CBCS SCHEME

USN | | | | | | | | | | **17MAT31**

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the Fourier series expansion for the periodic function f(x), if in one second $f(x)=\begin{cases}0; & -\pi<x<0\\ x; & 0<x<\pi\end{cases}$. **(08 Marks)**

b. Expand the function $f(x) = x(\pi-x)$ over the interval $(0, \pi)$ in half range Fourier cosine series. **(06 Marks)**

c. The following value of function y gives the displacement in inches of a certain machine part for rotations x of a flywheel. Expand y in terms of Fourier series upto the second harmonic.

Rotations	x	0	$\pi/6$	$2\pi/6$	$3\pi/6$	$4\pi/6$	$5\pi/6$	π
Displacement	y	0	9.2	14.4	17.8	17.3	11.7	0

(06 Marks)

OR

2 a. Find the Fourier series expansion for the function : $f(x)=\begin{cases}\pi x; & 0\le x\le 1\\ \pi(2-x); & 1\le x\le 2\end{cases}$

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

b. Expand in Fourier series $f(x) = (\pi - x)^2$ over the interval $0 \le x \le 2\pi$. **(06 Marks)**

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

t (secs)	0	T/6	T/3	T/2	2T/3	5T/6	T
A (Amps)	1.98	1.30	1.05	1.30	–0.88	–0.25	1.98

Expand the function (periodic current) by Fourier series and show that there is a direct current part of 0.75 amp and also obtain amplitude of first harmonic. **(06 Marks)**

Module-2

3 a. Find Fourier transform of $f(x)=\begin{cases}1-x^2; & |x|<1\\ 0; & |x|>1\end{cases}$

and hence evaluate $\int_0^{\infty}\frac{x\cos x-\sin x}{x^3}dx$. **(08 Marks)**

b. Find Fourier Cosine transform of the function :

$$f(x)=\begin{cases}4x; & 0<x<1\\ 4-x; & 1<x<4\\ 0; & x>4\end{cases}$$ **(06 Marks)**

c. Find z-transforms of : i) $a^n \sin n\theta$ ii) $a^{-n}\cos n\theta$. **(06 Marks)**

OR

4 a. Find Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate : $\int_0^\infty \frac{x \sin mx}{1+x^2} dx, m > 0$. **(08 Marks)**

b. Find z-transform of $u_n = \cosh\left(\frac{n\pi}{2} + \theta\right)$. **(06 Marks)**

c. Solve the difference equation using z-transforms $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$. Given $u_0 = u_1 = 0$. **(06 Marks)**

Module-3

5 a. If θ - is the acute angle between the two regression lines relating the variables x and y, show that $\tan\theta = \left(\frac{1-r^2}{r}\right)\left(\frac{\sigma_x \sigma_y}{\sigma_x^2 \sigma_y^2}\right)$. **(08 Marks)**

Indicate the significance of the cases $r = \pm 1$ and $r = 0$.

b. Fit a straight line $y = ax + b$ for the data.

x	12	15	21	25
y	50	70	100	120

(06 Marks)

c. Find a real root of the equation by using Newton-Raphson method near $x = 0.5$, $xe^x = 2$, perform three iterations. **(06 Marks)**

OR

6 a. Compute the coefficient of correlation and equation of regression of lines for the data :

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(08 Marks)

b. The Growth of an organism after x – hours is given in the following table :

x (hours)	5	15	20	30	35	40
y (Growth)	10	14	25	40	50	62

Find the best values of a and b in the formula $y = ae^{bx}$ to fit this data. **(06 Marks)**

c. Find a real root of the equation $\cos x = 3x - 1$ correct to three decimals by using Regula – False position method, given that root lies in between 0.6 and 0.7. Perform three iterations. **(06 Marks)**

Module-4

7 a. Find y(8) from y(1) = 24, y(3) = 120, y(5) = 336, y(7) = 720 by using Newton's backward difference interpolation formula. **(08 Marks)**

b. Define f(x) – as a polynomial in x for the following data using Newton's divided difference formula. **(06 Marks)**

x	–4	–1	0	2	5
f(x)	1245	33	5	9	1335

c. Evaluate the integral $I = \int_0^6 \frac{dx}{4x+5}$ using Simpson's $\frac{1}{3}$rd rule using 7 ordinates. **(06 Marks)**

