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CBCS Scheme

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15MAT31

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – III

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. Express $f(x)=(\pi-x)^2$ as a Fourier series of period 2π in the interval $0<x<2\pi$. Hence deduce the sum of the series $1+\frac{1}{2^2}+\frac{1}{3^2}+\ldots\ldots$ **(08 Marks)**

b. The turning moment T units of the Crank shaft of a steam engine is a series of values of the crank angle θ in degrees. Find the first four terms in a series of sines to represent T. Also calculate T when $\theta = 75^\circ$. **(08 Marks)**

θ:	0°	30°	60°	90°	120°	150°	180°
T:	0	5224	8097	7850	5499	2626	0

OR

2 a. Find the Fourier Series expansion of the periodic function,
$$f(x)=\begin{cases} l+x, & -l\le x\le 0 \\ l-x, & 0\le x\le l \end{cases}.$$ **(06 Marks)**

b. Obtain a half-range cosine series for $f(x)=x^2$ in $(0,\pi)$. **(05 Marks)**

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

t sec:	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$
A amp:	1.98	1.30	1.05	1.30	-0.88	-0.25

Show that there is a direct current part 0.75 amp in the variable current and obtain the amplitude of the first harmonic. **(05 Marks)**

Module-2

3 a. Find the Fourier transform of $f(x)=\begin{cases} 1 & \text{for } |x|<1 \\ 0 & \text{for } |x|>1 \end{cases}$ and evaluate $\int_0^\infty\left(\frac{\sin x}{x}\right)dx$ **(06 Marks)**

b. Find the Fourier cosine transform of, $f(x)=\begin{cases} x & \text{for } 0<x<1 \\ 2-x & \text{for } 1<x<2 \\ 0 & \text{for } x>2 \end{cases}$. **(05 Marks)**

c. Obtain the inverse Z-transform of the following function, $\frac{z}{(z-2)(z-3)}$. **(05 Marks)**

OR

4 a. Find the Z-transform of $\cos\left(\frac{n\pi}{2}+\alpha\right)$. **(06 Marks)**

b. Solve $u_{n+2}-5u_{n+1}+6u_n=36$ with $u_0=u_1=0$, using Z-transforms. **(05 Marks)**

c. If Fourier sine transform of f(x) is $\frac{e^{-a\alpha}}{\alpha}$, $\alpha\neq 0$. Find f(x) and hence obtain the inverse Fourier sine transform of $\frac{1}{\alpha}$. **(05 Marks)**

Module-3

5 a. Calculate the Karl Pearson's co-efficient for the following ages of husbands and wives: **(06 Marks)**

Husband's age x:	23	27	28	28	29	30	31	33	35	36
Wife's age y:	18	20	22	27	21	29	27	29	28	29

b. By the method of least square, find the parabola $y = ax^2 + bx + c$ that best fits the following data: **(05 Marks)**

x:	10	12	15	23	20
y:	14	17	23	25	21

c. Using Newton-Raphson method, find the real root that lies near x = 4.5 of the equation $\tan x = x$ correct to four decimal places. (Here x is in radians). **(05 Marks)**

OR

6 a. In a partially destroyed laboratory 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 $\overline{x}$, $\overline{y}$ and the coefficient of correlation between x and y. **(06 Marks)**

b. Find the curve of best fit of the type $y = ae^{bx}$ to the following data by the method of least squares: **(05 Marks)**

x:	1	5	7	9	12
y:	10	15	12	15	21

c. Find the real root of the equation $xe^x - 3 = 0$ by Regula Falsi method, correct to three decimal places. **(05 Marks)**

Module-4

7 a. From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policies maturing at age of 46: **(06 Marks)**

Age:	45	50	55	60	65
Premium (in Rupees):	114.84	96.16	83.32	74.48	68.48

b. Using Newton's divided difference interpolation, find the polynomial of the given data: **(05 Marks)**

x	3	7	9	10
f(x)	168	120	72	63

c. Using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule to find $\int_0^{0.6} e^{-x^2}dx$ by taking seven ordinates. **(05 Marks)**

