

Tribhuvan University
Institute of Science and Technology
2074



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

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.*

Attempt any two questions:

(10×2=20)

1. Explain equilibrium current across the pn junction? Use Fermi-Dirac statistics and Maxwell-Boltzmann distribution to show the flow n to p is equal to the flow from p to n . How electron current from p to n (that is, associated with minority carries) is not affected by the height of the potential energy barrier? Explain. (10)
2. Describe moment of inertia and torque for a rotating rigid body. Find the expression for rotational kinetic energy and discuss the conditions for conservation. (10)
3. Explain the theory of black body radiation. Why this theory needs quantum mechanical interpretation? How this interpretation became experimentally successful? Explain. (10)

Attempt any eight questions:

(5×8=40)

4. Explain Hall effect and discuss the importance of Hall voltage while manufacturing *electronic* devices. (5)
5. Discuss effective mass of electrons and holes. (5)
6. Describe electrical conductivity of semiconductors. (5)
7. An oscillating block of mass 250 g takes 0.15 sec to move between the endpoints of the motion, which are 40 cm apart. (a) What is the frequency of the motion? (b) What is the amplitude of the motion? (c) What is the force constant of the spring? (5)
8. A current of 50 A is established in a slab of copper 0.5 cm thick and 2 cm wide. The slab is placed in a magnetic field B of 1.5 T. The magnetic field is perpendicular to the plane of the slab and to the current. The free electron concentration in copper is 8.4×10^{28} electrons/m³. What will be the magnitude of the Hall voltage across the width of the slab? (5)
9. The uncertainty in the position of a particle is equal to the de Broglie wavelength of the particle. Calculate the uncertainty in the velocity of the particle in terms of the velocity of the de Broglie wave associated with the particle. (5)
10. (a) How many atomic states are there in hydrogen with $n = 3$? (b) How are they distributed among the subshells? Label each state with the appropriate set of quantum numbers n, l, m_l, m_s . (c) Show that the number of states in a shell, that is, states having the same n , is given by $2n^2$. (5)
11. Copper has a face-centered cubic structure with a one-atom basis. The density of copper is 8.96 g/cm³ and its atomic weight is 63.5 g/mole. What is the length of the unit cube of the structure? (5)

12. The output of a digital circuit (y) is given by the expression:

$$y = (B + \overline{CB} \cdot A) (\overline{A+C})$$

where A, B and C represent inputs

Draw a circuit of above question using OR, AND and NOT gate and hence find its truth table (5)

Bachelor Level / First Year/ First Semester/ Science
Computer Science and Information Technology (CSc. 111)
(Digital Logic)

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

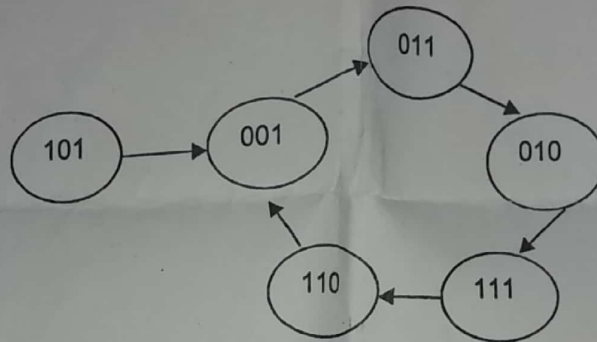
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Attempt any two questions:

(2×10=20)

1. Implement the following function $F = \sum (0, 3, 5, 6, 7)$ using
 (a) Decoder
 (b) Multiplexer
 (c) PLA

2. Differentiate between PAL and PLA. Design a counter as shown in the state diagram below



3. Draw a block diagram, truth table and logic circuit of 1*16 Demultiplexer and explain its working principle.

Attempt any eight questions:

(8×5=40)

4. Perform the arithmetic operation $(+42)+(-13)$ and $(-42)-(-13)$ in binary using the signed -2's-complement representation for negative numbers.

5. Express the complement of the following function in sum of minterms.
 $F(A, B, C, D) = \sum(0, 2, 6, 11, 13, 14)$

6. Reduce the following function using k-map
 $F = wxy + yz + xy'z + x'y$

7. Design a combinational circuit with three inputs and six outputs. The output binary number should be the square of the input binary number.

8. Design a 5×32 decoder with four 3×8 decoder with enable and one 2×4 decoder. Use block diagrams only.

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9. Design and explain the Decimal adder with truth table and suitable diagram.

