CBCS SCHEME

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18MAT31

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:
i) $(3t+4)^2 + 5^t$
ii) $e^{-t}\cos^2 3t$
iii) $\dfrac{\cos at - \cos bt}{t}$ **(10 Marks)**

b. Given $f(t) = \begin{cases} E, & 0 < t < a/2 \\ -E, & a/2 < t < a \end{cases}$ where $f(t+a) = f(t)$, show that $L[f(t)] = \dfrac{E}{S}\tanh(as/4)$. **(05 Marks)**

c. Employ Laplace transform to solve the equation: $y'' + 5y' + 6y = 5e^{2t}$, taking $y(0) = 2$, $y'(0) = 1$. **(05 Marks)**

OR

2 a. Find the Inverse Laplace transform of:
i) $\dfrac{(s+2)^2}{s^6}$ ii) $\dfrac{s+1}{s^2+6s+9}$ iii) $\dfrac{3s+2}{s^2-s-2}$ **(10 Marks)**

b. Express $f(t) = \begin{cases} 1, & 0 < t \le 1 \\ t, & 1 < t \le 2 \\ t^2, & t > 2 \end{cases}$ in terms Heaviside's unit step function and hence find its Laplace transform. **(05 Marks)**

c. Find the Laplace transform of $\dfrac{s}{(s^2+a^2)^2}$ using convolution theorem. **(05 Marks)**

Module-2

3 a. Find the Fourier series expansion of f(x) = x – x^2 in $-\pi \le x \le \pi$. Hence deduce that $\dfrac{x^2}{12} = \dfrac{1}{1^2} - \dfrac{1}{2^2} + \dfrac{1}{3^2} - \dfrac{1}{4^2} + \ldots$ **(07 Marks)**

b. Find the half-range cosine series of f(x) = 2x-1 in the interval 0 < x < 1. **(06 Marks)**

c. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data:

x°	0	45	90	135	180	225	270	315
y	2	3/2	1	1/2	0	1/2	1	3/2

(07 Marks)

OR

4 a. Obtain the Fourier series of $f(x) = |x|$ in $(-l, l)$. Hence show that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$. **(07 Marks)**

b. Find the sine half range series of $f(x) = \begin{cases} \frac{1}{4} - x & \text{in} \quad 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{in} \quad \frac{1}{2} < x < 1 \end{cases}$ **(06 Marks)**

c. The following table gives the variations of a periodic current A over a certain period T:

t(sec)	0	T/6	T/3	T/2	2T/3	5T/6	T
A(amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

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

Module-3

5 a. If $f(x) = \begin{cases} 1 - x^2, & |x| < 1 \\ 0, & |x| \geq 1 \end{cases}$ find the Fourier transform of f(x) and hence find the value of $\int_0^\infty \frac{x\cos x - \sin x}{x^3} dx$. **(07 Marks)**

b. Find the Fourier sine and cosine transform of $f(x) = e^{-\alpha x}$, $\alpha > 0$. **(06 Marks)**

c. Solve $u_{n+2} + 4u_{n+1} + 3u_n = 3^n$, given $u_0 = 0$, $u_1 = 1$ by using z-transform. **(07 Marks)**

OR

6 a. 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)**

b. Find the Z-transform of $\cos\left(\frac{n\pi}{2} + \frac{\pi}{4}\right)$.

c. Find the inverse Z-transform of $\frac{3z^2 + 2z}{(5z - 1)(5z + 2)}$. **(06 Marks)**

(07 Marks)

Module-4

7 a. Solve $\frac{dy}{dx} = x - y^2$, $y(0) = 1$ using Taylor's series method considering upto fourth degree terms and find the value of $y(0.1)$. **(07 Marks)**

b. Using Runge-Kutta method of fourth order, find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}$, $y(0) = 1$ taking $h = 0.2$. **(06 Marks)**

c. Apply Milne's method to compute $y(1.4)$ correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and the data: $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.4649$, $y(1.3) = 2.7514$. **(07 Marks)**