OR

8 a. Find the number of men getting wages below ₹ 35 from the following data: **(06 Marks)**

Wages in ₹ :	0 – 10	10 – 20	20 – 30	30 – 40
Frequency :	9	30	35	42

b. Find the polynomial f(x) by using Lagrange's formula from the following data: **(05 Marks)**

x:	0	1	2	5
f(x):	2	3	12	147

c. Compute the value of $\int_{0.2}^{1.4} (\sin x - \log_e x + e^x)dx$ using Simpson's $\left(\frac{3}{8}\right)^{th}$ rule. **(05 Marks)**

Module-5

9 a. A vector field is given by $\vec{F} = \sin y\,\hat{i} + x(1+\cos y)\hat{j}$. Evaluate the line integral over a circular path given by $x^2 + y^2 = a^2$, $z = 0$. **(06 Marks)**

b. If C is a simple closed curve in the xy-plane not enclosing the origin. Show that $\int_C \vec{F}.d\vec{R} = 0$, where $\vec{F} = \dfrac{y\hat{i} - x\hat{j}}{x^2 + y^2}$. **(05 Marks)**

c. Derive Euler's equation in the standard form viz., $\dfrac{\partial f}{\partial y} - \dfrac{d}{dx}\left[\dfrac{\partial f}{\partial y'}\right] = 0$. **(05 Marks)**

OR

10 a. Use Stoke's theorem to evaluate $\int_C \vec{F}.d\vec{R}$ where $\vec{F} = (2x - y)\hat{i} - yz^2\hat{j} - y^2z\hat{k}$ over the upper half surface of $x^2 + y^2 + z^2 = 1$, bounded by its projection on the xy-plane. **(06 Marks)**

b. Show that the geodesics on a plane are straight lines. **(05 Marks)**

c. Find the curves on which the functional $\int_0^1 \left((y')^2 + 12xy\right)dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremized. **(05 Marks)**

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CBCS Scheme

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15CS32

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Analog and Digital Electronics (ADE)

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 operation and characteristics of N-channel JFET. **(08 Marks)**

b. With block diagram, explain the operation of a Astable multivibrator using IC 555. **(08 Marks)**

OR

2 a. With circuit diagram, explain the operation of a Relaxation oscillator. **(06 Marks)**

b. Fig. Q2(b), shows a Biasing configuration using DEMOSFET given that the saturation drain current is 8mA and the pinch off voltage is -2V.

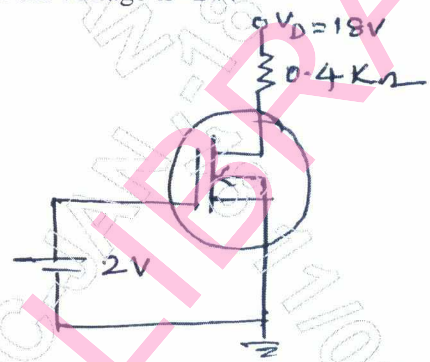

Fig. Q2(b)

Determine the value of gate source voltage drain current of drain source voltage. **(06 Marks)**

c. Write the advantages of MOSFET over JFET. **(04 Marks)**

Module-2

3 a. Give the simplest logic circuit for following logic equation where d represents don't care condition for following locations:

$F(A, B, C, D) = \sum m(7) + d\,(10, 11, 12, 13, 14, 15)$. **(06 Marks)**

b. Simplify the following Boolean function by using Quine – McClusky method.

