(Time: 3 hours) **(Total Marks: 80)**

N.B. 1. Question **No. 1** is compulsory
2. Attempt any **three** questions from remaining five questions
3. Assume suitable data if **necessary** and justify the assumptions
4. Figures to the **right** indicate full marks

Q1	a	Draw the Detailed Von- Neumann architecture and explain in brief	05
	b	Explain IEEE-754 Floating point Representation	05
	c	Explain the difference between Encoder and decoder	05
	d	Differentiate between Hardwired control unit and Micro programmed control unit	05
Q2	a	List out the basic and universal logic gates with the symbol, truth table, output expression	05
	b	What do you mean by BCD? Perform 792 + 128 using BCD addition	05
	c	Explain the various Addressing Modes	10
Q3	a	What is the difference between Computer organization and Computer architecture explain it with a example	05
	b	List & explain the characteristics of memory	05
	c	Draw the Flowchart for the Booth's Algorithm for signed integer multiplication and perform the multiplication between -6 and 2 using this Algorithm	10
Q4	a	List the various methods to design the Hardwired control unit and explain any one	05
	b	Explain the Micro instruction format	05
	c	Explain Flynn's Classification	10
Q5	a	List and explain the various pipeline Hazards	05
	b	Write a microprogram to represent the Interrupt cycle	05
	c	Consider a 2-way set associative mapped cache of size 16 KB with block size 256 bytes. The size of main memory is 128 KB. Find- 1. Number of bits in tag 2. Tag directory size	10
Q6	a	Represent -7.14 using double precision format of IEEE 754 standards	05
	b	Explain the concept of locality of reference	05
	C	Explain the various Bus arbitration methods	10

Duration: 3 Hours **Total Marks 80**

N.B: 1) Question **number 1** is compulsory.

2) Attempt **any three** out of the remaining.

3) Assume suitable data if **necessary** and justify the assumptions.

4) Figures to the **right** indicate full marks.

Q.1 Attempt **any four** **20**

i. Give applications of Computer Graphics.
ii. What is an antialiasing? Explain any 3 antialiasing techniques.
iii. Compare DDA and BRESENHAM line drawing algorithm.
iv. Explain Viewing transformation pipeline.
v. Give fractal dimension of Koch curve.

Q.2 **20**

a. Given a line AB where A(0,0) and B(1,3) find out all the coordinates of line AB using DDA algorithm.
b. Describe different traditional animation techniques.

Q.3 **20**

a. Describe homogeneous coordinates.
b. Describe with neat diagram Boundary Fill and Flood fill algorithm.

Q.4 **20**

a. Derive window to viewport coordinate transformation.
b. Derive matrix for 2D rotation at any arbitrary (fix) point.

Q.5 **20**

a. Give properties of Bezier curve.
b. Describe with neat diagram Sutherland Hodgman polygon clipping algorithm.

Q.6 **20**

a. Describe with neat diagram Depth Buffer algorithm.
b. What is projection? Explain with neat diagram different perspective projections.

Time: 3 hours **Marks: 80**

N.B. (1) Question No. 1 is compulsory.

(2) Answer any three questions from Q.2 to Q.6.

(3) Use of Statistical Tables permitted.

(4) Figures to the right indicate full marks

Q1 A If f(t) =$(\sqrt{t}+\frac{1}{\sqrt{t}})^2$, find L[f(t)] and hence find L{e^{2t}f(t)} 5

B Find $L^{-1}\{\frac{1}{s(s^2+4)}\}$ 5

C Obtain half-range cosine series for f(x) = x(2-x) in 0<x<2 5

D Find moment generating function of the following distribution. Hence find mean and variance. 5

X	1	3	4	5
P(X)	0.4	0.1	0.2	0.3

Q2 A Find the orthogonal trajectories of the family of curves e^{-x}[xsiny- ycosy] = c 6

B Find L{t$(\frac{cost}{e^t})^2$} 6

C Find the Fourier series expansion for f(x) = 2, -2 < x < 0. 8
=0, 0 < x < 2

Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\cdots$

Q3 A Find $L^{-1}\{\log(1-\frac{1}{s^2})\}$ 6

B Find the analytic function f(z)= u + iv where u + v = $\frac{sin2x}{cosh2y-cos2x}$, using Milne-Thompson's Method. 6

C Fit a parabola x = a +by +cy^2 for the following data: 8

X :	1	2	3	4	5
Y :	10	12	15	14	15

Q4 A The first 4 moments of a distribution about origin of the random variable X are -1.5, 17, -30 and 108. Compute Mean, variance, μ_3 and μ_4. 6

B Consider the equations of regression lines 5x-y=22 and 64x-45y=24. Find $\bar{x}$, $\bar{y}$ and correlation coefficient r. 6

C Find $L^{-1}\{\frac{(s+3)^2}{(s^2+6s+13)^2}\}$ 8

Q5 A Find the Laplace transform of $\cos^3 t \cos 5t$. 6

B Find Spearman's rank correlation coefficient for the data below: 6

X :	32	55	49	60	43	37	43	49	10	20
Y :	40	30	70	20	30	50	72	60	45	25

C Obtain Fourier Series for f(x) = $\frac{1}{2}(\pi - x)$ in $(0, 2\pi)$.

