(15) III CS, IS (S)

CBCS Scheme

USN | | | | | | | | | | | 15MAT31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. Expand $f(x) = x - x^2$ as a Fourier series in the interval $(-\pi, \pi)$. **(08 Marks)**

b. Obtain the half-range cosine series for the function $f(x) = x(l - x)$ in the interval $0 \le x \le l$. **(08 Marks)**

OR

2 a. Obtain the Fourier series of $f(x) = \dfrac{\pi - x}{2}$ in $0 < x < 2\pi$. Hence deduce that $\dfrac{\pi}{4} = 1 - \dfrac{1}{3} + \dfrac{1}{5} - \dfrac{1}{7} + \ldots\ldots$ **(06 Marks)**

b. Find the half-range sine series for the function
$$f(x) = \begin{cases} \frac{1}{4} - x & \text{in} \quad 0 < x < 1/2 \\ x - \frac{3}{4} & \text{in} \quad 1/2 < x < 1 \end{cases}.$$ **(05 Marks)**

c. Compute the constant term and the coefficient of the 1st sine and cosine terms in the Fourier series of y as given in the following table:

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

(05 Marks)

Module-2

3 a. If $f(x) = \begin{cases} 1 - x^2; & |x| < 1 \\ 0; & |x| \ge 1 \end{cases}$. Find the Fourier transform of f(x) and hence find the value of $\displaystyle\int_0^\infty \frac{x\cos x - \sin x}{x^3}\,dx$. **(06 Marks)**

b. Find the Fourier sine and cosine transform of
$$f(x) = \begin{cases} x, & 0 < x < 2 \\ 0, & \text{elsewhere} \end{cases}.$$ **(05 Marks)**

c. Solve using Z-transform $y_{n+2} - 4y_n = 0$ given that $y_0 = 0$, $y_1 = 2$. **(05 Marks)**

OR

4 a. Obtain the inverse Fourier sine transform of $F_S(\alpha) = \dfrac{e^{-a\alpha}}{\alpha}$, $a > 0$. **(06 Marks)**

b. Find the Z-transform of $2n + \sin\left(\dfrac{n\pi}{4}\right) + 1$. **(05 Marks)**

c. If $U(z) = \dfrac{z}{z^2 + 7z + 10}$, find the inverse Z-transform. **(05 Marks)**

Module-3

5 a. Obtain the coefficient of correlation for the following data:

x :	10	14	18	22	26	30
y :	18	12	24	6	30	36

(06 Marks)

b. By the method of least square find the straight line that best fits the following data:

x :	1	2	3	4	5
y :	14	27	40	55	68

(05 Marks)

c. Use Newton-Raphson method to find a root of the equation $\tan x - x = 0$ near $x = 4.5$. Carry out two iterations. **(05 Marks)**

OR

6 a. Find the regression line of y on x for the following data:

x :	1	3	4	6	8	9	11	14
y :	1	2	4	4	5	7	8	9

Estimate the value of y when x = 10. **(06 Marks)**

b. Fit a second degree parabola to the following data:

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(05 Marks)

c. Solve $xe^x - 2 = 0$ using Regula – Falsi method. **(05 Marks)**

Module-4

7 a. From the data given in the following table. Find the number of students who obtained less than 70 marks.

Marks :	0-19	20-39	40-59	60-79	80-99
Number of students :	41	62	65	50	17

(06 Marks)

b. Find the equation of the polynomial which passes through the points (4, -43), (7, 83), (9, 327) and (12, 1053). Using Newton's divided difference interpolation. **(05 Marks)**

c. Compute the value of $\int_{0.2}^{1.4} (\sin x - \log x + e^x)\,dx$ using Simpson's $\frac{3}{8}^{\text{th}}$ rule taking six parts.

(05 Marks)

OR

8 a. Using Newton's backward interpolation formula find the interpolating polynomial for the function given by the following table:

x :	10	11	12	13
f(x) :	22	24	28	34

Hence fine f(12.5). **(06 Marks)**

b. The following table gives the premium payable at ages in years completed. Interpolate the premium payable at age 35 completed. Using Lagrange's formula.