$F(A, B, C, D) = \sum m\,(0, 2, 3, 6, 7, 8, 10, 12, 13)$. **(10 Marks)**

OR

4 a. What are Hazards? Explain the types of Hazards and it covers. **(08 Marks)**

b. Discuss Briefly an HDL Implementation models. **(04 Marks)**

c. Explain the concept of Duality in Digital circuits. **(04 Marks)**

Module-3

5 a. What is multiplexer? Design a 32:1 multiplexer using 16:1 MUX and one 2:1 multiplexer. **(05 Marks)**

b. Show how using a 3 to 8 Decoder and multi input OR Gates following Boolean Expressions can be realized simultaneously. **(06 Marks)**

$F(A, B, C) = \sum m(0, 4, 6)$

$F(A, B, C) = \sum m(1, 2, 3, 7)$

$F(A, B, C) = \sum m(0, 5)$

c. Show how two 1 to 16 DEMUX can be connected to get 1 to 32 DEMUX. **(05 Marks)**

OR

6 a. Explain parity Generators and checkers using suitable examples. **(05 Marks)**

b. What is Magnitude Comparator? Explain 1 bit magnitude comparator. **(05 Marks)**

c. What is PLA? Design seven segment Display using PLA. **(06 Marks)**

Module-4

7 a. Explain 4 bit serial in parallel out register. **(04 Marks)**

b. Explain a 3 bit binary Ripple up counter. Give the block diagram, truth table and output waveforms. **(06 Marks)**

c. Explain the working of JK master slave Flip Flop along with implementation using NAND Gates. **(06 Marks)**

OR

8 a. Design synchronous MOD – 6 counter with truth table and state diagram. **(06 Marks)**

b. What is universal shift Register? Explain any one application of universal shift register with block diagram and truth table. **(06 Marks)**

c. Write the comparison between Synchronous and Asynchronous counter. **(04 Marks)**

Module-5

9 a. Explain 5 bit Resistive divider with diagram. **(06 Marks)**

b. Explain with neat diagram the working principle of Digital clock. **(05 Marks)**

c. Explain the terms Accuracy and Resolution for D/A converter. **(05 Marks)**

OR

10 a. Explain with Block diagram the operation of successive approximation converter. **(08 Marks)**

b. Explain counter type A/D converter with diagram. **(08 Marks)**

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15CS33

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Data Structures and Applications

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. Define data structures. Give its classification. **(06 Marks)**
b. Define structures with example. **(04 Marks)**
c. Define pointers. Give advantages and disadvantages of pointers. **(06 Marks)**

OR

2 a. Write a program to (i) reverse a string, (ii) concatenate two strings. **(08 Marks)**
b. Explain dynamic memory allocation in detail. **(08 Marks)**

Module-2

3 a. Define stack. Implement push and pop functions for stack using arrays. **(08 Marks)**
b. Write the postfix form of the following expression:
(i) $((6 + (3 - 2)*4)\uparrow 5 + 7)$ (ii) $A \$ B \$ C * D$ **(08 Marks)**

OR

4 a. Define queues. Implement Qinsert and Qdelete function for queues using arrays. **(08 Marks)**
b. Define recursion. Write recursive program for (i) factorial of a number, (ii) tower of Hanoi. **(08 Marks)**

Module-3

5 a. Write the following functions for singly linked list: (i) Reverse the list (ii) Concatenate two lists. **(08 Marks)**
b. Write functions insert_front and delete_front using doubly linked list. **(08 Marks)**

OR

6 a. Write an algorithm to add two polynomials. **(08 Marks)**
b. Define sparse matrix. Give sparse matrix representation of linked list for given matrix.

$$A = \begin{bmatrix} 0 & 0 & 4 & 0 & 0 \\ 6 & 5 & 0 & 0 & 0 \\ 0 & 3 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 2 \end{bmatrix}$$ **(08 Marks)**

Module-4

7 a. What is a tree? Explain :
i) Binary tree
ii) Strictly binary tree
iii) Complete binary tree
iv) Skewed binary tree **(08 Marks)**
b. Given inorder sequence: DJGBHEAFKIC and postorder sequence: JGDHEBKIFCA. Construct binary tree and give preorder traversal. **(08 Marks)**

OR

8 a. Explain threaded binary tree in detail. **(08 Marks)**

b. Write a function to insert an item into an ordered binary search tree (duplicate items are not allowed) **(08 Marks)**

Module-5

9 a. Define graph. Give adjacency matrix and adjacency linked list for the given weighted graph in Fig.Q9(a).