OR

8 a. Using modified Euler's method find y(20.2) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5 taking h = 0.2. **(07 Marks)**

b. Use Fourth order Runge-Kutta method to compute y(1.1) given that $\frac{dy}{dx} = xy^{1/3}$, y(1) = 1. **(06 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040 and y(0.3) = 2.090, find y(0.4) using Adams – Bashforth predictor-corrector method. **(07 Marks)**

Module-5

9 a. Given $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} - 2xy = 1$, y(0) = 1, y′(0) = 0, evaluate y(0.1) using Runge-Kutta method of 4^{th} order. **(07 Marks)**

b. Find the external of the functional $\int_{x_1}^{x_2}\left(y'^2 - y^2 + 2y\sec x\right)dx$. **(06 Marks)**

c. Derive Euler's equation in the standard form:

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0.$$ **(07 Marks)**

OR

10 a. 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

(07 Marks)

b. Find the external of the functional $\int_0^{\pi/2}(y^2 - y'^2 - 2y\sin x)\,dx$ under the end conditions y(0) = 0, y(π/2) = 0. **(06 Marks)**

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

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CBCS SCHEME

USN 1KS21CS402 **18MATDIP31**

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Express the complex number $\frac{5+5i}{3-4i}$ in the form x + iy. **(06 Marks)**

b. Find the amplitude and modulus of the complex number $\frac{4+2i}{2-3i}$ **(07 Marks)**

c. Prove that $(1+\cos\theta+i\sin\theta)^n+(1+\cos\theta-i\sin\theta)^n = 2^{n+1}.\cos^n\frac{\theta}{2}\cos\left(\frac{n\theta}{2}\right)$ **(07 Marks)**

OR

2 a. Show that the points A(–1, 4, –3), B(3, 2, –5), C(–3, 8, –5) and D(–3, 2, 1) are coplanar. **(06 Marks)**

b. Find the cube roots of $1-i$ **(07 Marks)**

c. Find the sine of the angle between $\vec{a}=4\hat{i}-\hat{j}+3\hat{k}$ and $\vec{b}=-2\hat{i}+\hat{j}-2\hat{k}$. **(07 Marks)**

Module-2

3 a. Prove that $\sqrt{1+\sin 2x}=1+x-\frac{x^2}{2}-\frac{x^3}{6}+\frac{x^4}{24}+\ldots\ldots$ by using Maclaurin's series. **(06 Marks)**

b. If $u=f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$ prove that $x.\frac{\partial u}{\partial x}+y.\frac{\partial u}{\partial y}+z.\frac{\partial u}{\partial z}=0$ **(07 Marks)**

c. If $u=\tan^{-1}\left(\frac{x^3y^3}{x^3+y^3}\right)$ prove that $x.\frac{\partial u}{\partial x}+y.\frac{\partial u}{\partial y}=\frac{3}{2}\sin 2u$. **(07 Marks)**

OR

4 a. Obtain the Maclaurin's series expansion of e^x. **(06 Marks)**

b. If $u=e^{x^3+y^3}$ prove that $x.\frac{\partial u}{\partial x}+y.\frac{\partial u}{\partial y}=3u\log u$ **(07 Marks)**

c. If $u=x-y$ and $v=\frac{1}{x-y}$, find $\frac{\partial(u,v)}{\partial(x,y)}$ **(07 Marks)**

Module-3

5 a. Find the directional derivative of x^2yz^3 at (1, 1, 1) in the direction of $\hat{i}+\hat{j}+2\hat{k}$. **(06 Marks)**

b. A particle moves along a curve $x = e^{-t}$, $y = 2\cos 3t$, $z = 2\sin 3t$, where t is the time. Determine the component of velocity and acceleration at t = 0 in the direction of $\hat{i}+\hat{j}+\hat{k}$. **(07 Marks)**

c. Find the angle between the tangents to the curve $x=t^2$, $y=t^3$, $z=t^4$ at t = 2 and t = 3. **(07 Marks)**

