Q. P. Code: 26350

(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
a) Explain block diagram of op-amp.
b) Explain working of Integrator with circuit diagram.
c) Convert following binary number to decimal ,Octal, Hexadecimal
$(11010.11)_2$
d) Covert S-R flip flop to D flip flop.
e) State De Morgan's theorem & implement OR gate using NAND gate only.

Q2. a) Draw the truth table of full adder and realized using 3:8 decoder. 10

b) Explain Voltage Divider biasing Circuit with its stability factor. 10

Q3. a) Implement following using only one 8:1 Multiplexer and few gates.

$F(A,B,C,D)= \sum m(0,1,3,4,5,8,9,10,12,15)$ 10

b) Draw circuit diagram and explain the operation of Astable Multivibrator using IC555. 10

Q4. a) Reduce the expression $f(A,B,C,D) = \sum m(1,5,6,12,13,14) + d(2,4)$ using K map method. Implement the reduced expression using logic gates. 10

b) Explain in brief Bidirectional Shift Registers. 10

Q5. a) Write VHDL program for full subtractor. 10

b) Design MOD- 11 ripple counter using suitable J-K flip-flop. 10

Q6 Write short notes on any four 20
a) Explain important features of differential amplifier.
b) Write comparison between FET and BJT.
c) Explain essential features of VHDL.
d) Draw diagram of a master slave JK flip-flop.
e) Explain working of LCD.

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(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]**

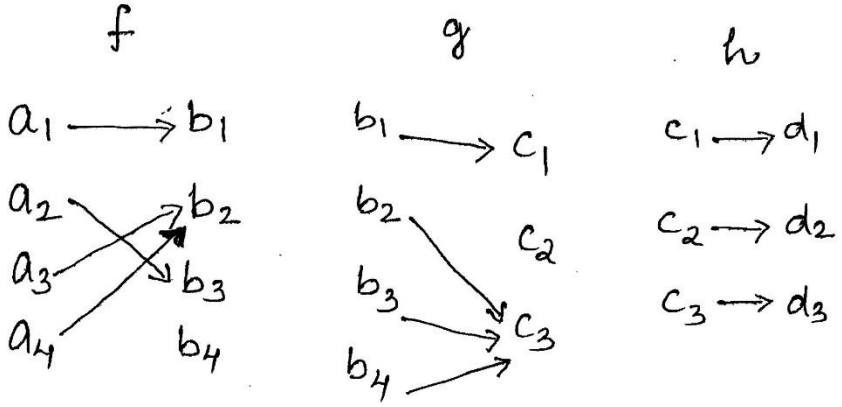
[c] Determine the constants a, b, c, d, e so that the function $f(z) = ax^4 + bx^2y^2 + cy^4 + dx^2 - 2y^2 + i\left(4x^3y - exy^3 + 4xy\right)$ is analytic. **[5]**

[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 $f(t) = \begin{cases} 1 & 0 \le t < a \\ -1 & a < t < 2a \end{cases}$ and $f(t+2a) = f(t)$. **[6]**

[c] Let f, g, h be the functions shown in the diagraph : **[8]**



Find : (i) g◦f, h◦(g◦f), (h◦g)◦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 diagraph 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 $a_{r+2} + 2\,a_{r-1} - 3a_r = 0$ 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-ai| = a under the transformation $w=\frac{1}{z}$.

Paper / Subject Code: 49801 / APPLIED MATHEMATICS- III

Time: 3 Hours **Marks: 80**

N.B.:1) Question no.1 is compulsory.
2) Attempt any three questions from Q.2to Q.6.
3) Figures to the right indicate full marks.

Q1. a) Find the Laplace transform of $e^{-t}t\cosh 2t$. **[5]**

b) Find the half-range cosine series for $f(x)=\begin{cases}1 & ,o<x<\frac{a}{2}\\ -1 & ,\frac{a}{2}<x<a\end{cases}$ **[5]**

c) Find $\nabla\left(\bar{a}.\nabla\frac{1}{r}\right)$ where $\bar{a}$ is a constant vector. **[5]**

d) Show that the function $f(z)=z^3$ is analytic and find $f'(z)$ in terms of z. **[5]**

Q2. a) Find the inverse Z-transform of $F(z)=\frac{3z^2-18z+26}{(z-2)(z-3)(z-4)}$,$3<z<4$. **[6]**

b) Find the analytic function whose imaginary part is $\tan^{-1}\left(\frac{y}{x}\right)$. **[6]**

c) Obtain Fourier series for the function $f(x)=\begin{cases}\frac{\pi}{2}+x & ,-\pi<x<0\\ \frac{\pi}{2}-x & ,0<x<\pi\end{cases}$, **[8]**

