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15MAT31

# Third Semester B.E. Degree Examination, June/July 2019
## 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 :

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

Hence deduce that $\sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}=\frac{\pi^2}{8}$. **(08 Marks)**

b. Express y as a Fourier series up to the second harmonics, given :

| x | 0 | $\pi/3$ | $2\pi/3$ | $\pi$ | $4\pi/3$ | $5\pi/3$ | $2\pi$ |
|---|---|---|---|---|---|---|---|
| y | 1.98 | 1.30 | 1.05 | 1.30 | –0.88 | –0.25 | 1.98 |

**(08 Marks)**

**OR**

2 a. Obtain the Fourier series for the function $f(x) = 2x - x^2$ in $0 \le x \le 2$. **(08 Marks)**

b. Obtain the constant term and the first two coefficients in the only Fourier cosine series for given data :

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

**(08 Marks)**

### Module-2

3 a. Find the Fourier transform of $xe^{-|x|}$. **(06 Marks)**

b. Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a>0$. **(05 Marks)**

c. Obtain the z – transform of $\sin n\theta$ and $\cos n\theta$. **(05 Marks)**

**OR**

4 a. Find the inverse cosine transform of $F(\alpha)=\begin{cases}1-\alpha, & 0\le\alpha\le 1\\ 0, & \alpha>1\end{cases}$.

Hence evaluate $\int_0^{\infty}\frac{\sin^2 t}{t^2}dt$. **(06 Marks)**

b. Find inverse Z – transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$ **(05 Marks)**

c. Solve the difference equation $y_{n+2}+6y_{n+1}+9yl=2^n$ with $y_0=0, y_1=0$, using z – transforms. **(05 Marks)**

## Module-3

5 a. Find the lines of regression and 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 polynomial to the data :

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

**(05 Marks)**

c. Find the real root of the equation $x\sin x + \cos x = 0$ near $x = \pi$, by using Newton – Raphson method upto four decimal places. **(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 $\bar{x}, \bar{y}$ and the coefficient of correlation between x and y. **(06 Marks)**

b. Fit a curve of the type $y = ae^{bx}$ to the data :

| x | 5 | 15 | 20 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|
| y | 10 | 14 | 25 | 40 | 50 | 62 |

**(05 Marks)**

c. Solve $\cos x = 3x - 1$ by using Regula – Falsi method correct upto three decimal places, (Carryout two approximations). **(05 Marks)**

## Module-4

7 a. Give 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. Find the interpolating polynomial for the data :

| x | 0 | 1 | 2 | 5 |
|---|---|---|---|---|
| y | 2 | 3 | 12 | 147 |

By using Lagrange's interpolating formula. **(05 Marks)**

c. Use Simpson's $\frac{3}{8}$th rule to evaluate $\int_0^{0.3} (1-8x^3)^{1/2}\,dx$ considering 3 equal intervals.

**(05 Marks)**

**OR**

8 a. The area of a circle (A) corresponding to diameter (D) is given below :

| D | 80 | 85 | 90 | 95 | 100 |
|---|---|---|---|---|---|
| A | 5026 | 5674 | 6362 | 7088 | 7854 |

Find the area corresponding to diameter 105, using an appropriate interpolation formula. **(06 Marks)**

b. Given the values :

| x | 5 | 7 | 11 | 13 | 17 |
|---|---|---|---|---|---|
| f(x) | 150 | 392 | 1452 | 2366 | 5202 |

Evaluate f(9) using Newton's divided difference formula. **(05 Marks)**

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

## Module-5

9 a. Using Green's theorem, evaluate $\int_C (2x^2 - y^2)dx + (x^2 + y^2)dy$ where C is the triangle formed by the lines x = 0, y = 0 and x + y = 1. **(06 Marks)**

b. Verify Stoke's theorem for $\vec{f} = (2x - y)i - yz^2j - y^2zk$ for the upper half of the sphere $x^2 + y^2 + z^2 = 1$. **(05 Marks)**

c. Find the extermal of the functional $\int_{x_1}^{x_2} \{y^2 + (y^1)^2 + 2ye^x\}dx$. **(05 Marks)**

