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18MAT31

Third Semester B.E. Degree Examination, June/July 2024
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
i) $e^{-t}\cos^2 3t$ ii) $t\cos t$ **(06 Marks)**

b. A periodic function of period $\frac{2\pi}{\omega}$ is defined by

$$f(t)=\begin{cases} E\sin\omega t, & 0\le t\le \frac{\pi}{\omega} \\ 0, & \frac{\pi}{\omega}\le t\le \frac{2\pi}{\omega}\end{cases}$$ where E and ω are constants.

Show that $L\{f(t)\}=\frac{E\omega}{(s^2+\omega^2)(1-e^{-\pi s/\omega})}$ **(07 Marks)**

c. Find the Inverse Laplace transform of
i) $\frac{2s-1}{s^2+2s+17}$ ii) $\log\left(\frac{s^2+1}{s(s+1)}\right)$ **(07 Marks)**

OR

2 a. Express the function f(t) in terms of unit step function and find its Laplace transform, where

$$f(t)=\begin{cases} \cos t, & 0<t\le\pi \\ 1, & \pi<t\le 2\pi \\ \sin t, & t>2\pi\end{cases}$$ **(06 Marks)**

b. Using the convolution theorem, obtain inverse Laplace transform of $\frac{s}{(s+1)(s^2+1)}$ **(07 Marks)**

c. Solve the equation $y'' + 5y' + 6y = e^t$ under the condition $y(0) = 0$, $y'(0) = 0$ **(07 Marks)**

Module-2

3 a. Find the Fourier series of the function $f(x) = x^2$ in $(-\pi, \pi)$. **(08 Marks)**

b. Define half range sine and cosine series in the interval $(0, l)$. **(04 Marks)**

c. Find the constant term and the first two harmonics in the fourier series for f(x) given by the following table.

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0

(08 Marks)

OR

4 a. Obtain the fourier series of the saw-tooth function

$f(x) = \frac{Ex}{T}$ for $0 < x < T$ given that $f(x + T) = f(x)$ for all $x > 0$. **(06 Marks)**

b. Obtain the Fourier series expansion of

$$f(x) = \begin{cases} \pi x & \text{in } 0 \le x \le 1 \\ \pi(2-x) & \text{in } 1 \le x \le 2 \end{cases}$$ over the interval (0, 2)

Deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots$ **(07 Marks)**

c. Expand $f(x) = \sin x$ in half range cosine series over the interval $(0, \pi)$. **(07 Marks)**

Module-3

5 a. Prove that fourier transform of

$$f(x) = \begin{cases} 1 + \frac{x}{a}, & -a < x < 0 \\ 1 - \frac{x}{a}, & 0 < x < a \\ 0, & \text{otherwise} \end{cases}$$ is $\frac{4\sin^2 \frac{au}{2}}{au^2}$, if Fourier transform of f(x) is F(u). **(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. Find z-transform of $5n^2 + 4\sin\left(\frac{n\pi}{2} + \frac{\pi}{4}\right)$ **(07 Marks)**

OR

6 a. Find the fourier cosine transform of

$$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2 - x & \text{for } 1 < x < 2 \\ 0 & \text{for } x > 2 \end{cases}$$ **(07 Marks)**

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

c. Solve the difference equation

$u_{n+2} + 3u_{n+1} + 2u_n = 3^n$, given $u_0 = 0$, $u_1 = 1$, using z-transform. **(06 Marks)**

Module-4

7 a. Use Taylor's series method to find the value of y at x = 0.1, given that $dy/dx = x^2 + y^2$, $y(0) = 1$. Consider upto 4th degree term. **(06 Marks)**

b. By using modified Euler's method, solve the initial value problem $\frac{dy}{dx} = \log(x + y)$, $y(1) = 2$ at the point x = 1.2. Take h = 0.2 and carryout two modifications. **(07 Marks)**

c. Given $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$, $y(0.1) = 1.1169$, $y(0.2) = 1.2773$, $y(0.3) = 1.5049$. Find y(0.4) correct to three decimal places using Milne's predictor – corrector method. Apply corrector formula once. **(07 Marks)**

