(Time: 3 hours) **Max. 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.

Q.1 **(a)** Find all basic, feasible and degenerate solutions for the following equations: $2x_1 + 6x_2 + 2x_3 + x_4 = 3$; $6x_1 + 4x_2 + 4x_3 + 6x_4 = 2$ **05**

(b) Integrate the function $f(z) = x^2 + i\,xy$ from A (1,1) to B (2,4) along the curve $x = t, y = t^2$. **05**

(c) A machine is set to produce metal plates of thickness 1.5 cms with S.D. of 0.2 cms. A sample of 100 plates produced by the machine gave an average thickness of 1.52 cms. Is the machine fulfilling the purpose? Test at 1% Level of Significance. **05**

(d) The sum of the Eigen values of a 3 × 3 matrix is 6 and the product of the Eigen values is also 6. If one of the Eigen value is one, find the other two Eigen values. **05**

Q.2 **(a)** Evaluate $\oint \frac{sin^6 z}{(z-\pi/6)^n}\,dz$ where c is the circle $|z|$ = 1 for n = 1, n =3. **06**

(b) Solve the following LPP using Simplex Method

Maximize $z = 3\,x_1 + 5x_2$

subject to

$$3x_1 + 2x_2 \le 18,$$
$$x_1 \le 4,$$
$$x_2 \le 6,$$
$$x_1, x_2 \ge 0$$

06

(c) The following data is collected on two characters. Based on this, can you say that there is no relation between smoking and literacy? Use Chi-square test at 5% Level of significance. **08**

	Smokers	Non-smokers
Literates	40	35
Iliterates	35	85

Q.3 **(a)** Find the Eigen values and Eigen vectors of the following matrix. **06**

$$A = \begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$$

(b) The incomes of a group of 10,000 persons were found to be normally distributed with mean of rs. 750 and Standard deviation of rs. 50. What is the lowest income of richest 250? **06**

(c) Obtain Taylor's and Laurent's expansions of $f(z) = \frac{z-1}{z^2-2z-3}$ indicating region of convergence. **08**

Q.4 **(a)** A man buys 100 electric bulbs of each of two well-known makes taken at random from stock for testing purpose. He finds that 'make A' has a mean life of 1300 hrs with a S.D. of 82 hours and 'make B' has a mean life of 1248 hours with S.D. of 93 hours. Discuss the significance of these results. **06**

(b) Using the Residue theorem, Evaluate $\int_0^{2\pi} \frac{d\theta}{5-3\cos\theta}$. **06**

(c) (i) Out of 1000 families with 4 children each, how many would you expect to have (a) at least one boy (b) at most 2 girls.

(ii) Find the Moment Generating Function of Binomial Distribution and hence find its mean. **04+04**

Q.5 **(a)** Check whether the following matrix is Derogatory or Non-Derogatory:

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & -3 & 3 \end{bmatrix}$$ **06**

(b) The means of two random samples of sizes 9 and 7 are 196.42 and 198.82 respectively. The sum of the squares of the deviations from the means are 26.94 and 18.73 respectively. Can the samples be regarded to have been drawn from the same normal population? **06**

(c) Use the dual simplex method to solve the following L.P.P.

Minimise $z = x_1 + x_2$

subject to

$$2x_1 + x_2 \geq 2$$
$$-x_1 - x_2 \geq 1$$
$$x_1, x_2 \geq 0$$ **08**

Q.6 **(a)** Show that the matrix A satisfies Cayley-Hamilton theorem and hence find A^{-1}.

Where $A = \begin{bmatrix} 2 & 0 & -1 \\ 0 & 2 & 0 \\ -1 & 0 & 2 \end{bmatrix}$ **06**

(b) A random variable X has the probability distribution

$P(X = x) = \frac{1}{8} 3c_x, x = 0, 1\ 2, 3.$ Find mean and variance. **06**

(c) Using Kuhn-Tucker conditions, solve the following NLPP

Maximize $z = 10x_1 + 10x_2 - {x_1}^2 - {x_2}^2$

subject to

$$x_1 + x_2 \leq 8$$
$$-x_1 + x_2 \leq 5$$
$$x_1, x_2 \geq 0$$ **08**

Duration : 3 Hrs **Maximum Marks : 80**

Note:

1) Question No 1 is compulsory.
2) Solve any three questions out of remaining five questions.

Q.1) **Solve any 4** **20**

1) Derive the complexity of quick sort for best case and worst case.
2) What is asymptotic analysis? Define Big O, Omega and Theta notations.
3) Write an algorithm to find all pairs shortest path using dynamic programming.
4) Write a note on "Optimal Storage on Tapes".
5) Define master theorem. Solve the following using master method. $T(n)=8T(n/2)+n^2$

Q.2. A) Write an algorithm for finding minimum and maximum using divide and conquer. Also derive its complexity. **10**

B) Write Kruskal's algorithm and show its working by taking suitable example of graph with 5 vertices. **10**

Q.3. A) Solve fractional knapsack problem for the following. **10**
n=6, p=(18, 5, 9, 10, 12, 7) w=(7, 2, 3, 5, 3, 2)

B) Write an algorithm for Knuth Morris Pratt (KMP) pattern matching. **10**

Q.4. A) Write an algorithm to solve N Queens problem. Show its working for N =4. **10**

B) Write an algorithm to solve sum of subset problem and solve the following problem. n=4, w = {4, 5, 8, 9}, required sum = 9. **10**

Q.5. A) Prove that Vertex Cover problem is NP Complete. **10**

B) Find the longest common subsequence for the following two strings. **10**
X=ABACABB Y= BABCAB

Q.6) Write short note on **any 2.** **20**
(a) Assembly Line Scheduling
(b) Job Sequencing with Deadlines
(c) 15 Puzzle Problem (d) P, NP and NPC Classes

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Q.P. Code: 40879

(80 Marks) **(3 Hours)**

- Question no. 1 is compulsory.
- Answer any three questions from question no. 2 – 6.
- Assume suitable data, if necessary.

