

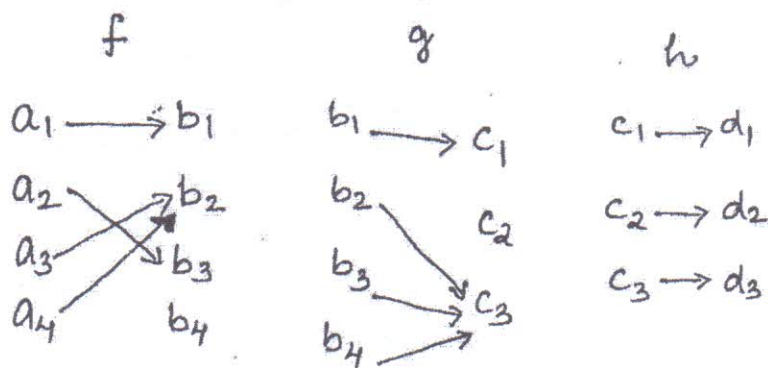
## Sem-III - Choice based

(3 Hours)

(Total Marks : 80)

- Note: 1. Question no. 1 is compulsory.  
2. Attempt any three questions out of remaining five questions.

- Q.1. [a] Evaluate  $L[\sin 2t \cos t \cosh 2t]$ . [5]  
 [b] How many friends must you have to guarantee that atleast five of them have birthday in the same month. [5]  
 [c] Determine the constants a, b, c, d, e so that the function  $f(z) = ax^4 + bx^2y^2 + cy^4 + dx^2 - 2y^2 + i(4x^3y - exy^3 + 4xy)$  is analytic. [5]  
 [d] Out of one lakh people 51500 are female and 48500 are male. Among the females 9000 are singers, among the males 30200 are singers. A person chosen randomly. If A, B, C are the events that a singer is chosen, a female is chosen and male is chosen respectively then find (i)  $P(A/B)$  (ii)  $P(A/C)$  (iii)  $P(A/C)$  (iv)  $P(C/A)$ . [5]
- Q.2. [a] Using Venn diagram show that  $P \cap (Q \oplus R) = (P \cap Q) \oplus (P \cap R)$ . [6]  
 [b] Evaluate  $L\{f(t)\}$  where  $f(t) = \begin{cases} 1 & 0 \leq t < a \\ -1 & a < t < 2a \end{cases}$  and  $f(t+2a) = f(t)$ . [6]  
 [c] Let f, g, h be the functions shown in the diagram : [8]



- Find : (i)  $g \circ f$ ,  $h \circ (g \circ f)$ ,  $(h \circ g) \circ f$ ,  $h^{-1}$   
 (ii) Identify onto and one-one function for 3 of them.

- Q.3. [a] Find analytic function  $f(z) = u + iv$  where  $v = \frac{x}{x^2 + y^2} + \cosh x \cos y$ . [6]  
 [b] Solve  $(D^2 + 2D + 5)y = e^{-t} \sin t$ , when  $y(0) = 0$ ,  $y'(0) = 1$ . [6]  
 [c] Evaluate (i)  $L\left\{\frac{1}{t}(1 - \cos t)\right\}$  [8]  
 (ii)  $\int_0^\infty e^{-t} \left( \int_0^t u^4 \sinh u \cosh u \, du \right) dt$



