CBCS SCHEME

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18MAT31

Third Semester B.E. Degree Examination, Feb./Mar. 2022
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. Evaluate (i) $L\left\{\frac{\cos 2t - \cos 3t}{t}\right\}$ (ii) $L(t^2 e^{-3t} \sin 2t)$ **(06 Marks)**

b. If $f(t) = \begin{cases} t, & 0 \le t \le a \\ 2a - t, & a \le t \le 2a \end{cases}$, $f(t+2a) = f(t)$ then show that $L(f(t)) = \frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$ **(07 Marks)**

c. Solve by using Laplace Transforms

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

OR

2 a. Evaluate $L^{-1}\left(\frac{4s+5}{(s+1)^2(s+2)}\right)$ **(06 Marks)**

b. Find $L^{-1}\left(\frac{s}{(s^2+a^2)^2}\right)$ by using convolution theorem. **(07 Marks)**

c. Express $f(t) = \begin{cases} \sin t, & 0 \le t < \pi \\ \sin 2t, & \pi \le t < 2\pi \\ \sin 3t, & t \ge 2\pi \end{cases}$

in terms of unit step function and hence find its Laplace Transform. **(07 Marks)**

Module-2

3 a. Obtain fourier series for the function $f(x) = |x|$ in $(-\pi, \pi)$ **(06 Marks)**

b. Expand $f(x) = \frac{(\pi - x)^2}{4}$ as a Fourier series in the interval $(0, 2\pi)$ and hence deduce that

$$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots\dots\dots$$ **(07 Marks)**

c. Express y as a Fourier series upto the second harmonic given :

x:	0	60	120	180	240	300
y:	4	3	2	4	5	6

(07 Marks)

OR

4 a. Find the Half-Range sine series of $\pi x - x^2$ in the interval $(0, \pi)$ **(06 Marks)**

b. Obtain fourier expansion of the function $f(x) = 2x - x^2$ in the interval $(0, 3)$. **(07 Marks)**

c. Obtain the Fourier expansion of y upto the first harmonic given :

x	0	1	2	3	4	5
y	9	18	24	28	26	20

(07 Marks)

Module-3

5 a. If $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$, find the Fourier transform of f(x) and hence find the value of $\int_0^\infty \frac{\sin x}{x} dx$ (06 Marks)

b. Find the infinite Fourier cosine transform of $e^{-\alpha x}$. (07 Marks)

c. Solve using z-transform $y_{n+2} - 4y_n = 0$ given that $y_0 = 0, y_1 = 2$ (07 Marks)

OR

6 a. Find the fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx$; $m > 0$. (06 Marks)

b. Obtain the z-transform of $\cos n\theta$ and $\sin n\theta$. (07 Marks)

c. Find the inverse z-transform of

$$\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$$

(07 Marks)

Module-4

7 a. Solve $\frac{dy}{dx} = x^3 + y$, $y(1) = 1$ using Taylor's series method considering up to fourth degree terms and find y(1.1). (06 Marks)

b. Given $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$ compute y(0.2) by taking h = 0.2 using Runge – Kutta method of fourth order. (07 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) correct to 4 decimal places using Adams-Bashforth method. (07 Marks)

OR

8 a. Use fourth order Runge-Kutta method, to find y(0.8) with h = 0.4, given $\frac{dy}{dx} = \sqrt{x+y}$, y(0.4) = 0.41 (06 Marks)

b. Use modified Euler's method to compute y(20.2) and y(20.4) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5 Taking h = 0.2. (07 Marks)

c. Apply Milne's predictor-corrector formulae to compute y(2.0) given $\frac{dy}{dx} = \frac{x+y}{2}$ with

x	0.0	0.5	1.0	1.5
y	2.000	2.6360	3.5950	4.9680

(07 Marks)

Module-5

9 a. Using Runge-Kutta method, solve

$\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$, for x = 0.2, correct to four decimal places, using initial conditions $y(0) = 1, y'(0) = 0$ **(07 Marks)**