**OR**

10 a. Using Gauss divergence theorem, evaluate $\int_S \vec{f} \cdot \hat{n}\, ds$, where $\vec{f} = 4xzi - y^2j + yzk$ and s is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z = 1. **(05 Marks)**

b. A heavy cable hangs freely under the gravity between two fixed points. Show that the shape of the cable is a Catenary. **(06 Marks)**

c. Find the extermal of the functional $\int_0^{\pi/2} \{(y^1)^2 - y^2 + 4y\cos x\}dx$, give that $y = 0 = y(\pi/2)$. **(05 Marks)**

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15CS32

# Third Semester B.E. Degree Examination, June/July 2019
## 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 Enhancement – MOSFET (E-MOSFET) **(10 Marks)**

b. Explain any two applications of field Effect Transistor (FET) along with the circuit diagram. **(06 Marks)**

**OR**

2 a. Explain the operation of Astable multi-vibrator with a neat diagram. **(08 Marks)**

b. Explain performance parameters of operational amplifiers. **(08 Marks)**

### Module-2

3 a. Describe positive and negative logic. list the equivalences between them. **(04 Marks)**

b. Simplify the following boolean function using k-map method.
$F(A, B, C, D) = \pi M (0, 1, 2, 4, 5, 10) + d(8, 9, 11, 12, 13, 15)$
Get the simplified POS form of k-map. **(04 Marks)**

c. What is a Hazard? Explain Static – 0 hazard and its Hazard cover. **(08 Marks)**

**OR**

4 a. Give simplified logic equation using Quine-McClusky method for the following Boolean function $F(A, B, C, D) = \sum m(0, 3, 5, 6, 7, 11, 14)$. **(12 Marks)**

b. Mention the different verilog HDL model and write the verilog HDL code using structural model for the circuit given in Fig Q4(b)

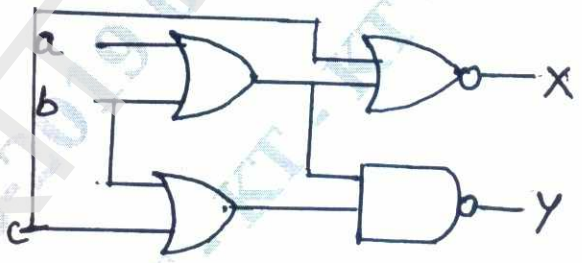


Fig Q4(b) **(04 Marks)**

### Module-3

5 a. Implement the following function using 8:1 multiplexer
$F(A, B, C, D) = \sum m(0, 1, 5, 6, 8, 10, 12, 15)$ **(06 Marks)**

b. Show that using a 3:8 decoder and multi-input OR gate, the following boolean expression can be realized $F_1 (A, B, C) = \sum m (0, 4, 6)$
$F_2 = (A, B, C) = \sum m (1, 2, 3, 7)$ **(04 Marks)**

c. Design even parity generator. **(06 Marks)**

OR

6 a. Design seven segment decoder using Programmable Logic Array (PLA) **(08 Marks)**

b. What is Magnitude comparator? Design one bit comparator using basic gates? **(08 Marks)**

## Module-4

7 a. Explain the working of a JK master – slave Flip – Flop along with its implementation using NAND gates. **(08 Marks)**

b. Draw the state transition tables of JK, T, D and SR Flip – Flops. **(08 Marks)**

OR

8 a. Explain a 4-bit serial – In – Serial – out (SISO) registers using negative edge triggered D-Flip-Flops. Draw the waveform to shift binary number 1111 into this register. **(08 Marks)**

b. Write the comparison between synchronous and asynchronous counter. **(04 Marks)**

c. Explain Ring counter with a neat diagram. **(04 Marks)**

## Module-5

9 a. Define counter. Design and Implement a MOD – 5 synchronous counter using JK Flip-Flop. **(10 Marks)**

b. With a neat diagram explain Digital clock. **(06 Marks)**

OR

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

b. Explain the Binary ladder with digital input of 0100. **(06 Marks)**

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15CS33

# Third Semester B.E. Degree Examination, June/July 2019
## 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. What is a Pointer? How do you declare and initialize the pointer? How do you access the value pointed to by a pointer. **(06 Marks)**

b. What is Self – referential structure? List the difference between structure and union. **(06 Marks)**

c. What is String? Explain the following string functions with examples :
i) STRTOK ii) STRCAT iii) SUBSTR. **(04 Marks)**