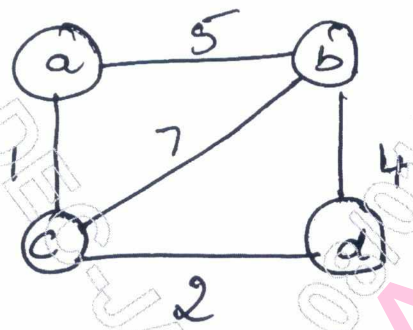

Fig.Q9(a) **(08 Marks)**

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

OR

10 a. Write an algorithm for Radix sort. **(08 Marks)**

b. Explain Hashing in detail. **(08 Marks)**

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Third Semester B.E. Degree Examination, Dec.2017/Jan.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. List the steps needed to execute the machine instruction Add LOCA, RO in terms of transfers between the processor and the memory along with some simple control commends. Assume that the instruction itself is stored in the memory at location INSTR and that this address is initially in register PC. The first two steps might be expressed as:

- Transfer the contents of Register PC to register MAR.
- Issue a Read command to the memory and then wait until it has transferred the requested word into register MDR.

Remember to include the steps needed to update the contents of PC from INSTR to INSTR+1 so that the next instruction can be fetched. **(08 Marks)**

b. What is performance measurement? Explain the overall SPEC rating for the computer in a program suit. **(08 Marks)**

OR

2 a. With relevant figure define the little Endian and big Endian assignments. **(04 Marks)**

b. Consider a computer that has a byte addressable memory organized in 32 bit words according to the big Endian scheme. A program reads ASCII characters entered at a keyboard and store them in successive byte location starting at location 1000. Show the contents of the two memory words at locations 1000 and 1004 after the name "Johnson" has been entered. (ASCII codes J = 4 AH, o = 6 FH, h = 68 H, n = 6 EH, S = 73 H) **(04 Marks)**

c. Write about shift and rotate instruction with neat diagram and example of each. **(08 Marks)**

Module-2

3 a. With supporting diagram, explain the following with respect to interrupts:
i) Vectored interrupts
ii) Interrupt Nesting
iii) Simultaneous requests. **(06 Marks)**

b. Three devices A, B and C are connected to the bus of a computer. I/O transfers for all three devices use interrupt control. Interrupt nesting for devices A and B is not allowed, but interrupt requests from C may be accepted while either A or B is being services. Suggest different ways in which this can be accomplished in each of the following cases:
i) The computer has one interrupt request line.
ii) Two interrupt request line, INTR1 and INTR2 are available with INTR1 having higher priority. Specify when and how interrupts are enabled and disable in each case. **(06 Marks)**

c. Illustrate the tree structure of USB with diagram. **(04 Marks)**

OR

4 a. With a neat diagram, explain the centralized arbitration and distributed bus arbitration scheme. **(08 Marks)**

b. With neat timing diagram illustrate the asynchronous bus data transfer during an input operation. Use handshake scheme. **(08 Marks)**

Module-3

5 a. Draw a diagram and explain the working of 16 Megabit DRAM chip configured as 2M × 8. **(08 Marks)**

b. Describe organization of an 2M × 32 memory using 512K × 8 memory chips. **(08 Marks)**

OR

6 a. Discuss in detail the working of set associative mapped cache with two blocks per set with relevant diagram. **(08 Marks)**

b. Define the following with respect to cache memory: (i) Valid bit, (ii) Dirty data, (iii) Stale data, (iv) Flush the cache. **(04 Marks)**

c. A block-set associative cache consists of a total of 64 blocks divided into 4-blocks sets. The main memory contains 4096 blocks, each consisting of 128 words.
   i) How many bits are there in a main memory address?
   ii) How many bits are there in each of the TAG, SET and WORD fields? **(04 Marks)**

Module-4

7 a. Convert the following pairs of decimal numbers to 5-bit signed 2's complement binary numbers and add them. State whether or not overflow occurs in each case.
i) 5 and 10 ii) −14 and 11 iii) −5 and 7 iv) −10 and −13 **(04 Marks)**

b. Design the 16 bit carry look ahead adder using 4-bit adder. Also unite the expression for C_{i+1}. **(08 Marks)**

c. Draw the two n-bit number x and y to perform addition/subtraction. **(04 Marks)**

