CBCS Scheme

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

15MAT31

Third Semester B.E. Degree Examination, June/July 2017
Engineering Mathematics - III

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Obtain the Fourier series expansion of

$$f(x) = \begin{cases} \pi x & 0 \le x \le 1 \\ \pi(2-x) & 1 \le x \le 2 \end{cases}$$ **(08 Marks)**

and deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$.

b. Obtain the constant term and first sine and cosine terms in the Fourier expansion of y from the following table. **(08 Marks)**

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

OR

2 a. Expand f(x) = |x| as a Fourier series in $-\pi \le x \le \pi$ and deduce that **(06 Marks)**

$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$.

b. Obtain the half range cosine series for the function $f(x) = x \sin x$ in $0 < x < \pi$. **(05 Marks)**

c. The following table gives variations of periodic current over a period T. Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic. **(05 Marks)**

t(sec)	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$
A (amp)	1.98	1.3	1.05	1.3	-0.88	-0.25

Module-2

3 a. Find the Fourier Transform of

$$f(x) = \begin{cases} 1-x^2 & |x| \le 1 \\ 0 & |x| > 1 \end{cases}$$ **(06 Marks)**

Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3} \cos \frac{x}{2}\, dx$.

b. Find the Fourier cosine transform of

$$f(x) = \begin{cases} x & \text{for} \quad 0 < x < 1 \\ 2-x & \text{for} \quad 1 < x < 2 \\ 0 & \text{for} \quad x > 2 \end{cases}$$ **(05 Marks)**

c. Find the inverse Z – transform of

$$\frac{3z^2 + 2z}{(5z-1)(5z+2)}.$$ **(05 Marks)**

OR

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

b. Find the Z – transform of i) $\cosh n\theta$ ii) n^2. **(05 Marks)**

c. Solve the difference equation $y_{n+2} + 4y_{n+1} + 3y_n = 3^n$ with $y_0 = 0$, $y_1 = 1$. **(05 Marks)**

Module-3

5 a. Find the coefficient of correlation and two regression lines for the following data : **(06 Marks)**

x	1	2	3	4	5	6	7	8	9	10
y	10	12	16	28	25	36	41	49	40	50

b. Fit a curve of the form $y = ae^{bx}$ for the following data : **(05 Marks)**

x	5	6	7	8	9	10
y	133	55	23	7	2	2

c. Use Newton – Raphson method to find a real root of the equation $x \sin x + \cos x = 0$ near $x = \pi$. **(05 Marks)**

OR

6 a. In a partially destroyed lab record, only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively. Calculate $\bar{x}$, $\bar{y}$ and coefficient of correlation between x and y. **(06 Marks)**

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

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

c. Use the regula – falsi method to obtain a root of the equation $2x - \log_{10}x = 7$ which lies between 3.5 and 4. Carryout 2 iterations. **(05 Marks)**

Module-4

7 a. The population of a town is given by the table **(06 Marks)**

Year	1951	1961	1971	1981	1991
Population in thousands	19.96	39.65	58.81	77.21	94.61

Using Newton's forward and backward interpolation formula, calculate the increase in the population from the year 1955 to 1985.

b. Use Lagrange's interpolation formula to find y at x = 10, given **(05 Marks)**

x	5	6	9	11
y	12	13	14	16

c. Given the values

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

Construct the interpolating polynomial using Newton's divided difference interpolation formula. **(05 Marks)**

OR

8 a. From the following table, estimate the number of students who obtained marks between 40 and [illegible]. **(06 Marks)**

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

b. Apply Lagrange's formula inversely to obtain the root of the equation f(x) = 0, given f(30) = -30 , f(34) = -13 , f(38) = 3 , f(42) = 18. **(05 Marks)**

c. Use Simpson's $\frac{1}{3}$ rule to find $\int_0^{0.6} e^{-x^2} dy$ by taking 7 ordinates. **(05 Marks)**

Module-5

9 a. Find the work done in moving a particle in the force field $\vec{F} = 3x^2 i + (2xz - y)j + z k$ along the curve defined by $x^2 = 4y$, $3x^3 = 8z$ from x = 0 to x = 2. **(06 Marks)**

b. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)i - 2xy j$ around the rectangle $x = \pm a$, $y = 0$, $y = b$. **(05 Marks)**

c. Solve the Euler's equation for the functional $\int_{x_0}^{x_1} (1 + x^2 y')y' dx$. **(05 Marks)**