Hence ,deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\cdots$ and $\frac{\pi^4}{96}=\frac{1}{1^4}+\frac{1}{3^4}+\frac{1}{5^4}+\cdots$

Q3. a) Find $L^{-1}\left[\frac{s^2}{(s^2+1)(s^2+4)}\right]$ using convolution theorem. **[6]**

b) Show that the set of functions $\phi_n(x)=\sin\left(\frac{n\pi x}{l}\right), n=1,2,3\ldots$ is orthogonal in $[0\ ,l]$. **[6]**

c) Using Green's theorem evaluate $\oint_C\left(e^{x^2}-xy\right)dx-(y^2-ax)dy$ where C is the circle $x^2+y^2=a^2$. **[8]**

Q4. a) Find Laplace transform of $f(t)=\begin{cases}\frac{t}{a} & ,o<t\le a\\ \frac{(2a-t)}{a} & ,a<t<2a\end{cases}$ and $f(t)=f(t+2a)$. **[6]**

b) Prove that a vector field $\bar{f}$ is irrotational and hence find its scalar potential $\bar{f}=(y\sin z-\sin x)\,i+(x\sin z+2yz)j+(xy\cos z+y^2)k$. **[6]**

c) Obtain the Fourier expansion of $f(x)=\left(\frac{\pi-x}{2}\right)^2$ in the interval $0\le x\le 2\pi$ and $f(x+2\pi)=f(x)$ .Also deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\cdots$ **[8]**

Q5.a) Use Gauss's Divergence Theorem to evaluate $\iint_S \bar{N}.\bar{F}ds$ where $\bar{F}=4xi+3yj-2zk$ and S is the surface bounded by x=0, y=0, z=0 and 2x+2y+z=4. **[6]**

b) Find the Z-transform of $f(k)=ke^{-ak}$, k≥ 0 . **[6]**

c) i) Find $L^{-1}\left[\frac{s+2}{s^2(s+3)}\right]$. **[8]**

ii) Find $L^{-1}\left[\log\left(\frac{s+a}{s+b}\right)\right]$.

Q6.a) Solve using Laplace transform **[6]**
$(D^2+3D+2)y=2(t^2+t+1)$, with $y(0)=2$ and $y'(0)=0$.

b) Find the bilinear transformation which maps the points Z=1, i, -1 onto the points W=i, 0, -i . **[6]**

c) Find Fourier sine integral of $f(x)=\begin{cases}x & ,0<x<1\\ 2-x & ,1<x<2\\ 0 & ,x>2\end{cases}$ **[8]**

Paper / Subject Code: 41005 / Automata Theory

Sem IV IT – CBCNS, Dec 18

15/12/18

Q. P. Code: 40017

Duration: 3 Hours Marks :80

N.B. (1) Question No. 1 is compulsory.
(2) Solve any three questions from remaining questions.
(3) Draw suitable diagrams wherever necessary.
(4) Assume suitable data, if necessary.

Q.1 Attempt any four sub-questions.

a) State and explain advantages and limitation of regular and context free grammar. 05

b) Design a Mealy machine for a binary adder. 05

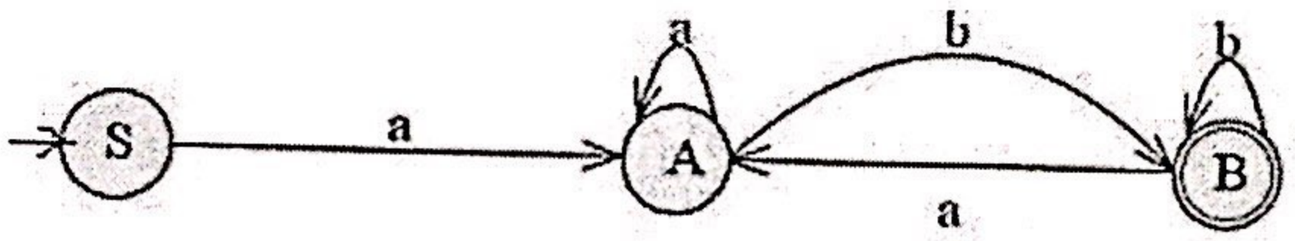
c) Give formal definition of PDA. 05

d) Construct the DFA that accept set of all strings over the alphabet $\sum = \{a, b\}$ containing either the substring 'aaa' or 'bbb'. 05

