CBCS Scheme

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15MAT31

Third Semester B.E. Degree Examination, June/July 2018
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Obtain the Fourier series for the function :

$$f(x) = \begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$$

Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ----$. **(08 Marks)**

b. Obtain the half–range cosine series for the function $f(x) = (x-1)^2$, $0 \le x \le 1$. Hence deduce that $\frac{\pi^2}{6} = \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + -----$. **(08 Marks)**

OR

2 a. Find the Fourier series of the periodic function defined by $f(x) = 2x - x^2$, $0 < x < 3$. **(06 Marks)**

b. Show that the half range sine series for the function $f(x) = \ell x - x^2$ in $0 < x < \ell$ is

$$\frac{8\ell^2}{\pi^3} \sum_{0}^{\infty} \frac{1}{(2n+1)^3} \sin\left(\frac{2n+1}{\ell}\right)\pi x .$$ **(05 Marks)**

c. Express y as a Fourier series upto 1st harmonic given :

x	0	1	2	3	4	5
y	4	8	15	7	6	2

(05 Marks)

Module-2

3 a. Find the Fourier transform of

$$f(x) = \begin{cases} 1-|x|, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$$

and hence deduce that $\int_0^{\infty} \frac{\sin^2 t}{t^2} dt = \frac{\pi}{2}$. **(06 Marks)**

b. Find the Fourier Sine and Cosine transforms of $f(x) = e^{-\alpha x}$, $\alpha > 0$. **(05 Marks)**

c. Solve by using z – transforms $y_{n+1} + \frac{1}{4} y_n = \left(\frac{1}{4}\right)^n$ $(n \ge 0), y_0 = 0$. **(05 Marks)**

OR

4 a. Find the Fourier transform of $f(x) = e^{-|x|}$. **(06 Marks)**

b. Find the Z – transform of $\sin(3n + 5)$. **(05 Marks)**

c. Find the inverse Z – transform of : $\frac{z}{(z-1)(z-2)}$. **(05 Marks)**

Module-3

5 a. Find the correlation coefficient and the equation of the line of regression for the following values of x and y. **(06 Marks)**

x	1	2	3	4	5
y	2	5	3	8	7

b. Find the equation of the best fitting straight line for the data : **(05 Marks)**

x	0	1	2	3	4	5
y	9	8	24	28	26	20

c. Use Newton – Raphson method to find a real root of the equation $x \log_{10} x = 1.2$ (carry out 3 iterations). **(05 Marks)**

OR

6 a. Obtain the lines of regression and hence find the coefficient of correlation for the data :

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(06 Marks)

b. Fit a second degree parabola to the following data : **(05 Marks)**

x	1	2	3	4	5
y	10	12	13	16	19

c. Use the Regula–Falsi method to find a real root of the equation $x^3 - 2x - 5 = 0$, correct to 3 decimal places. **(05 Marks)**

Module-4

7 a. Given $\sin 45° = 0.7071$, $\sin 50° = 0.7660$, $\sin 55° = 0.8192$, $\sin 60° = 0.8660$ find $\sin 57°$ using an appropriate interpolation formula. **(06 Marks)**

b. Construct the interpolation polynomial for the data given below using Newton's divided difference formula :

x	2	4	5	6	8	10
y	10	96	196	350	868	1746

(05 Marks)

c. Use Simpson's $\frac{1}{3}$rd rule with 7 ordinates to evaluate $\int_2^8 \frac{dx}{\log_{10} x}$. **(05 Marks)**

OR

8 a. Given f(40) = 184, f(50) = 204, f(60) = 226, f(70) = 250, f(80) = 276, f(90) = 304, find f(38) using Newton's forward interpolation formula. **(06 Marks)**

b. Use Lagrange's interpolation formula to fit a polynomial for the data :

x	0	1	3	4
y	−12	0	6	12

Hence estimate y at x = 2. **(05 Marks)**

c. Evaluate $\int_0^1 \frac{x}{1+x^2}\,dx$ by Weddle's rule taking seven ordinates and hence find $\log_e 2$. **(05 Marks)**