OR

8 a. For the following data calculate the differences and obtain backward difference interpolation polynomial. Hence find f(0.35). **(08 Marks)**

x	0.1	0.2	0.3	0.4	0.5
f(x)	1.40	1.56	1.76	2.0	2.28

b. Using Lagrange's interpolation find y when x = 10.

x	5	6	9	11
y	12	13	14	16

(06 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2}\,dx$ by Weddle's rule considering seven ordinates. **(06 Marks)**

Module-5

9 a. Verify the Green's theorem in the plane for $\int_c (x^2+y^2)dx + 3x^2y\,dy$ where C – is the circle $x^2+y^2 = 4$ traced in positive sense. **(08 Marks)**

b. Evaluate $\int_c (\sin z.dx - \cos x dy + \sin y dx)$ by using Stokes theorem, where C – is the boundary of the rectangle $0 \le x \le \pi$, $0 \le y \le 1$ and $z = 3$. **(06 Marks)**

c. Find the curve on which the functional : $\int_0^1 [y'^2 + 12xy]dx$ with y(0) = 0, y(1) = 1 can be extremised. **(06 Marks)**

OR

10 a. Given $f = (3x^2 - y)i + xzj + (yz - x)k$ evaluate $\int_c f \cdot dr$ from (0, 0, 0) to (1, 1, 1) along the paths $x = t$, $y = t^2$ and $z = t^3$. **(08 Marks)**

b. Derive Euler's equation in the form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. **(06 Marks)**

c. Prove that the shortest distance between two points in a plane is a straight line. **(06 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

17MATDIP31

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Prove that $(1+\cos\theta+i\sin\theta)^n+(1+\cos\theta-i\sin\theta)^n=2^{n+1}\cos^n\left(\frac{\theta}{2}\right)\cos\left(\frac{n\theta}{2}\right)$ **(08 Marks)**

b. Express $\sqrt{3}+i$ in the polar form and hence find its modulus and amplitude. **(06 Marks)**

c. Find the sine of the angle between vectors $\vec{a}=\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}-3\hat{j}+2\hat{k}$ **(06 Marks)**

OR

2 a. Express $\dfrac{3+4i}{3-4i}$ in the form x + iy. **(08 Marks)**

b. If the vector $2\hat{i}+\lambda\hat{j}+\hat{k}=0$ and $4\hat{i}-2\hat{j}-2\hat{k}$ are perpendicular to each other, find λ. **(06 Marks)**

c. Find λ, such that the vectors $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}+2\hat{j}-3\hat{k}$, $3\hat{i}+\lambda\hat{j}+5\hat{k}$ are coplanar. **(06 Marks)**

Module-2

3 a. If $y=e^{a\sin^{-1}x}$, prove that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-(n^2+a^2)y_n=0$ **(08 Marks)**

b. With usual notations, prove that $\tan\phi=r\dfrac{d\theta}{dr}$. **(06 Marks)**

c. If $u=\log_e\dfrac{x^3+y^3}{x^2+y^2}$, prove that $x\dfrac{\partial u}{\partial x}+y\dfrac{\partial u}{\partial y}=1$. **(06 Marks)**

OR

4 a. Using Maclaurin's series, expand $\tan x$ upto the term containing x^5. **(08 Marks)**

b. Find the pedal equation of $r=a(1-\cos\theta)$. **(06 Marks)**

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

Module-3

5 a. Obtain a reduction formula for $\int_0^{\pi/2}\cos^n x\,dx$, (n > 0). **(08 Marks)**

b. Evaluate $\int_0^a \dfrac{x^7}{\sqrt{a^2-x^2}}dx$ **(06 Marks)**

c. Evaluate $\int_1^2\int_1^3 xy^2\,dx\,dy$ **(06 Marks)**

OR

6 a. Obtain a reduction formula for $\int_0^{\pi/2} \sin^n x\, dx$, $(n > 0)$. **(08 Marks)**

b. Evaluate $\int_0^{2a} x^2 \sqrt{2ax - x^2}\, dx$ **(06 Marks)**

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

Module-4

7 a. A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$ and $z = 3t - 5$, where 't' is the time. Find its velocity and acceleration vectors and also magnitude of velocity and acceleration at $t = 1$. **(08 Marks)**

b. In which direction of the directional derivative of x^2yz^3 is maximum at (2, 1, –1) and find the magnitude of this maximum. **(06 Marks)**

c. Show that $\vec{F} = (y + z)\hat{i} + (x + z)\hat{j} + (x + y)\hat{k}$ is irrotational. **(06 Marks)**