OR

10 a. Verify Green's theorem for $\int_c (xy + y^2)dx + x^2 dy$, where c is bounded by y = x and $y = x^2$. **(06 Marks)**

b. Evaluate the surface integral $\iint_s \vec{F} . N ds$ where $\vec{F} = 4xi - 2y^2 j + z^2 k$ and s is the surface bounding the region $x^2 + y^2 = 4$, z = 0 and z = 3. **(05 Marks)**

c. Show that the shortest distance between any two points in a plane is a straight line. **(05 Marks)**

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CBCS Scheme

USN | | | | | | | | | | | **15CS32**

Third Semester B.E. Degree Examination, June/July 2017
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. Explain with help of a circuit diagram and characteristic curves working of N-channel DE MOSFET. **(12 Marks)**
b. List and explain any one application of FET and its working with circuit Diagram. **(04 Marks)**

OR

2 a. Explain the performance parameters of operational amplifier. **(08 Marks)**
b. Mention and explain the working of any two applications of operational amplifier. **(08 Marks)**

Module-2

3 a. What is a logical gate? Realize $((A+B)\cdot C)D$ using only NAND Gates. **(04 Marks)**
b. Describe positive and Negative logic. List the equivalences between them. **(04 Marks)**
c. Find the minimal SOP (sum of product) for the following Boolean functions using K-map
i) $f(a, b, c, d) = \sum m(6, 7, 9, 10, 13) + d(1, 4, 5, 11)$
ii) $f(a, b, c, d) = \pi M(1, 2, 3, 4, 10) + d(0, 15)$ **(08 Marks)**

OR

4 a. Using Quine – MCClusky Method simplify the following Boolean equation.
$f(a, b, c, d) = \sum m(0, 1, 2, 3, 10, 11, 12, 13, 14, 15)$. **(10 Marks)**
b. Define Hazard. Explain Different Types of Hazards. **(06 Marks)**

Module-3

5 a. What is multiplexer? Design a 32 to 1 multiplexer (MUX) using two 16 to 1 MUX and one 2 to 1 MUX. **(04 Marks)**
b. Show How using 3 to 8 Decoder and multi input OR gates, following Boolean Expressions can be realized simultaneously
$F_1(a, b, c) = \sum m(0, 4, 6)$, $F_2(a, b, c) = \sum m(0, 5)$, $F_3(a, b, c) = \sum m(1, 2, 3, 7)$ **(05 Marks)**
c. Design 7 segment Decoder using PLA. **(07 Marks)**

OR

6 a. Implement the Boolean function expressed by SOP $f(a, b, c, d) = \sum m(1, 2, 5, 6, 9, 12)$ using 8 : 1 MUX. **(04 Marks)**
b. What is magnitude comparator? Design and explain 2 bit magnitude comparator. **(08 Marks)**
c. Differentiate between combinational and sequential circuit. **(04 Marks)**

Module-4

7 a. With a neat logic diagrams and truth table. Explain the working of JK master slave Flip-Flop along with its implementation using NAND Gates. **(10 Marks)**
b. Derive the characteristic equation for SR, D and JK Flip-Flop. **(06 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

8 a. Using Negative Edge triggered D-Flip Flop. Draw a Logic diagram of 4 bit serial in serial out (SISO) Register. Draw the waveform to shift Binary number 1010 into this register. **(06 Marks)**

b. Explain with neat diagram How shift Register can be applied for serial addition. **(07 Marks)**

c. Differentiate between synchronous and Asynchronous counter. **(03 Marks)**

Module-5

9 a. Design Asynchronous counter for the sequences $0 \rightarrow 4 \rightarrow 1 \rightarrow 2 \rightarrow 6 \rightarrow 0 \rightarrow 4$. Using S. R Flip-Flop. **(12 Marks)**

b. With neat diagram. Explain Digital Clock. **(04 Marks)**

OR

10 a. Explain 2 bit simultaneous A/D converter. **(10 Marks)**

b. What is Binary Ladder? Explain the Binary Ladder with Digital input of 1000. **(06 Marks)**

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CBCS Scheme

USN | | | | | | | | | | | **15CS33**

Third Semester B.E. Degree Examination, June/July 2017
Data Structure and Applications