OR

8 a. With an example explain the Booths algorithm to multiply two signed operands. **(08 Marks)**

b. Multiply each of the following pairs of signed 2's complement number using the Booth algorithm. (A = multiplicand and B = multiplier).
   i) A = 010111 and B = 110110
   ii) A = 110011 and B = 101100
   iii) A = 110101 and B = 011011
   iv) A = 001111 and B = 001111 **(08 Marks)**

Module-5

9 a. Discuss with neat diagram, the single bus organization of the data path inside a processor. **(08 Marks)**

b. Write the sequence of control steps required for single bus structure for each if the following instructions.
   i) Add the contents of memory location NUM to register R1.
   ii) Add the contents of memory location whose address is at memory location NUM to register R1. **(08 Marks)**

OR

10 a. Discuss the microwave oven with neat block diagram. **(08 Marks)**

b. Discuss the digital camera with neat block diagram. **(08 Marks)**

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CBCS Scheme

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Third Semester B.E. Degree Examination, Dec.2017/Jan.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. List and explain features of UNIX operating system. **(07 Marks)**

b. Discuss internal and external commands, with suitable examples. **(06 Marks)**

Write the outputs of the following commands :

i) cal 8 1947

ii) echo 'Todays date is `date`'

iii) date + "Date is : %a/%h/%Y". **(03 Marks)**

OR

2 a. Explain "man" documentation, and its internal commands. **(08 Marks)**

b. Describe command arguments and options with suitable examples. **(04 Marks)**

c. How an ordinary user can become a super user and vise versa? Explain with suitable commands. **(04 Marks)**

Module-2

3 a. What is a file system? Explain Unix file system with neat diagram, also explain parent and child relationships with suitable examples. **(08 Marks)**

b. What is pathname? List and explain types of path-names with an examples. **(06 Marks)**

c. Write the command line to perform the followings :

i) Change current directory to home directory

ii) Change to parent of parent directory. **(02 Marks)**

OR

4 a. What are file permissions? Describe different ways of changing the file permissions. **(07 Marks)**

b. Explain CP and Od commands with options. **(06 Marks)**

c. Write the output for the following command lines.

i) mv filenamea dir_name

ii) ℓs ¦ wc -w

iii) who ¦ wc -ℓ. **(03 Marks)**

Module-3

5 a. List and explain the different modes of Vi editor, also explain different ways of quitting Vi editor. **(08 Marks)**

b. Discuss the following commands with respect to Vi editor.
i) b ii) w iii) | iv) G v) :1, 5w ab.txt vi) h vii) J viii) abbr. **(08 Marks)**

OR

6 a. What are wild cards characters? Explain each of them with suitable examples. **(08 Marks)**

b. What is the purpose of grep? Explain grep with all options. **(06 Marks)**

c. Explain tee command with an example. **(02 Marks)**

Module-4

7 a. Explain test command for handling strings. **(04 Marks)**

b. Write a shell script using case to perform all arithmetic operations. **(06 Marks)**

c. Explain for loop, also possible sources of argument list. **(06 Marks)**

OR

8 a. Explain cut command with all options, with examples. **(05 Marks)**

b. What are links? How to create different types of links? And list their differences. **(06 Marks)**

c. Discuss umask and default file permissions. **(05 Marks)**

Module-5

9 a. Discuss how to execute commands periodically with suitable example. **(05 Marks)**

b. Explain find command in detail. **(06 Marks)**

c. What is process? Explain different mechanisms of process creation. **(05 Marks)**

OR

10 a. Explain string handling functions in PERL. **(07 Marks)**

b. Write a PERL programs check the given year is leap year or not. **(07 Marks)**

c. Explain split function in PERL briefly. **(02 Marks)**

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CBCS Scheme

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Third Semester B.E. Degree Examination, Dec.2017/Jan.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 three propositions p, q, r $[P \to (q \wedge r)] \Leftrightarrow [(p \to q) \wedge (p \to r)]$. Using truth table. **(05 Marks)**

b. Establish the validity of the argument :