Age completed :	25	30	40	60
Premium in Rs. :	50	55	70	95

(05 Marks)

c. Evaluate $\int_{4}^{5.2} \log_e x \; dx$ taking 6 equal strips by applying Waddles rule. **(05 Marks)**

Module-5

9 a. Verify Green's theorem for $\oint(xy + y^2)dx + x^2dy$ where c is the closed curve of the region bounded by y = x and y = xz. **(06 Marks)**

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

c. A heavy cable hangs freely under gravity between two fixed points. Show that the shape of the cable is a catenary. **(05 Marks)**

OR

10 a. Use divergence theorem to evaluate $\iint_S \vec{F}\hat{n}\, ds$ over the entire surface of the region above XoY plane bounded by the cone $z^2 = x^2 + y^2$, the plane z = 4 where $\vec{F} = 4xz^1\hat{i} + xyz^2\hat{j} + 3z\hat{k}$. **(06 Marks)**

b. Find the extremal of the functional $\int_{x_1}^{x_2}\left[(y^1)^2 - y^2 + 2y\sec x\right]dx$. **(05 Marks)**

c. Prove that the shortest distance between two points in a plane is along the straight line joining them. **(05 Marks)**

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CBCS Scheme

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

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Analog and Digital Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the working of N – channel DE – MOSFET, with the help of neat diagram. **(08 Marks)**

b. With circuit diagram, explain any two application of FET. **(06 Marks)**

c. How CMOS can be used as inverting switch? **(02 Marks)**

OR

2 a. Design a voltage divider bias network using a DEMOSFET with supply voltage V_{DD} = 16V, I_{DSS} = 10mA and V_P = 5V to have a quiescent drain current of 5mA and gate voltage of 4V. (Assume the drain resistor R_D to be four times the source resistor R_S and R_2 = 1kΩ). **(08 Marks)**

b. Explain the performance parameters of Op-amp. **(08 Marks)**

Module-2

3 a. Minimize the following Boolean function using K – map method
$f(a, b, c, d) = \Sigma m (5, 6, 7, 12, 13) + \Sigma d (4, 9, 14, 15)$. **(06 Marks)**

b. Apply Quine Mc – Clusky method to find the essential prime implicants for the Boolean expression $f(a, b, c, d) = \Sigma m (1, 3, 6, 7, 9, 10, 12, 13, 14, 15)$. **(10 Marks)**

OR

4 a. A digital system is to be designed in which the month of the year is given as input is four bit form. The month January is represented as '0000', February as '0001' and so on. The output of the system should be '1' corresponding to the input of the month containing 31 days or otherwise it is '0'. Consider the excess number in the input beyond '1011' as don't care conditions for the system of four variables. (ABCD) find the following :
i) Write truth table and Boolean expression in SOP Σm and POS ΠM form.
ii) Using K – map simplify the Boolean expression of canonical mini term form.
iii) Using Basic gates implement logical circuit. **(10 Marks)**

b. What is Hazard? List the type of hazards and explain static 0 and static – 1 hazard. **(06 Marks)**

Module-3

5 a. Implement the following function using 8:1 multiplexer $f(a, b, c, d) = \Sigma m (0, 1, 5, 6, 8, 10, 12, 15)$. **(06 Marks)**

b. Realize the following function using 3:8 decoder
i) $f(a, b, c) = \Sigma m (1, 2, 3, 4)$ ii) $f(a, b, c) = \Sigma m(3, 5, 7)$. **(04 Marks)**

c. What is Magnitude Comparator? Explain 1 bit magnitude comparator. **(06 Marks)**

OR

6 a. Design 7 – segment decoder using PLA. **(08 Marks)**

b. Differentiate between Combinational and Sequential circuit. **(04 Marks)**

c. Write VHDL code for given circuit. **(04 Marks)**

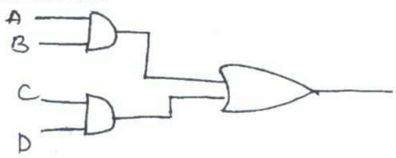

Fig.Q6(c)

Module-4

7 a. What is Race around condition? With block diagram and truth table, explain the working of JK master – slave flip – flop. **(10 Marks)**

b. Give State transition diagram and characteristics equation for JK and SR Flip Flop. **(06 Marks)**