Time: 3 hrs. Max. Marks: 80

Note: Answer 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. Write a C program with an appropriate structure definition and variable declaration to read and display information about 5 employees using nested structures. Consider the following fields like Ename, Empid, DOJ (Date, Month, Year) and Salary (Basic, DA, HRA). **(08 Marks)**

b. Give ADT of sparse matrix and show with a suitable example sparse matrix representation storing as triples. Give a sample transpose function to transpose sparse matrix. **(08 Marks)**

OR

2 a. What is a polynomial? What is the degree of the polynomial? Write a function to add two polynomials. **(08 Marks)**

b. List and explain the functions supported by C for dynamic memory allocation. **(04 Marks)**

c. Write a C program to concatenate Fname and Lname of a person without using any library function. **(04 Marks)**

Module-2

3 a. Define stack and write the ADT of stack. Implement push and pop functions for stack using arrays with StackFull and StackEmpty conditions. **(08 Marks)**

b. What is an input restricted double ended queue? Implement the same with the supporting functions. **(08 Marks)**

OR

4 a. 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)**

b. Write a function to evaluate a postfix expression and trace the same for the expression a b/c – d e ∗ + a c ∗ where a = 6, b = 3, c = 1, d = 2, e = 4. **(06 Marks)**

c. Explain with a suitable example, how would you implement circular queue using dynamically allocated arrays. **(06 Marks)**

Module-3

5 a. Give the node structure to create a linked list of integers and write C functions to perform the following:
i) Create a three node list with data 10, 20 and 30.
ii) Insert a node with the data value 15 in between the nodes having the data values 10 and 20.
iii) Delete the node whose data is 20.
iv) Display the resulting singly linked list. **(10 Marks)**

b. Write a node structure for linked representation of polynomial. Explain the algorithm to add two polynomials represented using linked list. **(06 Marks)**

OR

6 a. Write C functions to perform the following:
   i) Reversing a singly linked list.
   ii) Concatenating singly linked list.
   iii) Finding the length of the list. **(06 Marks)**

b. List out the difference between the doubly linked list and singly linked list. Illustrate with example the following operations on a doubly linked list:
   i) Inserting a node at the beginning.
   ii) Inserting at the intermediate position.
   iii) Deletion of a node with a given value.
   iv) Search a key element. **(10 Marks)**

Module-4

7 a. Define binary trees. Explain the following with example:
   i) Complete binary tree
   ii) Skewed binary tree
   iii) Almost complete binary tree
   iv) Degree of a binary tree. **(09 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. **(07 Marks)**

OR

8 a. Draw a binary tree for the following expression $3+4*(7-6)/4+3$. Traverse the above generated tree using inorder, preorder and postorder. Also write a function in C for each one. **(09 Marks)**

b. What is the advantage of threaded binary tree over binary tree? Explain the construction of threaded binary tree for 10, 20, 30, 40, 50. **(07 Marks)**

Module-5

9 a. Define graph. Write the difference between graph and trees. For the given graph, show the adjacency matrix and adjacency list representation of the graph. [Refer Fig.Q9(a)]

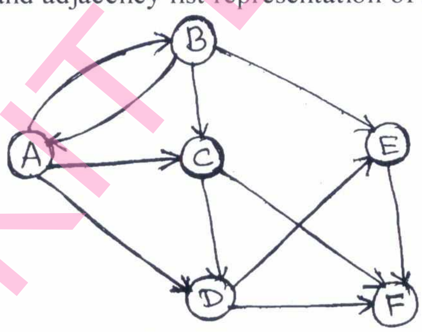

Fig.Q9(a) **(08 Marks)**

b. What are the methods used for traversing a graph? Explain any one with example. **(08 Marks)**

OR

10 a. Write a C function for insertion sort. Sort the following list using insertion sort: 50, 30, 10, 70, 40, 20, 60. **(08 Marks)**

b. What is collision? What are the methods to resolve collision? Explain linear probing with an example. **(08 Marks)**

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CBCS Scheme

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Third Semester B.E. Degree Examination, June/July 2017

Computer Organization

Time: 3 hrs. Max. Marks: 80

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 block diagram discuss the basic operational concept of a computer. **(06 Marks)**
b. Explain the methods to improve the performance of computer. **(04 Marks)**
c. Explain Big-Endian, little Endian and assignment byte addressability. **(06 Marks)**

OR

2 a. What are addressing modes? Explain the different 4 types addressing modes with example. **(08 Marks)**
b. Write the use of Rotate and shift instruction with example. **(04 Marks)**
c. What is stack and queue? Write the line of code to implement the same. **(04 Marks)**