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

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

OR

10 a. Given the differential equation $2\frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$ and the following table of initial values:

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y′	2	2.3178	2.6725	2.0657

Compute y(1.4) by applying Milne's Predictor-corrector formula. **(07 Marks)**

b. Prove that geodesics of a plane surface are straight lines. **(07 Marks)**

c. On what curves can the functional $\int_0^1 (y'^2 + 12xy)\,dx$ with y(0) = 0, y(1) = 1 can be extremized? **(06 Marks)**

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CBCS SCHEME

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18MATDIP31

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Additional Mathematics – I

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 modulus and amplitude of the complex number : $\dfrac{(2-3i)(2+i)^2}{1+i}$. **(07 Marks)**

b. Prove that $\left(\dfrac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i\sin n\theta$. **(06 Marks)**

c. Show that the vectors $\vec{a}-2\vec{b}+3\vec{c}$, $-2\vec{a}+3\vec{b}-4\vec{c}$, $-\vec{b}+2\vec{c}$ are coplanar. **(07 Marks)**

OR

2 a. Given $\vec{a}=2\hat{i}+2\hat{j}-\hat{k}$, $\vec{b}=6\hat{i}-3\hat{j}+2\hat{k}$. Find : i) $\vec{a}\cdot\vec{b}$ ii) $\vec{a}\times\vec{b}$ iii) $|\vec{a}\times\vec{b}|$. **(07 Marks)**

b. Determine the value of λ, so that $\vec{a}=2\hat{i}+\lambda\hat{j}-\hat{k}$, and $\vec{b}=4\hat{i}-2\hat{j}-2\hat{k}$, are perpendicular. **(06 Marks)**

c. Express $1-i\sqrt{3}$ in the polar form and hence find its modulus and amplitude. **(07 Marks)**

Module-2

3 a. Using Euler's theorem, prove that $xu_x + yu_y = -3\cot u$ where $u=\sin^{-1}\left(\dfrac{x^2y^2}{x+y}\right)$. **(07 Marks)**

b. Using Maclaurin's series, prove that $\sqrt{1+\sin 2x} = 1 + x - \dfrac{x^2}{2} - \dfrac{x^3}{3} + \dfrac{x^4}{24} + \ldots\ldots$. **(06 Marks)**

c. If $u = x + 3y^2$, $v = 4x^2yz$, $w = 2z^2 - xy$, evaluate $\dfrac{\partial(u,v,w)}{\partial(x,y,z)}$ at the point $(1, -1, 0)$. **(07 Marks)**

OR

4 a. Obtain Maclaurin's series expansion for the function e^x upto x^4. **(07 Marks)**

b. If $u=\sin^{-1}\left[\dfrac{x^3+y^3}{x+y}\right]$ prove that $x\dfrac{\partial u}{\partial x}+y\dfrac{\partial u}{\partial y} = 2\tan u$. **(06 Marks)**

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

Module-3

5 a. A particle moves along the curve $x = (1-t^3)$, $y=(1+t^2)$, $z=(2t-5)$ determine its velocity and acceleration at t = 1 sec. **(07 Marks)**

b. 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 $(1, -1, 1)$. **(06 Marks)**

c. Find the constants a, b, c so that $\vec{f} = (x+2y+az)\hat{i} + (bx-3y-z)\hat{j} + (4x+cy+2z)\hat{k}$ is irrotational. **(07 Marks)**

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.