OR

8 a. Using modified Euler's method compute y(1.1) correct to five decimal places taking h = 0.1, given that $\frac{dy}{dx}+\frac{y}{x}=\frac{1}{x^2}$ and $y=1$ at $x=1$. **(06 Marks)**

b. Use fourth order Runge-Kutta method to find y at x = 0.1, given that $\frac{dy}{dx}=3e^x+2y$, y(0) = 0 and h = 0.1. **(07 Marks)**

c. Apply Adam's – Bashforth method to solve the equation $(y^2+1)dy - x^2\,dx = 0$ at x = 1 given y(0) = 1, y(0.25) = 1.0026, y(0.5) = 1.0206, y(0.75) = 1.0679. Apply corrector formula once. **(07 Marks)**

Module-5

9 a. By Runge-Kutta method solve $y'' = xy'^2 - y^2$ for x = 0.2 correct to four decimal places, using initial conditions y = 1 and y' = 0 when x = 0. Take step length h = 0.2. **(06 Marks)**

b. Derive the Euler's equation in the form $\frac{\partial f}{\partial y}-\frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right)=0$. **(07 Marks)**

c. Prove that geodesics on a plane are straight line. **(07 Marks)**

OR

10 a. Using Runge-Kutta method solve the differential equation at x = 0.1 under the given conditions:

$\frac{d^2y}{dx^2}=x^3\left(y+\frac{dy}{dx}\right)$, $y(0)=1$, $y'(0)=0.5$. Take step length h = 0.1. **(06 Marks)**

b. Apply Milne's method to compute y(0.8) given that $\frac{d^2y}{dx^2}=1-2y\frac{dy}{dx}$ and the following table of initial values.

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y'	0	0.1996	0.3937	0.5689

Apply corrector formula once. **(07 Marks)**

c. Find the extremal of the functional $\int_a^b (x^2y'^2+2y^2+2xy)dx$ **(07 Marks)**

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18CS32

Third Semester B.E. Degree Examination, June/July 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. Define Data Structures. Give its classification. What are the basic operations that can be performed on Data structure? **(07 Marks)**

b. Give the ADT for sparse matrix. Express the given sparse matrix in the triplet form and find its transpose.

$$A = \begin{bmatrix} 30 & 0 & 0 & 25 & 0 \\ 0 & 0 & 40 & 0 & 22 \\ 0 & 0 & 0 & 0 & 42 \\ 52 & 0 & 0 & 61 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 10 & 0 & 0 \end{bmatrix}$$ **(07 Marks)**

c. Write a program to search for key element in an array using binary search technique. **(06 Marks)**

OR

2 a. Define strings. List and explain any 4 operations with example. **(10 Marks)**

b. Write a program to implement a C program for the following array operations:
(i) Creating an array of N integer elements.
(ii) Display of array elements with suitable headings.
(iii) Inserting an element at a given valid positions
(iv) Deleting an element at a given valid positions.
Support the program with functions for each of the above operations. **(10 Marks)**

Module-2

3 a. Define a stack. Write an algorithm to perform different operations on stack and then using diagrammatic representation. **(10 Marks)**

b. Convert the following infix expression to postfix expression,
(i) $((A+(B-C)*D)\wedge E+F)$
(ii) $X\$Y\$Z-M+N+P/Q$ **(06 Marks)**

c. Write a program to find GCD of 2 integer numbers. Using recursion. **(04 Marks)**

OR

4 a. Define a queue. Write a program to implement Qinsert ( ), Qdisplay ( ), Qdelete ( ) in C using arrays. **(10 Marks)**

b. Write an algorithm for evaluating a valid postfix expression. Trace the same on $562+*841-+*$. **(07 Marks)**

c. Differentiate recursion and iteration process. **(03 Marks)**

Module-3

5 a. With the C-statements, explain how do you create a node, add and delete on singly linked list (SLL) with proper messages where each node containing the details of an employee in the form of Empid, empage, empname, empsalary as data fields. **(10 Marks)**

b. Write C functions for the following operations on Doubly linked list (DLL) :
   (i) Concatenation of two DLL
   (ii) Search the DLL for the given key element. **(10 Marks)**