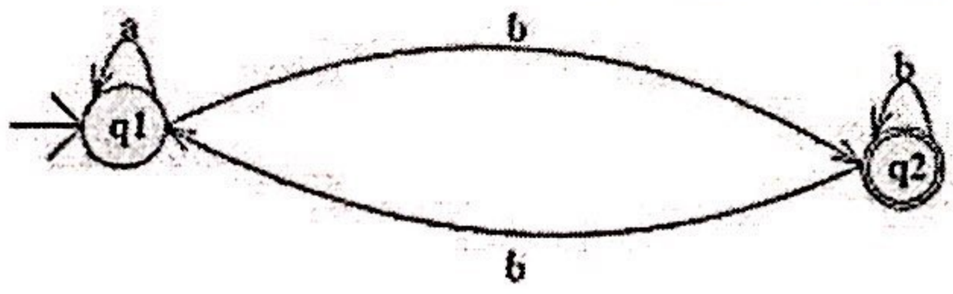
e) Find the CNF equivalent to
$S \rightarrow aAbB$, $A \rightarrow aA \mid a$, $B \rightarrow bB \mid b$. 05

Q2. a) What is NFA? Design a NFA for a binary number where the first and last digit is same. 10

b) Write a necessary function for the given automata. 10



Q3.a) i) Find a regular expression RE corresponding to the following FA 10



ii) Give a regular expression for a language over the alphabet $\sum = \{a, b\}$ containing at most two a's

b) Construct a Mealy machine that accepts strings ending in '00' and '11'. Convert the same to Moore machine. 10

Q. P. Code: 40017

Q4.a) Design a PDA for CFL that checks the well formedness of parenthesis i.e the language L of all balanced string of two types of paranthesis "( )" and "[ ]". Trace the sequence of moves made corresponding to input string (([ ]) [ ]). 10

b) Construct a TM accepting palindromes over $\sum$= {a,b}. 10

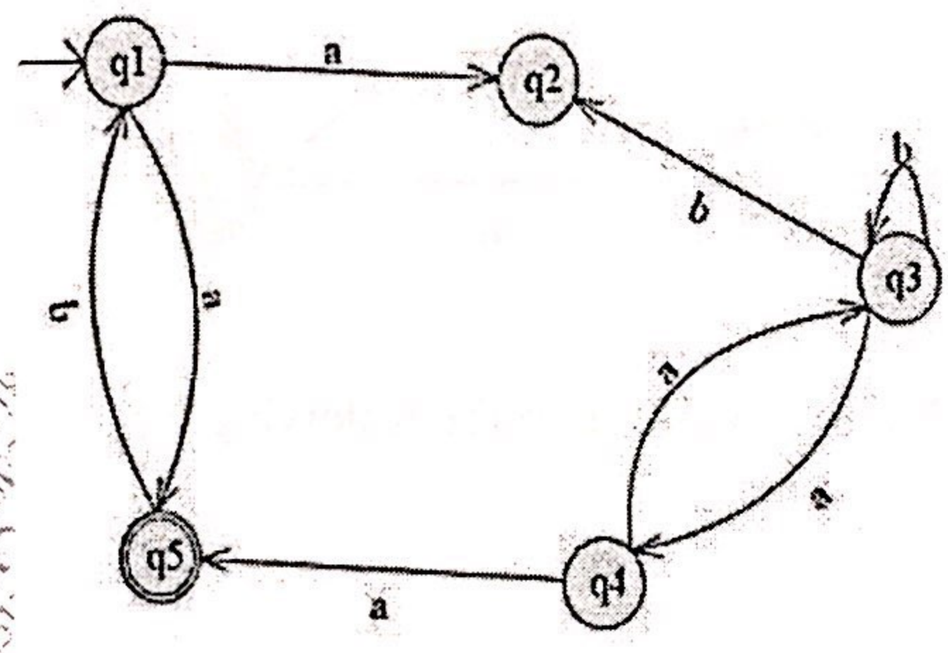
Q5. a) Let G be the grammar. Find the leftmost derivation, rightmost derivation and parse tree for the string 001222. 10

G: $S \rightarrow 0S \mid 1A \mid 2B \mid \varepsilon$

$A \rightarrow 1A \mid 2B \mid \varepsilon$

$B \rightarrow 2B \mid \varepsilon$

b) Design a NFA for accepting input strings that contain either the keyword 000 or the keyword 010 and convert it into an equivalent DFA. 10



Q6. Write short notes on (any four) 20

a) Variants of Turing Machines

b) Algorithm for CFG to CNF Conversion

c) Chomsky Hierarchy

d) Limitation of Finite Automata

e) Halting Problem.