- Q.4. [a] Evaluate using convolution theorem  $L^{-1} \left[ \frac{(s+2)}{(s^2+4s+8)^2} \right]$  [6]
- [b] Find bilinear transformation which maps the points  $z = -1, 1, \infty$  onto  $w = -i, -1, i$ . [6]
- [c] Three machines A, B and C produce respectively 25%, 35% and 40% of the total number of items of a factory. The percentages of defective output of these machines are respectively 5%, 4% and 2%. An item is selected at random and is found to be defective. Find the probability that the item was produced by machine A. [8]
- Q.5. [a] Suppose repetitions are not permitted. [6]
- (i) How many four-digit numbers can be formed from the digits 1, 2, 3, 5, 7, 8?
- (ii) How many of the numbers in part (a) are less than 4000?
- (iii) How many of the numbers in part (a) are multiples of 5?
- [b] Let  $A = \{1, 2, 3, 4, 12\}$  and let  $R$  be the relation on  $A$  defined by  $xRy$  if and only if " $x$  divides  $y$ ", Show that  $(A, R)$  is a PO set. Draw the diagram of  $R$ . [6]
- [c] Evaluate (i)  $L^{-1} \left[ \frac{e^{-5s}}{(s-2)^4} \right]$  (ii)  $L^{-1} \left[ \log \left( \frac{s+3}{s+5} \right) \right]$  [8]
- Q.6. [a] It is known that at the university 60% of the professors play tennis, 50% of them play bridge, 70% jog, 20% play tennis and bridge, 30% play tennis and jog, 40% play bridge and jog. If someone claimed that 20% of the professors jog and play bridge and tennis, would you believe this claim? Why? [6]
- [b] Solve  $a_{r+2} + 2a_{r+1} - 3a_r = 0$  that satisfies  $a_0 = 1, a_1 = 2$ . [6]
- [c] (i) If  $f(z)$  is an analytic and  $|f(z)|$  is constant, show that  $f(z)$  is constant. [8]
- (ii) Find the image of  $|z-a| = a$  under the transformation  $w = \frac{1}{z}$ .



(3 Hours)

[Total Marks: 80]

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

(2) Solve any three questions out of remaining five.

(3) Figures to right indicate full marks.

(4) Assume suitable data where necessary.

Q1 Solve any four

(20)

- What are the important features of differential amplifier, also states its types.
- State De'sMorgan theorem & implement OR gate using NAND gate only.
- ADD  $(83)_{10}$  &  $(34)_{10}$  in BCD.
- Convert S-R flip flop to D flip-flop.
- State advantages & disadvantages of multiplexer.
- Explain VHDL format in brief.

Q2. A) Simplify the following using Quine-Mcclusky method

$$F(A,B,C,D) = \sum m(0,3,4,11,15) + d(1,2,5)$$

(10)

B) Design &amp; implement one digit BCD adder using IC 7483

(10)

Q3. A) Design MOD-11 ripple counter using suitable flip-flop.

(7)

B) Convert the following decimal number into binary, octal &amp; hexadecimal

$$\text{i) } (555)_{10} \quad \text{ii) } (138)_{10} \quad \text{iii) } (79)_{10}$$

(9)

C) Why transistor biasing is required, state factors required for it

(4)

Q4. A) Draw truth table of full subtractor &amp; realize using 3-8 decoder

(10)

B) Draw the circuit diagram of voltage divider bias circuit using CE configuration

And explain how it stabilizes the operating point

(10)

Q5. a)  $Y = ABC + BC'D + A'BC$  & realize using gates

(6)

a) Explain parallel I/P serial output shift register

(6)

b) Minimize the following expression using only one 8:1 MUX.

$$F(A,B,C,D) = \sum m(1,2,9,10,11,14,15)$$

(8)

Q6. Write short notes on any four

(20)

- BCD & excess-3 codes
- Current mirror circuit
- Ring counter
- ALU
- Modelling styles in VHDL



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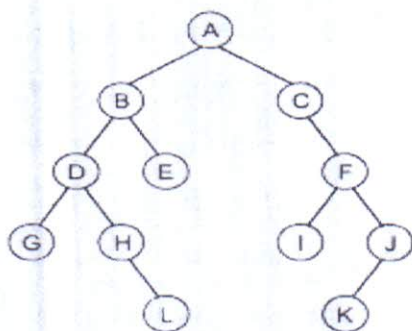
N.B.: (1) Question No.1 is compulsory.

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

(3) Assume Suitable data if necessary.

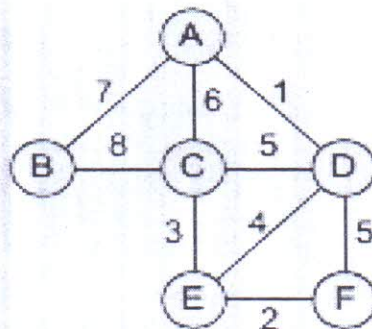
(4) **Figures** to the **right** indicate full **marks**.