$p \to q$
$q \to (r \wedge s)$
$\neg r \vee (\neg t \vee u)$
$\underline{p \wedge t}$
$\therefore u$ **(06 Marks)**

c. Prove that for all integers 'k' and 'ℓ', if 'k' and 'ℓ' are both odd, then $k + \ell$ is even and $k\ell$ is odd by direct proof. **(05 Marks)**

OR

2 a. Determine the truth value of each of the following quantified statements; the universe being the set of all non - zero integers. **(05 Marks)**

i) $\exists x, \exists y\ [xy = 1]$
ii) $\exists x, \forall y\ [xy = 1]$
iii) $\forall x, \exists y, [xy = 1]$
iv) $\exists x, \exists y\ [(2x + y = 5) \wedge (x - 3y = -8)]$.
v) $\exists x, \exists y\ [(3x - y = 17) \wedge (2x + 4y = 3)]$. **(06 Marks)**

b. Find whether the following arguments are valid or not for which the universe is set of all triangles. In triangle XYZ, there is no pair of angles of equal measure. If the triangle has two sides of equal length, then it is isosceles. If the triangle is isosceles, then it has two angles of equal measure. Therefore triangle XYZ has no two sides of equal length. **(05 Marks)**

c. If a proposition has truth value 1, determine all truth value assignments for the primitive propositions p, r, s for which the truth value of following compound proposition is 1.
$[q \to \{(\neg p \vee r) \wedge \neg s\}] \wedge \{\neg s \to (\neg r \wedge q)\}$. **(05 Marks)**

Module-2

3 a. Prove by mathematical induction that, for every positive integer n, 5 divides $n^5 - n$. **(05 Marks)**

b. For the Fibonacci sequence F_0, F_1, F_2 - - - - prove that $F_n = \frac{1}{\sqrt{5}}\left[\left(\frac{1+\sqrt{5}}{2}\right)^n - \left(\frac{1-\sqrt{5}}{2}\right)^n\right]$. **(06 Marks)**

c. Find the coefficient of :

i) x^9y^3 in the expansion $(2x - 3y)^{12}$
ii) x^{12} in the expansion $x^3(1 - 2x)^{10}$. **(05 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

4 a. By mathematical induction. Prove that, for every positive integer n, the number $A_n = 5^n + 2.3^{n-1} + 1$ is a multiple of 8. **(05 Marks)**

b. How many positive integers 'n' can we form using the digits 3, 4, 4, 5, 5, 6, 7 if we want 'n' to exceed 5,000,000. **(06 Marks)**

c. A certain question paper contains three parts A, B, C with four questions in part A, five questions in part B and six questions in part C. It is required to answer seven questions selecting atleast two questions from each part. In how many ways can a student select his seven questions for answering? **(05 Marks)**

Module-3

5 a. Let $f : R \to R$ be defined by $f(x) = \begin{cases} 3x - 5, & \text{for } x > 0 \\ -3x + 1, & \text{for } x \le 0 \end{cases}$

i) Determine $f\left(\frac{5}{3}\right)$, $f^{-1}(3)$, $f^{-1}([-5, 5])$.

ii) Also prove that if 30 dictionaries contain a total of 61, 327 pages, then atleast one of the dictionary must have atleast 2045 pages. **(05 Marks)**

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

c. Let A = {1, 2, 3, 4, 5}. Define a relation R on A × A by (x_1, y_1) R(x_2, y_2) if and only if $x_1 + y_1 = x_2 + y_2$.

i) Determine whether R is an equivalence relation on A × A

ii) Determine equivalence class [(1, 2)], [(2, 5)]. **(05 Marks)**

OR

6 a. Let f and g be functions from R to R defined by $f(x) = ax + b$ and $g(x) = 1 - x + x^2$. If $(g \circ f)(x) = 9x^2 - 9x + 3$. Determined a, b. **(05 Marks)**

b. Let A = {1, 2, 3, 4, 6, 12}. On A define the relation R by aRb if and only if 'a' divides 'b' i) prove that R is a partial order on A ii) draw the Hasse diagram iii) write down the matrix of relation. **(06 Marks)**

c. Consider the Poset whose Hasse diagram is given below. Consider B = {3, 4, 5}. Refer Fig.Q6(c). Find :

i) All upper bounds of B
ii) All lower bounds of B
iii) The least upper bound of B
iv) The greatest lower bound of B
v) Is this a Lattice? **(05 Marks)**