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(Time: 3 Hrs) **Marks: 80**

N.B. : 1. Question no. 1 is C**ompulsory**.

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. 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.	**10**
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**

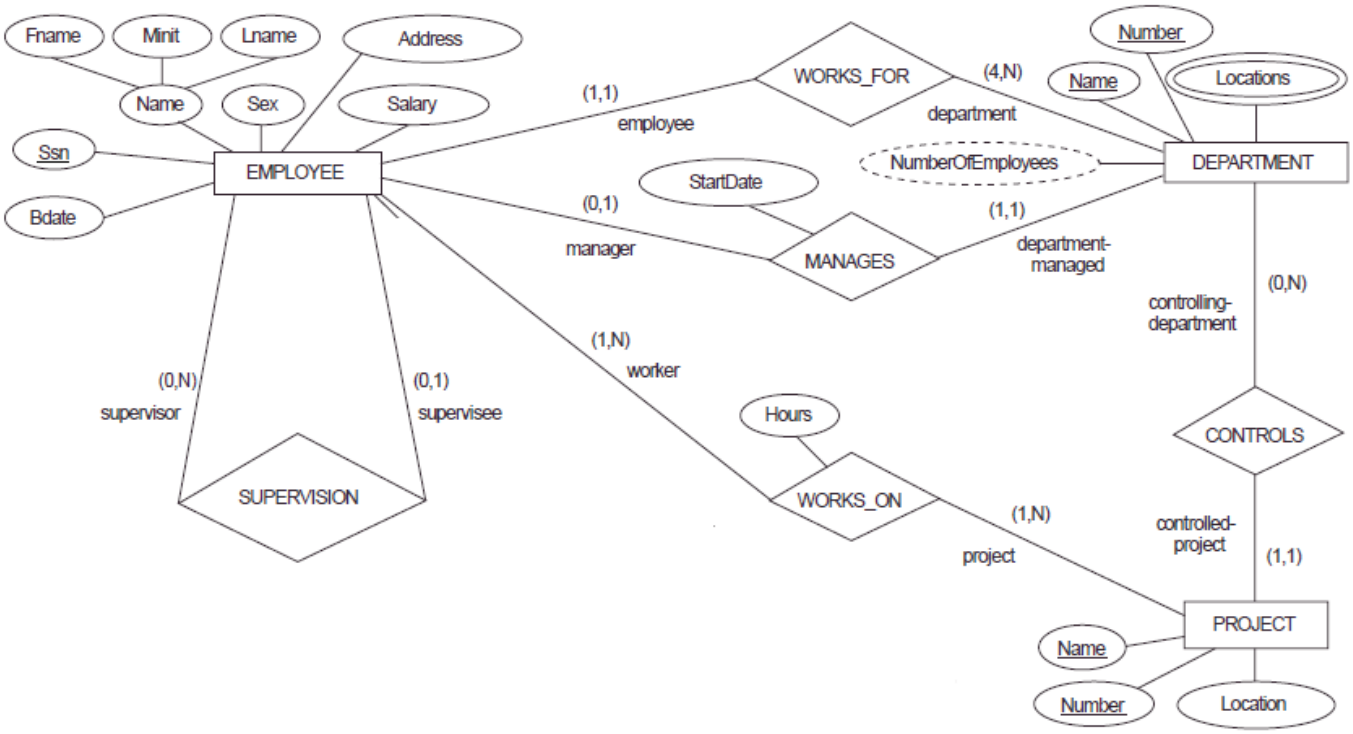

Figure-1 ER diagram for the COMPANY schema, with all role names and constraints on relationships.

Time: 3 hours Marks: 80

N.B 1) Question no. 1 is compulsory
2) Attempt any three out of remaining question

Q.1	a) What is ADT? Write ADT for Stack.	**3**
	b) Explain Asymptotic notations	**3**
	c) Draw all possible Binary Search Trees of 7,9,11	**3**
	d) Define Minimum spanning tree with example	**3**
	e) Write an algorithm to count the number of nodes in singly linked list.	**3**
	f) Explain with example i. Degree of a tree ii. Height of a tree	**3**
	g) Define algorithm and state its properties	**2**
Q.2	a) Write a program for insertion in singly linked list.	**10**
	b) Write an algorithm to implement stack as a array.	**10**
Q.3	a) Write a program for infix to postfix conversion	**10**
	b) Write properties of Heap. Also build Max-Heap from given data: 56 , 12, 45, 33, 8, 63, 74, 25, 18, 36	**10**
Q.4	a) Construct Binary Tree from given inorder and postorder traversal sequence given below: Inorder: "INFORMATION" Postorder : "INOFMAINOTR"	**10**
	b) Write an BFS and DFS algorithms for graph traversal	**10**
Q.5	a) What is an AVL tree? Construct an AVL tree for following set of data: 14, 10, 1, 20,17,24, 18,12,15, 11,4,6	**10**
	b) Write an algorithm to implement insertion sort. Explain its time complexity.	**10**
Q.6	Write short note on (**any four**) a) Red - black tree b) Selection sort c) Circular Queue d) Collision resolution techniques. e) linear and non linear data structures	**20**