OR

8 a. If $\phi = xy^2z^3 - x^3y^2z$, find $\nabla\phi$ and $|\nabla\phi|$ at (1, –1, 1). **(08 Marks)**

b. 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)**

c. If $x = t^2 + 1$, $y = 4t - 3$, $z = 2t^2 - 6t$ represents the parametric equation of a curve, find the angle between the tangents at $t = 1$ and $t = 2$. **(06 Marks)**

Module-5

9 a. Solve : $\left(x \tan\frac{y}{x} - \frac{y}{x}\sec^2\frac{y}{x}\right)dx = x \sec^2\frac{y}{x} dy$ **(08 Marks)**

b. Solve : $xy(1 + xy^2)\frac{dy}{dx} = 1$ **(06 Marks)**

c. Solve : $\frac{dy}{dx} + \frac{y\cos x + \sin y + y}{\sin x + x\cos y + x} = 0$ **(06 Marks)**

OR

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

b. Solve : $(1 + y^2)dx = (\tan^{-1}y - x)dy$ **(06 Marks)**

c. Solve : $(y \log y)dx + (x - \log y)dy = 0$. **(06 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | | **17CS32**

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Analog and Digital Electronics

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain construction and working principle of operations of n-channel D-MOSFET along with its drain and trans-conductance characteristics. **(10 Marks)**

b. Write the difference between JEFT's and MOSFET's. **(05 Marks)**

c. For a given self-bias configuration in Fig.Q.1(c), determine: i) I_{d_q} and $V_{g'eq}$ ii) V_{ds} and V_D. **(05 Marks)**

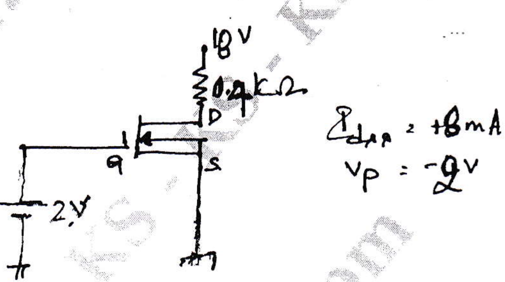

Fig.Q.1(c)

OR

2 a. List of differences between ideal and practical op-amp amplifier. **(06 Marks)**

b. With a neat diagram and waveform explain astable multivibrator using 555 timers. **(07 Marks)**

c. With neat diagram and waveform explain the working of relaxation oscillation oscillator. **(07 Marks)**

Module-2

3 a. Explain positive and negative logic. List the equivalence between them. **(08 Marks)**

b. Find the minimal SOP form for the given min-terns using K-map.
$F(A, B, C, D) = \sum m(4, 5, 6) + d(10, 12, 13, 14, 15)$. **(06 Marks)**

c. Find the minimal POS form for the given MAX-TERM using K-map.
$f(a, b, c, d) = \pi M(5, 7, 8, 9, 12) + d(0, 6, 10, 15)$. **(06 Marks)**

OR

4 a. Using Quine-Mc-Clusky method simplify the following Boolean equation.
$f(a, b, c, d) = \sum m(0, 1, 10, 11, 13, 15) + d(2, 3, 12, 14)$. **(10 Marks)**

b. Define Hazard. Explain different types of Hazards. **(06 Marks)**

c. Write the VHDL code for the circuit shown in Fig.Q.4(c): **(04 Marks)**

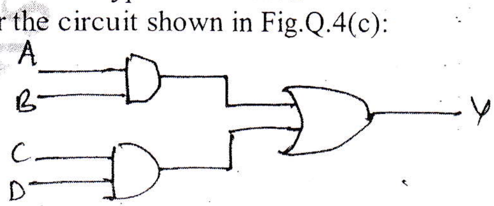

Fig.Q.4(c)

Module-3

5 a. What is multiplexers? Design 8:1 multiplexer using 2:1 multiplexers. (08 Marks)
b. Explain the purpose of using parity generators and checkers using suitable illustrations. (06 Marks)
c. What is magnitude comparator? Explain 1 bit magnitude comparator. (06 Marks)