OR

6 a. Find the directional derivate of $\phi = x^2yz + 4xz^2$ at $(1,-2,-1)$ along $\vec{a} = 2\hat{i} - \hat{j} - 2\hat{k}$ **(07 Marks)**

b. Find curl $\vec{f}$ given that $\vec{f} = xyz^2\hat{i} + xy^2z\hat{j} + x^2yz\hat{k}$. **(06 Marks)**

c. If $\vec{f} = x^2i + y^2j + z^2k$ and $\vec{g} = yzi + zxj + xyk$. Show that $\vec{f} \times \vec{g}$ is a solenoidal vector. **(07 Marks)**

Module-4

7 a. Obtain the reduction formula, $I_n = \int \cos^n x dx$, where n is a positive integer. **(07 Marks)**

b. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xydydx$. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^1 \int_0^1 (x + y + z)dxdydz$. **(07 Marks)**

OR

8 a. Evaluate : $\int_0^{\pi/6} \sin^6(3x)dx$. **(07 Marks)**

b. Evaluate : $\int_0^{\pi} x \sin^4 x \cos^6 x \, dx$. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^1 \int_0^y xyz \, dxdydz$. **(07 Marks)**

Module-5

9 a. Solve : $(2x + y + 1)\,dx + (x + 2y + 1)\,dy = 0$. **(07 Marks)**

b. Solve : $(4xy + 3y^2 - x)\,dx + (x^2 + 2xy)\,dy = 0$. **(06 Marks)**

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

OR

10 a. Solve : $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)dy = 0$. **(07 Marks)**

b. Solve : $y(2xy + 1)dx - x\,dy = 0$. **(06 Marks)**

c. Solve : $\frac{dy}{dx} + y\cot x = \cos x$. **(07 Marks)**

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CBCS SCHEME

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Third Semester B.E. Degree Examination, Feb./Mar. 2022
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. Explain the various operations on Data structures. **(06 Marks)**

b. Define Structures. Explain the types of structures with examples for each. **(07 Marks)**

c. List and explain the functions supported in C for Dynamic Memory Allocation. **(07 Marks)**

OR

2 a. Define Pattern Matching. Write the Knuth Morris Pratt Pattern matching algorithm and apply the same to search the pattern ‘abcdabcy’ in the text ‘abcxabcdabxabcdabcy’. **(10 Marks)**

b. Write the Fast Transpose algorithm to transpose the given Sparse Matrix. Express the given Sparse Matrix as triplets and find its transpose.

$$A = \begin{bmatrix} 10 & 0 & 0 & 25 & 0 \\ 0 & 23 & 0 & 0 & 45 \\ 0 & 0 & 0 & 0 & 32 \\ 42 & 0 & 0 & 31 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 30 & 0 & 0 \end{bmatrix}.$$

(10 Marks)

Module-2

3 a. Define Stacks. List and explain the various operations on stacks using arrays with stack overflow and stack underflow conditions. **(10 Marks)**

b. Write an algorithm to convert an infix expression to postfix expression and also trace the same for the expression (a + b) * d + e/f + c. **(10 Marks)**

OR

4 a. Define Recursion. Explain the types of recursion. Write the recursive function for
i) Factorial of a number ii) Tower of Hanoi. **(10 Marks)**

b. Give the Ackermann function and apply the same to evaluate A(1, 2). **(04 Marks)**

c. Explain the various operations on Circular queues using arrays. **(06 Marks)**

Module-3

5 a. Give the node structure of create a single linked list of integers and write the functions to perform the following operations :
i) Create a list containing three nodes with data 10, 20, 30 using front insertion.
ii) Insert a node with data 40 at the end of list.
iii) Delete a node whose data is 30.
iv) Display the list contents. **(10 Marks)**

b. Write the functions for : i) Finding the length of the list ii) Concatenate two lists
iii) Reverse a list. **(10 Marks)**

OR

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

b. For the given Sparse matrix, write the diagrammatic linked list representation.

$$A \begin{bmatrix} 3 & 0 & 0 & 0 \\ 5 & 0 & 0 & 6 \\ 0 & 0 & 0 & 0 \\ 4 & 0 & 0 & 8 \\ 0 & 0 & 9 & 0 \end{bmatrix}.$$

(04 Marks)

c. List out the differences between single linked list and double linked list. Write the functions to perform following operations on double linked list :
i) Insert a node at rear end of the list ii) Delete a note at rear end of the list
iii) Search a node with a given key value. **(08 Marks)**