- Q1. (a) Explain linear and non linear data structures. 2
- (b) Define a graph. List the types of graph with examples. 3
- (c) What is expression tree? Give Example. 3
- (d) Define asymptotic notations with an example 3
- (e) Define Double Ended queue. List the variants of double ended queue. 3
- (f) What is Recursion? State its advantages and disadvantages. 3
- (g) What is linked list? State the advantages of linked list. 3
- Q2. (a) Write an algorithm for merge sort and comment on its complexity. 10
- (b) Write an algorithm for implementing stack using array. 10
- Q3. (a) Define Binary Tree. Find in-order, pre-order and post-order of following binary tree. 10



- (b) Write an algorithm for implementing Queue using array. 10
- Q4. (a) Explain Quick sort using an example. Write algorithm for it and comment on its complexity. 10

- (b) What is collision? What are the methods to resolve collision? Explain Linear probing with an example. 10
- Q5. (a) Write an algorithm for converting infix to postfix expression. 10
- (b) Define Binary Search Tree. Write an algorithm for following operations on binary search tree 10
- (1) Insertion
- (2) Deletion
- Q6. (a) Write an algorithm for following operations on Doubly linked List 10
- (1) Insertion
- (2) Deletion
- (3) Traversal
- (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



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NB. : 1. Question no. 1 is Compulsory.

2. Solve any **Three** questions out of remaining **Five** questions.

- |      |  |    |
|------|--|----|
| Qu-1 | a) Justify the term Data Independence.   | 5  |
|      | b) Explain Weak Entity with example.   | 5  |
|      | c) Explain programming with JDBC.  | 5  |
|      | d) List aggregate functions and justify the need of any two aggregate functions.   | 5  |
| Qu-2 | a) With reference to figure-1 list and explain the Attributes, Keys, Relationship types.   | 10 |
|      | b) Explain Illustrate relational algebra with example.   | 10 |
| Qu-3 | a) Explain Functions and Procedures in SQL with suitable example.  | 10 |
|      | b) Illustrate sparse and dense indexing with suitable example.   | 10 |
| Qu-4 | a) Describe/list the steps/rules of ER-to-relational mapping and use the same to map the ER diagram shown in figure-1 to relational database schema.                       | 10 |
|      | b) Use the relational database schema of Qu-4 a) and write the following queries.  | 10 |
|      | i) Retrieve the birthdate and address of the employee(s) whose name is 'Vaidehi Chavan'.   |    |
|      | ii) Retrieve the name and address of all employees who work for the 'Research' department.   |    |
|      | iii) For every project located in 'Mumbai', list the project number, the controlling department number, and the department manager's last name, address, and birthdate.    |    |
|      | iv) Retrieve a list of employees and the projects they are working on, ordered by department and, within each department, ordered alphabetically by last name, first name. |    |
| Qu-5 | a) Explain Event Condition Action (ECA) model with suitable example.   | 10 |
|      | b) Illustrate the need of normalization? explain all forms with an example.  | 10 |
| Qu-6 | Attempt the following.   |    |
|      | a) Functional Dependencies   | 5  |
|      | b) Operation on Files  | 5  |
|      | c) Foreign Key   | 5  |
|      | d) Views in SQL  | 5  |



