CBCS SCHEME

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21MAT31

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Transform Calculus Fourier Series & 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, (i) $e^{-3t}\sin 5t.\cos 3t$ (ii) $\dfrac{e^{at}-e^{bt}}{t}$. **(06 Marks)**

b. If a periodic function of period 'a' is defined by $f(t)=\begin{cases} E, & \text{for } 0<t<\frac{a}{2} \\ -E, & \text{for } \frac{a}{2}<t<a \end{cases}$ then show that $L\{f(t)\}=\dfrac{E}{S}\tanh\left(\dfrac{as}{4}\right)$. **(07 Marks)**

c. Using convolution theorem find the inverse Laplace transform of $\dfrac{s}{(s+2)(s^2+9)}$. **(07 Marks)**

OR

2 a. Express the function $f(t)=\begin{cases} \cos t & \text{for } 0<t<\pi \\ \cos 2t & \text{for } \pi<t<2\pi \\ \cos 3t & t>2\pi \end{cases}$ interms of unit step function and hence find its Laplace transform. **(07 Marks)**

b. Find the inverse laplace transform of $\dfrac{2s^2-6s+5}{s^3-6s^2+11s-6}$. **(06 Marks)**

c. Solve the differential equation $\dfrac{d^2y}{dt^2}+4\dfrac{dy}{dt}+4y=e^{-t}$ with $y(0)=y'(0)=0$ by using Laplace transform. **(07 Marks)**

Module-2

3 a. Find a Fourier series to represent $f(x)=|x|$ in $-\pi\le x\le\pi$. **(06 Marks)**

b. Obtain the half-range cosine series for $f(x)=x\sin x$ in $(0,\pi)$ and hence show that $\dfrac{\pi-2}{4}=\dfrac{1}{1.3}-\dfrac{1}{3.5}+\dfrac{1}{5.7}-.......\infty$ **(07 Marks)**

c. Express y as a Fourier series up to second harmonics for the following data :

x:	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y:	1	1.4	1.9	1.7	1.5	1.2	1.0

(07 Marks)

OR

4 a. Obtain the Fourier series expansion for the function, $f(x) = 2x - x^2$ in (0, 2). **(06 Marks)**

b. Find the half range sine series for the function, $f(x) = \begin{cases} \frac{1}{4} - x & \text{for } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{for } \frac{1}{2} < x < 1 \end{cases}$ **(07 Marks)**

c. The following table gives the variation of periodic current over period :

t sec :	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
A (amp) :	1.98	1.30	1.05	1.30	−0.88	−0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic. **(07 Marks)**

Module-3

5 a. Find the Fourier transform of the function $f(x) = \begin{cases} 1 - x^2 & \text{for } |x| \le 1 \\ 0 & \text{for } |x| > 1 \end{cases}$. Hence evaluate $\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3} \right) dx$. **(06 Marks)**

b. Find the Fourier sine and cosine transform of $f(x) = \begin{cases} x & \text{if } 0 < x < 1 \\ 2 - x & \text{if } 1 < x < 2 \\ 0 & \text{otherwise} \end{cases}$. **(07 Marks)**

c. Find the z-transform of $\cosh\left(n\frac{\pi}{2} + \theta \right)$. **(07 Marks)**

OR

6 a. Find the Fourier sine transform of $f(x) = e^{-ax}$, a>0. **(06 Marks)**

b. Find the inverse z transform of $\frac{18z^2}{(2z-1)(4z+1)}$. **(07 Marks)**

c. Solve the difference equation $u_{n+2} + 6u_{n+1} + 9u_n = z^n$ with $u_0 = u_1 = 0$ using z-transform. **(07 Marks)**

Module-4

7 a. Classify the following partial differential equations :

(i) $\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + 4\frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$.

(ii) $x^2\frac{\partial^2 u}{\partial x^2} + (1 - y^2)\frac{\partial^2 u}{\partial y^2} = 0$, $-\infty < x < \infty$, $-1 < y < 1$.

