CBCS SCHEME

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15MAT31

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. An alternating current after passing through a rectifier has the form,

$$I = \begin{cases} I_0 \sin x & \text{for } 0 < x < \pi \\ 0 & \text{for } \pi < x < 2\pi \end{cases}$$

where I_0 is the maximum current and the period is 2π. Express I as a Fourier series. **(08 Marks)**

b. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data: **(08 Marks)**

x^0	0	45	90	135	180	225	270	315
y	2	1.5	1	0.5	0	0.5	1	1.5

OR

2 a. Obtain the Fourier series expansion of the function, $f(x) = |x|$ in $(-\pi, \pi)$ and hence deduce that,

$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$$ **(06 Marks)**

b. Find the Fourier series expansion of the function,

$$f(x) = \begin{cases} \pi x & \text{in } 0 \le x \le 1 \\ \pi(2 - x) & \text{in } 1 \le x \le 2 \end{cases}$$ **(05 Marks)**

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

t(sec)	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
A(amplitude)	1.98	1.30	1.05	1.3	−0.88	−0.25	1.98

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

Module-2

3 a. Find the complex Fourier transform of the function $f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$. Hence evaluate

$$\int_0^\infty \frac{\sin x}{x} dx.$$ **(06 Marks)**

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

c. Compute the inverse z-transforms of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$. **(05 Marks)**

OR

4 a. Find the z-transform of $e^{-an}n + \sin n\frac{\pi}{4}$. **(06 Marks)**

b. Solve $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using z-transform. **(05 Marks)**

c. Find the Fourier cosine transform of, $f(x) = \begin{cases} 4x & 0 < x < 1 \\ 4 - x & 1 < x < 4 \\ 0 & x > 4 \end{cases}$. **(05 Marks)**

Module-3

5 a. Find the Correlation coefficient and equations of regression lines for the following data:

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

(06 Marks)

b. Fit a straight line to the following data:

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

(05 Marks)

c. Find a real root of the equation $xe^x = \cos x$ correct to three decimal places that lies between 0.5 and 0.6 using Regula-falsi method. **(05 Marks)**

OR

6 a. The following regression equations were obtained from a correlation table.

$y = 0.516x + 33.73$

$x = 0.516y + 32.52$

Find the value of (i) Correlation coefficient (ii) Mean of x's (iii) Mean of y's. **(06 Marks)**

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

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

(05 Marks)

c. Use Newton-Raphson's method to find a real root of $x\sin x + \cos x = 0$ near $x = \pi$, carry out three iterations. **(05 Marks)**

Module-4

7 a. The following data gives the melting point of an alloy of lead and zinc, where t is the temperature in °C and P is the percentage of lead in the alloy:

P%	60	70	80	90
t	226	250	276	304

Find the melting point of the alloy containing 84% of lead, using Newton's interpolation formula. **(06 Marks)**

b. Apply Lagrange's interpolation formula to find a polynomial which passes through the points $(0, -20)$, $(1, -12)$, $(3, -20)$ and $(4, -24)$ **(05 Marks)**

c. Find the approximate value of $\int_0^{\pi/2} \sqrt{\cos\theta}\,d\theta$ by Simpson's $\frac{3}{8}^{th}$ rule by dividing it into 6 equal parts. **(05 Marks)**

OR

8 a. From the following table :

x°	10	20	30	40	50	60
$\cos x$	0.9848	0.9397	0.8660	0.7660	0.6428	0.5

Calculate $\cos 25^\circ$ using Newton's forward interpolation formula. **(06 Marks)**

b. Use Newton's divided difference formula and find f(6) from the following data:

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

(05 Marks)

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

Module-5

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

b. Solve the variational problem $\delta\int_0^1 (12xy + y'^2)dx = 0$ under the conditions $y(0) = 3$, $y(1) = 6$. **(05 Marks)**

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

OR

10 a. A cable hangs freely under gravity from the fixed points. Show that the shape of the curve is a catenary. **(06 Marks)**

b. Use Stoke's theorem to evaluate for $\vec{F} = (x^2 + y^2)i - 2xyj$ taken around the rectangle bounded by the lines $x = \pm a$, $y = 0$, $y = b$. **(05 Marks)**

c. Evaluate $\iint_S (yzi + zxj + xyk).\hat{n}ds$ where S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$ in the first octant. **(05 Marks)**