OR

6 a. Design 7-segment decoder using PLA. (06 Marks)
b. With neat logic diagram and truth table, explain negative edge triggered J-K flip-flop. (06 Marks)
c. What is an Adder? Explain with truth table the half Adder, full Adder, half subtractor and full subtractor. (08 Marks)

Module-4

7 a. With a neat logic diagram and truth table explain the working of J-K master slave flip-flop using NAND gates. (08 Marks)
b. Give characteristic table, characteristic equation and excitation table for S-R, D and J-K flip-flop. (08 Marks)
c. Write a VHDL code for D-flip-flop. (04 Marks)

OR

8 a. What is a register? With neat diagram explain 4-bit parallel-in-serial out shift register. (08 Marks)
b. Explain with a neat diagram how a shift register can be applied for serial-addition. (06 Marks)
c. Differentiate between synchronous and asynchronous counters. (06 Marks)

Module-5

9 a. Define counter. Design a synchronous counter for the sequence, $0 \rightarrow 3 \rightarrow 1 \rightarrow 2 \rightarrow 6 \rightarrow 7 \rightarrow 0 \rightarrow 3$ using J-K flip flop. (12 Marks)
b. Explain with neat diagram the working principle of Digital Clock. (08 Marks)

OR

10 a. Explain the binary ladder with digital input of 1000. (06 Marks)
b. Explain 2-bit simultaneous A/D converter. (08 Marks)
c. Explain the terms accuracy and resolution for D/A converters. (06 Marks)

* * * * *

CBCS SCHEME

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

17CS33

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Data Structure and Applications

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define data structure. List and explain data structure operations. **(05 Marks)**
b. Write the bubble sort algorithm. **(05 Marks)**
c. List and explain in detail, three types of structures used to store the strings. **(10 Marks)**

OR

2 a. Explain dynamic memory allocation. **(05 Marks)**
b. Explain about the representation of two dimensional arrays in memory. **(05 Marks)**
c. What do you mean by pattern matching? Let P and T be strings with lengths R and S respectively and are stored as arrays with one character per element. Write a pattern matching algorithm that finds index P in T. Also discuss about this algorithm. **(10 Marks)**

Module-2

3 a. Define stack. Write the procedure for two basic operations associated with stack. **(05 Marks)**
b. Write a short note on priority queues. **(05 Marks)**
c. Define recursion. What are the properties of recursive procedure? Write recursive procedure for : i) Tower of Hanoi ii) Factorial of a number. **(10 Marks)**

OR

4 a. Define queues. Write QINSERT and QDELETE procedures for queues using arrays. **(10 Marks)**
b. Write the postfix form of the following expression.
$A + (B * C - D/E \uparrow F) * G) * H$. **(05 Marks)**
c. Write a note on Ackermann function. **(05 Marks)**

Module-3

5 a. Write the following algorithm for singly linked list.
i) Inserting ITEM as the first node in the list
ii) Deleting the node with the given ITEM of information. **(10 Marks)**
b. Write the node structure for linked representation of polynomial. Write the function to add two polynomials represented using linked list. **(10 Marks)**

OR

6 a. Write the functions to perform the following :
   i) Inverting a singly linked list
   ii) Concatenating the singly linked list
   iii) Finding the length of a circular list. **(10 Marks)**

b. Write a note on header linked list. **(05 Marks)**

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

$$\begin{bmatrix} 2 & 0 & 0 & 0 \\ 4 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \\ 8 & 0 & 0 & 1 \\ 0 & 0 & 6 & 0 \end{bmatrix}.$$ **(05 Marks)**

Module-4

7 a. What is a tree? write the routines to traverse the given string using
   i) Pre-order traversal
   ii) In-order traversal
   iii) Post-order traversal. **(10 Marks)**

b. Define binary search tree. Write the recursive search and iterative search algorithm for a binary search free. **(10 Marks)**

OR

8 a. Write the routines for :
   i) Copying binary trees
   ii) Testing for equality of binary trees. **(10 Marks)**

b. List the rules to construct the threads. Write the routines for inorder traversal of a threaded binary tree. **(10 Marks)**

Module-5

9 a. Write an algorithm for an insertion sort. Also discuss about the complexity of insertion sort. **(10 Marks)**

b. Write an algorithm for : i) Breadth first search ii) depth first search. **(10 Marks)**