Module-5

9 a. Find the area between the parabolas $y^2 = 4x$ and $x^2 = 4y$ using Green's theorem in a plane. **(06 Marks)**

b. Verify Stoke's theorem for the vector $\vec{F} = (x^2 + y^2)i - 2xyj$ taken round the rectangle bounded by x = 0, x = a, y = 0, y = b. **(05 Marks)**

c. Find the extremal of the functional : $\int_{x_1}^{x_2} [y' + x^2(y')^2]\,dx$. **(05 Marks)**

OR

10 a. Verify Green's theorem in a plane for $\oint_C (3x^2 - 8y^2)\,dx + (4y - 6xy)\,dy$ where c is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$. **(06 Marks)**

b. If $\vec{F} = 2xyi + yz^2j + xzk$ and S is the rectangular parallelopiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1, z = 3 evaluate $\iint_S \vec{F} \cdot \hat{n}\,ds$. **(05 Marks)**

c. Find the geodesics on a surface given that the arc length on the surface is $S = \int_{x_1}^{x_2} \sqrt{x[1 + (y')^2}\,dx$. **(05 Marks)**

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Third Semester B.E. Degree Examination, June/July 2018
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Find the modulus and amplitude of $\frac{(1+i)^2}{3+i}$. **(05 Marks)**

b. Prove that $\left(\frac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i\sin n\theta$. **(05 Marks)**

c. If $z = \cos\theta + i\sin\theta$, then show that $x^n + \frac{1}{x^n} = 2\cos n\theta$, $x^n - \frac{1}{x^n} = 2i\sin n\theta$. **(06 Marks)**

OR

2 a. Find the sine of the angle between $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 2\hat{k}$. **(05 Marks)**

b. Find the unit vector perpendicular to both $\vec{a}$ and $\vec{b}$, where $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} + \hat{k}$ **(05 Marks)**

c. Show that (3, –2, 4), (6, 3, 1), (5, 7, 3) and (2, 2, 6) are coplanar. **(06 Marks)**

Module-2

3 a. Find the n^{th} derivative of sin(3x)cosx. **(05 Marks)**

b. Find the angle between radius vector and tangent to the curve $\gamma^m \cos m\theta = a^m$. **(05 Marks)**

c. Find the pedal equation of $\gamma = a(1 + \cos\theta)$. **(06 Marks)**

OR

4 a. If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin(2u)$. **(05 Marks)**

b. If $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 0$. **(05 Marks)**

c. If $u = x + y$, $v = y + z$, $w = z + x$, find $J\left(\frac{uvw}{xyz}\right)$. **(06 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi} x\cos^6 x\,dx$. **(05 Marks)**

b. Evaluate $\int_0^{\infty} \frac{x^2}{(1+x^6)^{7/2}}\,dx$ **(05 Marks)**

c. Evaluate $\int_0^1 x^5(1-x^2)^{5/2}\,dx$. **(06 Marks)**

OR

6 a. Evaluate $\int_1^2\int_3^4 (xy+e^y)\,dy\,dx$. **(05 Marks)**

b. Evaluate $\int_0^1\int_x^{\sqrt{x}} xy\,dy\,dx$. **(05 Marks)**

c. Evaluate $\int_0^1\int_0^1\int_0^y xyz\,dx\,dy\,dz$. **(06 Marks)**

Module-4

7 a. Find the angle between the tangents to the curve $x=t^2, y=t^3, z=t^4$ at $t=2$, and $t=3$. **(05 Marks)**

b. Find the unit normal to the curve $\vec{\gamma} = 4\sin t\,\hat{i} + 4\cos t\,\hat{j} + 3t\,\hat{k}$. **(05 Marks)**

c. Find the velocity and acceleration to the curve $\vec{\gamma} = t^2\,\hat{i} - t^3\,\hat{j} + t^4\,\hat{k}$ at $t=1$. **(06 Marks)**