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USN

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
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 MOSFET, with the help of neat diagram. **(08 Marks)**

b. What are applications of FET? **(04 Marks)**

c. What are the ideal characteristics of op-amp? **(04 Marks)**

OR

2 a. Explain the performance parameters of op-amp. **(08 Marks)**

b. Explain the relaxation oscillator, with the help of neat diagram. **(08 Marks)**

Module-2

3 a. Minimize the following Boolean function using K-map method,
$F(A, B, C, D) = \sum m(0, 2, 3, 8, 10, 11, 12, 14)$ **(06 Marks)**

b. Apply Quine Mc-Cluskey method to find the essential prime implicants for the Boolean expression,
$F(A,B,C,D) = \sum m(0,1,2,3,10,11,12,13,14,15)$ **(10 Marks)**

OR

4 a. Minimize the following Boolean function using K-map method.
$F(A,B,C,D) = \Pi M(0,1,2,3,4) + \sum d(5,7)$ **(06 Marks)**

b. What is Hazard? Explain its types with examples. **(10 Marks)**

Module-3

5 a. Implement the following function using 8 : 1 multiplexer
$F(A,B,C,D) = \sum m(1,2,5,7,8,10,11,13,14,15)$ **(06 Marks)**

b. Realize the following function using 3 : 8 decoder
(i) $F(A, B, C) = \sum m(1,3,4)$
(ii) $F(A, B, C) = \sum m(3,5,7)$ **(04 Marks)**

c. Design a priority encoder using the truth table. The order of priority for three inputs is $X_1 > X_2 > X_3$ **(06 Marks)**

Truth Table

Input				Output	
S	X_1	X_2	X_3	A	B
0	X	X	X	0	0
1	1	X	X	0	1
1	0	1	X	1	0
1	0	0	1	1	1
1	0	0	0	0	0

OR

6 a. Design seven segment decoder using PLA. **(08 Marks)**
b. Design Half adder and Full adder. **(08 Marks)**

Module-4

7 a. Explain Smith contact bounce circuit. **(08 Marks)**
b. Give state transition diagram and characteristic equations for SR-FF and JK-FF. **(08 Marks)**

OR

8 a. With neat diagram, explain Ring and Johnson counter. **(08 Marks)**
b. What is shift register? With neat diagram, explain 4-bit parallel in serial out shift registers. **(08 Marks)**

Module-5

9 a. Define counter. Design mod-8 up synchronous counter using JK-FF. **(12 Marks)**
b. Write VHDL code for mod-8 up counter. **(04 Marks)**

OR

10 a. Explain the binary ladder with digital of 1000. **(06 Marks)**
b. Explain with neat diagram, single slope A/D converters. **(10 Marks)**

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15CS33

Third Semester B.E. Degree Examination, Dec.2018/Jan.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. Write a C program with an appropriate structure definition and variable declaration to read and display information about an employee, using nested structures. Consider the following fields like Ename, Eid, DOJ(Date, Month, Year) and Salary (Basic, DA, HRA). **(06 Marks)**

b. Consider 2 polynomials $A(x) = 2x^{1000} + 1$ and $B(x) = x^4 + 10x^3 + 3x^2 + 1$, show how these polynomials are stored in the 1-D array also give its C representation. **(04 Marks)**

c. Write a C function to add 2 polynomials A and B store the result in polynomial C. **(06 Marks)**

OR

2 a. Consider the pattern ababab, construct the table and the corresponding labeled directed graph used in the second pattern matching algorithm. **(06 Marks)**

b. Write transpose algorithm to transpose the given sparse matrix, express the given sparse matrix as triplets and find its transpose $\begin{bmatrix} 15 & 0 & 0 & 22 & 0 & -5 \\ 0 & 10 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & -4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 91 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 28 & 0 & 0 & 0 \end{bmatrix}$. **(10 Marks)**

Module-2

3 a. Implement push and POP functions for stack with stack full (using dynamic arrays) and stack empty conditions. **(06 Marks)**

b. Define recursion, write a function for tower of hanoii. **(06 Marks)**

c. Write a note on Dequeues and Priority Queues. **(04 Marks)**

OR

4 a. Write a 'C' function to insert and delete an item into a circular queue. Explain how it is advantageous over linear Queue. **(06 Marks)**

b. Convert the following infix expression to postfix form, (i) $a + (b + c) + (b/d) * a + z * u$
(ii) $A - B/C(C * D\$E)$ **(04 Marks)**

c. Write a 'C' function to evaluate the postfix expression and trace the given postfix expression using stack $623 + -382/+*2\$3+$ **(06 Marks)**

