CBCS SCHEME

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21MAT31

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Transform Calculus, Fourier Series and Numerical Techniques

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Find the Laplace transform of $te^{2t} - \frac{2\sin 3t}{t}$. **(06 Marks)**

b. Given that $f(t) = \begin{cases} E, & 0 < t < a/2 \\ -E, & a/2 < t < a \end{cases}$

where $f(t + a) = f(t)$ show that $L\{f(t)\} = \frac{E}{S}\tan h\left(\frac{as}{4}\right)$. **(07 Marks)**

c. Using convolution theorem obtain the inverse. Laplace transform of the following function :

$\frac{1}{(s-1)(s^2+1)}$. **(07 Marks)**

OR

2 a. Find the inverse Laplace transform of :

$\frac{s+5}{s^2-6s+13}$. **(06 Marks)**

b. Express the following function interms of unit step function and hence find their Laplace transform.

$$f(t) = \begin{cases} 1, & 0 < t < 1 \\ t, & 1 < t \le 2 \\ t^2 & t > 2. \end{cases}$$ **(07 Marks)**

c. Solve the following intial value problem by using Laplace transform :

$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}, y(0) = 0, y'(0) = 0.$ **(07 Marks)**

Module-2

3 a. Obtain Fourier series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$. Hence deduce that

$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \text{------} = \frac{\pi}{4}$. **(06 Marks)**

b. Find a cosine Fourier series for $f(x) = (x-1)^2, 0 \le x \le 1$. **(07 Marks)**

c. Obtain the Fourier series of y upto the First harmonic for the following values.

x°	45	90	135	180	225	270	315	360
y	4.0	3.8	2.4	2.0	–1.5	0	2.8	3.4

(07 Marks)

OR

4 a. Obtain Fourier series for

$$f(x)=\begin{cases}\pi x & \text{in } 0\le x\le 1\\ \pi(2-x) & \text{in } 1\le x\le 2\end{cases}.$$ **(06 Marks)**

b. Obtain the sine half range series for the function :

$$f(x)=1-\left(\frac{x}{\pi}\right)\text{in } 0\le x\le\pi.$$ **(07 Marks)**

c. The following values of y and x are given. Find Fourier series of upto first harmonics.

x	0	2	4	6	8	10	12
y	9.0	18.2	24.4	27.8	27.5	22.0	9.0

(07 Marks)

Module-3

5 a. If $f(x)=\begin{cases}1-x^2, & |x|<1\\ 0, & |x|\ge 1\end{cases}$. Find Fourier transform of f(x) and hence find the value of

$$\int_0^\infty \frac{x\cos x-\sin x}{x^3}\,dx.$$ **(06 Marks)**

b. Find the Fourier sine transform of $f(x)=e^{-|x|}$ and hence evaluate

$$\int_0^\infty \frac{x\sin mx}{1+x^2}dx,\ m>0.$$ **(07 Marks)**

c. Solve by using Z-Transforms $U_{n+2}+2U_{n+1}+U_n=n$ with $U_0=0=U_1$. **(07 Marks)**

OR

6 a. Obtain the Fourier cosine transform of the function :

$$f(x)=\begin{cases}4x, & 0<x<1\\ 4-x, & 1<x\le 4\\ 0, & x>4.\end{cases}$$ **(06 Marks)**

b. Obtain the Z-transform of Cosn θ and Sinn θ **(07 Marks)**

c. Compute the inverse Z-transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$. **(07 Marks)**

Module-4

7 a. Classify the following partial differential equations :

i) $x^2u_{xx}+(1-y^2)u_{yy}=0,\ -\infty<x<\infty,-1<y<1$

ii) $(1+x^2)u_{xx}+(5+2x^2)u_{xt}+(4+x^2)u_{tt}=0$

iii) $(x+1)u_{xx}-2(x+2)u_{xy}+(x+3)u_{yy}=0.$ **(10 Marks)**

b. Solve $u_t=u_{xx}$ subject to the conditions u(0, t) = 0 = u(1, t) and u(x, 0) = sin(πx) by taking h = 0.2 for 5 levels. Further write down the following values from the table

i) u(0.2, 0.04)

ii) u(0.4, 0.08)

iii) u(0.6m 0.06). **(10 Marks)**

OR

8 a. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square Mesh with boundary values as shown. Find the iterative values of u_i(1 to 9) to the nearest integer.