Module-2

3 a. Define bus arbitration? Explain detail any one approach of bus arbitaration. **(08 Marks)**
b. What are priority interrupts? Explain any one interrupt priority scheme. **(04 Marks)**
c. Write a note on register in DMA interface. **(04 Marks)**

OR

4 a. With a block diagram explain how the printer interfaced to processor. **(08 Marks)**
b. Explain the following with respect to U.S.B
i) U.S.B Architecture
ii) U.S.B protocols. **(08 Marks)**

Module-3

5 a. Define :
i) Memory Latency
ii) Memory bandwidth
iii) Hit-rate
iv) Miss-penality. **(04 Marks)**
b. With a neat diagram explain the internal organization of a 2M×8 dynamic memory chip. **(06 Marks)**
c. Explain Associative mapping technique and set Associative mapping technique. **(06 Marks)**

OR

6 a. What is virtual memory? With a diagram explain how virtual memory address is translated. **(08 Marks)**
b. Write a note on :
i) Magnetic tape system
ii) Flash memory. **(08 Marks)**

Module-4

7 a. Perform following operations on the 5-bit signed numbers using 2's complement representation system. Also indicate whether overflow has occurred.
i) $(-9)+(-7)$ ii) $(+7)-(-8)$. **(04 Marks)**

b. Explain with a neat block diagram, 4 bit carry lookahead adder. **(05 Marks)**

c. Explain the concept of carry save addition for the multiplication operation, M×Q = P for 4-bit operands with diagram and suitable example. **(07 Marks)**

OR

8 a. Multiply the following signed 2's complement numbers using Booth's algorithm multiplicand = $(010111)_2$, multiplier = $(110110)_2$. **(05 Marks)**

b. Perform division operation on the following unsigned numbers using the restoring method. Dividend = $(10101)_2$ Divisor = $(00100)_2$, **(05 Marks)**

c. With a neat diagram, explain the floating point addition/subtraction unit. **(06 Marks)**

Module-5

9 a. Draw and explain multiple bus organization of CPU. And write the control sequence for the instruction Add R4, R5, R6 for the multiple bus organization. **(08 Marks)**

b. Explain with neat diagram, micro-programmed control method for design of control unit and write the micro-routine for the instruction Branch < 0. **(08 Marks)**

OR

10 a. With block diagram, explain the working of microwave oven in an embedded system. **(08 Marks)**

b. With block diagram, explain parallel I/O interface. **(08 Marks)**

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CBCS Scheme

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Third Semester B.E. Degree Examination, June/July 2017
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. With a neat diagram, explain the architecture of Unix operating system. **(08 Marks)**
b. With the help of a diagram, explain the parent – child relationship in Unix File System. **(04 Marks)**
c. Explain the following commands with the syntax and example :
i) tty   ii) printf   iii) date   iv) Uname **(04 Marks)**

OR

2 a. Explain the salient features of Unix operating system. **(08 Marks)**
b. Differentiate between external and internal commands in Unix with suitable example. **(04 Marks)**
c. Explain the following commands with syntax and example :
i) stty   ii) echo   iii) cal   iv) passwd **(04 Marks)**

Module-2

3 a. Illustrate with a diagram typical Unix file system and explain different types of files supported in Unix. **(08 Marks)**
b. Name the command used for creating, deleting and changing the directory. Explain with the syntax and example. **(08 Marks)**

OR

4 a. Which command is used for listing file attributes? Explain the significance of each field in the output. **(08 Marks)**
b. Files current permissions are rw - - w – r - - write chmod expressions required to change them for the following.
i) r - - r - - - - x   ii) rwxrwx - - x   iii) r - xr - xr - x   iv) rwxrwxr - -.
Using both relative and Absolute methods of assigning permissions. **(08 Marks)**

Module-3

5 a. Explain the three modes of Vi and explain how can you switch from one mode to another. **(04 Marks)**
b. Explain what these wild – card pattern match :
i) [A – Z] ????*   ii) *[!0 – 9]*   iii) ∗ · [!S] [!h] **(06 Marks)**
c. With suitable examples, explain the grep command and its various options. **(06 Marks)**

