

(3 Hours)

(Total Marks : 80)

Please check whether you have the right question paper.

- N.B.:**
- 1) Questions No. 1 is **compulsory**.
 - 2) Solve **any three** question out of remaining **five** questions.
 - 3) Assume suitable **data** if **necessary**.
 - 4) **Figures** to the **right** indicate **full marks**.

- 1 Solve any **four** out of five : (20)
 - a) Why biasing is necessary in BJT amplifier?
 - b) Solve $(35)_{10} - (47)_{10}$ using two's complement method.
 - c) Define :
 - i) truth table
 - ii) standard SOP
 - iii) De-Morgan's theorem
 - iv) Duality theorem
 - v) universal gate
 - d) Define multiplexer and state its application.
 - e) Convert S-R flip-flop to T flip-flop.
2. a) Using Quine-Me-dusky method determine minimum SOP form for (10)

$$f(A, B, C, D) = \sum m(0, 1, 3, 7, 8, 9, 11, 15)$$
- b) What do you mean by differential amplifier? What is its primary function? State (10)
different configurations of it, which one is popularly used.
3. a) Draw & explain Ring counter using suitable waveforms. (10)
- b) Implement the following using only one 4:1 MUX and few gates : (10)

$$f(A, B, C, D) = \sum m(0, 1, 3, 4, 5, 7, 9, 10, 12, 15)$$
4. a) Design MOD-9 Synchronous counter using J-K flip-flop. (10)
- b) Design four bit BCD adder using IC7483. (10)
5. a) What is shift register? Mention different modes of operation of shift register? (10)
- b) State and explain various VHDL data objects in brief. (10)
6. Solve the following (**Any Four**) : (20)
 - a) VHDL program format.
 - b) Difference between combinational circuit and sequential circuits.
 - c) Different biasing methods.
 - d) Race-around condition in flip-flop.
 - e) Current mirror circuit.
 - f) Arithmetic logic unit.

(3 Hours)

[Total Marks: 80]

N.B. (1) Question No.1 is compulsory.**(2) Out of remaining attempt any three.****(3) Assume & mention suitable data wherever required.****(4) Figures to right indicates full marks.****Q.1. Solve any four****[20]**

- Explain need of modulation. Justify it with example.
- Define the following terms.
 - Noise figure
 - Noise temperature
 - Noise bandwidth
 - Noise voltage
 - Modulation.
- Compare AM and FM.
- Explain in short pre-emphasis and De-emphasis.
- What is PSK signal. Draw the PSK signal for the following binary signal 111010011.
- Explain the principle of reflection and refraction.

Q.2 a). Define signal to noise ratio. Explain the effect of cascade connection on a signal to noise ratio. Derive Friss formula for two stage cascade amplifier.**[10]****b). State and prove the following properties of Fourier transform with example****i) Convolution in time domain ii) Time scaling****[10]****Q.3. a) The AM Transmitter develops an unmodulated power o/p of 400 Watts across a 50Ω resistive load. The carrier is modulated by a sinusoidal signal with a modulation index of 0.8. Assuming $f_m = 5\text{KHz}$ and $f_c = 1\text{MHz}$.****[10]****(i) Obtain the value of carrier amplitude V_c and hence write the expression for AM signal.****(ii) Find the total sideband power.****(iii) Draw the AM wave for the given modulation index.****b). With the help of neat circuit diagram explain Indirect method of FM generation. [10]****Q.4 a). What are the limitations of TRF receiver? Explain how these limitations are avoided using super-heterodyne receiver.****[10]****b). Compare ground wave, sky wave, space wave and tropospheric scatter propagation. [10]****Q.5 a). State Sampling theorem, write down the steps to prove sampling theorem, draw waveform for low pass band limited signal.****[10]****b). Draw the block diagram of PWM generator and detector. Explain the working giving waveforms at the output of each block.****[10]****Q.6. a). Explain slope overload error and hunting error in Delta modulation. Derive the condition to avoid slope overload distortion.****[10]****b). Explain the generation and detection of FSK signal.****[10]**

[Time: 3 Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B:** 1. Q 1 is compulsory.
2. Attempt any three from remaining
3. Rights indicate full marks.