OR

8 a. With neat diagram, explain Ring counter. **(04 Marks)**

b. What is Shift Register? With neat diagram, explain 4 bit parallel in serial out shift resisters. **(08 Marks)**

c. Compare Synchronous and Asynchronous counter. **(04 Marks)**

Module-5

9 a. Define Counter. Design A synchronous counter for the sequence $0 \rightarrow 4 \rightarrow 1 \rightarrow 2 \rightarrow 6 \rightarrow 0 \rightarrow 4$ using JK Flip – Flop. **(12 Marks)**

b. Explain Digital clock, with neat diagram. **(04 Marks)**

OR

10 a. Explain the Binary ladder with Digital input of 1000. **(06 Marks)**

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

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CBCS Scheme

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

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Data Structures 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. What is an algorithm? Explain the criteria that an algorithm must satisfy. **(08 Marks)**

b. Write a function to sort integers using selection sort algorithm. **(04 Marks)**

c. Consider two polynomials,

$A(x) = 4x^{15} + 3x^4 + 5$ and $B(x) = x^4 + 10x^2 + 1$

Show deagramatically how these two polynomials can be stored in a 1-D array. Also give its C representation. **(04 Marks)**

OR

2 a. Write the Knuth Morris Pratt pattern matching algorithm and apply the same to search the pattern 'abcdabcy' in the text 'abcxabcdabxabcdabcdabcy'. **(08 Marks)**

b. Write the fast transpose algorithm to transpose the given sparse matrix. Express the given sparse matrix as triplets and find its transpose.

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

(08 Marks)

Module-2

3 a. Write the algorithm to implement a stack using dynamic array whose initial capacity is 1 and array doubling is used to increase the stack's capacity (that is dynamically reallocate twice the memory) whenever an element is added to a full stack. Implement the operations-push, pop and display. **(08 Marks)**

b. Write the algorithm for of tower of Hanoi. **(04 Marks)**

c. Write a note on Ackerman's function. **(04 Marks)**

OR

4 a. List the disadvantages of linear queue and explain how is it solved in circular queue. Give the algorithm to implement a circular queue with suitable example. **(08 Marks)**

b. Convert the infix expression, $((a/(b-c+d))*(e-a)*c)$ to postfix expression. Write a function to evaluate that postfix expression and trace for the given data $a = 6$, $b = 3$, $c = 1$, $d = 2$, $e = 4$. **(08 Marks)**

Module-3

5 a. Give the node structure to create a singly linked list of integers and write functions to perform the following :
   (i) Create a list.
   (ii) Assume the list contains 3 nodes with data 10, 20, 30. Insert a node with data 40 at the end of the list.
   (iii) Insert a node with data 50 between the nodes having data values 10 and 20.
   (iv) Display the singly linked list. **(08 Marks)**

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

c. For the given sparse matrix, write the diagrammatic linked list representation.

$$A = \begin{bmatrix} 0 & 10 & 0 & 0 \\ 3 & 0 & 0 & 5 \\ 8 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 8 & 0 \end{bmatrix}.$$ **(04 Marks)**

OR

6 a. Write the functions for singly linked list with integer data to search an element in the list. **(08 Marks)**

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

Module-4

7 a. What is a tree? With suitable example define (i) Binary tree (ii) Level of a binary tree (iii) Complete binary tree. **(08 Marks)**

b. Write the routines to traverse the given tree using (i) Pre-order traversal and (ii) Post order traversal. **(08 Marks)**

OR

8 a. What is a binary search tree? Write algorithm to implement for recursive search or iterative search for a binary search tree. **(08 Marks)**

b. Write the routines for, (i) Create a binary tree. (ii) Testing for equality of binary trees. **(08 Marks)**

Module-5

9 a. What is a graph? Give the matrix and adjacency list representation of graphs. **(08 Marks)**

b. Write an algorithm for bubble sort. Trace the algorithm for the data :
30, 20, 10, 40, 80, 60, 70. **(08 Marks)**

OR

10 a. Explain open addressing and chaining used to handle overflows in hashing. **(05 Marks)**

b. Explain directoryless dynamic hashing. **(05 Marks)**

c. Briefly explain basic operations that can be performed on a file. Explain indexed sequential file organization. **(06 Marks)**

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CBCS Scheme

USN

15CS34

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. With a neat diagram, explain basic operational concept of computer. **(06 Marks)**
b. What is performance measurement? Explain overall SPEC rating for computer. **(04 Marks)**
c. Draw single bus structure, discuss about memory mapped I/O. **(06 Marks)**

OR

2 a. What is an addressing mode? Explain any three addressing modes with example. **(10 Marks)**
b. Explain BIG-ENDIAN and LITTLE-ENDIAN methods of byte addressing with proper example. **(06 Marks)**