OR

6 a. Briefly explain the extended Regular expression with an example. **(06 Marks)**
b. Explain the three sources of standard input and standard output. **(04 Marks)**

c. Write the Unix commands for the following :
   i) Find and replace all the occurrences of "Unix" with "UNIX" in the text file after confirming the user. [Vi editor command].
   ii) To delete all files with three character extension except "·out" from current directory.
   iii) List all the files in PWD which are having exactly five characters in their filename and any numbers characters in their extension.
   iv) Writing the first 50 lines to another file. [Vi editor command].
   v) Inserting a text at the beginning of the line. [Vi editor command].
   vi) Searching for a pattern in backward direction. **(06 Marks)**

Module-4

7 a. What is shell programming? Write a shell program to create a menu and execute a given options based on users choice. Options include
   i) List of users   ii) List of processes   iii) List of files
   iv) Current date   v) Content of files   vi) Display current login users. **(10 Marks)**
  b. Explain the following with an example: i) head ii) tail iii) cut. **(06 Marks)**

OR

8 a. What is shell script? Explain the following statements with syntax and example :
   i) if ii) case iii) while. **(10 Marks)**
  b. Distinguish between hard links and soft links with suitable example. **(06 Marks)**

Module-5

9 a. Write a Perl script to determine whether the given year is a leap year or not. **(08 Marks)**
  b. Explain the mechanisms of process creation. **(06 Marks)**
  c. What is an associative array? **(02 Marks)**

OR

10 a. Explain the following in PERL with example. i) Split iii) Join. **(08 Marks)**
  b. Explain variables and operators in PERL. **(06 Marks)**
  c. Briefly explain the subroutines in PERL. **(02 Marks)**

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CBCS Scheme

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15CS36

Third Semester B.E. Degree Examination, June/July 2017

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. Define the following with an example for each
 i) Proposition
 ii) Tautology
 iii) Contradiction
 iv) Dual of statement. **(06 Marks)**

b. Establish the validity of the following argument using rules of inference. If the band could not play rock music or the refreshments were not served on time, then the new year party could have been cancelled and Alica would have been angry. If the party were cancelled, then refunds would have to be made. No refunds were made, therefore the band could play rock music. **(05 Marks)**

c. Determine the truth value of the following statements if the universe comprises all nonzero integers :
 i) $\exists x \exists y [xy = 2]$
 ii) $\exists x \forall y [xy = 2]$
 iii) $\forall x \exists y [xy = 2]$
 iv) $\exists x \exists y [(3x + y = 8) \wedge (2x - y) = 7]$
 v) $\exists x \exists y [(4x + 2y = 3) \wedge (x - y = 1)]$ **(05 Marks)**

OR

2 a. Find the possible truth values for p, q and r if
 i) $p \rightarrow (q \vee r) = \text{FALSE}$
 ii) $p \wedge (q \rightarrow r) = \text{TRUE}$. **(05 Marks)**

b. Show that $(p \wedge (p \rightarrow q)) \rightarrow q$ is independent of its components. **(06 Marks)**

c. Give a direct proof for each of the following :
 i) For all integers k and ℓ, if k and ℓ are both even, then $k + \ell$ is even
 ii) For all integers k and ℓ, if k and ℓ are both even, then $k * \ell$ is even. **(05 Marks)**

Module-2

3 a. Prove by mathematical induction, for every positive integer 8 divides $5^n + 2 \cdot 3^{n-1} + 1$. **(06 Marks)**

b. Assuming PASCAL language is case insensitive, an identifier consists of a single letter followed by upto seven symbols which may be letters or digits (26 letters, 10 digits). There are 36 reserved words. How many distinct identifiers are possible in this version of PASCAL? **(05 Marks)**

c. Find the coefficient of $a^2b^3c^2d^5$ in the expansion of $(a + 2b - 3c + 2d + 5)^{16}$. **(05 Marks)**

OR

4 a. Prove that $4n < (n^2 - 7)$ for all positive integers $n \geq 6$. **(05 Marks)**

b. Lucas numbers are defined recursively as $L_0 = 2$, $L_1 = 1$ and $L_n = L_{n-1} + L_{n-2}$ for $n \geq 2$. If Fi^s are fibonacci numbers and Li^s are the Lucas numbers, prove that $L_n = F_{n-1} + F_{n+1}$ for all positive integers n. **(05 Marks)**

c. Find the number of distinct terms in the expansion of $(w + x + y + z)^{12}$. **(06 Marks)**