Module-4

7 a. Define a Tree. With suitable example explain i) Binary tree ii) Complete binary tree iii) Strict binary tree iv) Skewed binary tree. **(10 Marks)**

b. Write the routines to traverse the given tree using
i) Pre – Order traversal ii) Post – Order traversal. **(06 Marks)**

c. Write the recursive search algorithm for a Binary Search tree. **(04 Marks)**

OR

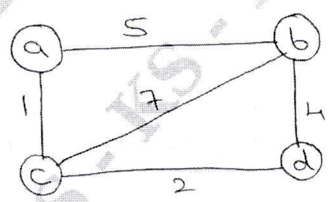
8 a. Draw a Binary tree for the following expression : ((6 + (3-2) *5) ^ 2+ 3.
Traverse the above generated tree using Pre – order and Post – order and also write their respective functions. **(10 Marks)**

b. Write the routines for :
i) Copying of binary trees ii) Testing equality of binary trees. **(10 Marks)**

Module-5

9 a. Define Graphs. Give the Adjacency matrix and Adjacency list representation for the following graph in Fig. Q9(a). **(08 Marks)**

Fig. Q9(a)



b. Write the algorithm for following Graph Traversal methods :
i) Breadth first search ii) Depth first search. **(08 Marks)**

c. Write an algorithm for insertion sort. **(04 Marks)**

OR

10 a. Define Hashing. Explain any three Hash functions. **(08 Marks)**

b. Explain Static and Dynamic hashing in detail. **(08 Marks)**

c. Define the term File Organization. Explain indexed sequential File Organization. **(04 Marks)**

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18CS33

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Analog and Digital Electronics

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. What is biasing? Mention different BJT biasing techniques. Explain voltage divider bias. (08 Marks)
b. Explain relaxation oscillator. (06 Marks)
c. Write a note on opto coupler. (06 Marks)

OR

2 a. Explain active filters. List advantages of active filters over passive filters. (06 Marks)
b. Explain with diagram, R-2R ladder type D to A converter. (08 Marks)
c. Define op-amp. Explain the performance parameters of op-amp. (06 Marks)

Module-2

3 a. Explain Don't Care condition with an example. (04 Marks)
b. Reduce the following functions using K-map technique:
$F(P, Q, R, S) = \Sigma m(0, 1, 4, 8, 9, 10) + d(2, 11)$ (08 Marks)
c. Using Quine McClusky method, simplify the expression:
$F(P, Q, R, S) = \Sigma m(0, 3, 5, 6, 7, 11, 14)$
Write the gate diagram for the same. (08 Marks)

OR

4 a. Explain entered variable map method. (05 Marks)
b. Apply Quine McClusky method to find the essential prime implicants for the Boolean expression $f(a, b, c, d) = \Sigma m(1, 3, 6, 7, 9, 10, 12, 13, 14, 15)$ (07 Marks)
c. For the below expression, draw the logic diagram using AOI logic for minimal sum. Obtain minimal sum using K-map.
$F(a, b, c, d) = \Sigma m(1, 2, 3, 5, 6, 7, 11, 12, 13, ,14, 15)$ (08 Marks)

Module-3

5 a. What is hazard? List the types of hazards. Explain static 0 and static 1 hazard. (06 Marks)
b. Differentiate between combinational and sequential circuit. (06 Marks)
c. Implement the following using PLA:
$A(x, y, z) = \Sigma m(1, 2, 4, 6)$
$B(x, y, z) = \Sigma m(0, 1, 6, 7)$
$C(x, y, z) = \Sigma m(2, 6)$ (08 Marks)

OR

6 a. Implement the following function using 8:1 multiplexer:
$f(a, b, c, d) = \Sigma m(0, 1, 5, 6, 8, 10, 12, 15)$ (07 Marks)
b. What is programmable logic array? How does PLA differ from PAL? (06 Marks)
c. Realize the following using 3:8 decoder:
(i) $f(a, b, c) = \Sigma m(1, 2, 3, 4)$ (ii) $f(a, b, c) = \Sigma m(3, 5, 7)$ (07 Marks)