Module-2

3 a. What is an Interrupt? With example illustrate concept of interrupt. **(06 Marks)**
b. Define Exception. Explain 2 kinds of exception. **(04 Marks)**
c. With a neat diagram explain DMA controller. **(06 Marks)**

OR

4 a. Explain PCI bus. **(05 Marks)**
b. List SCSI bus signal with their functionalities. **(05 Marks)**
c. Explain the tree structure of USB with split bus operation. **(06 Marks)**

Module-3

5 a. Briefly explain any two mapping function used in cache memory. **(08 Marks)**
b. With a neat diagram explain the internal organization of memory chip (2M×8 and dynamic memory chip). **(08 Marks)**

OR

6 a. Explain the following :
i) Hit Rate and Miss penalty ii) Virtual memory organization. **(08 Marks)**
b. With diagram explain how virtual memory translation take place. **(08 Marks)**

Module-4

7 a. Draw 4-bit carry-look ahead adder and explain. **(06 Marks)**
b. Perform multiplication for -13 and +09 using Booth's Algorithm. **(06 Marks)**
c. Design a logic circuit to perform addition/subtraction of 'n' bit number X and Y. **(04 Marks)**

OR

8 a. Explain IEEE standard for floating point number. **(06 Marks)**
b. With figure explain circuit arrangement for binary division. **(10 Marks)**

Module-5

9 a. With a figure explain single bus organization of datapath inside a processor. **(08 Marks)**
b. What are the actions required to Execute a complete instruction Add (R3), R_1. **(02 Marks)**
c. Give the control sequence for execution of instruction ADD (R3), R_1. **(06 Marks)**

OR

10 a. Briefly explain the block diagram of camera. **(08 Marks)**
b. Explain multiprocessors. Justify how time is reduced. **(08 Marks)**

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USN | | | | | | | | | | | 15CS35

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
UNIX and Shell Programming

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Discuss the salient features of UNIX Operating system. **(06 Marks)**
b. Explain the following commands with examples :
i) echo ii) ℓs iii) who iv) date. **(04 Marks)**
c. Write a note on man documentation and explain the keyword option and whatis option? **(06 Marks)**

OR

2 a. Explain how to display and set the terminal characteristics of a UNIX OS. **(06 Marks)**
b. Explain the contents of /etc/passwd and /etc/shadow file with respect to UNIX OS. **(06 Marks)**
c. Explain the commands to add and delete a user. **(04 Marks)**

Module-2

3 a. Explain the different file types available in UNIX. **(06 Marks)**
b. With the help of a neat diagram, explain the parent child relationship with respect to UNIX file system. **(05 Marks)**
c. Explain the following commands with example :
i) HOME ii) cd iii) pwd iv) mkdir v) rmdir. **(05 Marks)**

OR

4 a. Explain the following commands with example :
i) cat ii) mv iii) rm iv) cp v) wc. **(05 Marks)**
b. Explain the seven field output of ℓs - ℓ command. **(05 Marks)**
c. What are different ways of setting file permissions? **(06 Marks)**

Module-3

5 a. Explain the different modes of vi editor. **(04 Marks)**
b. Explain how the text is entered and replaced in input mode of vi editor. **(06 Marks)**
c. Discuss the navigation commands in vi editor with example. **(06 Marks)**

OR

6 a. Explain Shell's interpretive life cycle. **(04 Marks)**
b. Discuss the three standard files supported by UNIX. Also give details about the special files used for output redirection in UNIX. **(06 Marks)**
c. With the help of example, explain grep command and list its options with their significance. **(06 Marks)**

Module-4

7 a. Explain the shell features of "while" and "for" with syntax. **(08 Marks)**
b. Explain with example set and shift commands in UNIX to manipulate positional parameters. **(08 Marks)**

OR

8	a.	Differentiate between hard link and soft link.	**(04 Marks)**
	b.	Explain the following with example : i) head ii) tail iii) cut iv) paste.	**(08 Marks)**
	c.	Discuss briefly sort command with its options.	**(04 Marks)**

Module-5

9	a.	Explain mechanism of process creation.	**(04 Marks)**
	b.	Explain the following command : i) at ii) cron iii) nice iv) nohup.	**(08 Marks)**
	c.	Explain find command with its options.	**(04 Marks)**