OR

8 a. Find the directional derivative of $\varphi = x^3y^3z^3$ at (1, 2, 1) in the direction of $\hat{i}+2\hat{j}+2\hat{k}$. **(05 Marks)**

b. Find the unit normal to the surface $xy + x + zx = 3$ at $(1,1,1)$. **(05 Marks)**

c. If $\vec{F} = \nabla(x^3+y^3+z^3-3xyz)$, find div $\vec{F}$. **(06 Marks)**

Module-5

9 a. Solve $\frac{dy}{dx} = \frac{y^2}{xy - x^2}$. **(05 Marks)**

b. Solve $\frac{dy}{dx} + y \cot x = \sin x$. **(05 Marks)**

c. Solve $y(x + y)dx + (x + 2y - 1)dy = 0$. **(06 Marks)**

OR

10 a. Solve $(x^2 + y)dx + (y^3 + x)dy = 0$. **(05 Marks)**

b. Solve $\frac{dy}{dx} + \frac{y}{x} = xy^2$. **(05 Marks)**

c. Solve $(x^2 + y^2)\frac{dy}{dx} = xy$. **(06 Marks)**

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15CS32

Third Semester B.E. Degree Examination, June/July 2018
Analog and Digital Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What is MOSFET? Name its types. Explain the construction of n-channel E-MOSFET. **(06 Marks)**

b. Compare JFET and MOSFET. **(05 Marks)**

c. Explain self-bias circuit for JFET. **(05 Marks)**

OR

2 a. Define: i) CMRR ii) Slew rate iii) PSRR iv) Bandwidth pertaining to OPAMP. **(06 Marks)**

b. Explain with schematics operation of relaxation oscillator with relevant waveforms. **(05 Marks)**

c. What are active filters? Explain active low pass filter. **(05 Marks)**

Module-2

3 a. Using Q-M method, simplify the expression $f(A, B, C, D) = \Sigma(0, 3, 5, 6, 7, 11, 14)$. **(06 Marks)**

b. Explain about positive and negative logic prove that positive 'OR' is equal to negative 'AND'. **(05 Marks)**

c. What are Hazards? Briefly describe about designing Hazard free circuit. **(05 Marks)**

OR

4 a. Give Sum-Of-Product (SOP) and Product-Of-Sum (POS) circuit for $f(A, B, C, D) = \sum m (6, 8, 9, 10, 11, 12, 13, 14, 15)$. **(06 Marks)**

b. Explain the verilog program structure. **(05 Marks)**

c. Design a logic circuit to provide an output when any two or three of four switches are closed. **(05 Marks)**

Module-3

5 a. Implement the following Boolean function using 4:1 multiplexer $F(A, B, C, D) = \sum m (0, 1, 2, 4, 6, 9, 12, 14)$. **(06 Marks)**

b. Construct 16:1 multiplexer using 4:1 and 2:1 multiplexer. **(05 Marks)**

c. What is a decoder? Give the circuit for 3:8 decoder. **(05 Marks)**

OR

6 a. What is a magnitude comparator? Explain a 1-bit comparator with truth table and circuit diagram. **(06 Marks)**

b. Briefly explain about parity generators and checkers. For a 3 bit message, give the expression for even parity bit. **(05 Marks)**

c. Compare and contrast PLA and PAL. **(05 Marks)**

Module-4

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

b. Give a brief account an flip flop as finite state machine. **(05 Marks)**

c. Briefly describe about sequential logic circuit. **(05 Marks)**

OR

8 a. Enumerate different types of shift registers. Explain Serial In Serial Out (SISO) register. **(06 Marks)**

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

c. Using behavioral model write verilog HDL code for a 'D' flipflop with reset input. **(05 Marks)**

Module-5

9 a. Explain digital clock with block diagram. **(06 Marks)**

b. Design a 3 bit synchronous binary counter using JK flip flop. **(05 Marks)**

c. Mention different types of A/D converters and test its specifications. **(05 Marks)**