(iii) $(1 + x^2)\frac{\partial^2 u}{\partial x^2} + (5 + 2x^2)\frac{\partial^2 u}{\partial x \partial t} + (4 + x^2)\frac{\partial^2 u}{\partial t^2} = 0$.

(iv) $(x + 1)\frac{\partial^2 u}{\partial x^2} - 2(x + 2)\frac{\partial^2 u}{\partial x \partial y} + (x + 3)\frac{\partial^2 u}{\partial y^2} = 0$. **(10 Marks)**

b. Evaluate the values at the mesh points for the equation $u_{tt} = 16u_{xx}$ taking h = 1 upto t = 1.25. The boundary conditions are u(0, t) = u(5, t) = 0 and the initial conditions are $u(x, 0) = x^2(5 - x)$ and $u_t(x, 0) = 0$. **(10 Marks)**

OR

8 a. Using Schmidt two-level formula to solve the equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ under the conditions,

(i) $u(0, t) = u(1, t) = 0 \quad t \geq 0$

(ii) $u(x, 0) = \sin \pi x$, $0 < x < 1$ by taking $h = \frac{1}{4}$ and $\alpha = \frac{1}{6}$ co. **(10 Marks)**

b. Solve the two-dimensional Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ at the interior mesh points of the square region and the values of u at the mesh points on the foundary are shown in Fig.Q8 (b).

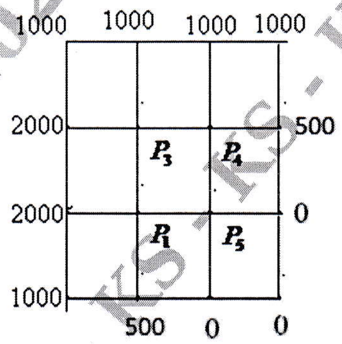

Fig. Q8 (b) **(10 Marks)**

Module-5

9 a. Using Runge-Kutta method of 4[th] order to solve the differential equation $\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 4y = 0$ with y(0) = 0.2 and $y'(0) = 0.5$ for x = 0.1. Correct to four decimal places. **(07 Marks)**

b. State and prove Euler's equation. **(07 Marks)**

c. Find the extremal of the functional $I = \int_0^{\frac{\pi}{2}} (y^2 - y'^2 - 2y \sin x) dx$ under the end conditions $y(0) = 0, y\left(\frac{\pi}{2}\right) = 0$ **(06 Marks)**

OR

10 a. Apply Milne's method to compute y(0.3). Given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$, $y'(0) = 0$, $y'(0.2) = 0.1996$, $y'(0.4) = 0.3937$, $y'(0.6) = 0.5689$ **(07 Marks)**

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

c. Find the extremal of the functional $I = \int_{x_1}^{x_2} (y^2 + y'^2 + 2ye^x) dx$ **(06 Marks)**

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21CS32

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 data structure? Explain in detail classification of data structures with example. **(10 Marks)**

b. Write an algorithm for inserting and deleting an element at a given location in an array and implement the same in 'C' language. **(10 Marks)**

OR

2 a. Explain the nested structures with an example of a 'C' program. **(07 Marks)**

b. What are self-referential structures? **(03 Marks)**

c. Explain 'C' library functions for memory allocation/deallocation functions with example. **(10 Marks)**

Module-2

3 a. What is stack? Explain basic operations of stack with algorithm. **(05 Marks)**

b. Write 'C' program to implement stack using array. **(05 Marks)**

c. Write an algorithm to convert an infix notation to post fix notation to post fix notation and apply the algorithm for the following infix expression to convert it into post fix.
$A-(B/C+(D\%E*F)/G)*H$. **(10 Marks)**