Module-4

7 a. What are the three different models for writing a module body in VHDL? Give example for any one model. (06 Marks)
b. Derive characteristic equation for JK, T, D and SR flip flop. (08 Marks)
c. Give VHDL code for 4:1 multiplexer using conditional assign statement. (06 Marks)

OR

8 a. Using structural model, write VHDL code for Half Adder. (06 Marks)
b. Derive the excitation table for JK and SR flip flop. How SR flip flop is converted to T flip flop? (08 Marks)
c. With logic diagram, explain JK flip flop. (06 Marks)

Module-5

9 a. Define counter. Design synchronous counter for the sequence 0, 4, 1, 2, 6, 0, 4 using JK flip-flop. (08 Marks)
b. What is shift register? With a neat diagram, explain 4 bit parallel in serial out shift register. (08 Marks)
c. Write a note on sequential parity checker. (04 Marks)

OR

10 a. With a neat diagram, explain ring counter. (06 Marks)
b. Design and implement MOD 5 synchronous counter using JK flip-flop. Explain with timing diagram. (08 Marks)
c. Write a note on parallel adder with accumulator. (06 Marks)

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CBCS SCHEME

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18CS34

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Computer Organization

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. With a neat diagram, explain the different processor registers. **(08 Marks)**

b. Explain the overall SPEC rating for the computer in a program suite. **(04 Marks)**

c. Explain one address , two address and three address instruction with examples. Also, use any of these instructions to carry out $C \leftarrow [A] + [B]$. **(08 Marks)**

OR

2 a. What is an addressing mode? Explain the different addressing modes. With an example for each. **(10 Marks)**

b. Explain shift and rotate operations, with example. **(10 Marks)**

Module-2

3 a. What is direct memory access, when it is used? Explain it with block diagram. **(08 Marks)**

b. Define the terms 'cycle stealing' and 'burst mode with respect to DMA. **(04 Marks)**

c. Define bus arbitration. Explain in detail centralizaed bus arbitration. **(08 Marks)**

OR

4 a. With a block diagram, explain how the keyboard is connected to processor. **(08 Marks)**

b. Explain the use of a PCI bus in a computer system with a neat sketch. **(08 Marks)**

c. What are the design objectives of USB? **(04 Marks)**

Module-3

5 a. Draw a neat block diagram of memory hierarchy in a computer system. Discuss the variation of size, speed and cost per bit in the hierarchy. **(08 Marks)**

b. Explain the working of a single transistor dynamic memory cell and internal organization of a 16 megabit DRAM chip configured as $2M \times 8$ cells. **(12 Marks)**

OR

6 a. Explain the different mapping functions used in cache memory. **(12 Marks)**

b. What is replacement policy? Explain LRU replacement algorithm. **(04 Marks)**

c. Explain memory interleaving with necessary diagram. **(04 Marks)**

Module-4

7 a. Perform the following operations on the 5-bit signed numbers using 2's complement representation system:

i) (-10) + (-13)

ii) (-10) – (+4)

iii) (-3) + (-8)

iv) (-10) – (+7) **(10 Marks)**

b. In a carry look ahead addition, explain the generate G_i and propagate P_i functions for stage i. Using this design explain 4 bit carry look ahead adder. **(10 Marks)**

OR

8 a. Perform the signed multiplication of numbers +13 and -6 using booth multiplication and bit pair recording method. List the tables used. **(10 Marks)**

b. Perform division of number 9 by 3(9 ÷ 3) using the restoring division algorithm. Write the steps of algorithm used. **(10 Marks)**

Module-5

9 a. Draw and explain multiple bus organization. Explain its advantages. **(10 Marks)**

b. Write and explain the control sequence for execution of an unconditional branch instruction. **(10 Marks)**