Module-3

5 a. Write 'C' function to perform the following:
  (i) To insert a node at front end of the single linked list.
  (ii) To delete a node at rear end of S.L.L.
  (iii) To create an ordered S.L.L
  (iv) To concatenate 2 S.L.L. **(12 Marks)**

b. What are the advantages of double linked list over single linked list? Explain with an example. **(04 Marks)**

OR

6 a. Write a C function to perform the following operations on double linked list:
   (i) Inserting a node at the beginning.
   (ii) Deleting a node at the rear end
   (iii) Inserting an item at a specified position. **(09 Marks)**

b. Write a C function to add 2 polynomials represented as circular list with header modes. **(07 Marks)**

Module-4

7 a. Define tree, for the tree given below define the following terminologies:
   (i) Degree
   (ii) Non Terminals and terminals nodes.
   (iii) Siblings
   (iv) Ancestors
   (v) Level
   (vi) Height or depth

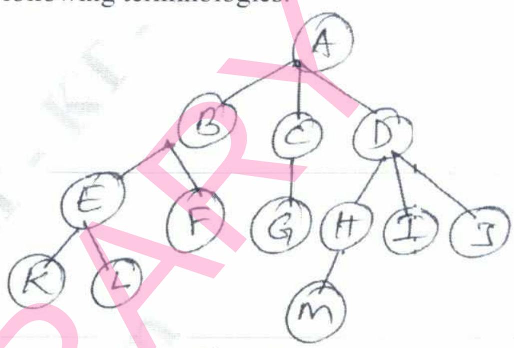


Fig. Q7 (a)

(05 Marks)

b. Explain Binary tree using Array representation and linked representation, which representation is more suitable and why? **(06 Marks)**

c. Write a note on threaded binary trees and write the rules to construct the threads. **(05 Marks)**

OR

8 a. Define binary search tree, write a function for recursive or iterative search for BST. **(06 Marks)**

b. For the given data draw a binary search tree 1, 3, 8, 5, 7, 9, 10, 12, 15, 14, 13, 11, 6 **(04 Marks)**

c. For a tree given below traverse the tree using inorder, preorder, postorder, traversals, write the C routines for any traversal. **(06 Marks)**

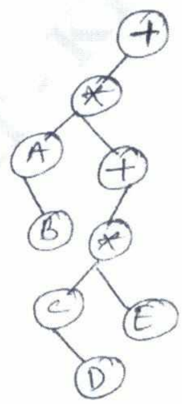
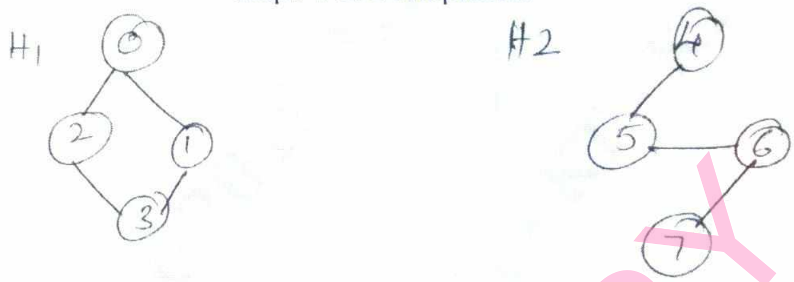


Fig. Q8 (c)

Module-5

9 a. Define Graph, for the given graph G show adjacency matrix and adjacency list representation of the graph.

Graph with 2 components



(08 Marks)

b. What are the methods used for traversing a graph, explain any one with example and write the function for the same. **(08 Marks)**

OR

10 a. Sort the following list of numbers using Radix sort:
45, 37, 05, 09, 06, 11, 18, 27 **(04 Marks)**

b. What are the types of file organization? Explain any two. **(08 Marks)**

c. Explain binary files, how are they different from text files. **(04 Marks)**

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CBCS SCHEME

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15CS34

Third Semester B.E. Degree Examination, Dec.2018/Jan.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. Define the functions of following processor registers :
i) MAR ii) MDR iii) IP iv) IR. **(04 Marks)**

b. How to measure the performance of a computer? Explain. **(05 Marks)**

c. Compute the content of 8 bit register namely R1 and R2 containing a value of $-17_{(10)}$ and $+98_{(10)}$ with initial carry bit as 1 after performing following shift or rotate operations by 2 times. i) SHR R1, 2 ii) SAR R1, 2 [Arithmetic shift]
iii) ROR R2, 2 iv) RCR R2, 2 [Rotate right with carry]. **(07 Marks)**