OR

6 a. Find div $\vec{F}$ and curl $\vec{F}$ where $\vec{F} = \nabla(xy + yz + zx)$ **(06 Marks)**

b. Find the constants a, b, c such that the vector

$\vec{F} = (x + y + az)\hat{i} + (x + cy + 2z)\hat{k} + (bx + 2y - z)\hat{j}$ is irrotational. **(07 Marks)**

c. If $\vec{F} = 2x^2\hat{i} - 3yz\hat{j} + xz^2\hat{k}$ and $\phi = 2z - x^3y$, find $\vec{F}\cdot(\nabla\phi)$ and $\vec{F}\times(\nabla\phi)$ at $(1, -1, 1)$. **(07 Marks)**

Module-4

7 a. Find the reduction formula for $\int \cos^n x.dx \;:\; n > 0$ **(06 Marks)**

b. Evaluate $\int_0^a \frac{x^4}{\sqrt{a^2 - x^2}} dx$ **(07 Marks)**

c. Evaluate $\int_0^1 \int_{x^2}^{x} (x^2 + 3y + 2)\, dy.dx$ **(07 Marks)**

OR

8 a. Find the reduction formula for $\int \sin^n x.dx \;:\; n > 0$ **(06 Marks)**

b. Evaluate $\int_0^{\pi} x.\cos^6 x.dx$ **(07 Marks)**

c. Evaluate $\int_0^a \int_0^a \int_0^a e^{x+y+z}\, dx\, dy\, dz$ **(07 Marks)**

Module-5

9 a. Solve : $\frac{dy}{dx} = -\frac{y}{x} + y^2 x$ **(06 Marks)**

b. Solve $y \sin 2x\, dx - (1 + y + \cos^2 x)dy = 0$ **(07 Marks)**

c. Solve $x.\frac{dy}{dx} + y = x^3 y^6$ **(07 Marks)**

OR

10 a. Solve $\frac{dy}{dx} = \frac{x^2 - 2xy}{x^2 - \sin y}$ **(06 Marks)**

b. Solve $dx + x\, dy = e^{-y}.\sec y\, dy$ **(07 Marks)**

c. Solve $3x(x + y^2)dy + (x^3 - 3xy - 2y^3)dx = 0$ **(07 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | **18CS32**

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. Compare Structures and Unions. **(04 Marks)**

b. Define data structures. Give its classifications. What are the basic operations that can be performed on data structures? **(08 Marks)**

c. What is a Sparse matrix? Write the ADT of sparse matrix. Give the triplet form of a given matrix and also find its transpose.

$$A = \begin{bmatrix} 7 & 0 & 0 & 0 & 0 \\ 0 & 0 & 9 & 0 & 0 \\ 3 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 5 \end{bmatrix}$$

Fig.Q1(c) **(08 Marks)**

OR

2 a. Define polynomial? Explain with example how $A(x) = 3x^{23} + 3x^4 + 4x^2 + 15$ and $B(x) = x^5 + 20x^3 + 2$, are stored in a 1-D array? **(06 Marks)**

b. What are the structures used to store strings in memory? Explain with examples. **(06 Marks)**

c. Write a C program to demonstrate the basic operations on arrays. **(08 Marks)**

Module-2

3 a. Define Stack. Write C functions for demonstrating various stack operations. **(08 Marks)**

b. Write an algorithm to evaluate postfix expression and trace the same on given expressions:

i) 1 2 3 + * 3 2 1 − + *

ii) 6 2 3 + − 3 8 2 / + * 2 $ 3 + **(08 Marks)**

c. Write the postfix form of the following expression using stack:

i) (a + b) * d + e / (f + a * d) + c

ii) ((a / (b − c + d)) * (e − a) * c) **(04 Marks)**

OR

4 a. Define queue. Write QINSERT and QDELETE procedures for queues using arrays. **(10 Marks)**

b. What is Recursion? Write recursion procedure for (i) Finding GCD of two numbers. (ii) To find n Fibonacci numbers. **(10 Marks)**

Module-3

5 a. What is a linked list? List and explain the different types of linked list with examples. **(08 Marks)**

b. Write the following algorithms for singly linked list:

(i) Inserting ITEM as the first node in the list.