OR

10 a. Draw the block diagram of the control unit organization and describe. **(10 Marks)**

b. Explain basic idea of instruction pipelining. **(10 Marks)**

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CBCS SCHEME

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18CS35

Third Semester B.E. Degree Examination, Feb./Mar. 2022
Software Engineering

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. Define software engineering. What are the different types of software products? **(06 Marks)**
b. Explain briefly the Software Engineering Ethics. **(06 Marks)**
c. List and explain the different types of Application Softwares. **(08 Marks)**

OR

2 a. What are the fundamental software process activities? With neat diagram, explain requirement engineering process. **(08 Marks)**
b. With neat diagram, explain Bohem's Spiral model. **(08 Marks)**
c. Explain Re-use oriented Software Engineering. **(04 Marks)**

Module-2

3 a. What is object orientation? Explain the characteristics of object oriented approach. **(10 Marks)**
b. Define model. Explain the three different models of object orientation. **(10 Marks)**

OR

4 a. Explain the following with suitable diagrams:
(i) Links and Associations
(ii) Generalization **(10 Marks)**
b. With neat diagram, explain the class model of a Windowing System. **(10 Marks)**

Module-3

5 a. With neat diagram, explain the context model for MHC-PMS system. **(10 Marks)**
b. Explain the state diagram of microwave oven. **(10 Marks)**

OR

6 a. Explain the Rational Unified Process. **(06 Marks)**
b. Explain Design Pattern with UML model of the observer model. **(08 Marks)**
c. What are the different implementation issues of Software Engineering? **(06 Marks)**

Module-4

7 a. What are the two distinct goals of Software Testing? **(05 Marks)**
b. Explain the three different types of testing carried out during software development. **(05 Marks)**
c. What are the different types of user testing? With neat diagram, explain the six stages of acceptance testing process. **(10 Marks)**

OR

8 a. Write the Lemman's law of program dynamic evolution. **(06 Marks)**
b. With neat diagram, explain the software reengineering process activities. **(08 Marks)**
c. What are the four strategic options for Legacy Systems? **(06 Marks)**

Module-5

9 a. What are the factors affecting the pricing of software product? (04 Marks)
b. With neat diagram, explain the project planning process. (06 Marks)
c. With neat diagram, explain the COCOMO – II estimation model. (10 Marks)

OR

10 a. Explain the product standards and process standards in software quality management. (06 Marks)
b. Explain three phases of software review process. (08 Marks)
c. Explain the various inspection checks in the program inspection. (06 Marks)

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CBCS SCHEME

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18CS36

Third Semester B.E. Degree Examination, Feb./Mar. 2022
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. Prove that for any propositions p, q, r the compound proposition $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$ is a Tautology. **(08 Marks)**

b. Prove the logical equivalence without using truth table:
$p \rightarrow (q \rightarrow r) \Leftrightarrow (p \wedge q) \rightarrow r$ **(05 Marks)**

c. Find whether the following argument is valid. No engineering student of first or second semester studies logic.
Anil is an Engineering student who studies logic
$\therefore$ Anil is not in second semester **(07 Marks)**

OR

2 a. Give a direct proof and an indirect proof for the given statement. "If 'n' is an odd integer, then n + 9 is an even integer". **(06 Marks)**

b. Prove the given logical equivalence problem using laws of logic.
$(p \rightarrow q) \wedge [\neg q \wedge (r \vee \neg q) \Leftrightarrow \neg (q \vee p)$. **(07 Marks)**

c. Verify the given argument is valid or not?