OR

10 a. Define graph. Explain in detail about directed graphs. **(10 Marks)**

b. Explain in detail about static and dynamic hashing. **(10 Marks)**

* * * * *

USN | | | | | | | | | | 17CS34

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Computer Organization

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain with a neat diagram the connection between the processor and the computer memory. **(05 Marks)**
b. Explain the Basic Instruction types with example. **(05 Marks)**
c. Define Addressing mode, explain the various addressing modes with example. **(10 Marks)**

OR

2 a. Write an assembly program that reads a line of characters and display it. **(05 Marks)**
b. What are assembler directives? Point out and explain the various directives with example. **(05 Marks)**
c. Point out various shifts and rotate instruction and example with a neat diagram and example. **(10 Marks)**

Module-2

3 a. Define interrupt. Point out and explain the various ways of enabling and disabling interrupts. **(07 Marks)**
b. What are Exceptions? Point out and explain the different kinds of exceptions. **(05 Marks)**
c. What is interrupt nesting, explain with a neat diagram the implementation of interrupt priority, using individual interrupt request and acknowledge lines. **(08 Marks)**

OR

4 a. What is Bus Arbitration? Explain centralized and distributed arbitration. With a neat diagram. **(10 Marks)**
b. Explain Universal serial Bus tree structure and split bus operation with a neat diagram. **(10 Marks)**

Module-3

5 a. Explain synchronous DRAMS with a block diagram. **(05 Marks)**
b. Define ROM ; point out and explain various types of ROMS. **(05 Marks)**
c. Define cache memory, explain various types of it with a neat block diagram. **(10 Marks)**

OR

6 a. What is Virtual memory? Explain virtual memory organization. **(07 Marks)**
b. Explain the optical disk organization with a neat diagram. **(10 Marks)**
c. Define Hit rate and miss penalty. **(03 Marks)**

Module-4

7 a. Draw 4-bit carry-look ahead adder and explain. **(10 Marks)**
b. Perform multification for –13 and + 9 using Booth's Algorithm and explain Booth's Algorithm process. **(10 Marks)**

OR

8 a. Explain with a neat figure the circuit arrangement for binary division. **(10 Marks)**
b. Explain IEEE standard for floating point number. **(10 Marks)**

Module-5

9 a. Explain three – bus organization of the datapath with a neat block diagrams. **(06 Marks)**
b. Explain Hard Wired Control Unit Organization in a processing unit. **(06 Marks)**
c. Write the control sequence for execution of the Instruction. Add (R_3), R_1 in the execution of a complete instruction. **(08 Marks)**

OR

10 a. Explain briefly the block diagram of a digital camera. **(10 Marks)**
b. With a neat block diagram, explain the working of microwave oven in an embedded system. **(10 Marks)**

* * * * *

CBCS SCHEME

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

17CS35

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Unix and Shell Programming

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. By writing a neat diagram, explain the architecture of UNIX. **(10 Marks)**

b. Discuss the following commands
i) ls ii) who iii) cat iv) echo **(10 Marks)**

OR

2 a. Explain the features of UNIX. **(10 Marks)**

b. Explain the commands used to add, modify and delete users. **(10 Marks)**

Module-2

3 a. What is a file? Explain different categories of files. **(10 Marks)**

b. By giving example, explain the following commands.
i) pwd ii) cd iii) mkdir iv) rmdir. **(10 Marks)**

OR

4 a. Discuss ls commands with options. **(10 Marks)**

b. Explain absolute method of changing permissions by giving example. **(10 Marks)**

Module-3

5 a. Explain different modes of Vi editor **(10 Marks)**

b. Discuss ex-mode commands of Vi editor. **(10 Marks)**

OR

6 a. Explain shell interpretive cycle. **(04 Marks)**

b. Which are standard files used in UNIX? Explain. **(08 Marks)**

c. By giving examples, explain extended regular expression. **(08 Marks)**

Module-4

7 a. With example, explain logical operators in shell programming. **(05 Marks)**

b. Discuss for statement in shell script with example. **(05 Marks)**

c. Write a shell program to do the following :
i) List of files ii) Processes of user iii) Today's date vi) Users of the system.
Using case conditional. **(10 Marks)**

OR

8 a. Discuss head and tail commands along with its options. **(10 Marks)**

b. By specifying examples, explain hard and soft links. **(10 Marks)**

Module-5

9 a. Along with the options and examples, explain ps command. **(10 Marks)**

b. By giving example, explain nice and nohup commands. **(10 Marks)**

OR

10 a. Explain string handling function of perl. **(06 Marks)**

b. With example, explain split and join function of perl. **(06 Marks)**

c. What is subroutine? Explain by giving example. **(08 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.