**OR**

2 a. Write appropriate structure definition and variable declarations to store following information about 50 students :
Name , USN , GENDER , DOB and Marks in three subjects $S_1$, $S_2$ and $S_3$ , Date of birth should be a structure containing fields day , month and year. **(06 Marks)**

b. What is Dynamically allocated arrays? Explain with suitable example. **(05 Marks)**

c. What is pointer to pointer? Give the following declaration.

```
int a = 8 ;
int b = 9 ;
int *b = &a ;
int *2 = &b ;
```

What is the value of each of the following expression?
i) ++ a ii) ++(*p) iii) --(*q) iv) --b. **(05 Marks)**

### Module-2

3 a. Define Stack? List the operations of on stack. Write the C implementation of these operations. **(08 Marks)**

b. Write an algorithm for evaluating a valid postfix expression. Trace the same on
562 + * 841 - **(08 Marks)**

**OR**

4 a. What is Recursion? Write a C implementation for Tower of Hanoi. **(08 Marks)**

b. What is a Queue? List different types of Queue. Write C implementation for insertQ( ) and deleteq( ) operation. **(08 Marks)**

### Module-3

5 a. What is a linked list? List different types of linked list. Write a C function to count number of elements present in a singly linked list. **(08 Marks)**

b. How can an ordinary queue be represented using a singly linked list? Write C functions for linked implementation of ordinary queue insertion and deletion. **(08 Marks)**

**OR**

6 a. What is doubly linked list? Write a C program to perform the following operations on doubly linked list i) Insert a node ii) Delete a node. **(08 Marks)**

b. Explain the following with suitable example i) Circular linked list ii) Doubly linked list. **(08 Marks)**

## Module-4

7 a. What is a Tree? List traversing Binary tree. Write algorithm for these tree traversal. **(07 Marks)**

b. Construct a binary tree from the traversal order given below :

| Preorder : | A | B | D | E | F | C | G | H | L | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inorder : | D | B | F | E | A | G | C | L | J | H | K |

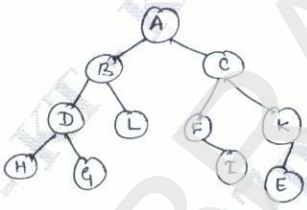
**(05 Marks)**

c. What is Threaded Binary tree? Explain right in an left in threaded binary trees. **(04 Marks)**

**OR**

8 a. Construct a binary tree for given expression ((6 + (3-2) * 5) ^ 2 + 3). **(06 Marks)**

b. Given the following graph, write inorder, preorder and postorder traversals. **(04 Marks)**




c. Define the following : i) Binary tree ii) Complete binary tree iii) Almost complete binary tree iv) Binary search tree. **(06 Marks)**

## Module-5

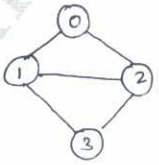
9 a. How an Insertion sort works? Suppose an array A contains 8 elements as follows : 77, 33, 44, 11, 88, 22, 66, 55. Trace insertion sort algorithm for sorting in ascending order. **(06 Marks)**

b. What is Hashing? Explain with example hash following hashing function : i) Division method ii) Midsquare method iii) Folding method. **(06 Marks)**

c. Define following terms : i) Graph ii) Multigraph iii) Graph with self edge iv) Subgraph. **(04 Marks)**

**OR**

10 a. Define Adjacency matrix and Adjacency list. Also show the adjancy matrix and adjacency. List for the given graph. **(08 Marks)**




b. Consider the following 4 – digit employee number 9614 , 5882 , 6713 , 4409 , 1825. Find the 2 – digit hash address of each number using
i) The division method with = 97.
ii) The midsquare mehod.
iii) The folding method without reversing.
iv) The folding method with reversing. **(08 Marks)**