(ii) Deleting the last node in the list. **(08 Marks)**

c. What is the advantage of doubly linked list over singly linked list? Illustrate with an example. **(04 Marks)**

OR

6 a. Write a node structure for linked representation of a polynomial. Explain the algorithm to add two polynomials represented using linked list. **(08 Marks)**

b. Write C functions insert_front( ) and delete_front( ) using doubly linked list. **(08 Marks)**

c. For the given Sparse matrix, give the linked list representation.

$$A = \begin{bmatrix} 0 & 0 & 4 & 0 & 0 \\ 6 & 5 & 0 & 0 & 0 \\ 0 & 3 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 2 \end{bmatrix}$$

(04 Marks)

Module-4

7 a. What is a tree? With suitable example, define

(i) Binary tree (ii) Complete binary tree (iii) Strictly Binary tree (iv) Skewed binary tree. **(10 Marks)**

b. Consider the following tree T in Fig.Q7(b). Write the preorder, inorder and postorder traversals for the tree T along with C functions. Also find the depth of tree T.

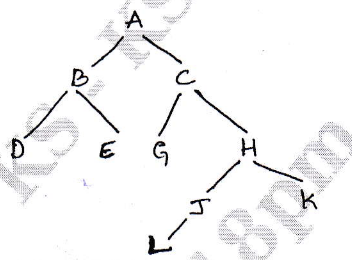

Fig.Q7(b) **(10 Marks)**

OR

8 a. Write the recursive search and iterative search algorithm for a binary search tree. **(08 Marks)**

b. For the given data, draw a binary search tree and show the array and linked representation of the same.

100, 85, 45, 55, 110, 20, 70, 65 **(06 Marks)**

c. What is the advantage of threaded binary tree over binary tree? Construct the threaded binary tree for 10, 20, 30, 40, 50. **(06 Marks)**

Module-5

9 a. What is a graph? Give the difference between graph and tree. For the given graph [Fig.Q9(a)], show the adjacency matrix and adjacency list representation of the graph.

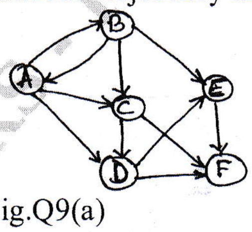

Fig.Q9(a) **(08 Marks)**

b. Write an algorithm for Breadth first search and depth first search. **(08 Marks)**

c. Define the following terms with examples:

i) Multigraph ii) Complete graph. **(04 Marks)**

OR

10 a. What is hashing? Explain any 3 popular Hash functions. **(08 Marks)**

b. Write an algorithm for Radix sort. **(06 Marks)**

c. Summarize any 3 widely used file organization techniques. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | | **18CS33**

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. Explain the construction and working principle of LED. **(05 Marks)**

b. List the types of transistor biasing. Explain Fixed Bias Circuit with necessary analysis. **(06 Marks)**

c. Explain the operation of astable multivibrator using IC555 and derive the expression for time period, frequency and duty cycle. **(09 Marks)**

OR

2 a. Explain the operation of peak detector circuit with neat diagram. **(05 Marks)**

b. List and explain the performance parameters of regulated power supply. **(06 Marks)**

c. Explain the 3 bit flush type ADC with necessary circuit and truth table. **(09 Marks)**