OR

10 a. Explain binary weighted resistor D/A converter. Mention its drawbacks. **(06 Marks)**

b. Describe about successive approximation type ADC. **(05 Marks)**

c. What is the resolution of a 12 bit D/A converter which uses a binary ladder, if the full scale output is +10V? **(05 Marks)**

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CBCS Scheme

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15CS33

Third Semester B.E. Degree Examination, June/July 2018
Data Structures and Applications

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Differentiate between structures and unions. **(04 Marks)**

b. Explain with example : i) insertion and ii) deletion in an array. **(08 Marks)**

c. Suppose each student in a class of 25 students is given 4 tests, assume the students are numbered from 1 to 25, and the test scores are assigned in the 25 × 4 matrix called SCORE. Suppose Base (SCORE) = 200, w = 4 and the programming language uses row–major order to store this 2D array, then find the address of 3rd test of 12th student i.e SCORE (12, 3). **(04 Marks)**

OR

2 a. List and explain any 4 functions supported in C for dynamic memory allocation with examples. **(08 Marks)**

b. Consider 2 polynomials $A(x) = 2x^{1000} + 1$ and $B(x) = x^4 + 10x^3 + 3x^2 + 1$ with a diagram show how these polynomials are stored in 1D array. **(02 Marks)**

c. With an example illustrate that "product of 2 sparse matrices may not be sparse". Also write a C function for matrix multiplication of 2 sparse matrices. **(06 Marks)**

Module-2

3 a. Write an algorithm to evaluate a postfix expression. Evaluate the following postfix expression abc + * d e/- where a = 5, b = 6, c = 2, d = 12, e = 4. **(06 Marks)**

b. Write the algorithm for Ackermann function. Evaluate A(1, 2) using ACKERMANN function. **(04 Marks)**

c. With a neat diagram explain ONE–WAY list representation of a priority queue. **(06 Marks)**

OR

4 a. Write a C program demonstrating the various stack operations, including cases for overflow and underflow of STACKS. **(08 Marks)**

b. Describe how you could model a maze, where 0 represents open paths and 1 represents barriers. What moves are permitted in the matrix model? Provide an example MAZE together with its allowable moves and table of moves. **(08 Marks)**

Module-3

5 a. Write a function for singly linked lists with integer data, to search an element in the list that is unsorted and a list that is sorted. **(08 Marks)**

b. Given 2 singly linked lists. LIST-1 and LIST-2. Write an algorithm to form a new list LIST-3 using concatenation of the lists LIST-1 and LIST-2. **(08 Marks)**

OR

6 a. Write a note on header linked list. Explain the widely used header lists with diagrams. **(05 Marks)**

b. List out any 2 differences between doubly linked lists and singly linked list. **(02 Marks)**

c. Illustrate with examples how to insert a node at the beginning, INSERT a node at intermediate position, DELETE a node with a given value. **(09 Marks)**

Module-4

7 a. Write a short note on threaded binary trees and state the rules to construct a threaded binary tree. **(08 Marks)**

b. With separate functions illustrate recursive search and iterative search of a binary search tree. **(08 Marks)**

OR

8 a. Consider the following tree T in (Fig.8(a)) write the preorder, inorder, postorder for the tree T. Also find the depth of TREE in (Fig.Q8(a)). **(04 Marks)**

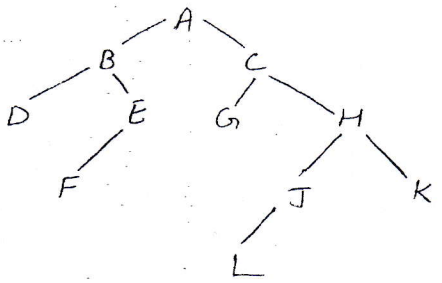

Fig.Q8(a)

b. Write functions to illustrate "copying of binary trees", and "testing equality of binary trees". **(08 Marks)**

c. Define complete binary tree. Illustrate with examples. **(04 Marks)**

Module-5

9 a. State and explain WARSHALLS algorithm with an example. **(08 Marks)**

b. Write an algorithm for insertion sort. Apply insertion sort, showing the various passes to sort the array A, where A = [77, 33, 44, 11, 88, 22, 66, 55]. **(08 Marks)**

