Time: 3 hour Max. Marks: 80

Note: 1. Question no**. 1** is compulsory.
2. Attempt any **three** questions out of remaining **five** questions.
3.Figures to the right indicate full marks.

Q1 (a) Find L $\left[\frac{(\cos at - \cos bt)}{t}\right]$, (05)

(b) Find the constants k, if $f(z) = r^3 cosk\theta + ir^k sin3\theta$ is analytic. (05)

(c) If A = $\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ Find A^{50} (05)

(d) If the vector $\vec{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is is irrotational; find the constants a, b, c. (05)

Q2 (a) Find the analytic function f(z) $in\ terms\ of\ z$ whose real part is $u = sinxcoshy$ (0 6)

(b) Obtain the Fourier series for $f(x) = e^{ax}$ in $(0,2\pi)$ (0 6)

(c) (i) If $L\{f(t)\} = \frac{1}{s\sqrt{s+1}}$, then find$L\{f(2t)\}$

(ii) Find $L(t^5 \cosh t)$ (08)

Q3 (a) Find $L^{-1}\left[\frac{s}{(s^2+4)(s^2+1)}\right]$ by convolution theorem. (06)

(b) Find Fourier expansion of f(x) = $2x - x^2$ in (0,3) (06)

(c) Evaluate by using Green's theorem $\int_C (x^2 - y)dx + (2y^2 + x)dy$, where C is the closed region bounded by $y = 4$ and $y = x^2$ (08)

Q4 (a) If $v = 3x^2y + 6xy - y^3$ show that V is Harmonic function. (06)

(b) Find the Eigenvalues of matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$ and Show that matrix satisfies the characteristic equation . (06)

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(c) Evaluate (i) $L^{-1}\left\{\frac{1}{s}\tan^{-1}\frac{1}{s}\right\}$ (ii) $L^{-1}\left\{\frac{1}{(S+1)^2+1}\right\}$ (08)

Q5 (a) Obtain the half range Fourier cosine series expansion for

$f(x) = x(2 - x)$ *in* $(0,2)$. (06)

(b) Find Eigen value and Eigen Vector Of Matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ (06)

(c) Show that $\vec{F} = (y^2 \cos x + z^3)i + (2y \sin x - 4)j + (3xz^2 + 2)k$ is conservative Field. Find (i) Scalar potential for $\vec{F}$ (ii) the work done in moving an object in this field From (0 ,1,-1) to ($\frac{\pi}{2}$, -1 , 2) (08)

Q6 (a) Find the orthogonal trajectory of family of curves given by

$2x - x^3 + 3xy^2 = a$ (06)

(b) Evaluate $\int_0^\infty e^{-3t} t \sin t \, dt$ (06)

(c) Show that the Matrix $\begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is diagonaisable. Find the diagonal form D And diagonalizing matrix M. (08)

Duration: 3hrs **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1 Attempt any FOUR [20]

a Describe the pinch-off condition in JFET with neat labeled diagram.

b Write a short note on memristors. Include suitable neat sketches wherever necessary.

c With neat sketch describe operation of the capacitor (C) filter with appropriate waveforms.

d Explain the concept of DC load line & Q – Point in bipolar junction transistor (BJT).

e For the circuit shown below in Fig. 1 draw output waveform if an input signal of 20V peak-to-peak is applied.

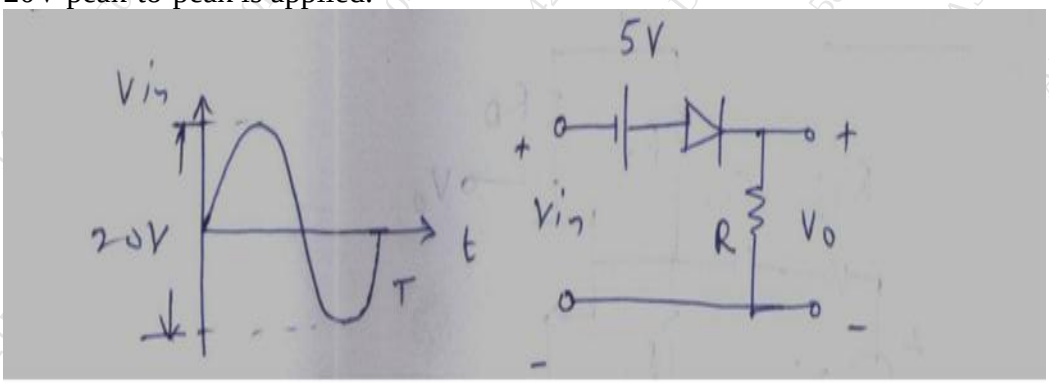

Fig. 1 for Q.1 (e)