Module-2

3 a. Find the minimum sum of products using K-map and identify prime implicants.
$f(a,b,c,d) = \sum m(0,2,6,10,11,12,13) + d(3,4,5,14,15)$ **(06 Marks)**

b. Find the minimum SOP and POS using K-map.
$f(a,b,c,d) = \sum m(6,7,9,10,13) + d(1,4,5,11)$ **(08 Marks)**

c. List the steps for Petrick's method. **(06 Marks)**

OR

4 a. Find all the prime implicants using Quine Mc Cluskey method. Verify the result using K-map.
$f(w,x,y,z) = \sum m(7,9,12,13,14,15) + d(4,11)$ **(12 Marks)**

b. Using Prime implication chart, find all the minimum SOP of the function using Quine McCluskey method.
$f(a,b,c,d) = \sum m(0,1,2,3,10,11,12,13,14,15)$ **(08 Marks)**

Module-3

5 a. Realize the function using only two input NAND gate and inverters.
$f_1 = \sum m(0,2,3,4,5)$, $f_2 = \sum m(0,2,3,4,7)$, $f_3 = \sum m(1,2,6,7)$ **(06 Marks)**

b. Draw the timing diagram of the circuit. Assume propagation delay of each gate is 20 ns. **(05 Marks)**

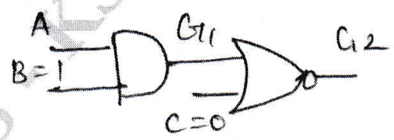

Fig. Q5 (b) – (i)

Fig. Q5 (b) – (ii)

c. List the types of hazards. Explain how static 1 hazard can be detected and removed with suitable example. **(09 Marks)**

OR

6 a. Write short notes on three state buffers. **(06 Marks)**

b. Design 7-segment decoder using PLA. **(06 Marks)**

c. Construct 8 : 1 mux using only 2 : 1 mux. **(08 Marks)**

Module-4

7 a. Given that A = "00101101" and B = "10011". Determine the value of F

F<=not B & "0111" or A&"1" and "1"&A **(04 Marks)**

b. Write the complete VHDL code for 4 bit binary adder. **(08 Marks)**

c. Explain how the VHDL code can be compiled simulated and synthesized with example. **(08 Marks)**

OR

8 a. Explain T Flip Flop with truth table. **(07 Marks)**

b. Explain Master-Slave JK flip flop with neat diagram. **(08 Marks)**

c. Write short notes on switch debouncing with an SR Latch. **(05 Marks)**

Module-5

9 a. Explain 8 bit serial in serial out shift register. **(10 Marks)**

b. Explain n bit parallel adder with accumulator. **(10 Marks)**

OR

10 a. Design and explain mod 8 synchronous counter using JK flip flop. **(10 Marks)**

b. Explain how moore transition and states can be constructed with examples. **(10 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

18CS34

Third Semester B.E. Degree Examination, Jan./Feb. 2023
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 concepts of a computer. Give the operating steps. **(10 Marks)**

b. Explain Big Endian and little Endian assignment. Consider a computer that has a byte addressable memory organized in 32 WORDS, according to a Big Endian scheme. A program reads ASCIL characters entered at a keyboard and store them in successive byte location starting at 3000. Show how the contents of 3 memory words at location 3000, 3004 and 3008 after the string "VTU BELAGAVI" has been entered.
(ASCII codes : V = 56H, T = 54H, U = 55H, " " = 20H, B = 42H, E = 45H, L = 4CH, A = 41H, G = 47H, I = 49H) **(10 Marks)**

OR

2 a. Define an addressing mode. Explain any 4 types of addressing modes with suitable example. **(10 Marks)**

b. Register R_1 and R_2 of computer contains the decimal values 1200 and 4600. What is effective address of the memory operand in each of following instructions :
(i) LOAD 20(R_1), R_5
(ii) MOVE #3000, R_5
(iii) SUBSTRACT (R_1)+, R_5
(iv) STORE 30(R_1, R_2), R_5
(v) ADD $-(R_2), R_5$ **(05 Marks)**

c. Explain logical shift instructions with examples. **(05 Marks)**

Module-2

3 a. List the difference between memory mapped I/O and I/O mapped I/O. **(04 Marks)**

b. With neat sketches, explain various methods for handling multiple interrupts requests raised by multiple devices. **(08 Marks)**

c. With neat diagram, explain centralized bus arbitration and distributed bus arbitration. **(08 Marks)**