Module-3

5 a. Let A = {a, b, c, d} and B = {1, 2, 3, 4, 5, 6}.

i) How many functions are there from A to B? How many of these are one-to-one? How many are onto?

ii) How many functions are there from B to A? How many of these are one-to-one? How many are onto? **(06 Marks)**

b. Prove that if $f : A \rightarrow B$, $g : B \rightarrow C$ are invertible functions, then $g \circ f : A \rightarrow C$ is invertible and $(gof)^{-1} = f^{-1} o g^{-1}$. **(06 Marks)**

c. For the Hasse diagram, given in Fig. Q5(c), write i) maximal ii) minimal iii) greatest and iv) least element (s). **(04 Marks)**

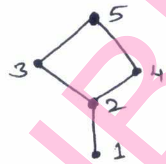

Fig. Q5(c)

OR

6 a. Let $f, g : z^+ \rightarrow z^+$, where for all $x \in z^+$, $f(x) = x + 1$ and $g(x) = \max\{1, x - 1\}$.

i) What is the range of f?

ii) Is f a onto function?

iii) Is f one-to-one?

iv) What is the range of g?

v) Is g an onto function? **(05 Marks)**

b. If $f : A \rightarrow B$ and $B_1, B_2 \leq B$, then prove the following :

i) $f^{-1}(B_1 \cap B_2) = f^{-1}(B_1) \cap f^{-1}(B_2)$

ii) $f^{-1}(B_1 \cup B_2) = f^{-1}(B_1) \cup f^{-1}(B_2)$

iii) $f^{-1}(\overline{B}_1) = \overline{f^{-1}(B_1)}$ **(06 Marks)**

c. Let A = {1, 2, 3, 4}, R = {(1, 3), (1, 1), (3, 1), (1, 2), (3, 3), (4, 4)}be the relation on A. Determine whether the relation R is reflexive, irreflexive, symmetric, antisymmetric or transitive. **(05 Marks)**

Module-4

7 a. Determine the number of positive integers n where $1 \leq n \leq 100$ and n is not divisible by 2, 3 or 5. **(05 Marks)**

b. Describe the expansion formula for rook polynomials. Find the rook polynomial for 3×3 board using the expansion formula. **(05 Marks)**

c. Solve the recurrence relation $b_n = bD_{n-1} - b^2D_{n-2}$, $n \geq 3$ given $D_1 = b > 0$ and $D_2 = 0$. **(06 Marks)**

OR

8 a. In how many ways can we arrange the letters in the CORRESPONDENTS so that ;
i) There is no pair of consecutive identical letters?
ii) There are exactly two pairs of consecutive identical letters
iii) There are atleast 3 pairs of consecutive identical letters **(06 Marks)**

b. Find the recurrence relation and the initial conditions for the sequence 0, 2, 6, 12, 20, 30, 42 ...... Hence find the general term of the sequence. **(05 Marks)**

c. Find the general solution of the equation $S(k) + 3S(k-1) - 4S(k-2) = 4^k$. **(05 Marks)**

Module-5

9 a. Define the following with an example
i) Simple graph
ii) Regular graph
iii) Subgraph
iv) Maximal subgraph
v) Induced subgraph. **(05 Marks)**

b. Show that there exists no simple graphs corresponding to the following degree sequences
i) 0, 2, 2, 3, 4
ii) 1, 1, 2, 3
iii) 2, 3, 3, 4, 5, 6
iv) 2, 2, 4, 6. **(04 Marks)**

c. Let T = (V, E) be a complete m-ary tree with $|V| = n$. If T has ℓ leaves and i internal vertices, then prove the following :
i) $n = m \cdot i + 1$
ii) $\ell = (m-1)i + 1$
iii) $i = \frac{(\ell - 1)}{(m-1)} = \frac{(n-1)}{m}$ **(07 Marks)**

OR

10 a. In the graph shown in Fig. Q10(a). Determine
i) a walk from b to d that is not a trail
ii) b – d trail that is not a path
iii) a path from b to d
iv) a closed walk from b to b that is not a circuit
v) a circuit from b to b that is not a cycle
vi) a cycle from b to b **(06 Marks)**