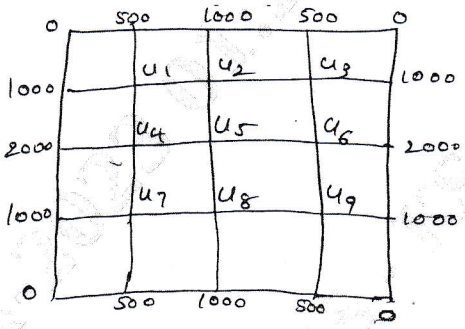

Fig.Q8(a) **(10 Marks)**

b. Solve $25u_{xx} = u_{tt}$ at the pivotal points given $u(0, t) = 0 = u(5, t)$, $u_t(x, 0) = 0$ and $u(x,0) = \begin{cases} 20x, & 0 \le x \le 1 \\ 5(5-x), & 1 \le x \le 5 \end{cases}$ by taking $h = 1$ compute $u(x, t)$ for $0 \le t \le 1$. **(10 Marks)**

Module-5

9 a. Given $y'' - xy' - y = 0$ with the initial conditions $y(0) = 1$, $y'(0) = 0$ compute $y(0.2)$ using fourth order Runge – Kutta method. **(06 Marks)**

b. Derive the Euler's equation. **(07 Marks)**

c. Find the extremal of the functional.

$$\int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x)dx .$$ **(07 Marks)**

OR

10 a. Obtain the solution of the equation $2\frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$ by computing the value of $y(1.4)$ by applying Milne's method using following data :

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y'	2	2.3178	2.6725	3.0657

(06 Marks)

b. Find the curve on which the functional $\int_0^1 [y']^2 + 12xy]dx$ with $y(0) = 0$ and $y(1) = 1$ can be determined. **(07 Marks)**

c. Prove that the shortest distance between two points in a plane is straight line. **(07 Marks)**

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CBCS SCHEME

USN | 1 | K | S | 2 | 1 | C | S | 0 | 4 | 3 | | 21CS32

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Data Structures and Applications

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What is linear array? Discuss the representation of linear array in memory. **(06 Marks)**

b. Differentiate between static and dynamic memory allocations. Discuss four dynamic memory allocation functions. **(06 Marks)**

c. Write a menu driven program in C for the following array operations:
(i) Inserting an element (ELEM) at a given valid position.
(ii) Deleting an element at a given valid position.
(iii) Display of array elements.
(iv) Exit
Support the program with functions for each of the above operations. **(08 Marks)**

OR

2 a. Give Abstract Data Type (ADT) for arrays. How array can be declared and initialized? **(06 Marks)**

b. With suitable example, discuss self-referential structures. **(06 Marks)**

c. Define Sparse matrix. How to represent a Sparse matrix? Write an algorithm/function to transpose a given Sparse matrix. **(08 Marks)**

Module-2

3 a. Define Stack. Discuss how to represent stack using dynamic arrays. **(06 Marks)**

b. Write a menu driven C program for the following operations on STACK of integers:
(i) Push an element on to stack
(ii) Pop an element from the stack
(iii) Display the contest of stack
(iv) Exit
Show the overflow and underflow conditions. **(06 Marks)**

c. What are the disadvantages of ordinary queue? Discuss the implementation of circular queue using arrays. **(08 Marks)**

OR

4 a. What is Recursion? Write recursive function to solve Towers of Hanoi problem. **(06 Marks)**

b. Discuss the following:
(i) Double Ended Queue
(ii) Priority Queue **(06 Marks)**

c. Write an algorithm to convert infix expression to postfix expression. Show the content of stack to convert the following infix expression:
A * (B + D)/E – F * (G + H/K) **(08 Marks)**