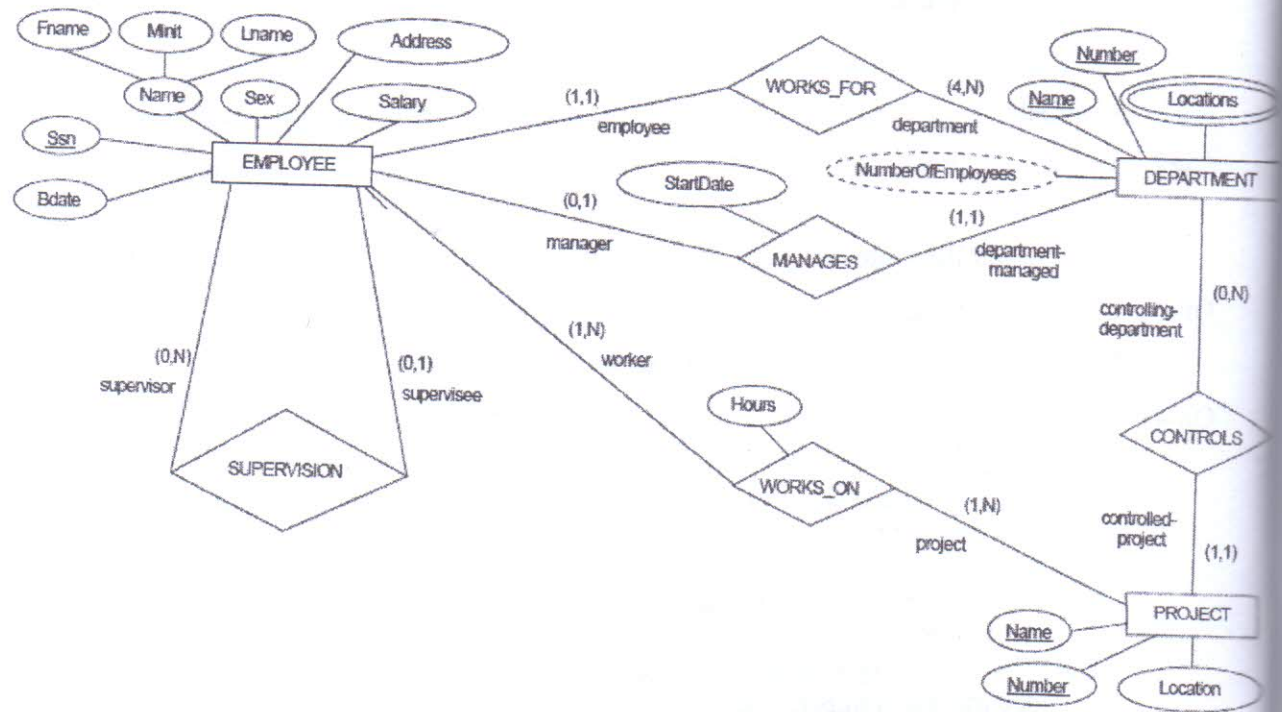


Figure-1 ER diagram for the COMPANY schema, with all role names and constraints on relationships.

(3 Hours)

Marks :80

- N.B (1) Question No. 1 is compulsory  
(2) Out of remaining questions attempt three  
(3) Figures to right indicate full marks.

Q1. Solve any four from the following (20)

- a) Compare PCM & DELTA modulation
- b) Different types of communication channel
- c) State advantages & disadvantages of ground wave propagation
- d) Explain in brief noise triangle in FM
- e) What do you mean by alising .how it can be avoided

Q2. A) Binary data 11010101 is transmitted over a baseband channel.

Draw the waveform for transmitted data using following format (10)

- a) Unipolar NRZ (b) unipolar RZ (c) Bipolar RZ (d) split phase Manchester
- (e) Polar Quaternary NRZ.

B) Explain generation & demodulation of PPM (10)

Q3. (A) Explain Foster Seeley discriminator with neat diagram. (10)

(B) Explain following noise parameter

- a) Noise figure b) Noise factor c) Noise temperature d) S/N ratio (6)

(C) What is the role of antialiasing filter in sampling (4)

Q4. (A) Draw the block diagram of analog & digital communication system  
& explain each block in it in brief. (10)

(B) What are the limitations of TRF receiver .How these are avoided in  
Super heterodyne receiver. (10)

Q5. (a) With reference to sky wave propagation explain the following term  
(i) Virtual height (ii) MUF (iii) skip distance (iv) skip distance (10)

(b) State & explain sampling theorem for low pass band limited signal (6)

(c) Write Fourier transform of unit step, Delta & Gate function (4)



- Q6 a) compare DSB-FC, DSB-SC &SSB. & hence calculate total power in following Forms of AM. I) DSB-FC & SSB-SC where A 400 W carrier is modulated to Depth of 75 %.
- b) Compare ASK, FSK & PSK
- c) Explain in brief Inter symbol interference.

(10)

(6)

(4)