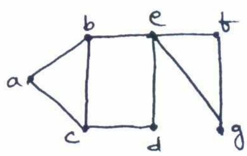

Fig. Q10(a)

b. Determine the order |V| of the graph G = (V, E) in the following cases
i) G is cubic graph with 9 edges
ii) G is regular with 15 edges
iii) G has 10 edges with 2 vertices of degree 4 and all other of degree 3. **(06 Marks)**

c. Obtain the optimal prefix code for the string ROAD IS GOOD. **(04 Marks)**

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CBCS Scheme

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

15MATDIP31

Third Semester B.E. Degree Examination, June/July 2017

Additional Mathematics - I

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

b. Express $\sqrt{3}+i$ in the polar form and hence find their modulus and amplitudes. **(05 Marks)**

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

OR

2 a. Simplify **(06 Marks)**

$$\frac{(\cos 3\theta + i\sin 3\theta)^4(\cos 4\theta + i\sin 4\theta)^5}{(\cos 4\theta + i\sin 4\theta)^3 + (\cos 5\theta + i\sin 5\theta)^{-4}}$$

b. If $\vec{a} = i+2j-3k$ and $\vec{b} = 3i-j+2k$, then show that $(\vec{a}+\vec{b})$ and $(\vec{a}-\vec{b})$ are orthogonal. **(05 Marks)**

c. Find the value of λ so that the vectors $\vec{a} = 2i-3j+k$, $\vec{b} = i+2j-3k$ and $\vec{c} = j+\lambda k$ are co-planar. **(05 Marks)**

Module-2

3 a. If y = cos (m log x) then prove that $x^2y_{n+2} + (2n+1)xy_{n+1} + (m^2+n^2)y_n = 0$. **(06 Marks)**

b. With usual notation prove that

$$\tan\phi = \frac{rd\theta}{dr}.$$ **(05 Marks)**

c. If $u = \log_e\left(\frac{x^4+y^4}{x+y}\right)$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3$. **(05 Marks)**

OR

4 a. Find the Pedal equation of $r = a[1-\cos\theta]$. **(06 Marks)**

b. Expand $\log_e(1+x)$ in ascending powers of x as far as the term containing x^4. **(05 Marks)**

c. Find the total derivative of $Z = xy^2 + x^2y$, where $x = at^2$ $y = 2at$. **(05 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi/6} \sin^6 3x\,dx$ using Reduction formula. **(06 Marks)**

b. Evaluate $\int_0^1 x^6\sqrt{1-x^2}\,dx$ – using Reduction formula. **(05 Marks)**

c. Evaluate $\int_1^2\int_0^{2-y} xy\,dx\,dy$. **(05 Marks)**

OR

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.

6 a. Evaluate $\int_0^{\pi/2} \sin^3 x \cos^7 x \, dx$. **(06 Marks)**

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

c. Evaluate $\int_0^3 \int_0^2 \int_0^1 (x + y + z) \, dz \, dx \, dy$. **(05 Marks)**

Module-4

7 a. A particle moves along the curve $\vec{r} = (1-t^3)\hat{i} + (1+t^2)\hat{j} + (2t - 5)\hat{k}$. Determine the velocity and acceleration. **(06 Marks)**

b. Find the directional derivative of $\phi = xy^2 + yz^3$ at the point (2,-1, 1) in the direction of the vector i + 2j + 2k. **(05 Marks)**

c. Find the constant 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. **(05 Marks)**

OR

8 a. Find the angle between the tangents to the curve $\vec{r} = t^2\,\hat{i} + 2t\,\hat{j} - t^3\,\hat{k}$ at the points $t = \pm 1$. **(06 Marks)**

b. Find the divergence and curl of the vector
$\vec{F} = (xyz + y^2z)\,\hat{i} + (3x^2 + y^2z)\,\hat{j} + (xz^2 - y^2z)\,\hat{k}$. **(05 Marks)**

c. If $\vec{F} = (ax + 3y + 4z)\,\hat{i} + (x - 2y + 3z)\,\hat{j} + (3x + 2y - z)\,\hat{k}$ is solenoidal, find a. **(05 Marks)**

Module-5

9 a. Solve $\dfrac{dy}{dx} = \dfrac{y}{x - \sqrt{xy}}$. **(06 Marks)**

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

c. Solve $\dfrac{dy}{dx} = \dfrac{x + 2y - 1}{x + 2y + 1}$. **(05 Marks)**

OR

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

b. Solve $x\dfrac{dy}{dx} + y = x^3 y^6$. **(05 Marks)**

c. $(1 + xy)\, y dx + (1 - xy)\, x dy = 0$. **(05 Marks)**

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