 and molecular weight 26.98 g/mole. (b) If the experimental value of Fermi energy (E_F) is 11.8 eV, what is the effective mass of electron in aluminum? Aluminum is trivalent. [5]
12. The output of a digital circuit (y) is given by this expression:

$$y = (\overline{AB} + \overline{BA})(\overline{A + B} + C)$$
Where A, B and C represent inputs. Draw a circuit of above equation using OR, AND and NOT gate and hence find its truth table. [5]

$$N_A = 6.023 \times 10^{23}$$

$$K_B = ?$$

$$1.038 \times 10$$

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Bachelor Level / First Year/ First Semester/ Science
Computer Science and Information Technology (CSc. 110)
(C Programming)
(NEW COURSE)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Section A

Attempt any two questions:

(2×10=20)

1. What is the difference between `exit(0)` and `exit(1)`? Discuss the need of nested structure with an example. Write a program to find the value of x^y without using POW function.

[2 + 3 + 5]

2. Why do we need break and continue statement? Define formal argument and actual argument in function with example. Identify and list the errors in following code. [2 + 3 + 5]

```
int main()
{
    int a,b,c;
    scanf("%d%d",&a,&b,&c);
    sum(a,b,c);
    return -1;
}

void sum(int x, int y, int z)
{
    intt sum;
    sum = a + b + c;
    return sum;
}
```

3. Write a program to demonstrate the following menu driven program. The user will provide an integer and an alphabet for making a choice and corresponding task has to be performed accordingly as follows.

- A. Find Odd or Even
- B. Find Positive or Negative
- C. Find the Factorial Value
- D. Exit

The choice will be displayed until the user give "D" as choice.

[10]

Section B

Attempt any eight questions:

(8×5=40)

4. How do you swap the values of two integers without using the third temporary variable? Justify with the example.

[5]

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1

5. Write a program to find the sum of digits of a given integer using recursion. [5]
6. Differentiate between constant and literals. Why do we need to define the types of data? [3 + 2]
7. Write a program to find the second largest number in the given array of numbers. [5]
8. Create a structure "Employee" having Name, Address, Salary, Age as member functions. Display the name of employee having age between 40 and 50 and are living in Kathmandu. [5]
9. List any one advantage and disadvantage of pointer. How do you pass pointers as function arguments? [2 + 3]
10. Suppose a file named "Num.txt" contains a list in integers. Write a program to extract the prime numbers only from that file and write them on "Prime.txt" file. [5]
11. What is the advantage of union over structure? List any four string library functions with prototype. [1 + 4]
12. Write short notes on [2.5 + 2.5]
 - a. Local, Global and Static variables
 - b. Conditional operator