OR

4 a. Explain the I/O interface for an input device to the processor with a neat block diagram. **(08 Marks)**

b. With neat diagram, explain synchronous bus transfer during an input operation. **(06 Marks)**

c. Explain the tree structure of USB with split bus operation. **(06 Marks)**

Module-3

5 a. Explain the organization of 1K*1 memory chip. **(06 Marks)**

b. With neat diagram, explain the internal organization of 2M*8 dynamic memory chip. **(10 Marks)**

c. Explain the memory hierarchy with respect to speed, size and cost. **(04 Marks)**

OR

6 a. Design a memory organization of 2M*32 memory module using 512K*8 static memory chips and explain the same. **(08 Marks)**

b. Illustrate the cache mapping techniques. **(06 Marks)**

c. Calculate the average access time experienced by a processor, if cache hit rate is 0.88, Miss penality is 0.015 ms and cache access time 10 ms? **(06 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 overflow occurs in each case :

(i) 6, 10 (ii) −3,−8 (iii) −10,−13 (iv) −14,11 **(10 Marks)**

b. Describe the principle of carry-look Ahead addition for 4-bit adder circuit, built using B-cells and calculate the number of gate delays for S_3 and C_4. **(10 Marks)**

OR

8 a. Explain Booth multiplication algorithm. Apply the same to multiply signed number −13 and 9. **(08 Marks)**

b. Perform the division of numbers 8 by 3 (8÷3) using Restoring Division Method. **(08 Marks)**

c. Design a logic circuit to perform addition / substraction of 2n-bit numbers X and Y. **(04 Marks)**

Module-5

9 a. Illustrate the sequence of operations required to execute the instruction ADD (R_3), R_1 on a single Bus processor. **(10 Marks)**

b. Explain the 3 Bus organization of a data path with a neat diagram. **(10 Marks)**

OR

10 a. With neat diagram, explain the microprogrammed control method for design of control unit and write the micro-routine for instruction BRANCH < 0. **(10 Marks)**

b. Bring out the difference between micro programmed and Hard wired control. **(04 Marks)**

c. With neat diagram, explain 4-stage pipeline. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

18CS35

Third Semester B.E. Degree Examination, Jan./Feb. 2023
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. Identify and explain principal stages of spiral model with a neat diagram. Mention its advantages and disadvantages. **(10 Marks)**

b. Identify IEEE principle of code of ethics in software engineering. **(05 Marks)**

c. Organize and explain structure of software requirement document. **(05 Marks)**

OR

2 a. Identify and explain functional and non-functional requirements in software engineering. **(10 Marks)**

b. Build and explain Insulin pump control system with a neat diagram. **(10 Marks)**

Module-2

3 a. What is object orientation and object oriented development? Identify and explain 3 models with an example for each. **(10 Marks)**

b. Identify and explain object oriented themes in detail with an example for each. **(10 Marks)**

OR

4 a. Making use of object oriented concepts explain link and association, with an example for each. **(10 Marks)**

b. Apply generalization and inheritance in object oriented development, explain each with an example. **(10 Marks)**

Module-3

5 a. What is system modeling? Identify and list different types of system models. Explain any 2 system models with a neat diagram. **(10 Marks)**

b. Build and explain a sequence model to show the operations of mental health care patient monitoring system. **(10 Marks)**

OR

6 a. Explain Rational Unified Process. Identify and describe the phases of RUP with a neat diagram and mention its importance in software engineering. **(08 Marks)**

b. Identify and explain basic 5 phases of object oriented design using UML. **(07 Marks)**

c. Identify and explain the features of open source development and licensing. **(05 Marks)**

Module-4

7 a. What is development testing? Explain test driven development in software engineering, with a neat diagram. **(10 Marks)**

b. Identify and explain six stages of acceptance testing process with a neat diagram and an example. **(10 Marks)**