OR

6 a. Explain the following with suitable example: (i) Circular linked list (ii) Doubly linked list **(10 Marks)**

b. Write an algorithm to add 2 polynomials using circular singly linked list and also represent one example of polynomial using CSLL. **(10 Marks)**

Module-4

7 a. Define the following tree terminologies with example :
   (i) Degree of a node
   (ii) Strictly Binary tree
   (iii) Level of a binary tree
   (iv) Siblings
   (v) Skewed BT **(10 Marks)**

b. Write recursive functions for in-order, pre-order, post-order traversal of binary tree. Also give the 3 traversal for the BT given below Fig.Q7 (b). **(10 Marks)**

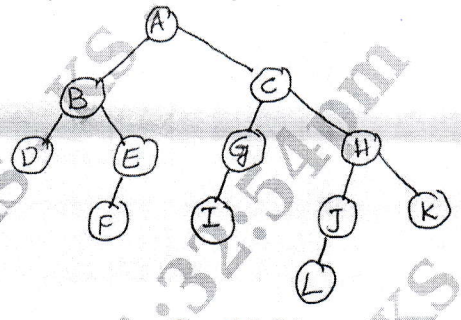

Fig. Q7 (b)

OR

8 a. Define Binary Search Tree (BST). Construct BST for the element step-by-step.
100, 85, 45, 55, 110, 20, 70, 65, 113, 145, 132, 96 **(10 Marks)**

b. Construct an expression tree for the given expression and traverse in preorder and postorder for the same.
$((6+(3-2)*5)\wedge 2+3)$ **(10 Marks)**

Module-5

9 a. Define the following terms : (i) Graph (ii) Multigraph (iii) Loop (iv) Subgraph **(04 Marks)**

b. What is Hashing? Explain the following hashing functions :
   (i) Division method
   (ii) MidSquare method
   (iii) Folding method. **(08 Marks)**

c. Write a C program to sort the elements in increasing order using insertion sort technique. **(08 Marks)**

OR

10 a. What is file? List basic file operations. Explain any four operations with syntax and example. **(08 Marks)**

b. Write the adjacency matrix and adjacency list representation for the given graph in Fig. Q10 (b). **(06 Marks)**

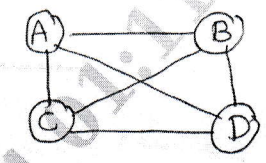

Fig. Q10 (b)

c. Explain with example the Radix sort technique and trace it. Arrange the numbers in ascending order with 2 and 3 digit numbers. **(06 Marks)**

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18CS33

Third Semester B.E. Degree Examination, June/July 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. Explain the construction working and characteristics of Light Emitting Diode. **(06 Marks)**

b. With a neat circuit diagram and Mathematical analysis explain fixed bias circuit. **(07 Marks)**

c. Show how IC-555 timer can be used as Astable Multivibrator with Waveforms. **(07 Marks)**

OR

2 a. Discuss successive approximation register method of A to D converter with detailed conversion process. **(08 Marks)**

b. With neat diagram and waveform, explain working of inverting Schmitt trigger circuit. **(06 Marks)**

c. Explain Adjustable Voltage Regulator with diagram and suitable equations. **(06 Marks)**

Module-2

3 a. Simplify the following function using K-map and obtain simplified Boolean expressions:
$f_1(a, b, c, d) = \sum m(0, 1, 2, 4, 5, 6, 8, 9, 10, 12, 13)$
$f_2(a, b, c, d) = \sum m(1, 3, 5, 7, 9) + \sum d(6, 12, 13)$. **(10 Marks)**

b. Simplify the following Boolean function by using Quine-Mcclusky (QM) method
$F(A, B, C, D) = \sum m(0, 2, 3, 6, 7, 8, 10, 12, 13)$. Find all the prime implicants. **(10 Marks)**