OR

4 a. What is queue? Explain basic operations of queue with algorithm. **(06 Marks)**

b. Write 'C' program to implement linear queue using array. **(07 Marks)**

c. Explain different types of queues with example. **(07 Marks)**

Module-3

5 a. What are linked lists? Explain with algorithm inserting a new node in a linked list for the following cases:
Case 1 : The new node is inserted at the beginning.
Case 2 : The new node after a given node. **(10 Marks)**

b. What are circular linked lists? Explain with algorithm deleting a node from a circular linked list for the following cases:
Case 1 : The first node
Case 2 : The last node. **(10 Marks)**

OR

6 a. Represent polynomial using linked list and explain addition of two polynomial with algorithm. **(10 Marks)**

b. Write a 'C' program to implement stack using linked list. **(10 Marks)**

Module-4

7 a. What are binary trees? Explain the linked representation of binary tree. **(08 Marks)**

b. What is binary search tree? Construct the binary tree for the following expression: $exp = ((a+b)-(c*d))\%((e \wedge f)/(g-h))$. **(07 Marks)**

c. Write applications of trees. **(05 Marks)**

OR

8 a. Explain pre-order and in-order traversal with example and also write algorithm. **(10 Marks)**

b. Explain inserting and deleting a new node in a binary search tree with algorithm. **(10 Marks)**

Module-5

9 a. What are AVL trees? Explain operations on AVL trees with example. **(10 Marks)**

b. What are red-black trees? Explain operations on red-black trees with example. **(10 Marks)**

OR

10 a. Explain the graph representation using adjacency matrix. **(05 Marks)**

b. Explain the two standard graph traversal algorithms in detail with example. **(10 Marks)**

c. Explain different hash functions with example. **(05 Marks)**

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21CS33

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. What is BiaSing? List the types of BiaSing and discuss fixed bias. **(06 Marks)**

b. Describe the working of Schmitt trigger circuit (non inverting) with transfer characteristics. **(08 Marks)**

c. Explain First Order Low Pass Filter with Mathematical Analysis. **(06 Marks)**

OR

2 a. Discuss Regulated power supply with block diagram. **(06 Marks)**

b. With neat sketch, explain successive approximation ADC method. **(08 Marks)**

c. With the help of a neat diagram, explain the working principle of relaxation oscillator. **(06 Marks)**

Module-2

3 a. Reduce the following function using K-map technique and implement the expression with Basic gates :

$f(a,b,c,d) = \sum m(0, 1, 6, 8, 9, 11) + \sum d(3, 7, 14, 15)$ **(10 Marks)**

b. What are Prime Implicants? Find all the prime implicants and simplified expression for the function using Q-M method,

$f(a,b,c,d) = \sum m(0, 2, 3, 4, 8, 10, 12, 13, 14) + d(11, 15)$ **(10 Marks)**

OR

4 a. Simplify the following POS expression using K-map and implement using Basic gates,

$f(a,b,c,d) = \Pi M(0, 1, 3, 4, 5, 7, 11, 12, 13, 14, 15)$ **(08 Marks)**

b. Obtain the simplified expression using EVM method for the given function,

$f(a,b,c,d) = \sum m(0, 1, 5, 13, 14, 15) + dC(8, 9, 10, 11)$ **(06 Marks)**

c. With example, explain Petrick's method. **(06 Marks)**

Module-3

5 a. Implement the following function using 8 : 1 multiplexer,

$F(a,b,c,d) = \sum m(0, 1, 5, 6, 8, 10, 12, 15)$ **(07 Marks)**

b. Implement 7-segment decoder using PLA. **(08 Marks)**

c. Discuss Four kinds of three state buffers. **(05 Marks)**

OR

6 a. Implement Full Adder using 3 : 8 Decoder. **(07 Marks)**

b. Design Hexadecimal to ASCII code converter using suitable ROM. Give the connection diagram of ROM. **(08 Marks)**

c. Explain static 1 Hazard with its recover method. **(05 Marks)**

Module-4

7 a. Explain the structure of VHDL program. Write VHDL code of JK Flip Flop. (08 Marks)
b. Derive characteristic equation of JK, D, D, SR flip flops. (08 Marks)
c. What is T-FF? Give the implementation circuit. (04 Marks)