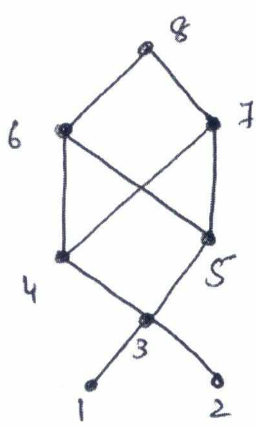

Fig.Q6(c)

Module-4

7 a. Out of 30 students in a hostel; 15 study history 8 study economics and 6 study geography. It is known that 3 students study all these subjects. Show that 7 or more students study none of these subjects. **(05 Marks)**

b. Five teachers T_1, T_2, T_3, T_4, T_5 are to be made class teachers for five classes C_1, C_2, C_3, C_4, C_5, one teacher for each class. T_1 and T_2 do not wish to become the class teachers for C_1 or C_2, T_3 and T_4 for C_4 or C_5 and T_5 for C_3 or C_4 or C_5. In how many ways can the teachers be assigned work without displeasing any teacher. **(06 Marks)**

c. Solve the recurrence relation $a_n - 6a_{n-1} + 9a_{n-2} = 0$ form $n \geq 2$. **(05 Marks)**

OR

8 a. Solve the recurrence relation $a_n - 3a_{n-1} = 5 \times 3^n$ for $n \geq 1$ given that $a_0 = 2$. **(05 Marks)**

b. Let a_n denote the number of n-letter sequences that can be formed using the letters A, B and C such that non terminal A has to be immediately followed by a B. Find the recurrence relation for a_n and solve it. **(06 Marks)**

c. Find the number of permutations of English letters which contain exactly two of the pattern car, dog, pun, byte. **(05 Marks)**

Module-5

9 a. Discuss Konigsberg bridge problem. **(05 Marks)**

b. Let G = G(V, E) be a simple graph with m edges and 'n' vertices. Then prove that :

i) $m \leq \frac{1}{2}n(n-1)$

ii) For a complete graph k_n, $m = \frac{1}{2}n(n-1)$ edges

iii) How many vertices and edges are there for $K_{4,7}$ and $K_{7,11}$. **(06 Marks)**

c. Merge sort the list –1, 7, 4, 11, 5, –8, 15, –3, –2, 6, 10, 3. **(05 Marks)**

OR

10 a. Prove that a tree with 'n' vertices has n – 1 edges. **(05 Marks)**

b. Obtain an optimal prefix code for the message LETTER RECEIVED indicate the code and weight. **(06 Marks)**

c. Determine whether the following graphs are isomorphic or not. **(05 Marks)**

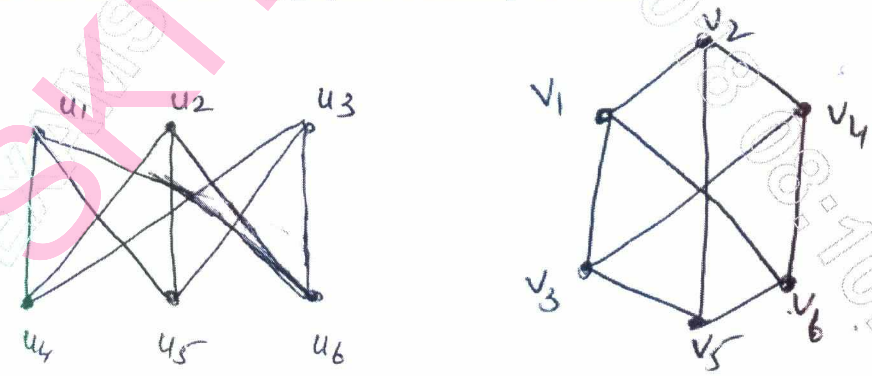

Fig.Q10(c)