OR

4 a. Minimize the following function using MEV technique, use 'd' a MEV variable
$f(A, B, C, D) = \sum m(0, 1, 2, 7, 8, 9, 14, 15)$. **(08 Marks)**

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

c. Solve the following clearly mention prime implicants and essential prime implicants
$f(a, b, c, d) = \sum m(1, 5, 6, 7, 11, 12, 13, 15)$. **(06 Marks)**

Module-3

5 a. What are Hazards in digital systems? Explain static 1 and static – 0 hazards. **(08 Marks)**

b. What is Multiplexer? Discuss 8 to 1 MUX with the help of logic diagram and equation. **(06 Marks)**

c. Discuss the importance of three state buffer with example. **(06 Marks)**

OR

6 a. Show how using a 3 to 8 decoder and multiinput or gates following Boolean expressions can be realized simultaneously
$F_1(A, B, C) = \sum m(0, 4, 6)$
$F_2(A, B, C) = \sum m(0, 5)$
$F_3(A, B, C) = \sum m(1, 2, 3, 7)$ **(06 Marks)**

b. Realize $f(a, b, c, d) = \sum m(1, 5, 6, 10, 13, 14)$ using AND-OR logic with number of levels, Gates and Gate inputs. **(06 Marks)**

c. Write a short note on PLA and PAL. **(08 Marks)**

Module-4

7 a. Discuss the operation of SR-Latch using NOR gates. Show how SR Latch can be used for switch debouncing. **(08 Marks)**

b. Explain Gated SR-latch using NAND gate. **(06 Marks)**

c. Differentiate between Latch and flip flop and explain the structure of VHDL program. **(06 Marks)**

OR

8 a. Explain the working operation of SR-flipflop and JK flip flop with truth table and waveforms. **(08 Marks)**

b. Draw the logic diagram of master slave JK flip flop using NAND gates and explain the working with suitable timing diagram. **(07 Marks)**

c. Discuss Toggle Flip Flop with truth table and characteristic equation. **(05 Marks)**

Module-5

9 a. Explain Parallel Adder with Accumulator with neat diagram and operation. **(08 Marks)**

b. What is Register? Explain how 4 bit register with data load clear and clock constructed using D flip flops. **(07 Marks)**

c. Discuss the operation of data transfer between Register. **(05 Marks)**

OR

10 a. Design the counter using D flip flop for the given sequence 0 – 3 – 2 – 6 – 4 – 7 – 0. **(08 Marks)**

b. Explain synchronous Binary Counter with logical diagram and transition table. **(06 Marks)**

c. Explain the working of 8 bit serial - in – serial - out shift register using SR flip flop. **(06 Marks)**

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18CS34

Third Semester B.E. Degree Examination, June/July 2024
Computer Organization

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, analyze the basic operational concept of a computer. Give the operational steps (operational steps). **(10 Marks)**

b. What is performance measurement? Explain the overall SPEC rating for the computer in a program suite. **(10 Marks)**

OR

2 a. Define addressing mode, explain the various addressing mode with examples. **(10 Marks)**

b. Explain in detail, various shift and rotate instruction and example with neat diagram. **(10 Marks)**

Module-2

3 a. With neat diagram, explain various methods for handling multiple interrupts requests raised by multiple devices. **(10 Marks)**

b. What is DMA Bus Arbitration? Briefly explain different bus arbitration techniques. **(10 Marks)**

OR

4 a. What is an interrupt? What are interrupt service routine and what are vector interrupts? Explain with example. **(10 Marks)**

b. Explain the following with respect to USB:
i) U.S.B. Architecture
ii) U.S.B. protocols. **(10 Marks)**

Module-3

5 a. Draw a diagram and explain the working of 16 megabit DRAM chip configured as 2m × 8. **(10 Marks)**

b. Explain direct mapping technique and associative mapping technique in mapping function. **(10 Marks)**