OR

10	a.	Explain the following string handling functions of PERL with examples : i) length ii) index iii) substr iv) reverse.	**(08 Marks)**
	b.	With suitable examples, explain split and join functions in Perl.	**(04 Marks)**
	c.	Explain file handling in Perl.	**(04 Marks)**

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CBCS Scheme

USN | | | | | | | | | | | 15CS36

Third Semester B.E. Degree Examination, Dec.2016/Jan.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. Let p, q and r be propositions having truth values 0, 0 and 1 respectively. Find the truth values of the following compound proposition
i) $(p \wedge q) \rightarrow r$ ii) $p \rightarrow (q \wedge r)$ iii) $p \wedge (r \rightarrow q)$ iv) $p \rightarrow (q \rightarrow (\neg r))$ **(04 Marks)**

b. Define tautology. Prove that for any propositions p, q, r the compound proposition $[(p \vee q) \wedge \{(p \rightarrow r) \wedge (q \rightarrow r)\}] \rightarrow r$ is tautology. **(04 Marks)**

c. Establish the validity of the following argument
$\forall x, [p(x) \vee q(x)]$
$\exists x, \neg p(x)$
$\forall x, [\neg q(x) \vee r(x)]$
$\forall x, [s(x) \rightarrow \neg r(x)]$
$\therefore \quad \exists x \ \neg s(x)$ **(04 Marks)**

d. Give i) direct proof and ii) proof by contradiction for the following statement. "If 'n' is an odd integer, then n+9 is an even integer". **(04 Marks)**

OR

2 a. Define dual of a logical statement. Verify the principle of duality for the following logical equivalence $[\sim (p \wedge q) \rightarrow \sim p \vee (\sim p \vee q)] \Leftrightarrow (\sim p \vee q)$. **(04 Marks)**

b. Prove the following by using laws of logic
i) $p \rightarrow (q \rightarrow r) \Leftrightarrow (p \wedge q) \rightarrow r$
ii) $[\sim p \wedge (\sim q \vee r)] \vee [(q \wedge r) \vee (p \wedge q)] \Leftrightarrow r$. **(04 Marks)**

c. Establish the validity of the following argument using the rules of inference:
$[p \wedge (p \rightarrow q) \wedge (s \vee t) \wedge (r \rightarrow \sim q)] \rightarrow (s \vee t)$ **(04 Marks)**

d. Define i) open sentence ii) quantifiers. For the following statements, the universe comprises all non-zero integers. Determine the truth values of each statement :
i) $\exists x, \exists y\,(xy = 1)$ ii) $\exists x, \forall y\,(xy = 1)$ iii) $\forall x, \exists y\,(xy = 1)$. **(04 Marks)**

Module-2

3 a. By mathematical induction, prove that
$1^2 + 3^2 + 5^2 \ldots\ldots + (2n-1)^2 = \dfrac{n(2n+1)(2n-1)}{3}$. **(05 Marks)**

b. For the Fibonacci sequence show that **(05 Marks)**
$$F_n = \frac{1}{\sqrt{5}}\left[\left(\frac{1+\sqrt{5}}{2}\right)^n - \left(\frac{1-\sqrt{5}}{2}\right)^n\right]$$

c. A women has 11 close relatives and she wishes to invite 5 of them to dinner. In how many ways can she invite them in the following situations : i) There is no restriction on the choice ii) Two particular persons will not attend separately iii) Two particular persons will not attend together. **(06 Marks)**

OR

4 a. Prove that every positive integer $n \geq 24$ can be written as a sum of 5's and /or 7's. **(04 Marks)**

b. Find an explicit definition of the sequence defined recursively by $a_1 = 7$, $a_n = 2a_{n-1}+1$ for $n \geq 2$. **(04 Marks)**

c. i) How many arrangements are there for all letters in the word SOCIOLOGICAL?
ii) In how many of these arrangements A and G are adjacent? In how many of these arrangements all the vowels are adjacent? **(04 Marks)**

d. Find the coefficient of i) x^9y^3 in the expansion of $(2x - 3y)^{12}$ ii) $a^2b^3c^2d^5$ in the expansion of $(a + 2b - 3c + 2d + 5)^{16}$. **(04 Marks)**