1. a. If A, B, C are subset of universal set V then prove that $A \times (B \cap C) = (A \times B) \cap (A \times C)$ **05**
- b. If $f: \mathbb{R} \rightarrow \mathbb{R}$ is given by $y = 2x + 1$, prove that f is one to one and onto and find f^{-1} **05**
- c. Find $L \{(1 + t\bar{e}^t)^3\}$ **05**
- d. Check whether the following function Harmonic or not $3x^2 + \sin x + y^2 + 5y + 4$ **05**
2. a. Find k if $f(z) = \frac{1}{2} \log(x^2 + y^2) + i \tan^{-1} \frac{kx}{y}$ is analytic **06**
- b. Find $L \{|\sin 2t|\}$ **06**
- c. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ $f(x) = x^2 + 2x - 1$ **08**
 $g: \mathbb{R} \rightarrow \mathbb{R}$ $g(x) = 4x^2 + 2$
Find (I) $f \circ g$ (II) $g \circ f$
3. a. Find Bilinear transformation under which $Z=1, -i, -1$ from point $w = i, 0, -i$ **06**
- b. If A be the set of non-integers and let R be a relation on $A \times A$ defined by $(a, b) R (c, d)$ if $ad=bc$, then prove that R is an equivalence relation. **06**
- c. Find (1) $L \left\{ \int_0^t e^{-u} \frac{\sin u}{u} du \right\}$ **08**
(2) $L \{(1 + 2t + 3t^2 + t^3)H(t - 2)\}$
4. a. Use convolution theorem and evaluate **06**
 $L^{-1} \left\{ \frac{(s+5)^2}{(s^2+10s+16)^2} \right\}$
- b. Find transitive clouser of following relation defined on $A = \{a, b, c, d, e\}$ by Warshal **06**
algorithm $R = \{(a, a) (a, b) (b, c) (c, d) (c, c) (d, e)\}$
- c. A man speaks truth 3 times out of 5 when a die is thrown he states that it gave an ace what **08**
is probability that this event has actually happened.

5. a. How many four digit numbers can be formed out of the digits 1, 2, 3, 5, 7, 8, 9 if no digit is repeated twice? How many of them will be greater than 3000. **06**
- b. Solve using Laplace transform **06**
 $\frac{d^2y}{dt^2} + 9y = 18$ given that $y(0) = 0$ and $y\left(\frac{\pi}{2}\right) = 0$
- c. Evaluate (1) $L^{-1}\left\{\frac{1}{\sqrt{2s+1}}\right\}$ **08**
 (2) $L^{-1}\left\{\frac{2s^2-6s+5}{s^3-6s^2+11s-6}\right\}$
6. a. Solve $a_n = 5a_{n-1} - 6a_{n-2}$ for $n \geq 2, a_0 = 0, a_1 = 1$ **06**
- b. Find orthogonal curves of family of curves $e^{-x} \cos y + xy = \alpha$, where α is the real constant **06**
- c. i. Find the image of rectangular region bounded by $x=0, x=3, y=0, y=2$ under the transformation $w = z(1+i)$ **08**
 ii. A fair dice is thrown thrice. Find probability that sum of numbers obtained is 10.

(3 Hours)

[Total Marks: 80]

N.B.:- (1) Question No. 1 is **Compulsory**.

(2) Solve any **three** questions from the remaining **five** questions.

(3) **Figures** to the **right** indicate **full** marks.

(4) Make **suitable** assumptions wherever **necessary** and state them **clearly**.