2 a Describe the working or operation of a bridge type full wave rectifier with a neat sketch. Draw the output voltage waveforms & mention the expression for DC or average output voltage (Vdc) [10]

b With a neat sketch, explain the Zener diode as a voltage regulator. Describe its operation for both, varying load resistance with a constant DC supply voltage & a varying DC supply voltage with a constant load resistance. [10]

3 a Explain how a PN junction is formed with a neat diagram. [10]

b Explain with the help of neat diagram construction, working & VI characteristics of n channel JFET. [10]

4	a	Draw a circuit diagram of common source (CS) E-MOSFET amplifier, derive equation of voltage gain (Av), input resistance (Ri) & output resistance (Ro)?	[10]
	b	For small signal amplifier in common emitter (CE) BJT configuration using voltage divider biasing perform small signal (AC) analysis using the hybrid – π model.	[10]
5	a	With a neat sketch, write a short note on solar cell describing its structure or construction, working & V-I characteristics. Mention few real-life applications of solar cells	[10]
	b	Draw circuit diagram and explain the operation of different biasing circuits used for E-MOSFET.	[10]
6	a	Explain construction and working principle of Single Electron Transistor.	[10]
	b	Draw all the different biasing circuits of BJT. Derive the expression of stability factor (SI) for the voltage divider biasing circuit.	[10]

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Duration: 3hrs **[Max Marks:80]**

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(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1		Attempt any FOUR	[20]
	a	Compare the traditional file system with DBMS.	
	b	Write short notes on: Data independence and types of data independence.	
	c	Explain various data definition (DDL) statements in SQL.	
	d	What is Redundancy? Explain the different anomalies in relational database.	
	e	Discuss Serializability? Explain conflict and view serializability in a transaction	
2	a	Describe Joins and different types of Joins operation in Relational algebra. Distinguish between Natural join and Inner join in Relational algebra.	[10]
	b	Explain different Set Relational Algebra Operator with example.	[10]
3	a	Draw ER Diagram for a Company has the following description : Company has several departments.Each department may have several Location. Departmentsare identified by a name, D_no;Location.A Manager control a particular department.Each department is associated with number of projects.Employees are identified by name, id, address, dob, date_of_joining.An employee works in only one department but can work on several project. We also keep track of number of hours worked by an employee on a single project. Each employee has dependent. Dependent has D_name, Gender andrelationship	[10]
	b	What is Entity set? And also define Relationship set., List and explain the symbols used to draw ER diagram	[10]
4	a	Consider the following schema for employee database. Employee (emp_id, empname, street, city, date of join) Works (empname, company-name, salary) Company (company-name, city) Manages (empname, manager-name) Write SQL queries for the following statements: i. write a SQL query to find empname who is getting salary between 500 and 2000. ' ii .Find the total no of employees 'in each company with salary greater than 50000	[10]

iii. Create Employee relation using SQL commands by considering emp_id as primary key.
iv. Select all Employee with a name have "S" in fourth position. "
v .Write a query to sort the records in the descending order of the their salary

b What are the different aggregate functions used in SQL? Explain with the help of example. [10]

5 a Define Normalization and different types of normalization methods with example [10]

b What do you mean by Lock Based protocol? Explain Two Phase (2PL) locking protocol and different types/versions of 2PL. [10]

6 a Describe concept of Transaction and also illustrate ACID properties in detail. [10]

b What is Transitive dependency. State and explain in which Normal form this concept is used. [10]

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Time: 3 Hrs **Marks: 80**

NB: (1) Question No. 1 is **Compulsory.**
(2) Attempt any **three** questions out of remaining **five.**
(3) Each question carries 20 marks and sub-question carry equal marks.
(4) Assume suitable data if required.

Q.1 Answer **any four**

a) Convert the decimal number (175.23)10 to their octal, hexadecimal, BCD and gray code equivalent. **5M**

b) Define Propagation delay, noise margin, power dissipation, fan in & fan out,5M

c) Design and implement half adder circuit. **5M**

d) A 7-bit hamming code is received as 1011011. Assume even parity and state weather received code is correct or wrong, if wrong then locate the bit error. **5M**

e) Differentiate between mealy and Moore machine **5M**

f) Explain the structural VHDL description of 2 to 4 decoder in detail. **5M**

Q.2 a) Draw the circuit diagram of TTL NAND gate with totem pole output and explain its working with the help of a truth table. **10M**

Q.2 b)Design and implement the following expression using a single 8:1multiplexer
$F(A,B,C,D)=\sum m(0,1,3,5,7,10,11,13,14,15)$ **10M**