OR

6 a. Analyze how data are written into (ROM) Read Only Memory. Discuss different types of Read Only Memories. **(10 Marks)**

b. What is cache memory? Explain any two mapping functions of cache memory. **(10 Marks)**

Module-4

7 a. Convert the following pairs of decimal numbers to 5-bit signed 2's complement binary numbers and add them. State whether or not over flow occurs in each case:
i) 5 and 10
ii) -14 and 11
iii) -5 and 7
iv) -10 and -13 **(04 Marks)**

b. Design the 16 bit carry look ahead adder using 4-bit adder. Also write the expression for C_{i+1}. **(10 Marks)**

c. Draw the two n-bit number x and y to perform addition/subtraction. **(06 Marks)**

OR

8 a. With an example explain the Booths algorithm to multiply two signed operands. **(10 Marks)**

b. Multiply each of the following pairs of signed 2's complement number using the booth algorithm (A = multiplicand and B = multiplier)

i) A = 010111 and B = 110110
ii) A = 110011 and B = 101100
iii) A = 110101 and B = 011011
iv) A = 001111 and B = 001111 **(10 Marks)**

Module-5

9 a. Discuss with neat diagram, the single bus organization of the data path inside a processor. **(10 Marks)**

b. Write the sequence of control steps required for single bus structure for each if the following instructions.

i) Add the contents of memory location NUM to register R1.
ii) Add the contents of memory location whose address is at memory location NUM to register R1. **(10 Marks)**

OR

10 a. Explain the following:

i) Hard-wired control
ii) Microprogrammed control. **(10 Marks)**

b. What is pipeline? Explain the 4 stages pipeline with its instruction execution steps and hardware organization. **(10 Marks)**

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18CS35

Third Semester B.E. Degree Examination, June/July 2024
Software Engineering

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 Software Engineering? Explain the waterfall model approach to develop a software product with a neat diagram. **(10 Marks)**

b. Explain Insulin pump control system with a neat diagram. **(10 Marks)**

OR

2 a. Explain Requirement Engineering process with a neat diagram. **(10 Marks)**

b. In connection with requirements analysis and elicitation, explain the following:
i) Scenario ii) Interviewing **(10 Marks)**

Module-2

3 a. What is object orientation? Explain the four aspects or characteristics required by an object oriented approach. **(10 Marks)**

b. What is an object oriented development? Explain object oriented themes. **(10 Marks)**

OR

4 a. Explain the following:
i) Link
ii) Association
iii) Multiplicity
iv) Ordering **(10 Marks)**

b. Explain association classes and qualified associations with an example for each. **(10 Marks)**

Module-3

5 a. What are structural models? In connection with structural models, explain the following:
i) Generalization ii) Aggregation **(10 Marks)**

b. What is Event-Driven modeling? Explain the state diagram of a microwave oven. **(10 Marks)**

OR

6 a. Explain the Rational Unified process, with a neat diagram. **(10 Marks)**

b. What are Design Models? Explain weather station state diagram. **(10 Marks)**

Module-4

7 a. What is Software Testing? Explain Test Driven Development with a neat diagram. **(10 Marks)**

b. What is Acceptance Testing? Explain Acceptance Testing process with a neat diagram. **(10 Marks)**

OR

8 a. What is Software Evolution? Explain software evolution process with a neat diagram. **(10 Marks)**

b. What is Software Re-Engineering? Explain software evolution process with a neat diagram. **(10 Marks)**

Module-5

9 a. What is Project Planning? Explain the project planning process with a neat diagram. **(10 Marks)**

b. Explain the following:
   i) Project scheduling
   ii) Estimation techniques **(10 Marks)**

OR

10 a. What is Software Quality? With a neat diagram, explain process based approach to achieve product quality. **(10 Marks)**

b. What is Software Review? Explain the software Review process with a neat diagram. **(10 Marks)**