OR

10 a. Write a short note on hashing. Explain any 3 popular HASH functions. **(08 Marks)**

b. What do you understand by the term file organization? Briefly summarize any 3 widely used file organization techniques. **(08 Marks)**

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15CS34

Third Semester B.E. Degree Examination, June/July 2018
Computer Organization

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Addressing Mode. Give the details of different addressing modes. **(08 Marks)**

b. Describe the basic operational concepts between the processor and memory. **(08 Marks)**

OR

2 a. What is Subroutine? How to pass parameters to subroutines? Illustrate with an example. **(08 Marks)**

b. How to encode assembly instructions into 32-bit words? Explain with examples. **(08 Marks)**

Module-2

3 a. Define Bus Arbitration. With diagrams, explain the centralized bus arbitration mechanism. **(08 Marks)**

b. With the help of timing diagram, briefly discuss the main phases of SCSI bus involved in its operation. **(08 Marks)**

OR

4 a. With neat diagrams, explain how to interface printer to the processor. **(08 Marks)**

b. Explain the following methods of handling interrupts from multiple devices.
i) Interrupt nesting/priority structure ii) Daisy chain method. **(08 Marks)**

Module-3

5 a. Describe how to translate virtual address into physical address with diagram. **(08 Marks)**

b. Draw and explain the internal organisation of 2M × 8 asynchronous DRAM chip. **(08 Marks)**

OR

6 a. Describe any two mapping functions in cache. **(08 Marks)**

b. Describe the principles of magnetic disk. **(08 Marks)**

Module-4

7 a. Perform the operations on 5 – bit signed numbers using 2's complement system. Also indicate whether overflow has occurred. **(06 Marks)**
i) (-10) + (-13) ii) (-10) – (-13) iii) (-2) + (-9).

b. Perform the multiplication of 13 and -6 using Booth algorithm and Bit – pair recoding method. **(10 Marks)**

OR

8 a. Perform the restoring division for 8 ÷ 3 by showing all the steps. **(06 Marks)**

b. Explain the logic diagram of 4 – bit carry look ahead adder and its operations. **(10 Marks)**

Module-5

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

b. Write down the control sequence for the instruction Add (R_3) , R_1 for single bus organization. **(06 Marks)**

OR

10 a. With block diagram, explain the general requirements and working of digital camera. **(10 Marks)**

b. Write the control sequence for an unconditional branch instruction. **(06 Marks)**

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15CS35

Third Semester B.E. Degree Examination, June/July 2018
UNIX and Shell Programming

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the architecture of UNIX operating system with a neat diagram. **(06 Marks)**

b. What are internal and external commands in UNIX? Explain with any three examples in each type. **(06 Marks)**

c. Explain the fields of /etc/passwd and /etc/shadow. **(04 Marks**

OR

2 a. Write a note on man command with options. **(06 Marks)**

b. Explain the following commands with examples :
i) printf ii) passwd iii) date iv) who. **(04 Marks)**

c. Describe with appropriate commands, how to display and set terminal characteristics. **(06 Marks)**

Module-2

3 a. Explain UNIX file system with the help of neat diagram. **(06 Marks)**

b. Explain briefly absolute and relative pathnames with examples. **(04 Marks)**

c. Briefly describe : i) HOME ii) PATH ii) WC iv) pwd. **(06 Marks)**

OR

4 a. Interpret the significance of seven fields of ls–l output. **(06 Marks)**

b. Assuming the files current permission are rwx r – – r – x, specify the chmod expression required to change the following using both absolute and relative method of assigning permissions.
i) rwxrwx r–x
ii) r–xr–x––x
iii) r––r–––w– **(06 Marks)**

c. Write a note on directory permissions with examples. **(04 Marks)**

Module-3

5 a. Explain with a neat diagram, three modes of Vi editor. **(06 Marks)**

b. Explain briefly S(substitute command) in exmode of Vi editor. **(04 Marks)**

c. Explain the following commands with examples :
i) set ii) map iii) abbr **(06 Marks**