10. Explain shift register with parallel load. Highlight on its practical implications.

11. Explain master slave J-K flipflop.

12. Write short notes on (any two):

(a) State diagram

(b) De-Morgan's theorem

(c) TTL

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

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

*Candidates are required to give their answers in their own words as far as practicable.
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Attempt any two questions:

(2×10=20)

1. Discuss structure of a C Program with suitable example. (10)
2. Discuss different types of if statements with suitable example of each. Differentiate if statement with switch statement. (8+2)
3. What is the structure? How is it different from array? Create a structure student having data members name, roll-number and percentage. Complete the program to display the name of student having percentage greater than or equal to 60. (1+2+7)

Attempt any eight questions:

(8×5=40)

4. What is algorithm? How is it different from flow chart? (2+3)
5. What is type conversion? Discuss type casting with suitable example. (1.5+3.5)
6. Discuss increment and decrement operators with example. (5)
7. Write a program that computes the sum of digits of a given integer number. (5)
8. What is function? Discuss the benefits of using function. (1.5+3.5)
9. Write a program to find sum and average of 10 integer numbers stored in an array. (5)
10. Define pointer. Discuss the relationship between pointer and one-dimensional array. (1.5+3.5)
11. Write a program to read and print data stored in a file input . txt. (5)
12. Why do we need graphics functions? Write a program to draw a circle. (2+3)

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

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.*

Attempt any three questions:

(3×10=30)

1. (a) A function is defined by $f(x) = \begin{cases} x+2 & \text{if } x < 0 \\ 1-x & \text{if } x > 0 \end{cases}$, calculate $f(-1)$, $f(3)$, and sketch the graph. (5)

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

2. (a) Find the derivative of $f(x) = \sqrt{x}$ and to state the domain of f' . (3+2)

- (b) Estimate the area between the curve $y^2 = x$ and the lines $x = 0$ and $x = 2$. (5)

3. (a) Find the Maclaurin series for e^x and prove that it represents e^x for all x . (4)

- (b) Define initial value problem. Solve that initial value problem of $y' + 5y = 1$, $y(0) = 2$. (4)

- (c) Find the volume of a sphere of radius r . (2)

4. (a) For what values of x does the series $\sum_{n=1}^{\infty} \frac{(x-3)^n}{x}$ converge? (5)

- (b) Calculate $\iint_R f(x, y) dA$ for $f(x, y) = 100 - 6x^2y$ and $R: 0 \leq x \leq 2, -1 \leq y \leq 1$. (5)

Attempt any ten questions:

(10×5=50)

5. If $f(x) = \sqrt{x}$ and $g(x) = \sqrt{3-x}$, find $g \circ f$ and $f \circ g$. (5)

6. Use continuity to evaluate the limit, $\lim_{x \rightarrow 4} \frac{5 + \sqrt{x}}{\sqrt{5+x}}$. (5)

7. Verify Mean value theorem of $f(x) = x^3 - 3x + 3$ for $[-1, 2]$. (5)

8. Sketch the curve $y = x^3 + x$. (5)

9. Determine whether the integral $\int_1^{\infty} \frac{1}{x} dx$ is convergent or divergent. (5)

10. Find the length of the arc of the semicubical parabola $y^2 = x^3$ between the points (1, 1) and (4, 8). (5)

11. Find the solution of $y'' + 6y' + 9 = 0$, $y(0) = 2$, $y'(0) = 1$. (5)

12. Test the convergence of the series $\sum_{n=1}^{\infty} \frac{n^n}{n!}$. (5)

13. Define cross product of two vectors. If $a = i + 3j + 4k$ and $b = 2i + 7j - 5k$, find the vector $\mathbf{a} \times \mathbf{b}$ and $\mathbf{b} \times \mathbf{a}$. (1+2+2)

14. Define limit of a function. Find $\lim_{x \rightarrow \infty} (x - \sqrt{x})$. (1+4)

15. Find the extreme values of $f(x, y) = y^2 - x^2$. (5)

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

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

*Candidates are required to give their answers in their own words as far as practicable.
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Attempt any two questions:

(2×10=20)

1. What is communication protocol? Discuss the OSI model with its layers. (2+8)
2. What is the objective of using operating system? How operating system performs process, memory and file management activities? (3+7)
3. What is data model? How ER-Model can be used to create conceptual data model? Explain with example. (3+7)

Attempt any eight questions:

(8×5=40)

4. What is computer system? Discuss components of computer system. (1+4)
5. Why bus is used in computer? How control bus differs from data bus? (2+3)
6. How many numbers of bits are equivalent 1 Kilobyte? Discuss the working mechanism of magnetic tape. (2+3)
7. Mention the use of plotter. How quality of printer is determined? (2.5+2.5)
8. What do you mean by Internet of Things (IoT)? As an IT expert, mention the possible applications of IoT that you have observed in Nepal. (2+3)
9. Define each of the terms confidentiality, integrity, and authentication. (5)
10. What is multimedia? Discuss the applications of multimedia. (1+4)
11. What is BigData? How centralized database is different than the distributed database? (1+4)
12. Convert $(10.4)_{10}$ to binary. Add $(10111)_2$ with $(01111)_2$. (2+3)