1. (a) Define generalization and specialization. 5
- (b) Explain different keys in DBMS. 5
- (c) Explain role of DBA. 5
- (d) Compare traditional file system with DBMS. 5

2. (a) List the functional dependencies which satisfy the relation: 10

| X | y | z |
|----|----|----|
| X1 | Y1 | Z1 |
| X1 | Y2 | Z1 |
| X2 | Y2 | Z1 |
| X2 | Y2 | Z1 |

- (b) Suppose you are given the following requirements for a simple database of the National Cricket Trophy (NCT): 10
 - the NCT has many teams,
 - each team has a name, a city, a coach, a captain, and a set of players,
 - each player belongs to only one team,
 - each player has a name, a position (such as left wing or goalie), a skill level,
 - and a set of injury records,
 - a team captain is also a player,
 - a game is played between two teams (referred to as host team and guest team) and has a date (such as May 11th, 1999) and a score (such as 4to 2).

Construct ER diagram for the NCT database.

3. (a) Explain different types of operations in relational algebra. 10
- (b) Explain Joins and types of Joins with suitable example. 10

4. (a) Define Normalization. Explain 1NF,2NF and 3NF with suitable example. 10
- (b) Consider the following schema for College Library. 10

Student (Roll_no, Name, Branch)

Book (ISBN, Title, Author, Publisher)

Issue (Roll_no, ISBN, Date_of_ Issue)

Write SQL queries for the following statements:

- i. List Roll Number and Name of all students of the branch IT.
 - ii. Find the name of students who have issued a book published by 'XYZ' publisher.
 - iii. List title of all books and their author issued by student 'Alice'.
 - iv. List title of all books issued on or before 31st DEC, 2019
5. (a) Explain Event Condition Action (ECA) model with suitable example. **10**
(b) Explain types of Integrity Constraints with example. **10**
6. Write note on (any four): **20**
- (a) DDL commands.
 - (b) Hashing Techniques.
 - (c) Data Independence.
 - (d) Types of attributes.
 - (e) Aggregate function in SQL.

(3 Hours)

[Total Marks: 80]

N.B.: (1) Question No.1 is compulsory.

(2) Attempt **any three** out of remaining questions.

(3) Assume Suitable data if necessary.

(4) **Figures** to the **right** indicate full **marks**.

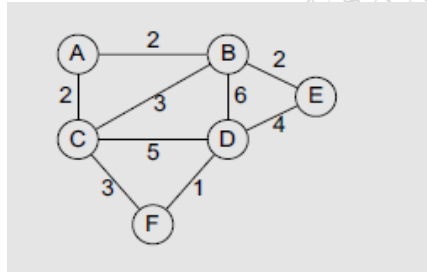
1.
 - (a) Explain different types of queues in data structures. **3**
 - (b) How does binary search different from linear search? **3**
 - (c) Explain Doubly Linked List. **3**
 - (d) Define graph and list any three applications of graph. **3**
 - (e) Write postfix form of the following infix expression.
 $A+(B*(C-D)/E)$ **3**
 - (f) Explain linear and nonlinear data structures. **2**
 - (g) Write a note on recursion. **3**

2.
 - (a) Explain Binary search tree. Construct Binary search tree for following elements: **10**
45, 39, 56, 12, 34, 78, 32, 10, 89, 54, 67, 81
 - (b) What is Singly Linked List? Write an algorithm to implement following operations on Singly linked List. **10**
 (1)Insertion(All cases)
 (2)Deletion(All cases)
 (3)Traversal

3.
 - (a) Write an algorithm for implementing stack using array. **10**
 - (b) Write an algorithm for merge sort and comment on its complexity. **10**

4.
 - (a) Construct the binary tree for Inorder and Preorder traversal sequence given below **10**
 Inorder: DBEAFCG
 Preorder: ABDECFG
 Write a function to traverse a tree in Postorder sequence.
 - (b) Write an algorithm for quick sort and comment on its complexity. **10**

5. (a) What is collision? What are the methods to resolve collision? Explain Linear probing with an example. **10**
- (b) What is Minimum Spanning Tree? Draw the MST using kruskal's and prim's algorithm and find out the cost with all intermediate steps. **10**



6. Write short notes on (Any 4) **20**
- Asymptotic notations
 - Double Ended Queue(De-Queue)
 - Insertion Sort
 - DFS and BFS
 - Expression Tree.