OR

2 a. What is the need of processor stack? Explain a commonly used layout for information in a subroutine stack frame. **(06 Marks)**

b. With relevant examples briefly explain about any 2 encoding types of machine instruction. **(05 Marks)**

c. With a memory layout starting at address 'i' represent how "ABCD" data is stored in big endian and little endian assignment scheme in a system of word length 16 bits. **(05 Marks)**

Module-2

3 a. Explain how simultaneous interrupt requests from several I/O devices can be handled by processor through a single INTR line. **(06 Marks)**

b. What is bus arbitration? With neat diagram explain about distributed arbitration process. **(06 Marks)**

c. With a neat diagram, explain about how data is read in asynchronous bus scheme. **(04 Marks)**

OR

4 a. Explain with a neat block diagram, the hardware components needed for connecting a keyboard to a processor. **(08 Marks)**

b. With a neat sequence diagram explain the process of, how output operation is carried between processor and output device connected to host through USB hub. **(08 Marks)**

Module-3

5 a. With a neat diagram, explain the design of 2M × 32 memory module using 1M × 8 memory chips. **(07 Marks)**

b. Consider a cache consisting of 256 blocks of 16 words each, for a total of 4096 words and assume main memory is addressable by 16 bit address and it consists of 4K blocks. How many bits are there in each of Tag, block/set and word fields for different mapping techniques? **(09 Marks)**

OR

6 a. Explain the process of address translation with a neat diagram. **(06 Marks)**

b. With a neat diagram discuss about organization of magnetic disk. **(06 Marks)**

c. Calculate the average access time experienced by processor if miss penalty is 17 clock cycles and Miss rate is 10% and cache access time is 1 clock cycle. **(04 Marks)**

Module-4

7 a. Design and explain the working of 16 bit carry look ahead adder built from 8 bit carry look ahead adder. Compare its performance with 16 bit ripple carry adder built from 8 bit ripple carry adder. **(10 Marks)**

b. Calculate the product of $-2_{(10)} X + 14_{(10)}$ using bit pair recording multiplier method. Why bit pair method is better than Booth algorithm? **(06 Marks)**

OR

8 a. Perform the non restoring division for the given binary numbers where dividend is $1011_{(2)}$ and divisor is $0101_{(2)}$ with all cycles. **(08 Marks)**

b. Represent $0.0625_{(10)}$ in double precision format and calculate the decimal value of A floating point number represented in single precision format as 44900000H. **(08 Marks)**

Module-5

9 a. Write and discuss about micro-routine for complete execution of instruction Add (R1), R2 in single bus organization. **(08 Marks)**

b. With a detailed block diagram explain about hardwired control unit. **(08 Marks)**

OR

10 a. With a block diagram explain briefly about an embedded processor. **(06 Marks)**

b. Explain briefly about different ways of implementing multiprocessor system with supportive diagrams. **(06 Marks)**

c. Write the control sequence for instruction Add R4, R5, R6 for 3 bus organization. **(04 Marks)**

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CBCS SCHEME

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

Third Semester B.E. Degree Examination, Dec.2018/Jan.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. Explain the UNIX architecture with a neat sketch. **(08 Marks)**

b. Explain the following commands: i) man-k ii) apropos iii) what is iv) ℓs-r. **(04 Marks)**

c. What is the output of the following commands:
i) date + % h   ii) date + "% h % m"   iii) echo "$x"   iv) cal. **(04 Marks)**

OR

2 a. Explain how to create a user or group. Along with the updations made in /etc/passwd file. **(08 Marks)**

b. What is the difference between internal and external command give example? **(04 Marks)**

c. Write a note on file and process. **(04 Marks)**

Module-2

3 a. Explain the parent child relationship UNIX. **(08 Marks)**

b. Write the output and tree structure for the following commands; assume present working directory is /home /vtu.

```
mkdir scheme
cd scheme
mkdir 2002/Branch   2006/Branch
cd 2002/Branch
mkdir CSE  ECE  ME
cd  ../../2006/Branch
mkdir CSE  ECE  ME
cd  ../../2002/Branch/ECE
pwd
cd ../../2006/CSE
pwd.
```
(08 Marks)