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18CS36

Third Semester B.E. Degree Examination, June/July 2024
Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following :
(i) Proposition
(ii) Tautology
(iii) Contradiction
Verify whether the following compound proposition is a Tautology
$[(p \to q) \wedge (q \to r)] \to (p \to r)$ **(07 Marks)**

b. By constructing the Truth Table show that,
$[(p \vee q) \to r] \Leftrightarrow [(p \to r) \wedge (q \to r)]$ **(07 Marks)**

c. Let $p(x) : x^2 - 7x + 10 = 0$, $q(x) : x^2 - 2x + 3 = 0$, $r(x) : x < 0$
Find the truth or falsity of the following statements, when the universe U contains only the integers 2 and 5.
(i) $\forall x, p(x) \to \neg r(x)$ (ii) $\forall x, q(x) \to r(x)$ (iii) $\exists x\, q(x) \to r(x)$
(iv) $\exists x\, p(x) \to r(x)$ **(06 Marks)**

OR

2 a. Define Converse, Inverse and Contra-positive of a conditional. Represent these in the form of a truth table. **(07 Marks)**

b. For each of the following statements, provide an indirect proof by stating and proving the contrapositive of the given statement.
(i) For all integers k and ℓ, if k ℓ is odd, then both k and ℓ are odd.
(ii) For all integers k and ℓ, if k+ ℓ is even, then k and ℓ are both even and odd.
(07 Marks)

c. (i) I will get grade A in this coarse or I will not graduate.
If I do not graduate, I will join the army
I got grade A.

$\therefore$ I will not join the army.
Is this a valid argument?

(ii) If Ravi studies, he will pass in Discrete Mathematics paper
If Ravi does not paly PUBG, then he will study,
Ravi failed in Discrete Mathematics paper

$\therefore$ Ravi played PUBG
Check the validity of this argument. **(06 Marks)**

Module-2

3 a. Prove by mathematical induction that, for every positive integer n, 5 divides $n^5 - n$. **(06 Marks)**

b. For all positive integers n, prove that, if $n \geq 24$, then n can be written as a sum of 5's and 7's. **(07 Marks)**

c. Define the well ordering principle, by using mathematical induction principle, prove that $\frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{0.11} + \ldots\ldots + \frac{1}{(3n-1)(3n+2)} = \frac{n}{6n+4}$. **(07 Marks)**

OR

4 a. Prove by mathematical induction that, for every positive integer n, the number $11^{n+2} + 12^{2n+1}$ is divisible by 133. **(06 Marks)**

b. Determine the coefficient of,

(i) $x^{11}y^4$ in the expansion of $(2x^3 - 3xy^2 + z^2)^6$.

(ii) $a^2b^3c^2d^5$ in the expansion of, $(a + 2b - 3c + 2d + 5)^{16}$ **(07 Marks)**

c. In how many ways can one distribute eight identical balls into four distinct containers so that,

(i) No container is empty?

(ii) The fourth container gets an odd number of balls? **(07 Marks)**

Module-3

5 a. Let $f: R \to R$ be defined by $f(x) = \begin{cases} 3x - 5 & \text{for } x > 0 \\ -3x + 1 & \text{for } x \leq 0 \end{cases}$.

(i) Determine f(0), f(-1), $f\left(\frac{5}{3}\right), f\left(\frac{-5}{3}\right)$.

(ii) Find $f^{-1}[(-5,5)]$ **(07 Marks)**

b. Let $A = \{1, 2, 3, 4\}$, $B = \{a, b, c\}$, $C = \{3, 4, 7\}$. Write down the following $A \cup (B \times C)$, $(A \cup B) \times C$, $(A \times C) \cup B \times C$. **(07 Marks)**

c. Let f, g, h be functions from Z to Z defined by $f(x) = x - 1$, $g(x) = 3x$,

$h(x) = 0$ if x is even

$= 1$ if x is odd

Determine $(f \circ (g \circ h))(x) = ((f \circ g) \circ h)(x)$ and verify $(f \circ (g \circ h)) = ((f \circ g) \circ h)$. **(06 Marks)**