Module-3

5 a. Let a function $f : R \rightarrow R$ be defined by $f(x) = x^2 + 1$. Find the images of $A_1=\{2, 3\}$, $A_2 = \{-2, 0, 3\}$, $A_3 = (0, 1)$ and $A_4 = [-6, 3]$. **(04 Marks)**

b. ABC is an equilateral triangle whose sides are of length one cm each. If we select 5 points inside the triangle, prove that at least two of these points are such that the distance between them is less than ½ cm. **(04 Marks)**

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

$$\text{and } h(x) = \begin{cases} 0 & \text{if x is even} \\ 1 & \text{if x is added} \end{cases}.$$

Determine $(f\circ(g\circ h))(x)$ and $((f\circ g)\circ h)(x)$ and verify that $f\circ(g\circ h) = (f\circ g)\circ h$. **(04 Marks)**

d. For A = {a, b, c, d, e} the Hasse diagram for the Poset (A, R) is as shown in Fig Q5(d). Determine the relation matrix for R and Construct the digraph for R **(04 Marks)**

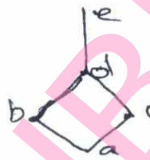

Fig Q5(d)

OR

6 a. Let A = {1, 2, 3} and B = {2, 4, 5}. Determine the
i) Number of binary relations on A.
ii) Number of relations from A to B that contain (1, 2) and (1, 5)
iii) Number of relations from A, B that contain exactly five ordered pairs
iv) Number of binary relations on A that contains at least seven ordered pairs. **(04 Marks)**

b. Let A = B = R be the set of the real numbers, the functions $f : A \rightarrow B$ and $g : B \rightarrow A$ be defined by $f(x) = 2x^3 - 1, \forall x \in A$; $g(y) = \left\{\frac{1}{2}(y+1)\right\}^{1/3} \forall y \in B$. Show that each of f and g is the inverse of the other. **(04 Marks)**

c. Define a relation R on A×A by $(x_1, y_1)\ R\ (x_2, y_2)$ iff $x_1+y_1 = x_2+y_2$, where A ={1, 2, 3, 4, 5}.
i) Verify that R is an equivalence relation on A×A.
ii) Determine the equivalence classes [(1, 3)] and [(2, 4)]. **(04 Marks)**

d. Consider the Hasse diagram of a POSET (A, R) given in Fig Q6(d). If B = {c, d, e} find all upper bounds, lower bounds, the least upper bound and the greatest lower bound of B. **(04 Marks)**

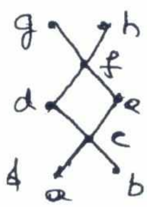

Fig Q6(d)

Module-4

7 a. Determine the number of positive integers n such that $1 \le n \le 100$ and n is not divisible by 2, 3, or 5. **(04 Marks)**

b. In how many ways can the 26 letters of the English alphabet be permuted so that none of the patterns CAR, DOG, PUN or BYTE occurs? **(04 Marks)**

c. 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 (from Monday to Friday)? **(04 Marks)**

d. The number of affected files in a system 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. **(04 Marks)**

OR

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

b. An apple, a banana, a mango and an orange are to be distributed to four boys B_1, B_2, B_3, and B4. The boys B_1 and B_2 do not wish to have apple, the boy, B_3 does not want banana or mango and B_4 refuses orange. In how many ways the distribution can be made so that no boy is displeased? **(05 Marks)**

c. Solve the recurrence relation $a_n = 3a_{n-1} - 2a_{n-2}$ for $n \ge 2$ given that $a_1 = 5$ and $a_2 = 3$. **(05 Marks)**

Module-5

9 a. Define :
  i) Bipartite graph
  ii) Complete bipartite graph
  iii) Regular graph
  iv) Connected graph with an example. **(04 Marks)**

b. Define isomorphism. Verify the two graphs are isomorphic **(04 Marks)**

Fig Q9(b)

c. Show that a tree with n vertices has n-1 edges. **(04 Marks)**

d. Obtain an optimal prefix code for the message ROAD IS GOOD. Indicate the code. **(04 Marks)**

OR

10 a. Determine the order $|V|$ of the graph G = (V, E) in
  i) G is a 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 vertices of degree 3. **(04 Marks)**

b. Prove that in a graph
  i) The sum of the degrees of all the vertices is an even number and is equal to twice the number of edges in the graph.
  ii) The number of vertices of odd degrees is even. **(04 Marks)**

c. Discuss the solution of Konigsberg bridge problem. **(04 Marks)**

d. Define optimal tree and construct an optimal tree for a given set of weights {4, 15, 25, 5, 8, 16}. Hence find the weight of the optimal tree. **(04 Marks)**