OR

4 a. What is the difference between absolute and relative path? **(04 Marks)**

b. Explain the output of ℓs-ℓ command. **(04 Marks)**

c. Files current permissions are rw - r - xr - - specify chmod expression required to change them for the following:
i) rwxrwxrwx
ii) r - - r - - - - -
iii) - - - - - - - - -
iv) - - - r - - r - - **(08 Marks)**

Module-3

5 a. Explain the different modes in vi editor. (05 Marks)

b. What is the output of the following commands:

i) ℓs [ijk] * .doc

ii) ℓs [a – z] ???? . txt

iii) ℓs foo \ * ? . txt

iv) ℓs . * . * (08 Marks)

c. Explain the 3 standard UNIX files. (03 Marks)

OR

6 a. Write a note on shell variables. (04 Marks)

b. With a suitable example. Explain the grep command and its various options. (08 Marks)

c. Explain the following environmental variables i) SHELL ii) PATH. (04 Marks)

Module-4

7 a. What is shell programming? Write a shell program that will do the following tasks in order: i) Clear the screen ii) Print current directory iii) Display current login users. (08 Marks)

b. Explain the shell features of 'while' and 'for' with syntax. (04 Marks)

c. Explain the following commands: i) umask ii) tail iii) head iv) pr. (04 Marks)

OR

8 a. What is the difference between hard link and soft link? (08 Marks)

b. Write a shell script to test file attributes. (08 Marks)

Module-5

9 a. Write a Perl program to print numbers that are accepted from keyboard using 'for'. (08 Marks)

b. Explain the mechanism of process creation. (08 Marks)

OR

10 a. Explain the process status command with its various options. (08 Marks)

b. Write a Perl program to convert decimal number to binary. (08 Marks)

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CBCS SCHEME

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

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Discrete Mathematical Structures

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 Tautology. Verify the following compound proposition is a tautology or not : $\{(p \vee q) \rightarrow r\} \leftrightarrow \{\sim r \rightarrow \sim (p \vee q)\}$. **(04 Marks)**

b. Check whether the following argument is valid or not :
If I study, then I will not fail in exam.
If I do not watch TV in the evenings, then I will study.
I failed in exam.
$\therefore$ I must have watched TV in the evenings. **(04 Marks)**

c. Define : i) open sentence ii) quantifiers. Write the following proposition in symbolic form and find its negation : "All integers are rational numbers and some rational numbers are integers". **(04 Marks)**

d. Give a direct proof of the statement, "For all integers K and ℓ, if K and ℓ are both even then $K + \ell$ is even and $K\ell$ is even". **(04 Marks)**

OR

2 a. Define converse, inverse and contra positive of an implication. Hence find converse, inverse and contra positive for "$\forall x, (x > 3) \rightarrow (x^2 > 9)$" where universal set is the set of real numbers R. **(04 Marks)**

b. Using the laws of logic, prove the following logical equivalence :
$[(\sim p \vee \sim q) \wedge (F_0 \vee p) \wedge P] \Leftrightarrow p \wedge \sim q$. **(04 Marks)**

c. What are bound variables and free variables. Identify the same in each of the following expressions :
i) $\forall y, \exists z \{\cos(x + y) = \sin(z - x)\}$
ii) $\exists x, \exists y \{(x^2 - y^2) = z\}$. **(04 Marks)**

d. Verify the validity of the following argument : If a triangle has two equal sides, then it is isosceles. If a triangle is isosceles, then it has two equal angles. The triangle ΔABC does not have two equal angles. $\therefore \Delta ABC$ does not have two equal sides. **(04 Marks)**

Module-2

3 a. Prove by mathematical induction $1.3 + 2.4 + 3.5 + \cdots + n(n+2) = \dfrac{n(n+1)(2n+7)}{6}$. **(04 Marks)**

b. Give a recursive definition for each of the following integer sequence :
i) $a_n = 7n$ ii) $a_n = 2 - (-1)^n$ for $n \in z^+$. **(04 Marks)**

c. How many positive integers can be formed by using the digits 3, 4, 4, 5, 5, 6, 7 to exceed 5,000,000? **(04 Marks)**

d. In how many ways can we distribute seven apples and six oranges among four children so that each child receives at least one apple? **(04 Marks)**