OR

8 a. Explain Master Slave JK FF with neat diagram, Truth table and timing diagram. (08 Marks)
b. What are the three different models of writing module body in VHDL. Give VHDL code of 4 : 1 multiplexer using conditional assign statement. (08 Marks)
c. Give excitation table of JK and SR FF. (04 Marks)

Module-5

9 a. With a neat diagram, explain n-bit parallel Adder with Accumulators (10 Marks)
b. Design Mod-8 Counter using JK Flip flop. (10 Marks)

OR

10 a. With neat diagram, explain SISO register. (10 Marks)
b. Design a synchronous counter for the given sequence.
$0 \rightarrow 4 \rightarrow 1 \rightarrow 2 \rightarrow 6 \rightarrow 0 \rightarrow 4$ (10 Marks)

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21CS34

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
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 a neat diagram, explain basic operational concepts of a computer. **(10 Marks)**

b. Define the basic performance equation. Summarize the measures to improve the performance. **(05 Marks)**

c. Explain the overall SPEC rating for the computer in a programming suit. **(05 Marks)**

OR

2 a. What is addressing mode? Explain different types of addressing mode with examples. **(10 Marks)**

b. Show the big and little endian assignments for the number 22354456. **(05 Marks)**

c. Explain with basic types of the instruction formats to carry our c ← [A] + [B]. **(05 Marks)**

Module-2

3 a. Illustrate a program that reads one line from the keyboard, stores in memory buffer, and echoes it back to the display in an I/O interfaces. **(05 Marks)**

b. Explain the following with respect to interrupts:
(i) Interrupt Nesting
(ii) Simultaneous requests **(10 Marks)**

c. Define exception. Explain two kinds of exception. **(05 Marks)**

OR

4 a. With a neat diagram, explain the centralized arbitration scheme and distributed bus arbitration scheme. **(10 Marks)**

b. With a neat timing diagram, illustrate the asynchronous bus data transfer during an input operation. Use Handshake scheme. **(05 Marks)**

c. With neat diagram, explain how to connect keyboard to processor. **(05 Marks)**

Module-3

5 a. With a neat diagram, explain the organization of a 2M × 32 memory module using 512K × 8 static memory chips. **(10 Marks)**

b. Explain different types of non volatile memories. **(05 Marks)**

c. Explain with a neat block diagram of memory hierarchy in a contemporary computer system indicating variation of size, speed and cost per bit in the hierarchy. **(05 Marks)**

OR

6 a. Briefly explain any two mapping function used in cache memory. **(10 Marks)**

b. With a diagram, explain how virtual memory address is translated. **(05 Marks)**

c. Calculate the average access time experienced by a processor, if a cache hit rate is 0.88, miss penalty is 0.015 millisec and cache access time is 10 micro seconds. **(05 Marks)**

Module-4

7 a. Convert the following numbers into signed 5 bit numbers and add them. Also, tell whether overflow has occurred or not. (i) 13, 5 (ii) −15, −7 **(05 Marks)**

b. Explain with diagram the design and working of 16 bit carry look ahead adder built from 4-bit adders. **(10 Marks)**

c. Solve the following using sequential circuit binary multiplier: (i) 11×13 (ii) 12×9 **(05 Marks)**

OR

8 a. With a neat diagram, explain single bus organization of computer. **(10 Marks)**

b. List out the actions needed to execute the instruction Add (R3), R1. Write the sequence control steps for the execution of the same. **(05 Marks)**

c. Explain with a neat diagram, micro-programmed control unit method for design of control unit. **(05 Marks)**

Module-5

9 a. Explain pipelining processing with example. **(10 Marks)**

b. Explain processor with multiple functional units. **(05 Marks)**

c. Explain arithmetic pipeline. **(05 Marks)**

OR

10 a. Explain four segment instruction pipeline. **(10 Marks)**

b. Explain SIMD array processor. **(05 Marks)**

c. Explain vector processing. **(05 Marks)**

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