OR

8 a. What is software evolution? Explain with a neat diagram. Mention different types of software maintenance and explain. **(08 Marks)**

b. With "Program Evolution Dynamics", identify and explain Lehman's law in software engineering process. **(08 Marks)**

c. Identify and list strategic options for legacy system management. **(04 Marks)**

Module-5

9 a. What is software pricing? Examine the factors affecting software process in software pricing. **(06 Marks)**

b. What are estimation techniques? List and explain COCOMO II model with a neat diagram. **(08 Marks)**

c. Explain Plan driven development with project plans and planning process with a neat diagram. **(06 Marks)**

OR

10 a. Identify and explain software quality attributes, software standards and its types in detail. **(08 Marks)**

b. Identify and explain Inspection checklist in software engineering reviews and inspections. **(06 Marks)**

c. Identify and explain Software Product metrics with software component analysis. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | |

18CS36

Third Semester B.E. Degree Examination, Jan./Feb. 2023
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. Test the validity of the following :

(i)
$$\begin{array}{l} p \wedge q \\ q \rightarrow r \\ r \rightarrow s \\ \hline \therefore s \end{array}$$

(ii)
$$\begin{array}{l} p \vee q \\ \neg p \vee r \\ \neg r \rightarrow s \\ \hline \therefore q \end{array}$$

(06 Marks)

b. State the converse inverse and contrapositive of the following conditions:
"If a triangle is not isosceles, then it is not equilateral". **(06 Marks)**

c. Prove that the following argument is valid
$$\begin{array}{l} \forall x\, [p(x) \rightarrow q(x)] \\ \forall x, [q(x) \rightarrow r(x)] \\ \hline \therefore \forall x\, [p(x) \rightarrow r(x)] \end{array}$$
(04 Marks)

d. Prove that for all integers m and n, if m and n are both odd, then m + n is even and mn is odd. **(04 Marks)**

OR

2 a. Simplify the following compound proposition using the laws of logic
i) $(p \vee q) \wedge [\neg\{(\neg p) \wedge q\}]$ ii) $(p \vee q) \wedge \{(\neg p \wedge \neg p) \wedge q\} \Leftrightarrow \neg p \wedge q$ **(06 Marks)**

b. Prove that for any proposition p, q, r the compound proposition
$[(p \vee q) \wedge \{(p \rightarrow q) \wedge (q \rightarrow r)\}]$ is a tautology. **(05 Marks)**

c. Determine the truth value of each of the following quantified statement, the universe being the set of all non zero integers.
(i) $\exists x, \exists y\, [xy = 1]$ (ii) $\exists x\, \forall y[xy = 1]$ (iii) $\forall x\, \exists y[xy = 1]$
(iv) $\exists x\, \exists y\, [(2x+y=5) \wedge (x - 3y = 8)]$ **(04 Marks)**

d. Simplify the following switch network.

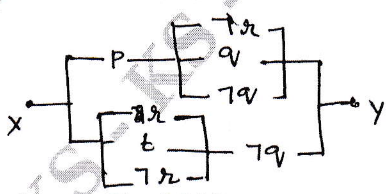

Fig.Q2(d) **(05 Marks)**

Module-2

3 a. Show that $1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = \dfrac{n(n+1)(2n+1)}{6}$ **(06 Marks)**

b. $a_n = a_{n-1} + a_{n-2} + a_{n-3}$ for $n \geq 3$ prove that $a_n \leq 3^n$. **(07 Marks)**

c. How many ways 10 roses, 14 sunflowers, 15 daffodils can be distributed among 3 girls? **(07 Marks)**

OR

4 a. Prove that $3 + 3^2 + 3^3 + \ldots + 3^n = \frac{3(3^n - 1)}{2}$. **(07 Marks)**

b. Find the number of signals that can be generated using six different colored flags when any number of them may be hoisted at any time. **(07 Marks)**

c. Determine the co-efficient xyz^2 in the expansion of $(2x - y - z)^4$. **(06 Marks)**