OR

4 a. If F_0, F_1, F_2, - - - - are Fibonacci numbers, then prove by induction $\sum_{i=1}^{n} \frac{F_{i-1}}{2^i} = 1 - \frac{F_{n+2}}{2^n}$. **(04 Marks)**

b. A sequence $\{a_n\}$ is defined recursively as $a_1 = 7$ and $a_n = 2a_{n-1} + 1$ for $n \geq 2$. Find a_n in explicit form. **(04 Marks)**

c. Find the number of arrangements of all the letters in the word "TALLAHASSEE". How many of these arrangements have no adjacent A's? **(04 Marks)**

d. Find the coefficient of $w^3x^2yz^2$ in the expansion of $(2w - x + 3y - 2z)^8$. **(04 Marks)**

Module-3

5 a. Define Cartesian product of two sets. For any three non-empty sets A, B and C. Prove that $A \times (B - C) = (A \times B) - (A \times C)$. **(04 Marks)**

b. Let f and g be two functions form R to R defined by $f(x) = 2x + 5$ and $g(x) = \frac{x-5}{2}$. Show that f and g are invertible to each other. **(04 Marks)**

c. Define partition of a set. If R is a relation defined on $A = \{1, 2, 3, 4\}$ by $R = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (3, 4), (4, 3), (4, 4)\}$, determine the partition induced by R. **(04 Marks)**

d. Let $A = \{a, b, c\}$, $B = P(A)$ where $P(A)$ is the power set of A. Let R be a subset relation on A. Show that (B, R) is a POSET and draw its Hasse diagram. **(04 Marks**

OR

6 a. Let R be an equivalence relation on set A and $a, b \in A$. Then prove the following are equivalent :

i) $a \in [a]$

ii) a R b iff $[a] = [b]$

iii) if $[a] \cap [b] \neq \phi$ then $[a] = [b]$. **(04 Marks)**

b. Prove that a function $f : A \rightarrow B$ is invertible iff it is one – one and onto. **(04 Marks)**

c. State Pigeonhole principle. Show that if any seven numbers from 1 to 12 are chosen, then two of them will add to 13. **(04 Marks)**

d. Show that the set of positive divisors of 36 is a POSET and draw its Hasse diagram. Hence find its i) least element ii) greatest element. **(04 Marks**

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. **(04 Marks)**

b. Define derangement. Find the number of derangements of 1, 2, 3, 4. List all these derangements. **(04 Marks)**

c. Find the rook polynomial for the following board [refer Fig.Q7(c)] :

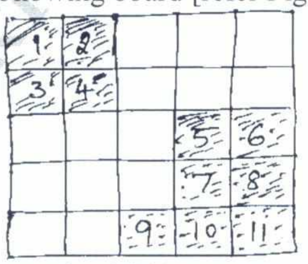

Fig. Q7(c) **(04 Marks)**

d. 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. **(04 Marks)**

OR

8 a. Determine the number of integers between 1 and 300 (inclusive) which are
i) divisible by exactly two of 5, 6, 8 ii) divisible by at least two of 5, 6, 8. **(04 Marks)**

b. In how many ways can be integers 1, 2, - - - -, 10 be arranged in a line so that no even integer is in its natural place. **(04 Marks)**

c. An apple, a banana, a mango and an ornage are to be distributed to four boys B_1, B_2, B_3, B_4. The boys B_1 and B_2 do not wish to have apple, the boy B_3 does not want banana or mango, B_4 refuses orange. In how many ways the distribution can be made so that no boy is displeased? **(04 Marks)**

d. Solve the recurrence relation $F_{n+2} = F_{n+1} + F_n$ for $n \geq 0$ given that $F_0 = 0$, $F_1 = 1$. **(04 Marks)**

Module-5

9 a. Define the following with an example for each :
i) Complete graph ii) regular graph iii) bipartite graph iv) complete bipartite graph. **(04 Marks)**

b. Define isomorphism of two graphs. Verify the following graphs are isomorphic or not : [Refer Fig.Q9(b)] **(04 Marks)**

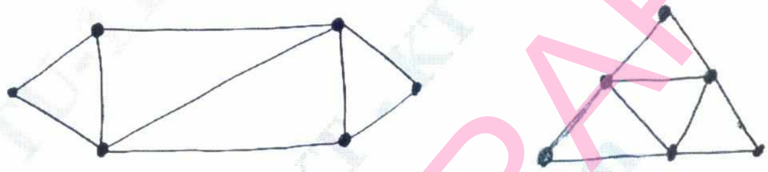

Fig.Q9(b)