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CBCS SCHEME

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15MATDIP31

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Additional Mathematics – I

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. Express complex numbers $\dfrac{(5-3i)(2+i)}{4+2i}$ in the form $a + ib$. **(06 Marks)**

b. If $x = \cos\theta + i\sin\theta$, then show that $\dfrac{x^{2n}-1}{x^{2n}+1} = i\tan\theta$ **(05 Marks)**

c. Prove that the area of the triangle whose vertices are A, B, C is $\dfrac{1}{2}\left[B\times C + C\times A + A\times B\right]$. **(05 Marks)**

OR

2 a. Find the cube root of $\sqrt{3} + i$. **(06 Marks)**

b. Find the modulus and amplitude of $\dfrac{3+i}{2+i}$ **(05 Marks)**

c. Prove that the vectors $i - 2j + 3k$, $-2i + 3j - 4k$ and $i - 3j + 5k$ are coplanar. **(05 Marks)**

Module-2

3 a. Find the n^{th} derivative of $e^{ax}\sin(bx + c)$. **(06 Marks)**

b. If $y = e^{a\sin^{-1}x}$, prove that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + a^2)y_n = 0$ **(05 Marks)**

c. If $u = \sin^{-1}\left(\dfrac{x^2+y^2}{x+y}\right)$ prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = \tan u$. **(05 Marks)**

OR

4 a. Find the pedal equation $r = a(1 + \cos\theta)$. **(06 Marks)**

b. Expand $\tan x$ in ascending powers of x. **(05 Marks)**

c. If $u = x + y + z$, $v = y + z$, $w = z$ then find $\dfrac{\partial(u,v,w)}{\partial(x,y,z)}$ **(05 Marks)**

Module-3

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

b. Evaluate $\displaystyle\int_0^a \frac{x^3}{\sqrt{a^2-x^2}}\,dx$. **(05 Marks)**

c. Evaluate $\displaystyle\int_1^2\int_1^3 xy^2\,dxdy$ **(05 Marks)**

OR

6 a. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2 yz \, dx \, dy \, dz$ **(06 Marks)**

b. Evaluate $\int_0^{\pi/6} \cos^4 3x \, dx$. **(05 Marks)**

c. Evaluate $\int_0^2 \frac{x^4}{\sqrt{4-x^2}} dx$. **(05 Marks)**

Module-4

7 a. A particle moves on the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$, where t is the time. Find the velocity and acceleration at $t = 1$ in the direction $i - 3j + 2k$. **(06 Marks)**

b. Find the unit vector normal to the surface $x^2 - y^2 + z = 2$ at the point $(1, -1, 2)$. **(05 Marks)**

c. Show that the vector $f = (2x - 5y)i + (x - y)j + (3x - z)k$ is a solenoidal. **(05 Marks)**

OR

8 a. If $f(x, y, z) = 3x^2y - y^3z^2$ then find grad f at the point $(1, -2, -1)$. **(06 Marks)**

b. Evaluate (i) div R, (ii) curl R, if $R = xi + yj + zk$. **(05 Marks)**

c. Find a, if $(axy - z^2)i + (x^2 + 2yz)j + (y^2 - axz)k$ is an irrotational vector. **(05 Marks)**

Module-5

9 a. Solve $(x^2 + y^2)dx + 2xydy = 0$ **(06 Marks)**

b. Solve $(e^x + 1)\cos x \, dx + e^y \sin x \, dy = 0$ **(05 Marks)**

c. Solve $(1 + xy)ydx + (1 - xy)xdy = 0$ **(05 Marks)**

OR

10 a. Solve $(x\log x)\frac{dy}{dx} + y = 2\log x$ **(06 Marks)**

b. Solve $(x + 2y^3)\frac{dy}{dx} = y$ **(05 Marks)**

c. Solve $(1 + e^{x/y})dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0$ **(05 Marks)**

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