OR

6 a. State pigeonhole principle. Let ΔABC be an equilateral triangle of side 1 cm each. Show that if we select 10 points in the interior, there must be at least two points whose distance is less than $\frac{1}{2}$ cm. **(07 Marks)**

b. Draw Hasse diagram representing the positive divisors of 36. **(07 Marks)**

c. Let $A = \{1, 2, 3\}$ and f, g, h, p be functions on A defined as follows :

$f = \{(1,2)(2,3)(3,1)\}$, $g = \{(1,2)(2,1)(3,3)\}$, $h = \{(1,1)(2,2)(3,1)\}$, $p = \{(1,1)(2,2)(3,2)\}$

Find $f \circ g$, $g \circ f$, $f \circ p$, $p \circ g$, $g \circ p$, $f \circ h \circ g$ **(06 Marks)**

Module-4

7 a. Define derangement. **(07 Marks)**

(i) There are eight letters to eight different people to be placed in eight different addressed envelopes. Find the number of ways of doing this so that at least one letter goes to the right person.

(ii) Find the number of derangement of 1, 2, 3, 4.

b. Find the rook polynomial for the 3×3 board by using the expansion formula. **(07 Marks)**

c. Define homogeneous and non-homogeneous recurrence relations of first order and solve the recurrence relation.

$a_n = 5a_{n-1} + 6a_{n-2}$, $n \geq 2$, $a_0 = 1$, $a_1 = 5$. **(06 Marks)**

OR

8 a. Solve the following :

(i) From seven consonants and five vowels how many sets consisting of four different consonants and three different vowels can be formed?

(ii) Find the number of arrangement of the letters in TALLAHASSE. Which have no adjacent A's. **(07 Marks)**

b. How many integers between 1 and 300 (inclusive) are,

(i) Divisible by 5, 6, 8?

(ii) Divisible by none of 5, 6, 8? **(07 Marks)**

c. An apple, a banana, a mango and an orange are to be distributed to four boys B_1, B_2, B_3 and B_4. The boys B_1 and B_2 do not wish to have apple, the boy B_3 does not want banana or mango and B_4 refuses orange. In how many ways the distribution can be made so that no boy is displeased? **(06 Marks)**

Module-5

9 a. Define the following terms with respect to graph :

(i) Directed graph

(ii) A walk

(iii) Sub-graph

(iv) Connected graph

(v) Simple graph

(vi) Regular graph

(vii) Complete graph **(07 Marks)**

b. Define complete bipartite graph. How many vertices and how many edges are there in $K_{4,7}$ and K_{7111}? **(07 Marks)**

c. Let $G = (V, E)$ be the undirected graph in the Fig. Q9 (c). How many paths are there in G from a to h? How many of these paths have a length 5? **(06 Marks)**

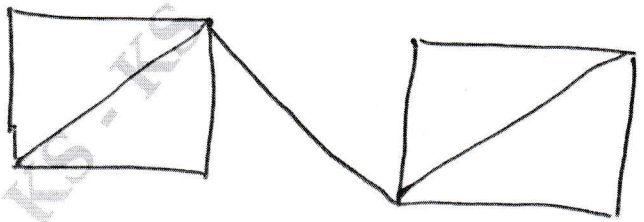

Fig. Q9 (c)

OR

10 a. Define a Tree. Prove that the tree G = (V, E) with P vertices has (P – 1) edges. **(07 Marks)**

b. Define a spanning tree of a graph. Find all the spanning trees of the following graph in Fig.Q10 (b). **(07 Marks)**

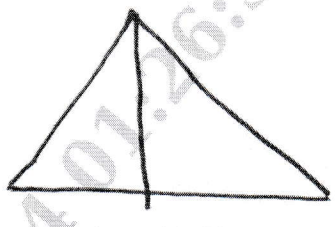

Fig. Q10 (b)

c. Obtain an optimal prefix code for the message LETTER RECEIVED using labelled binary tree. Indicate the code. **(06 Marks)**

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