Module-3

5 a. Write a C function to concatenate two singly linked list. **(06 Marks)**

b. Give the structure definition for singly linked list. Write a C function to:
(i) Insert an element at the end
(ii) Delete a node at the beginning **(08 Marks)**

c. Discuss how to read a polynomial consisting of 'n' terms implemented using linked list. **(06 Marks)**

OR

6 a. Write a function to delete a node whose information field is specified in singly linked list. **(06 Marks)**

b. What is circular doubly linked list? Write a C function to perform the following operations on circular doubly linked list:
(i) Insert a node at the beginning
(ii) Delete a node from the leas **(08 Marks)**

c. Discuss how to implement stacks and queues using linked list. **(06 Marks)**

Module-4

7 a. Define binary tree. List and discuss any two properties of binary tree. **(06 Marks)**

b. Write a function to perform the following operations on Binary Search Tree (BST):
(i) Deletion from a BST
(ii) Inserting an element into a BST **(08 Marks)**

c. Define Threaded Binary Tree. Discuss In-threaded binary tree. **(06 Marks)**

OR

8 a. Discuss how binary tree are represented using (i) Array (ii) Linked list **(06 Marks)**

b. Discuss inorder, preorder, postorder and level order traversal with suitable recursive function for each. **(08 Marks)**

c. Write a C function to evaluate an expression using expression tree. **(06 Marks)**

Module-5

9 a. Design a C program for the following operation on Graph (G) of cities:
(i) Create a graph of N cities using adjacency matrix
(ii) Print all the nodes reachable from a given starting node in a digraph using BFS/DFS method **(10 Marks)**

b. Discuss AVL tree with an example. Write a function for insertion into an AVL tree. **(10 Marks)**

OR

10 a. Define hashing. What are the two criteria, a good hash function should satisfy? Discuss open addressing and chaining method with an example. **(10 Marks)**

b. Define Red-Black tree, Splay tree and B tree. Discuss the method to insert an element into Red-Black tree. **(10 Marks)**

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CBCS SCHEME

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21CS33

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Analog and Digital Electronics

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Derive an expression for collector current and collector emitter voltage of voltage divider bias circuit (accurate analysis). **(08 Marks)**

b. Explain relaxation oscillator. **(06 Marks)**

c. Sketch and explain the working of Peak detector. **(06 Marks)**

OR

2 a. Explain R-2R ladder type DAC with a neat diagram. **(06 Marks)**

b. List the advantages of active filters over passive filters. **(06 Marks)**

c. For the circuit shown in Fig. Q2 (c) below find the value of R_1 and R_2 if supply voltages are +12 and −12 V. Assume hysteresis with −6 V.

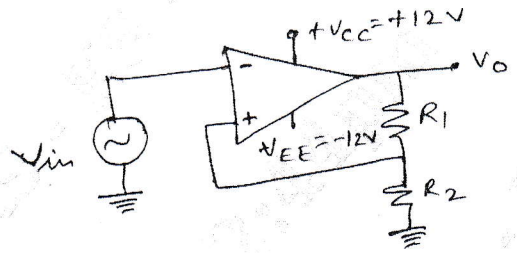

Fig. Q2 (c) **(08 Marks)**

Module-2

3 a. Find all the prime implicates of the function,
$f(a,b,c,d) = \Pi(0,2,3,4,5,12,13) + \Pi d(8,10)$
using the Quine-McCluskey method. **(10 Marks)**

b. Plot the Karnaugh maps and find all the minimal sums and minimal products of the following Boolean functions.
(i) $f(a,b,c) = \sum(2,4,5,6,7)$
(i) $f(a,b,c) = \Pi(1,4,5,6)$ **(10 Marks)**

OR

4 a. With an example, explain Petrik's method. **(06 Marks)**

b. For the given Boolean function, determine a minimal sum and a minimal product using MEV techniques using a, b and c as the map variables.
$f = \sum(3,4,5,7,8,11,12,13,15)$ **(08 Marks)**

c. Explain Entered variable map method. **(06 Marks)**

Module-3

5 a. Explain the importance of three-state buffer. **(06 Marks)**

b. With a neat diagram, explain 3 to 8 line decoder. **(06 Marks)**

c. What is a multiplexer? Write the logic diagram for 8 : 1 multiplexer using 4 input AND and OR gates. **(08 Marks)**