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15CS34

# Third Semester B.E. Degree Examination, June/July 2019
## 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. Explain the connection between processor and memory with neat diagram and show how to add A + B to form C with the help of the same diagram. **(08 Marks)**

b. Write short notes on :
(i) Performance equation (ii) SPEC Rating **(08 Marks)**

**OR**

2 a. What do you mean by addressing mode? Explain different types of addressing modes with example. **(10 Marks)**

b. Explain shift and rotate instructions with example. **(06 Marks)**

### Module-2

3 Write short notes on :
(i) Daisy chain (ii) Subroutine (iii) Interrupt hardware (iv) Exception **(16 Marks)**

**OR**

4 a. Explain how DMA (with register) is taking place in a system with necessary diagram. **(08 Marks)**

b. Define Bus arbitration. Discuss different types of Bus Arbitration methods with diagram. **(08 Marks)**

### Module-3

5 a. With diagram, describe the internal organization of a 128×8 memory chip. **(08 Marks)**

b. With the diagram of basic SRAM (Static RAM) and DRAM (Asynchronous DRAM) chip (cell), explain the read and write operations on each of them. **(08 Marks)**

**OR**

6 a. Describe different types of cache mapping techniques (between memory to cache memory) with diagram. **(10 Marks)**

b. Calculate the total capacity of a 4.8 inch disk having the following parameters:
(i) 100 data recording surfaces (ii) 100000 tracks per surface (iii) 100 sectors per track (iv) Each track contains 512 bytes of data. **(03 Marks)**

c. In a given system (i) hit rate (n) = 0.5 (ii) Miss penalty (M) = 100 ns (iii) Time to access cache memory (c) = 100 ns. Calculate the average access time ($t_{ave}$) experienced by the processor. **(03 Marks)**

### Module-4

7 a. Write down the steps of Booths multiplication algorithm. **(02 Marks)**

b. Perform Booths multiplication between (+13) × (– 6). **(08 Marks)**

c. Explain generation and propagation functions used in Carry-Look-Ahead Adder. **(06 Marks)**

**OR**

8 a. Explain Bit-Pair Recording / Fast multiplication with example. **(08 Marks)**

b. Write down the steps of restoring division algorithm. Apply Restoring division algorithm on 1000/11. **(08 Marks)**

## Module-5

9 a. Describe Multiple Bus Organization (with diagram). **(08 Marks)**

b. Write down the control sequence for execution of the instruction Add ($R_3$), $R_1$ **(08 Marks)**

**OR**

10 a. What do you mean by micro-instruction? Design Basic organization of a microprogrammed control unit with diagram. **(08 Marks)**

b. Describe a simple microcontroller with diagram. Also mention parallel and serial I/O port in brief. **(08 Marks)**

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15CS35

# Third Semester B.E. Degree Examination, June/July 2019
## 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. Describe the salient features of UNIX operating system. **(08 Marks)**

**OR**

2 a. Explain the following commands with example:
i) who ii) echo iii) date **(06 Marks)**

b. What are internal and external commands? List any two examples. **(04 Marks)**

c. With the help of examples, explain (i) man man (ii) apropos **(06 Marks)**

### Module-2

3 a. Explain the different types of files supported in UNIX. **(06 Marks)**

b. What is parent-child relationship? With the help of neat diagram, explain UNIX file system tree. **(06 Marks)**

c. With suitable example, bring out the difference between absolute and relative pathnames. **(04 Marks)**

**OR**

4 a. Briefly describe the significance of the seven fields of the 'ls – l' command. **(08 Marks)**

b. File current permissions are rw_ _w_r_ _. Write chmod expression required to change them for the following:
(i) r_ _ r_ _ _x (ii) r w x r w x_ _x (iii) r_x r_x r_x (iv) r w x r w x r_ _
using both relative and absolute methods of assigning permissions. **(08 Marks)**