Hence, deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots$ 8

Q6 A If f(x) is probability density function of a continuous random variable X, find k, mean and variance. 6

$$f(x) = \begin{cases} kx^2, & 0 \le x \le 1 \\ (2-x)^2, & 1 \le x \le 2 \end{cases}$$

B Check if there exists an analytic function whose real part is $u = \sin x + 3x^2 - y^2 + 5y + 4$. Justify your answer. 6

C Evaluate the following integral by using Laplace transforms 8

$$\int_0^\infty e^{-2t} \left[\int_0^t \left(\frac{e^{3u}\sin^2 2u}{u}\right) du\right] dt$$

Duration: 3 Hours **Total Marks: 80**

N.B. : 1) Question Number 1 is compulsory
2) Solve any three questions from the remaining questions
3) Make suitable assumptions if needed
4) Assume appropriate data whenever required. State all assumptions clearly.

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Q.1 **Solve any four of the following questions.**

a. What is a tautology? Check whether the following logical expression is tautology? **5**

$[(p \rightarrow r) \wedge (\sim q \rightarrow p) \wedge \sim r] \rightarrow q$

b. State the Pigeonhole principle and show that if any five numbers form 1 to 8 are chosen, then two of them will add to 9. **5**

c. Convert the following into CNF form. **5**

$(A \rightarrow B) \rightarrow ((B \rightarrow C) \rightarrow (A \rightarrow C))$

d Given S = {1, 2, ..., 10} and a relation R on S, where R = {(x, y)| x + y = 10}. Is it reflexive, symmetric, transitive, antisymmetric? **5**

e Define the following terms **5**

1. Planer graph 2. Cut Vertex 3.Chain 4. Monoid 5.Group

Q.2 **a** Let A= {p,q,r,s} and let R={(p,p),(p,q),(p,r),(q,p),(q,q),(r,p),(q,r),(r,q),(r,r),(s,s) }. Show that R is an equivalence relation . Determine the equivalence classes and find the rank of R. **8**

b. Show that A={0,3,6,9,12} is a ring w.r.t. the operation of addition & multiplication modulo 15. **8**

c Explain two different types of Quantifiers with example? **4**

Represent the following sentences using First Order logic

i) Some students took GenAI.

ii)Every student who takes GenAI passes it.

Q.3 **a** What is an Abelian Group? Let G = { 1,2,3,4,5,6,7} **8**

i) Prepare the composition table w.r.t the operation of multiplication modulo 8.

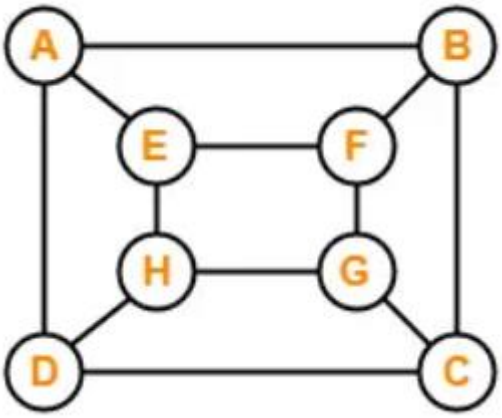
ii) Check whether it is an Abelian group? Justify your answer.

b Define minimum hamming distance. Find the code words generated by the parity check matrix H given below. **8**

$$H = \begin{matrix} 1\ 0\ 1 \\ 0\ 1\ 1 \\ 1\ 1\ 0 \\ 1\ 0\ 0 \\ 0\ 1\ 0 \\ 0\ 0\ 1 \end{matrix}$$

c **4**

Determine whether the following graph is Eulerian or Hamiltonian or both. Justify your answer.



Q.4 **a** Define function. What are three different types of functions.. Consider the function f and g from N x N to N given by f(x,y) = 2x+y and g(x,y)= xy ,identify its type. **8**

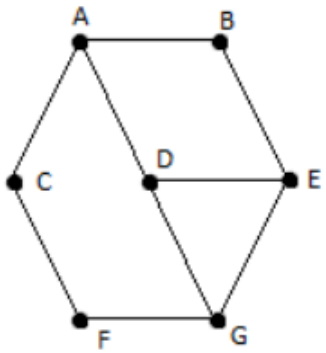
b Let A= {a,b,c,d,e} and let R be a relation on A. **8**
Let R={(a,a),(a,c),(b,b),(c,d),(c,e),(d,a),(e,b),(e,e)
Compute transitive closure using Warshall's algorithm

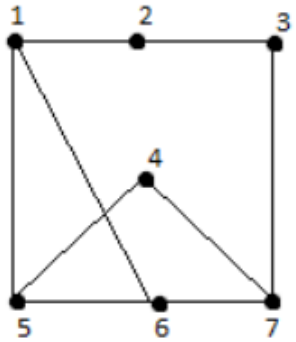
c Prove using Mathematical Induction that sum of cubes of three consecutive integers is divisible by 9. **4**

Q.5 **a** Let X={1,2,3,4,6,24,36,72} and R ={(x,y) ∈ R | x divides y} **8**
i) Write the pairs in a relation set R.
ii) Construct Hasse diagram.
iii) Mention Chains and Anti Chains from above set.
iv) Is it a lattice?

b Find the number of integers between 1 to 500 that are not divisible by 5,6, or 8? **8**

c Check whether the following graphs are Isomorphic or not? Justify **4**





Q.6. **a** Draw the Hasse Diagram of D_{72} **8**

i)Find the complement of each element

ii) Check whether it is a Distributive Lattice

b Let $f(x) = x + 3$, $g(x) = x - 3$ and $h(x) = 3x$ for $x \in R$, where R is the set of real numbers. **8**

Find i)$g \circ h$ ii) $f \circ g$. i)$g \circ h \circ f$ ii) $f \circ h \circ g$

c Find the generating functions for the following sequences: **4**

a. 0, 0, 0, 1, 2, 3, 4, 5, 6, 7,……

b. 6, -6, 6, -6, 6, -6,…….