$p \rightarrow (q \rightarrow r)$
$p \vee \neg s$
q
$\therefore s \rightarrow r$ **(07 Marks)**

Module-2

3 a. Prove that for each $n \in z^+$
$1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = 1/6\, n(n + 1)(2n + 1)$ **(07 Marks)**

b. Find the number of permutation of the letter of the word "MASSASAUGA". In how many of there all four 'A's are together? How many of them begin with 'S'? **(06 Marks)**

c. Find how many distinct four digit integers one can make from the digit 1, 3, 3, 7, 7, 8. **(07 Marks)**

OR

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

b. In how many ways can 10 identical pencils be distributed among 5 children in following cases:
i) There are no restrictions.
ii) Each child gets atleast one pencil.
iii) The youngest child gets at least two pencils. **(07 Marks)**

c. Find the number of arrangements of all the letters in "TALLAHASSEE"? How many of these arrangement have no adjacent 'A's? **(07 Marks)**

Module-3

5 a. Let $f : R \rightarrow R$ be defined by

$$f(x) = \begin{cases} 3x - 5 & \text{for } x > 0 \\ -3x + 1 & \text{for } x \le 0 \end{cases}$$

find $f^{-1}(0)$, $f^{-1}(1)$, $f^{-1}(3)$, $f^{-1}(-3)$, $f^{-1}(-6)$, $f^{-1}([-5, 5])$. **(07 Marks)**

b. On the set Z^{-1} a relation 'R' is defined by aRb if and only if "a divides b (exactly)" verify that 'R' is equivalence relation. **(06 Marks)**

c. Draw the Hasse diagram representing the positive divisor of 36. **(07 Marks)**

OR

6 a. Let A = {1, 2, 3, 4, 5} define relation 'R' on A×A by (X_1Y_1) R (X_2Y_2) if and only if $X_1 + Y_1 = X_2 + Y_2$.

i) Verify 'R' is a equivalence relation on A×A

ii) Determine the partition of A×A induced by R. **(07 Marks)**

b. Let A = {1, 2, 3, 4, 6} and 'R' be a relation on 'A' defined by aRb if and only if "a is multiple of b" represent the relation 'R' as a matrix, draw its diagraph and relation R. **(06 Marks)**

c. Let f, g, h be a function from R to R defined by f(x) = x + 2, g(x) = x – 2, h(x) = 3x for $\forall x \in R$ find gof, fog, fof, gog, foh, fohog. **(07 Marks)**

Module-4

7 a. How many integers between 1 and 300 (inclusive) are

i) Divisible by atleast one of 5, 6, 8

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

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

c. Solve the recurrence relation

$a_n - 3a_{n-1} = 5 \times 3^n$ for $n \ge 1$ given that $a_0 = 2$. **(06 Marks)**

OR

8 a. The number of virus affected files in a system is 1000 (to start with) and this 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)**

b. Solve the recurrence relation

$a_n = 2(a_{n-1} - a_{n-2})$ for $n \ge 2$ given that $a_0 = 1$ and $a_1 = 2$. **(07 Marks)**

c. Compute derangement of d_4, d_5, d_6, d_7. **(07 Marks)**

Module-5

9 a. Define Isomorphism. Verify the given two graphs are Isomorphic (Fig.Q.9(a)). **(07 Marks)**

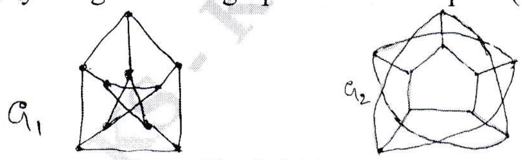

Fig.Q.9(a)

b. "A tree with 'n' vertices has n – 1 edges". Prove this. Define a tree. **(06 Marks)**

c. Construct an optimal prefix code for the given set of frequencies, 20, 28, 4, 17, 12, 7. **(07 Marks)**

OR

10 a. Explain complete graph, Bipartite graph, subgraph, regular graph, spanning subgraph, minimally connected graph, with example for each. **(07 Marks)**

b. Apply merge sort to the given list -1, 7, 4, 11, 5, -8, 15, -3, -2, 6, 10, 3. **(06 Marks)**

c. Obtain an optimal prefix code for the message "LETTER RECEIVED" indicate the code. **(07 Marks)**

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