### Module-3

5 a. What are the different modes of operations in Vi editor? Explain with a suitable diagram. **(08 Marks)**

b. Write the output for the following UNIX commands:
i) mv * ../bin ii) cp ?????? progs
iii) lp note[0-1][0-9] iv) rm *.[!ℓ][!o][!g] **(04 Marks)**

c. Explain concept of Escaping and Quoting with suitable example. **(04 Marks)**

**OR**

6 a. What are the three standard files in UNIX? **(06 Marks)**

b. Explain 'grep' command with its options. **(06 Marks)**

c. Write the output of the following:
i) sed '3q' abc
ii) ℓs – l/grep '^d' >directories
iii) sed –n '$p' abc
iv) sed –n '3, $!p' abc **(04 Marks)**

## Module-4

7 a. Explain the following environment variables with example each:
i) SHELL ii) LOGNAM iii) PATH iv) PS1 **(04 Marks)**

b. Explain sort command with options. **(08 Marks)**

c. What are hard link and symbolic links? **(04 Marks)**

**OR**

8 a. Explain special parameters used by the shell. **(08 Marks)**

b. Write a menu driven shell script to display list of files, process of user, today's date and users of the system. **(08 Marks)**

## Module-5

9 a. Explain the mechanism of process creation using system in UNIX. **(06 Marks)**

b. Explain here document (<<) with an example. Also mention its use. **(04 Marks)**

c. Explain the following commands with example: (i) kill (ii) bg (iii) fg **(06 Marks)**

**OR**

10 a. Explain split and join functions with example. **(04 Marks)**

b. How is file managed in perl? Explain with an example. **(04 Marks)**

c. Using command line arguments, write a Perl program to find whether a given year is leap. **(06 Marks)**

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15CS36

# Third Semester B.E. Degree Examination, June/July 2019
# 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. Simplify the switching network shown in Fig Q1(a)

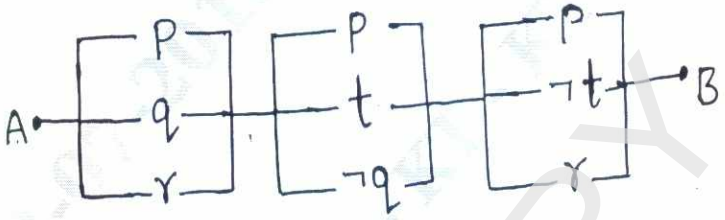


Fig Q1(a) **(08 Marks)**

b. Give a direct proof of the statement "If n is an odd integer then $n^2$ is also an odd integer". **(04 Marks)**

c. Let p(x), q(x) and r(x) be open statements that are defined for the given universe. Show that the argument.

$\forall x,[p(x) \rightarrow q(x)]$

$\forall x,[q(x) \rightarrow r(x)]$

$\therefore \exists x,[p(x) \rightarrow r(x)]$ is valid **(04 Marks)**

**OR**

2 a. Define tautology, prove that for any proposition p, q, r the compound proposition $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow q)$ is a tautology using truth table. **(05 Marks)**

b. Show that RVS follows logically form the premises CVD, $CVD \rightarrow \neg H$, $\neg H \rightarrow (A \wedge \neg B)$ and $(A \wedge \neg B) \rightarrow (RVS)$. **(04 Marks)**

c. Using rules of inference shows that the following argument is valid.

$\forall x,[p(x) \vee q(x)] \wedge \exists x, \neg p(x) \wedge$

$\forall x,[\neg q(x) \vee r(x)] \wedge \forall x,[s(x) \rightarrow \neg r(x)]$

$\therefore \exists x, \neg S(x)$ **(07 Marks)**

## Module-2

3 a. Prove by mathematical induction that, for all integers $n \geq 1$, $1 + 2 + 3 + \ldots + n = \frac{1}{2}n(n+1)$. **(06 Marks)**

b. The Fibonacci numbers are defined recursively by $F_0 = 0$, $F_1 = 1$, $F_n = F_{n-1} + F_{n-2}$ for $n \geq 2$. Evaluate $F_2$ to $F_{10}$. **(04 Marks)**

c. In the word S, O, C, I, O, L, O, G, I, C, A, L.