CBCS Scheme

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

15MATDIP31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Additional Mathematics – I

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. Simplify $\dfrac{(\cos 3\theta - i\sin 3\theta)^2(\cos 4\theta + i\sin 4\theta)^5}{(\cos\theta + i\sin\theta)^3(\cos 2\theta - i\sin 2\theta)^4}$. (06 Marks)

b. Determine λ such that $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - 4\hat{k}$ and $\vec{c} = \hat{i} + \lambda\hat{j} + 3\hat{k}$ are coplanar. (05 Marks)

c. Find sine angle of two vectors $4\hat{i} + 3\hat{j} + \hat{k}$ and $2\hat{i} - \hat{j} + 2\hat{k}$. (05 Marks)

OR

2 a. Express $\dfrac{1}{2+i} - \dfrac{(1+i)^2}{3+i}$ in the form a + ib. (06 Marks)

b. Find modulus and amplitude of $1 + \cos\theta + i\sin\theta$. (05 Marks)

c. If $\vec{a} = 3\hat{i} + 7\hat{j} - 2\hat{k}$, $\vec{b} = 2\hat{i} + 5\hat{j} + 10\hat{k}$ find $(\vec{a} + \vec{b}) \times (\vec{a} - \vec{b})$. (05 Marks)

Module-2

3 a. If $y = a\cos(\log x) + b\sin(\log x)$ show that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$. (06 Marks)

b. With usual notation prove that $\tan\varphi = r\dfrac{d\theta}{dr}$. (05 Marks)

c. If $u = e^{ax+by} f(ax - by)$ prove that $b\dfrac{\partial u}{\partial x} + a\dfrac{\partial u}{\partial y} = 2abu$. (05 Marks)

OR

4 a. Find n^{th} derivative of $y = e^x \sin 4x \cos x$ (06 Marks)

b. Find pedal equation of $r = a(1 + \cos\theta)$. (05 Marks)

c. If $u = f(x - y, y - z, z - x)$ show that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = 0$. (05 Marks)

Module-3

5 a. Evaluate $\displaystyle\int_0^{\pi} \sin^5(x/2)\,dx$. (06 Marks)

b. Evaluate $\displaystyle\int_0^{2a} x^2\sqrt{2ax - x^2}\,dx$. (05 Marks)

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

OR

6 a. Evaluate $\int_0^a \frac{x^3 dx}{\sqrt{a^2 - x^2}}$. **(06 Marks)**

b. Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y \, dx \, dy$. **(05 Marks)**

c. Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} \, dz \, dy \, dx$. **(05 Marks)**

Module-4

7 a. A particle moves along the curve c : $x = t^3 - 4t$, $y = t^2 + 4t$, $z = 8t^2 - 3t^3$ where t denotes time. Find velocity and acceleration at $t = 2$. **(06 Marks)**

b. Find unit normal vector to surface $Q = x^2yz + 4xz^2$ at (1, -2, -1). **(05 Marks)**

c. Show that $\vec{f} = (2xy^2 + yz)\hat{i} + (2x^2y + xz + 2yz^2)\hat{j} + (2y^2z + xy)\hat{k}$ is irrotational. **(05 Marks)**

OR

8 a. A particle moves along the curve c : $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where 't' is the time. Find the components of velocity and acceleration at $t = 1$ in the direction $\hat{i} - 3\hat{j} + 2\hat{k}$. **(06 Marks)**

b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at (2, -1, 2). **(05 Marks)**

c. If $\phi = 2x^3y^2z^4$ find div(gradϕ). **(05 Marks)**

Module-5

9 a. Solve : $\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0$. **(06 Marks)**

b. Solve : $x^2y \, dx - (x^3 + y^3) \, dy = 0$. **(05 Marks)**

c. Solve : $(y^3 - 3x^2y) \, dx - (x^3 - 3xy^2) \, dy = 0$. **(05 Marks)**

OR

10 a. Solve : $\frac{dy}{dx} = \frac{y}{x} + \sin\left(\frac{y}{x}\right)$. **(06 Marks)**

b. Solve : $(x^2 + y^2 + x)dx + xy \, dy = 0$. **(05 Marks)**

c. Solve : $\frac{dy}{dx} + y \cot x = \cos x$. **(05 Marks)**

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