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54936

(3 Hours) **[Total Marks: 80]**

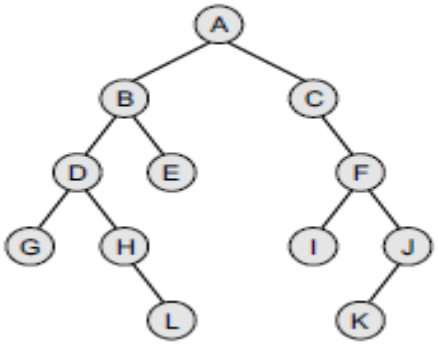
N.B.: (1) Question No.1 is compulsory.

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

(3) Assume Suitable data if necessary.

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

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

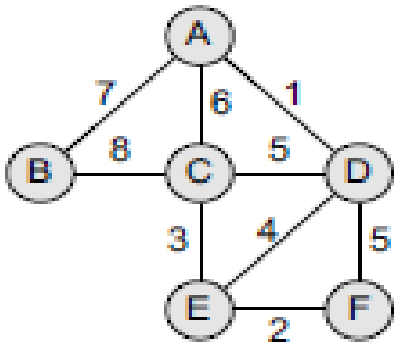
(b) What is collision? What are the methods to resolve collision? Explain Linear probing with an example. 10

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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Paper / Subject Code: 51402 / Logic Design (IT)

S.E. Sem. III (CBCGS) Dec 2018

Q.P. Code: 24573

(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)**

a) What are the important features of differential amplifier, also states its types.

b) State De'sMorgon theorem & implement OR gate using NAND gate only.

c) ADD $(83)_{10}$ & $(34)_{10}$ in **BCD.**

d) Convert S-R flip flop to D flip-flop.

e) State advantages & disadvantages of multiplexer.

f) Explain VHDL format in brief.

Q2. A) Simplify the following using Quine-Mcclusky method **(10)**

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

B) Design & 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 & hexadecimal

i) $(555)_{10}$ ii) $(138)_{10}$ iii) $(79)_{10}$ **(9)**

C) Why transistor biasing is required, state factors required for it **(4)**

Q4 A) Draw truth table of full subtractor & 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)**

a) BCD & excess-3 codes

b) Current mirror circuit

c) Ring counter

d) ALU

e) Modelling styles in VHDL

SE / Sem III / IT / CBCGS / Dec-18

17/12/18 LC

(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 %. **(10)**

b) Compare ASK, FSK & PSK **(6)**

c) Explain in brief Inter symbol interference. **(4)**

S.E.(INFORMATION TECHNOLOGY)(Sem III) (CBSGS) / 49802 - PRINCIPES OF ANALOG & DIGITAL COMMUNICATION

Duration: 3 Hours **Marks: 80**

Please check whether you have got the right question paper.

N.B: 1. Question No 1 is compulsory
2. Answer any three from the remaining.

1. Attempt any four from the following. (**20**)
   (a) Draw and explain basic analog communication system.
   (b) Explain Noise Figure and derive friss formula.
   (c) Explain Super heterodyne receiver.
   (d) How to generate PPM.
   (e) Explain FDM with neat diagram.

2. (a) What is thermal noise? Derive the expression for root mean square voltage of thermal noise? (**06**)
   (b) Explain shot noise. (**04**)
   (c) Derive the AM expression and explain each term. (**10**)

3. (a)Explain Ratio detector with neat diagram. (**10**)
   (b)State and prove sampling theorem. (**10**)

4. (a) Explain ADM Transmitter and receiver with neat block diagrams. (**10**)
   (b) Explain BPSK generation and detection with neat block diagrams. (**10**)

5. (a) Explain line coding with five data formats with examples. (**10**)
   (b) What is Image signal and how to reject it? Also define selectivity, sensitivity and fidelity of a receiver. (**10**)

6. Answer any four (**20**)
   (a) Need for modulation.
   (b) State and prove time shifting property of Fourier Transform.
   (c) Explain any method to generate SSB SC AM.
   (d) Digital communication with block diagram.
   (e) Explain BASK generation.