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

d. Construct an optimal prefix code for the symbols a, o, q, u, y, z that occur with frequencies 20, 28, 4, 17, 12, 7 respectively. **(04 Marks)**

OR

10 a. Explain Konigsberg bridge problem. **(04 Marks)**

b. Define the following with an example :
i) subgraph ii) spanning subgraph
iii) induced subgraph iv) edge–disjoint and vertex – disjoint subgraphs. **(04 Marks)**

c. If a tree T has four vertices of degree 2, one vertex of degree 3, two vertices of degree 4 and one vertex of degree 5, find the number of leaves in T. **(04 Marks)**

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

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CBCS SCHEME

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15MATDIP31

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Find the modulus and amplitude of $\dfrac{(3-\sqrt{2}i)^2}{1+2i}$. **(06 Marks)**

b. Find the cube root of $(1-i)$. **(05 Marks)**

c. Prove that $\left(\dfrac{1+\sin\theta+i\cos\theta}{1+\sin\theta-i\cos\theta}\right)^n = \cos\left(n\dfrac{\pi}{2}-n\theta\right)+i\sin\left(n\dfrac{\pi}{2}-n\theta\right)$. **(05 Marks)**

OR

2 a. For any three vector a, b, c show that
$\left[\vec{a}+\vec{b},\ \vec{b}+\vec{c},\ \vec{c}+\vec{a}\right] = 2\left[\vec{a}\,\vec{b}\,\vec{c}\right]$ **(06 Marks)**

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

c. Find the angle between the vectors $\vec{a}=5\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}-3\hat{j}+6\hat{k}$ **(05 Marks)**

Module-2

3 a. Find the n^{th} derivative of $\cos x\cos 2x\cos 3x$. **(06 Marks)**

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

c. Find the angle between the radius vector and tangents for the curve $r^2\cos 2\theta = a^2$ **(05 Marks)**

OR

4 a. If $u=e^{ax+by}+(ax-by)$ prove that $b\dfrac{\partial u}{\partial x}+a\dfrac{\partial u}{\partial y}=2abu$. **(06 Marks)**

b. 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)**

c. If $x=u(1-v)$, $y=uv$. Find $\dfrac{\partial(x,y)}{\partial(u,v)}$. **(05 Marks)**

Module-3

5 a. Obtain the reduction formula for $\int_0^{\pi/2}\cos^n x\,dx$ (n>0). **(06 Marks)**

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

c. Evaluate $\int_0^1\int_0^1\int_0^y xyz\,dx\,dy\,dz$. **(05 Marks)**

OR

6 a. Obtain the reduction formula for $\int_0^{\frac{\pi}{2}} \sin^n x dx$, $n > 0$. **(06 Marks)**

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

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

Module-4

7 a. A particle moves along a curve $x = e^{-t}$, $y = 2\cos 3t$, $z = 2\sin 3t$ where t is the time. Determine the component of velocity and acceleration vector at t = 0 in the direction of $\hat{i} + \hat{j} + \hat{k}$. **(08 Marks)**

b. Find the value of the constant a, b, such that $\vec{F} = (axy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (bxz^2 - y)\hat{k}$ is irrotational. **(08 Marks)**

OR

8 a. If $\vec{F} = (x + y + 1)\hat{i} + \hat{j} - (x + y)\hat{k}$ show that $\vec{F} \cdot \text{curl}\,\vec{F} = 0$. **(06 Marks)**

b. If $\phi(x, y, z) = x^3 + y^3 + z^3 - 3xyz$ find $\nabla\phi$ at $(1, -1, 2)$. **(05 Marks)**

c. Find the directional derivative $\phi(x, y, z) = x^2yz + 4xz^2$ at $(1, -2, -1)$ in the direction of $2\hat{i} - \hat{j} - 2\hat{k}$. **(05 Marks)**

Module-5

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

b. Solve $ye^{xy}dx + (xe^{xy} + 2y)dy = 0$ **(05 Marks)**

c. $\frac{dy}{dx} - \frac{2y}{x} = x + x^2$. **(05 Marks)**

OR

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

b. Solve $(y^3 - 3x^2y)dx - (x^3 - 3xyz)dy = 0$ **(05 Marks)**

c. Solve $(1 + y^2)dx + (x - \tan^{-1} y)dy = 0$ **(05 Marks)**

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