OR

6 a. Discuss different types of hazards in combinational circuits. **(08 Marks)**

b. Distinguish between combinational and sequential circuit. **(06 Marks)**

c. Write a note on PLA and PAL. **(06 Marks)**

Module-4

7 a. Explain the working of JK master slave flip-flop with a sketch, truth table and symbol. **(06 Marks)**

b. What is D flip flop? Illustrate the operation of the clear and preset inputs in D-flip-flop with timing diagram. **(08 Marks)**

c. What is VHDL? Show how to model the 4 to 1 multiplexer using a VHDL conditional assignment statement. **(06 Marks)**

OR

8 a. What is T-flip-flop? Show how to convert D-flip flop into T-flip-flop. **(08 Marks)**

b. What are the three different models for writing a module body in VHDL? Give example for any one model. **(06 Marks)**

c. Explain with a neat diagram, VHDL program structure. **(06 Marks)**

Module-5

9 a. With a neat diagram, explain 4-bit parallel adder with accumulator. **(10 Marks)**

b. Define counter. Design mod-5 counter using J-K flip flop. **(10 Marks)**

OR

10 a. With neat diagram, explain 4 bit SISO register. **(08 Marks)**

b. Mention the Application of shift registers. **(05 Marks)**

c. Explain the working of a 3 bit shift register. **(07 Marks)**

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CBCS SCHEME

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Third Semester B.E. Degree Examination, Jan./Feb. 2023
Computer Organization and Architecture

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With the help of a neat block diagram discuss the basic operational concept of a computer. **(08 Marks)**

b. Write a program to evaluate the arithmetic statement Y= (A + B) * (C + D) using three address, two address, one address and zero address instruction. **(08 Marks)**

c. Write the basic performance equation indicate the role of each parameter in the equation. **(04 Marks)**

OR

2 a. Define Addressing Mode. Explain the various addressing mode. **(10 Marks)**

b. With proper example explain Big - Endian and Little - Endian of byte addressing. **(06 Marks)**

c. What is performance measurement? Explain the overall SPEC rating of a computer. **(04 Marks)**

Module-2

3 a. With respect to handling interrupts from multiple devices explain:
(i) Interrupt nesting (ii) Dairy chain method. **(10 Marks)**

b. What is Bus arbitration? Explain centralized and distributed arbitration method with neat diagrams. **(10 Marks)**

OR

4 a. Illustrate a program that reads one line from keyboard, stored it in memory buffer and echoes if back to display in I/O interfaces. **(10 Marks)**

b. Discuss with a neat circuit diagram, the general 8 bit parallel interface circuit. **(10 Marks)**

Module-3

5 a. Explain the internal organization of 16-megabit DRAM chip configured as 2M × 8. **(08 Marks)**

b. With a neat figure illustrate the structure of synchronous DRAM (SDRAM). **(08 Marks)**

c. Discuss about any two types of Read Only Memory (ROM). **(04 Marks)**

OR

6 a. State the importance of cache memory and describe the different types of cache mapping techniques with diagram. **(12 Marks)**

b. With relevant figure explain organization of (1k × 1) memory chip. **(08 Marks)**

Module-4

7 a. With the help of logic diagram explain 4-bit carry look adder and its operation. **(10 Marks)**

b. Illustrate the hardware arrangement for sequential multiplication with an example. **(10 Marks)**

OR

8 a. Draw the single bus architecture and explain the control sequence for execution of instruction ADD (R3), R1. **(10 Marks)**

b. With neat sketches, explain the detailed organization of hardwired control unit. **(10 Marks)**

Module-5

9 a. With a suitable example explain the concept of pipeline processing. **(10 Marks)**

b. Draw and explain pipeline for floating point addition and subtraction. **(10 Marks)**

OR

10 a. With the help of flowchart and timing diagram explain four segment instruction pipeline. **(10 Marks)**

b. Explain the organization of SIMD array processor with an appropriate diagram. **(10 Marks)**

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