i) How many arrangements are there for all letters?

ii) In how many of these arrangements all vowels are adjacent? **(06 Marks)**

**OR**

4 a. Obtain the recursive definition for the sequence $\{a_n\}$ in each of the following cases.
(i) $a_n = 5n$ (ii) $a_n = 6^n$ (iii) $a_n = n^2$ **(06 Marks)**

b. Find the coefficient of
i) $x^9 y^3$ in the expansion fo $(2x - 3y)^{12}$
ii) $x^{12}$ in the expansion of $x^3 (1 - 2x)^{10}$ **(04 Marks)**

c. A message is made up of 12 different symbols and is to be transmitted through a communication channel. In addition to the 12 symbols, the transmitter will also send a total of 45 blank spaces between the symbols, with atleast 3 spaces between each pair of consecutive symbols. In how many ways can the transmitter send such a message? **(06 Marks)**

## Module-3

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

$$f(x) = \begin{cases} 3x - 5 & \text{for } x > 0 \\ -3x + 1 & \text{for } x \leq 0 \end{cases}$$ determine f(0), f(-1), $f^{-1}(0)$, $f^{-1}(+3)$, $f^{-1}([-5, 5])$ **(08 Marks)**

b. Define an equivalence relation. Write the partial order relation for the positive divisors of 36 and write its Hasse diagram (HASSE). **(08 Marks)**

**OR**

6 a. Consider the function $f : R \rightarrow R$ defined by $f(x) = 2x + 5$. Let a function $g : R \rightarrow R$ be defined by $g(x) = \frac{1}{2}(x - 5)$. Prove that g is an inverse of f. **(03 Marks)**

b. State Pigeonhole principle. Let ABC is an equilateral triangle whose sides are of length 1cm each. If we select 5 points inside the triangle, prove that atleast two of their points are such that the distance between them is less than ½ cm. **(05 Marks)**

c. If A = {1, 2, 3, 4}, R and S are relations on A defined by R = {(1, 2), (1, 3), (2, 4), (4, 4)} S ={(1, 1), (1, 2), (1,3), (1, 4), (2, 3), (2, 4)} find RoS, SoR, $R^2$, $S^2$ and write down their matrices. **(08 Marks)**

## Module-4

7 a. Find the number of derangements of 1, 2, 3, 4 list all such derangements. **(04 Marks)**

b. Determine the number of integers between 1 and 300 (inclusive) which are divisible by exactly 2 of 5, 6, 8. **(06 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)**

**OR**

8 a. Five teachers $T_1$, $T_2$, $T_3$, $T_4$, $T_5$ are to be made class teachers for 5 classes $C_1$, $C_2$, $C_3$, $C_4$, $C_5$ one teacher for each class $T_1$ and $T_2$ donot wish 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 teachers be assigned the work (without displeasing any teacher)? **(08 Marks)**

b. Solve the recurrence relation,
$a_n = 2(a_{n-1}) - a_{n-2})$, where $n \geq 2$ and $a_0 = 1$, $a_1 = 2$. **(08 Marks)**

## Module-5

9 a. Prove that the undirected graph G = (V, E) has an Euler circuit if and only if G is connected and every vertex in G has even degree. **(08 Marks)**

b. Define binary rooted tree and Balanced tree. Draw all the spanning trees of the graph shown in Fig 9(b)

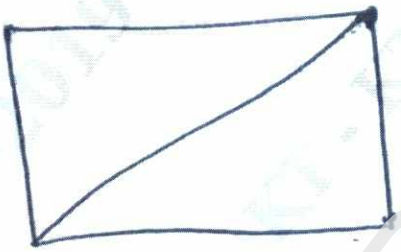

Fig Q9(b) **(08 Marks)**

**OR**

10 a. Define, with an example for each Regular graph, complement of a graph, Euler trail and Euler circuit and complete graph. **(10 Marks)**

b. Apply Merge sort to the list
6, 2, 7, 3, 4, 9, 5, 1, 8 **(06 Marks)**

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15MATDIP31

# Third Semester B.E. Degree Examination, June/July 2019
## 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. Express the complex number $\frac{(1+i)(1+3i)}{1+5i}$ in the form a + ib. **(05 Marks)**