Module-3

5 a. For any non-empty set A, B, C prove that $(A \cap B) \times C = (A \times C) \cap (B \times C)$. **(05 Marks)**

b. Let A = {1, 2, 3, 4, 5, 6, 7} and B = {w, x, y, z}. Find the number of onto functions from A to B. **(07 Marks)**

c. Let f, g, h be functions from z to z defined by $f(x) = x - 1$, $g(x) = 3x$, $h(x) = \begin{cases} 0 \text{ if } x \text{ is even} \\ 1 \text{ if } x \text{ is odd} \end{cases}$, determine f o (g o h) (x) = (f o g) o h(x) and verify that f o (g o h)(x) = (fog) o h(x). **(08 Marks)**

OR

6 a. How many persons must be chosen in order that at least seven of them will have birthday in the same calendar month? **(04 Marks)**

b. For a given set A = {1, 2, 3, 4} and let R be a relation on A. R = {(1, 2) (1, 3) (1, 4) (2, 3) (2, 4) (3, 4) (2, 1) (3, 1) (4, 1)}.

i) Draw the diagraph of R.

ii) Determine the indegree and outdegree of the vertices in the diagraph. **(06 Marks)**

c. Find the number of edges used in Hasse diagram, for the Poset [{2, 3, 6, 12, 15, 48, 120, 240}, where x divides y]. Also determine maximal and minimal elements in Poset upper bound and lower bound LUB and GLB for the set B = {12, 15}. **(10 Marks)**

Module-4

7 a. How many solutions are there to $x_1 + x_2 + x_3 = 17$ where $x_i \leq 7$ for $1 \leq i \leq 3$. **(07 Marks)**

b. A Girl student has sarees of 5 different colors blue, green, red, white and yellow. On Monday she does not wear green, on Tuesdays blue or red, on Wednesday blue or green, on Thursday red or yellow, on Friday red. In how many ways can she dress without repeating a color during a week? **(07 Marks)**

c. The number of virus affected files in a system is 1000 (to start with) and this number increases 250% every two hours. Use a recurrence relation to determine the number of virus affected files in the system after one day. **(06 Marks)**

OR

8 a. In how many ways can the 26 letters of the English alphabet be permuted so that none of the patterns FUN, CASE, FLOW occur. **(07 Marks)**

b. In how many ways can you put 7 fruits into their respective fruit box such that exactly 3 go into the right fruit boxes? **(06 Marks)**

c. Determine rook polynomial for the following :

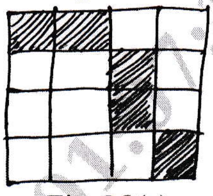

Fig.Q8(c) **(07 Marks)**

Module-5

9 a. For the graph mentioned below :

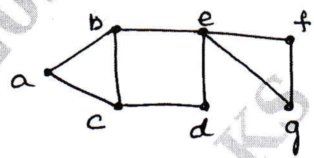

Fig.Q9(a)

What vertices would you use to

i) Determine a walk from b to d that is not a trail.

ii) Determine b to d trial is not a path.

iii) A path from b to d.

iv) A closed walk from b to b that is not a cycle.

v) A cycle from b to b. **(10 Marks)**

b. Prove that every tree T = < V, E > = | E | + 1 = | V |. **(05 Marks)**

c. Construct an optimal prefix code for the symbols a, o, q, u, y, z, that occur with frequencies 20, 28, 4, 17, 12, 7 respectively. **(05 Marks)**

OR

10 a. Define the following with an example :

i) Induced graph ii) Complete graph iii) Isomorphic graph. **(10 Marks)**

b. Prove that for every tree T = < V, E >, if | V | ≥ 2, then T has at least two pendant vertices. **(05 Marks)**

c. Illustrate with an example Eulerian Graph. **(05 Marks)**

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