CBCS SCHEME

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

17CS36

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define proposition, tautology, contradiction. Determine whether the following compound statement is a tautology or not.
$\{(p \vee q) \to r\} \leftrightarrow \{\neg r \to \neg(p \vee q)\}$ **(06 Marks)**

b. Using the laws of logic, show that $(p \to q) \wedge [\neg q \wedge (r \vee \neg q)] \Leftrightarrow \neg(q \vee p)$ **(07 Marks)**

c. Establish the validity of the following argument

$$\begin{array}{l} \forall x,\ p(x) \vee q(x) \\ \exists x,\ \neg p(x) \\ \forall x,\ \neg q(x) \vee r(x) \\ \forall x,\ s(x) \to \neg r(x) \\ \hline \therefore \exists x,\ \neg s(x) \end{array}$$

(07 Marks)

OR

2 a. Define converge, inverse and contra positive of a conditional. Find converse, inverse and contra positive of $\forall x, (x > 3) \to (x^2 > 9)$, where universal set is R. **(06 Marks)**

b. Test the validity of the following arguments:

i) If there is a strike by students, the exam will
be postponed but the exam was not postponed.
―――――――――――――
∴ there was no strike by students.

ii) If Ravi studies, then he will pass in DMS.
If Ravi doesn't play cricket, then he will study.
Ravi failed in DMS.
―――――――――――――
∴ Ravi played cricket

(06 Marks)

c. Define dual of logical statement. Write the dual of the statement $(p \vee T_0) \wedge (q \vee F_0) \vee (r \wedge s \wedge T_0)$. **(02 Marks)**

d. Let $p(x) : x \geq 0$
$q(x) : x^2 \geq 0$ and $r(x) : x^2 - 3x - 4 = 0$
Then, for the universe completing of all real numbers, find the truth values of :
i) $\exists x\{p(x) \wedge q(x)\}$ ii) $\forall x\{p(x) \to q(x)\}$ iii) $\exists x\{p(x) \wedge r(x)\}$ **(06 Marks)**

Module-2

3 a. Prove that for any positive integer n, $\sum_{i=1}^{n} \frac{F_{i-1}}{2^i} = 1 - \frac{F_{n+2}}{2^n}$, F_n denote the Fibonacci number. **(06 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? **(07 Marks)**

c. Determine the coefficient of $a^2b^3c^2d^5$ in the expansion of $(a + 2b - 3c + 2d + 5)^{16}$. **(07 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. Prove by using principle of mathematical induction

$$\sum_{i=1}^{n} i\cdot 2^{i} = 2+(n-1)\cdot 2^{n+1}$$ (06 Marks)

b. A committee of 12 is to be selected from 10 men and 10 women. In how many ways can the selection be carries out if
   i) There are no restrictions
   ii) There must be six men and six women
   iii) There must be an even number of women. (07 Marks)

c. Determine the number of integer solutions of $x_1 + x_2 + x_3 + x_4 = 32$ where $x_i \geq 0$, $1 \leq i \leq 4$. (07 Marks)

Module-3

5 a. If A = {1, 2, 3, 4, 5} and there are 6720 injective functions $f : A \rightarrow B$, what is |B|? (03 Marks)

b. Let m, n be positive integers with $1 < n \leq m$ then prove that,
$s(m+1, n) = s(m, n-1) + ns(m, n)$ (05 Marks)

c. If $f : R \rightarrow R$ defined by $f(x) = x^2$, determine whether the function is one-to-one and whether it is onto. If it is not onto, find the range. (06 Marks)

d. Let A = {1, 2, 3, 4, 5} × {1, 2, 3, 4, 5} and define R on A by (x_1, y_1) R (x_2, y_2) if $x_1 + y_1 = x_2 + y_2$, verify that R is an equivalence relation on A. (06 Marks)