Q.3 a) Design and implement D FF using T FF and JK FF using D FF **10M**

Q.3 b) Design MOD 6 counter by using MOD 8 counter.10M

Q.4 a) Reduce the following state table using partitioning method of state reduction. **10M**

PS	Next State X=0 X=1		Output
A	B	C	1
B	D	F	1
C	F	E	0
D	B	G	1
E	F	C	0
F	E	D	0
G	F	G	0

Q.4 b) Implement CMOS as a NAND & NOR gate.10M

Q.5 a) Implement following function using PLA. **10M**
$F1=\sum m = (0,3,4,7)$ and $F2=\sum m = (1,2,5,7)$

Q.5 b)Implement and explain synchronous MSI counter using IC 74163. 10M

Q.6 a) Implement and explain 4 bit BCD adder using IC 7483 **10M**

Q.6 b) Write a VHDL program and explain the design procedure 8 bit comparator. **10M**

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Duration: 3hrs **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required, and state it clearly.

1		Attempt any FOUR	[20]
	a	Explain linear and nonlinear data structures.	
	b	Evaluate the given postfix expression using stack 2 3 4 +∗ 5 ∗	
	c	What are the advantages of a linked list over arrays?	
	d	Explain different graph traversal techniques.	
	e	Given an array int a[]={69,78,63,98,67,70,52,55,96}. Calculate the address of a[6] if the base address of an array is 2100.	
2	a	Write a C program to implement queue using Arrays.	[10]
	b	Given the postorder and inorder traversal of a binary tree, construct the original tree. Postorder: D E F B G L J K H C A Inorder: D B F E A G C L J H,K	[10]
3	a	What is hashing? What properties should a hash function demonstrate?	[10]
	b	Write a program to implement a stack using linked list.	[10]
4	a	Consider the following sorted array DATA with 13 elements: 11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 99 Illustrate the working of binary search technique while searching an element (i) 40 (ii) 85.	[10]
	b	What is a Binary search tree? Construct a Binary search tree for the following elements. 13, 3, 4, 12, 14, 10, 5, 1, 8, 2, 7, 9, 11, 6, 18	[10]
5	a	Explain insertion sort using an example. Write an algorithm for it and comment on its complexity	[10]
	b	Write short notes on BFS and DFS algorithms.	[10]

6 a Write a C program to implement a singly linked list. The program should be able to perform the following operations: [10]

1. insert a node in the end
2. delete the last node
3. display the nodes.

b Given the frequency for the following symbols, compute the Huffman code for each symbol. [10]

Symbol	A	B	C	D	E	F
Frequency	9	12	5	45	16	13

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

N.B.: (1) Question No. 1 is **Compulsory**.
(2) Attempt any **three** questions out of the remaining **five**.
(3) Each question carries 20 marks and sub-question carry equal marks.
(4) Assume suitable data if required.

Q.1 Solve any **Four** from the following: **20**

a Draw the transfer characteristics of MOS transistors state the significance of threshold voltage.

b List different types of Diff-Amp and state which one is preferred.

c State and explain Miller's theorem.

d State the features of IC 555 Timer.

e Explain the advantages of Switching Voltage Regulator over the Linear Voltage regulator.

Q.2 a Describe the general frequency response of an amplifier and define the low, mid and high frequency ranges. Define low cut off and high cut off frequency for the amplifier. **10**

b Draw a neat circuit diagram for non-inverting Amplifier. State what type of feedback is employed in the circuit. Derive the expression for the gain of an amplifier. Design a circuit to obtain the gain of 11. **10**

Q.3 a Draw small signal equivalent circuit of dual input balanced output MOSFET differential amplifier. Derive the expression for A_D (Differential mode gain), A_{CM} (Common mode gain) and CMRR. **10**

b. Draw the circuit diagram for Trans- resistance Amplifier (Current to Voltage converter). State different applications of the circuit. **10**

Q.4 a Draw the circuit diagram and explain the operation of RC Wien Bridge oscillator Design the circuit to oscillate with frequency 2 KHz. **10**

b Draw the circuit diagram of differentiator using OPAMP and derive the expression of output voltage. State its applications. **10**

Q.5 a Draw neat circuit diagram and explain the operation of Astable multivibrator using IC 555. How you will modify the circuit to achieve 50% Duty Cycle. **10**

b Draw the circuit diagram of basic MOSFET differential amplifier and explain its operation. Sketch and explain its DC transfer characteristics. **10**

Q.6 a Define following OPAMP parameters. State its ideal and practical value for 741 IC. **10**

i)Input offset voltage ii) Slew rate iii) CMRR iv)Input bias current iv) Power Supply Rejection Ratio)Input resistance.

b Design the Schmitt Trigger Circuit (Regenerative Comparator) to obtain the Hysteresis of 2Volts. **10**