OR

6 a. Define wild card. With examples, explain shells wild cards. **(06 Marks)**

b. Explain the three standard files with respect to UNIX operating system. **(06 Marks)**

c. Write a command for the following using grep
i) To delete all blank lines from a file named Emp
ii) To list only subdirecteries in the current directory
iii) To display lines containing pattern in file sample SIGSTOP or SIGTSTP
iv) To display number of lines that does not contain pattern 'USA' in file times.txt. **(04 Marks)**

Module-4

7 a. Define shell script. Write a menu driven shell script which displays :
   i) Current users of system
   ii) List of flies
   iii) Today's date
   iv) Process status
   v) Contents of a file **(06 Marks)**

b. Explain expr command applicable to computation and string functions. **(06 Marks)**

c. Explain with example set and shift command in UNIX to manipulate positional parameters. **(04 Marks)**

OR

8 a. Explain the following filters with examples :
   i) head ii) tail iii) cut iv) paste. **(08 Marks)**

b. Differentiate between hardlink and softlink in UNIX with examples. **(04 Marks)**

c. Explain the following with examples :
   i) Umask ii) /dev/null and /dev/tty. **(04 Marks)**

Module-5

9 a. Explain three distinct phases of process creation. Explain how shell is created. **(08 Marks)**

b. Explain the following commands with examples.
   i) Running jobs in background (& and nohup)
   ii) Execute later (at and batch). **(06 Marks)**

c. Write find command to locate from home directory.
   i) All files having inode number 9076
   ii) All files named a.out and all C sources files and remove them interactively. **(02 Marks)**

OR

10 a. Explain string handling functions in Perl with examples. **(06 Marks)**

b. Write a Perl program to find whether a given year is leap year or not using command line arguments. **(04 Marks)**

c. Explain the following in Perl with examples. i) split ii) join. **(06 Marks)**

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15CS36

Third Semester B.E. Degree Examination, June/July 2018
Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 80

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 :
$\{p \rightarrow (q \rightarrow r)\} \rightarrow \{(p \rightarrow q) \rightarrow (p \rightarrow r)\}$ is a tautology. **(06 Marks)**

b. Prove the following logical equivalence using the laws of logic:
$(p \rightarrow q) \wedge [\neg q \wedge (r \vee \neg q)] \Leftrightarrow \neg (q \vee p)$. **(05 Marks)**

c. Prove the following logical equivalence using the laws of logic:
$[\neg p \wedge (\neg q \wedge r)] \vee (q \wedge r) \vee (p \wedge r) \Leftrightarrow r$. **(05 Marks)**

OR

2 a. Prove the validity of the arguments using rule of inference.

$(\neg p \vee \neg q) \rightarrow (r \wedge s)$
$r \rightarrow t$
$\neg t$
$\therefore p$ **(05 Marks)**

b. Test the validity of the arguments using rule of inference.

$(\neg p \vee q) \rightarrow r$
$r \rightarrow (s \vee t)$
$\neg s \wedge \neg u$
$\neg u \rightarrow \neg t$
$\therefore p$ **(05 Marks)**

c. Find whether the following argument is valid:

No Engineering student of 1st or 2nd semester studies logic
Anil is an Engineering student who studies logic

$\therefore$ Anil is not in second semester. **(06 Marks)**

Module-2

3 a. Prove by mathematical induction that :
$1^2 + 3^2 + 5^2 + - - - - + (2n-1)^2 = \frac{1}{3} n (2n-1)(2n+1)$. **(05 Marks)**

b. A sequence $\{C_n\}$ is defined recursively by ,
$C_n = 3C_{n-1} - 2C_{n-2}$ for all $n \geq 3$ with $C_1 = 5$ and $C_2 = 3$ as the initial conditions, show that $C_n = -2^n + 7$. **(06 Marks)**

c. Determine the coefficient of xyz^2 in the expansion of $(2x - y - z)^4$. **(05 Marks)**