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

c. Show that $(a+ib)^n+(a-ib)^n = 2(a^2+b^2)^{n/2}\cos\left(n\tan^{-1}\left(\frac{b}{a}\right)\right)$ **(06 Marks)**

**OR**

2 a. If $\vec{A} = i-2j+3k$ and $\vec{B} = 2i+j+k$, find the unit vector perpendicular to both $\vec{A}$ and $\vec{B}$. **(05 Marks)**

b. Show that the points $-6i+3j+2k$, $3i-2j+4k$, $5i+7j+3k$ and $-13i+17j-k$ are coplan. **(05 Marks)**

c. Prove that $\left[\vec{B}\times\vec{C},\ \vec{C}\times\vec{A},\ \vec{A}\times\vec{B}\right] = \left[\vec{A}\,\vec{B}\,\vec{C}\right]^2$ **(06 Marks)**

### Module-2

3 a. Find the $n^{th}$ derivative of $\frac{x}{(x-1)(2x+3)}$. **(05 Marks)**

b. Find the angle of intersection of the curves $r = a(1+\cos\theta)$ and $r = b(1-\cos\theta)$. **(05 Marks)**

c. Obtain the Maclourin series expansion of the function sin x upto the term containing $x^4$. **(06 Marks)**

**OR**

4 a. Show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y} = 2u\log u$ where $\log u = \frac{x^3+y^3}{3x+4y}$. **(05 Marks)**

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

c. If $u = x+3y^2-z^3$, $v = 4x^2yz$, $w = 2z^2-xy$, evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at (1, –1, 0). **(06 Marks)**

### Module-3

5 a. Obtain the reduction formula for $\int\sin^n x\,dx$. Hence evaluate $\int_0^{\pi/2}\sin^n x\,dx$. **(05 Marks)**

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

c. Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)dx\,dy\,dz$. **(06 Marks)**

**OR**

6 a. Evaluate $\int_0^{2a}\int_0^{x^2/4a} xy\,dy\,dx$. **(05 Marks)**

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

c. Evaluate $\int_0^a \frac{x^7\,dx}{\sqrt{a^2-x^2}}$ by using reduction formula. **(06 Marks)**

## Module-4

7 a. A particle moves along the curve $x = t^3+1$, $y = t^2$, $z = 2t+3$ where t is the time. Find the components of velocity and acceleration at $t = 1$ in the direction of $i+j+3k$. **(05 Marks)**

b. Find $\text{div}\vec{F}$ and $\text{curl}\vec{F}$ where $\vec{F} = \text{grad}(x^3+y^3+z^3-3xyz)$. **(05 Marks)**

c. Prove that $\text{div}(\text{curl}\vec{F}) = 0$. **(06 Marks)**

**OR**

8 a. Find the directional derivative of $f(x,y,z) = xy^3+yz^3$ at (2, −1, 1) in the direction of $i+2j+2k$. **(08 Marks)**

b. Prove that $\nabla^2\left(\frac{1}{r}\right) = 0$ where $r = \sqrt{x^2+y^2+z^2}$. **(08 Marks)**

## Module-5

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

b. Solve $\left[y\left(1+\frac{1}{x}\right)+\cos y\right]dx + (x+\log x - x\sin y)dy = 0$. **(05 Marks)**

c. Solve $\frac{dy}{dx} - \frac{y}{1+x} = e^{3x}(x+1)$. **(06 Marks)**

**OR**

10 a. Solve $(xy^3+y)dx + 2(x^2y^2+x+y^4)dy = 0$. **(08 Marks)**

b. Solve $(3y+2x+4)dx - (4x+6y+5)dy = 0$. **(08 Marks)**

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