OR

6 a. If $f : R \rightarrow R$ defined by $f(x) = x^3$, determine whether f is invertible and if determine f^{-1}. (05 Marks)

b. Define the relation R for two lines ℓ_1 and ℓ_2 by ℓ_1 R ℓ_2 if ℓ_1 is perpendicular to ℓ_2. Determine whether the relation is reflexive, symmetric, antisymmetric or transitive. (05 Marks)

c. Let A = {1, 2, 3, 6, 9, 18} and R on A by xRy if x|y. Draw the Hasse diagram for the poset(A, R). (05 Marks)

d. For A = {1, 2, 3, 4}, let R{(1, 1) (1, 2) (2, 3) (3, 3) (3, 4)} be a relation on A. Draw the directed graph G on A that is associated with R. Do likewise for R^2, R^3. (05 Marks)

Module-4

7 a. Determine the number of positive integers n where $1 \leq n \leq 100$ and n is not divisible by 2, 3 or 5. (06 Marks)

b. How many derangements are there for 1, 2, 3, 4 and 5? (07 Marks)

c. Solve the recurrence relation $2a_{n+3} = a_{n+2} + 2a_{n+1} - a_n$, $n \geq 0$, $a_0 = 0$, $a_1 = 1$, $a_2 = 2$. (07 Marks)

OR

8 a. In how many ways can the 26 letters of the alphabet be permuted so that none of the patterns car, dog, pun or byte occurs? (06 Marks)

b. Find the root polynomial for 3 × 3 board using the expansion formula. (07 Marks)

c. The number of bacteria in a culture is 1000 (approximately) and this number increases 250% every two hours. Use a recurrence relation to determine the number of bacteria present after one day. (07 Marks)

Module-5

9 a. Show that the graphs Fig.Q9(a)(i) and (ii) are isomorphic.

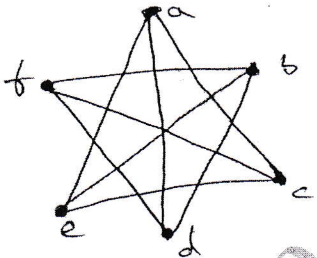

Fig.Q9(a)(i)

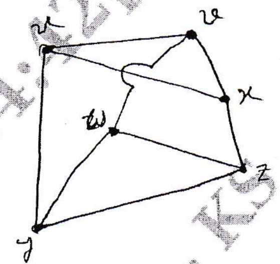

Fig.Q9(a)(ii) **(06 Marks)**

b. Let G = (V, E) be an undirected graph or multigraph with no isolated vertices. Then prove that G has an Euler circuit if and only if G is connected and every vertex in G has even degree. **(07 Marks)**

c. Construct an optimal prefix code for the symbols a, b, c, d, e, f, g, h, i, j that occur with respective frequencies 78, 16, 30, 35, 125, 31, 20, 50, 80, 3. **(07 Marks)**

OR

10 a. Let G = (V, E) be a connected undirected graph. What is the largest possible value for |V| if |E| = 19 and $\deg(v) \geq 4$ for all $v \in V$? **(06 Marks)**

b. For every tree T = (V, E) if $|V| \geq 2$, then prove that T has atleast two pendant vertices. **(07 Marks)**

c. For the tree shown in Fig.Q10(c), list the vertices according to a preorder and a postorder traversal.

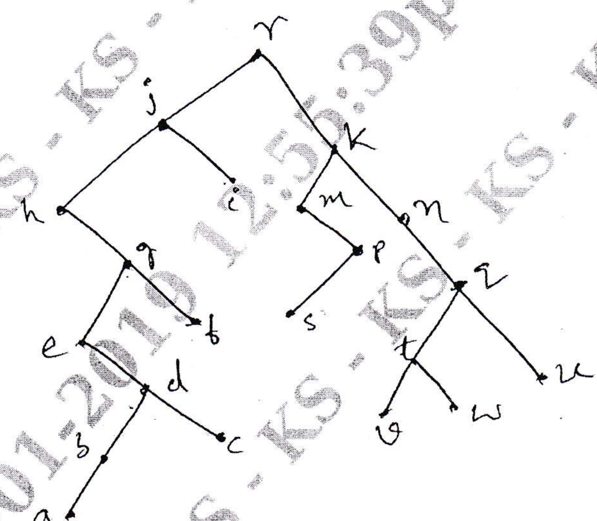

Fig.Q10(c) **(07 Marks)**

* * * * *