OR

4 a. A certain question paper contains two parts A and B, each containing 4 questions. How many different ways a student can answer 5 questions by selecting atleast 2 questions from each part? **(05 Marks)**

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

c. How many numbers greater than 1000000 can be formed by using the digits 1, 2, 2, 2, 4, 4, 0? **(05 Marks)**

Module-3

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

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

Determine $f^{-1}(0), f^{-1}(1), f^{-1}(-1), f^{-1}(3), f^{-1}(-3), f^{-1}(-6)$, **(06 Marks)**

b. Evaluate S(5, 4). **(05 Marks)**

c. Let f, g, h be the function form R to R defined by $f(x) = x + 2$, $g(x) = x - 2$, $h(x) = 3x$ for all $x \in R$. Find gof, fog, fof, hog, foh. **(05 Marks)**

OR

6 a. Let 'S' be the set of all non-zero integers and $A = S \times S$ on A, define the relation R by (a, b)R(c, d) if and only if ad = bc. Show that 'R' is an equivalence relation. **(06 Marks)**

b. Draw the Hasse diagram representing the positive divisors of 36. **(06 Marks)**

c. Let A = {a, b, c, d, e}. Consider the partition P = {{a, b}, {c, d}, {e}} of A. Find the equivalence relation inducing this partition. **(04 Marks)**

Module-4

7 a. In a survey of 260 college students, the following data were obtained. 64 had taken mathematics course, 94 had taken CS course, 58 had taken EC course, 28 had taken both Mathematics and EC course, 26 had taken both Mathematics and CS course, 22 had taken both CS and EC course, and 14 had taken all three types of course. Determine how many of these students had taken none of the three subjects. **(05 Marks)**

b. Find the rook polynomial for the 3 × 3 board using expansion formula. **(06 Marks)**

c. Solve the recurrence relation :

$a_n + a_{n-1} - 6a_{n-2} = 0 \quad n \geq 2$, given $a_0 = -1$ and $a_1 = 8$. **(05 Marks)**

OR

8 a. An apple, a banana, a mango and an orange are to be distributed among 4 boys B_1, B_2, B_3, B_4. The boys B_1 and B_2 do not wish to have an 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)**

b. How many permutation of 1, 2, 3, 4, 5, 6, 7, 8 are not derangements? **(04 Marks)**

c. 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)**

Module-5

9 a. Define isomorphism. Show that the following graph are isomorphic to each other. Refer Fig.Q9(a). **(06 Marks)**

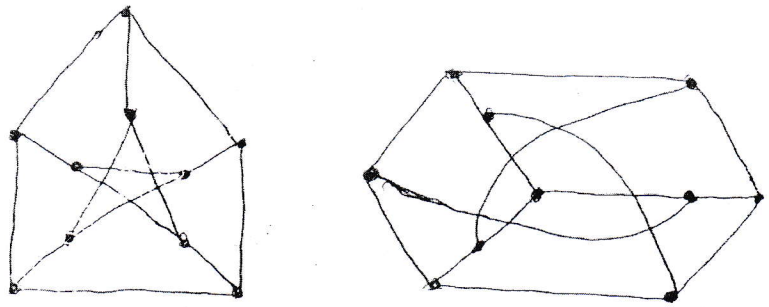

Fig.Q9(a)

b. "A tree with 'n' vertices is having 'n – 1' edges". Prove the given statement. **(05 Marks)**

c. Define complete graph, general graph and Bipartite graph with example for each. **(05 Marks)**

OR

10 a. For a graph with 'n' vertices and 'm' edges, if 'δ' is minimum, 'Δ' is maximum of the degree of vertices. Show that :

$$\delta \leq \frac{2m}{n} \leq \Delta .$$ **(05 Marks)**

b. Obtain the optimal prefix code for the message."ROAD IS GOOD". Indicate the code. **(06 Marks)**

c. Apply the merge sort to the following given list of element.

{–1, 0, 2, –2, 3, 6, –3, 5, 1, 4}. **(05 Marks)**

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