Q.1. Answer following questions in brief.

a Convert the following number 256.325 into IEEE 32 bit Single Precision Format and IEEE 64 bit Double Precision Format **(05)**

b Discuss difference between RISC and CISC processors. **(05)**

c Explain function of 8089 I/O processor in brief. **(05)**

d Differentiate between SRAM and DRAM **(05)**

Q.2. a. Explain cache consistency and coherency with suitable examples. Also, give methods to maintain cache consistency. **(10)**

b. Explain DMA based data transfer techniques. **(10)**

Q.3. a. Explain how Virtual Address is translated to Physical address with suitable example. **(10)**

b. Compare between Cache Look Aside Architecture and Cache Look through Architecture **(10)**

Q.4. a. Explain the Bus Arbitration Techniques **(08)**

b. Explain hardwired Control Unit with help of neat diagram. Compare it with microprogrammed control unit. **(12)**

Q.5. a. What is TLB? Explain working of TLB. **(10)**

b. Describe register organization within CPU. **(10)**

Q.6. Write short note on

a. Hazards in Pipelining **(05)**

b. Interrupt driven I/O **(05)**

c. Interleaved memory **(05)**

d. Modes of DMA **(05)**

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Q.P.Code: 21849

[3 Hours] **[Total Marks: 80]**

Please check whether you have got the right question paper.

N.B: (1) Question No.1 is compulsory
(2) Attempt any three of remaining five questions
(3) Assume any suitable data if necessary and justify the same

Q 1	**a)**	**What is aliasing and antialiasing?**	**5**
	b)	**Write the flood fill approach for 8 connected method.**	**5**
	c)	**Explain the concept of halftoning with example.**	**5**
	d)	**Prove that two successive rotations are additive**	**5**
Q 2	**a)**	**Plot the points for midpoint ellipse with rx=3 and ry=5 for region 1.**	**10**
	b)	**Explain the steps for 2D rotation about arbitrary point.**	**10**
Q 3	**a)**	**Explain Liang Barsky line clipping algorithm. Apply the algorithm to the line with coordinates (30,60) and (60,25) against the window(xmin,ymin)=(10,10) and (xmax,ymax)=(50,50).**	**10**
	b)	**Explain Weiler Artherton polygon clipping algorithm with suitable example.**	**10**
Q 4	**a)**	**What is window and viewport? Derive the matrix for viewport transformation.**	**10**
	b)	**Explain what is meant by Bezier curve? State the various properties of Bezier curve.**	**10**
Q 5	**a)**	**What is meant by parallel and perspective projection? Derive matrix for perspective projection.**	**10**
	b)	**Explain Z Buffer algorithm for hidden surface removal.**	**10**
Q 6		**Write short notes on(any two)**	
	a)	**Koch curve**	
	b)	**Sweep representation**	**20**
	c)	**Gouraud and phong shading**	
	d)	**Inside Outside test**	

Duration: 3hours **Marks: 80**

NB: (1) Question no. 1 is compulsory.
(2) Attempt any three out of remaining five questions.
(3) Assume data if required

Q-1 Attempt any FOUR

a Define Operating System. Brief the Functions of OS. 5

b Explain Shell. Explain use of chmod command in linux. 5

c Discuss various scheduling criteria. 5

d Explain the effect of page frame size on performance of page replacement algorithms. 5

e Explain Thrashing. 5

2-a Differentiate between monolithic, layered and microkernel structure of OS. 10

b Describe the differences among short term, medium-term, and long term Scheduling 10

3-a Discuss how the following pairs of scheduling criteria conflict in certain settings. 10
a) CPU utilization and response time
b) Average Turnaround time and maximum waiting time

b Consider the following snapshot of the system. Using Bankers Algorithm, determine whether or not system is in safe state. If yes determine the safe sequence.

	Allocation	**Max**	**Available**
	A B C D	**A B C D**	**A B C D**
P0	3 0 1 4	5 1 1 7	0 3 0 1
P1	2 2 1 0	3 2 1 1	
P2	3 1 2 1	3 3 2 1	
P3	0 5 1 0	4 6 1 2	
P4	4 2 1 2	6 3 2 5	

4-a Calculate number of page faults and page hits for the page replacement policies FIFO, Optimal and LRU for given reference string 6, 0, 5, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 5, 2, 0, 5, 6, 0, 5 (assuming three frame size). 10

b Explain synchronization problem in detail. How counting semaphore can be used to solve readers writers problem. 10

5-a Given memory partitions of 150k,500k,200k,300k,550k(in order) how would each of the first fit, best fit and worst fit algorithm places the processes of 220k,430k,110k,425k(in order).Evaluate, which algorithm makes most efficient use of memory? 10

b Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests in FIFO is ordered as 80, 1470, 913, 1777, 948, 1022, 1750,130. What is the total distance that the disk arm moves for following by applying following algorithms? 10
1. FCFS 2. SSTF 3. LOOK 4. SCAN

Q-6 Write short notes on: (any two): 20
(a) Linux Virtual File system
(b) Process State transition
(c) System Calls
