Time : 3 Hrs. **Marks : 80**

Note:- 1) Question No. 1 is Compulsory.

2) Solve any three out of remaining question.

Q.1 Answer any four. (20)

a) Differentiate between Moore machine and Mealy machine.

b) What do you mean by ambiguous grammar? Prove that the following grammar is ambiguous.

$S \rightarrow aS / aSbS / €$

c) Distinguish between NFA and DFA.

d) What is Halting problem? Explain with example.

e) What is a regular expression? Design DFA corresponding to the regular expression $(0+1)^* 101(0+1)^+$

Q.2 a) Define the structure of Push Down Automata (PDA). Explain the power and limitations of PDA. (10)

b) Design PDA to accept language $L = \{a^n b^{2n} \mid n \geq 1\}$. (10)

Q.3 a) Define CFG. Design a CFG for the language $L = \{ 0^n 1^{2n} \mid n \geq 0 \}$. (10)

b) Find the leftmost derivation, rightmost derivation and parse trees for the string aaabbabbba using CFG: (10)

$S \rightarrow aB / bA$

$A \rightarrow aS / bAA / a$

$B \rightarrow bS / aBB / b$

Q.4 a) Describe Chomsky Normal Form (CNF). Convert the following CFG to CNF (10)

$S \rightarrow aAbB$

$A \rightarrow Ab / b$

$B \rightarrow Ba / a$

b) Explain Greibach Normal Form (GNF) Convert the following CFG to GNF (10)

$S \rightarrow XY$

$X \rightarrow 0X / 1Y / 1$

$Y \rightarrow 1$

Q.5 a) What is a Turing Machine (TM)? Explain the working of TM with a neat sketch.

Also describe the variants of TM (10)

b) Design a TM to accept ($a^n b^n c^n$). Can a DFA be designed for the same? Justify. (10)

Q.6 Write short notes on (any four) (20)

a) Application of FA, CFG, PDA and TM

b) Chomsky Hierarchy

c) Right Linear and Left Linear Grammars

d) Phases of Compiler

e) Reduced DFA

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(3 Hours)

Total Marks: 80

N.B.: (1) Question No.1 is compulsory.
(2) Attempt any three questions from the remaining five questions.
(3) Make suitable assumptions wherever necessary but justify your assumptions.

Q.1. a. Explain TCP/IP Reference Model.	05 M
b. Explain Sliding Window Protocol.	05 M
c. Explain different classes of IPv4 Addresses.	05 M
d. Explain Domain Name System	05 M
Q.2.a. Explain ISO-OSI reference Model	10 M
Q.2.b.What is Network Address translation? Explain.	10 M
Q.3.a. Briefly explain TCP header with a diagram.	10 M
Q.3.b. What are different UDP Applications?	10 M
Q.4.a. Explain IPv6 Header with a diagram.	10 M
Q.4.b. Explain Fast Ethernet and Gigabit Ethernet.	10 M
Q.5.a. Compare Lossy Compression and Lossless Compression.	10 M
Q.5.b. Explain HTTP Protocol.	10 M
Q.6.Write short notes on **(Any Two)**	20 M

a. Congestion Control
b. VLAN
c. Routing Algorithms.

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Duration: 3hrs **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1		Attempt any FOUR	**[20]**
	a	Discuss any five arithmetic instructions of 8086 with examples.	
	b	Explain Memory hierarchy with diagram.	
	c	Minimize the following boolean function using K map $F(A, B, C) = \Sigma m(0, 1, 6, 7) + \Sigma d(3, 5)$	
	d	Explain full adder with diagram	
	e	Convert $(-1259.125)_{10}$ in the IEEE 754 single precision standard.	
2	a	Explain concept of DMA in detail with diagram	**[10]**
	b	Discuss various cache memory mapping techniques with advantages and disadvantages of it.	**[10]**
3	a	Draw Flowchart of Restoring division technique and divide 13 by 5 using Restoring division technique.	**[10]**
	b	List and explain Key Characteristics of Computer memory.	**[10]**
4	a	Write 8086 Assembly Language Program to count the number of 0's and 1's in given 8-bit numbers.	**[10]**
	b	Discuss various Pipeline Hazards with examples.	**[10]**
5	a	Draw flowchart of Booth's algorithm. Using Booth's algorithm demonstrate multiplication of (-11)*(-5).	**[10]**
	b	Discuss various addressing modes of 8086 microprocessor with example.	**[10]**
6	a	Write short note on Flip Flops	**[10]**
	b	Minimize the following boolean function using K map $F(A, B, C, D) = \Sigma m(0, 2, 8, 10, 14) + \Sigma d(5, 15)$	**[10]**

(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.

Q1 a) If $A = \begin{bmatrix} 2 & 4 \\ 0 & 3 \end{bmatrix}$ then find the Eigen values of $A^3 + 6A^{-1} + 2I$ [5]

b) Evaluate $\int_0^{1+i} (x^2 + iy)\, dz$,along the path $(i) y = x$, $(ii)\ y = x^2$ [5]

c) Write the dual of the following problem [5]

$$\text{Maximise} \quad z = 3x_1 + 10x_2 + 2x_3$$
$$subject\ to \quad 2x_1 + 3x_2 + 2x_3 \leq 8$$
$$3x_1 - 2x_2 + 4x_3 = 4$$
$$x_1, x_2, x_3 \geq 0$$

d) A certain drug administered to 12 patients resulted in the following change in their Blood Pressure

5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4 [5]

Can we conclude that drug increase the Blood Pressure?

Q2 (a) Using Cauchy's residue theorem evaluate [6]

$\int_C \frac{1-2z}{z(z-1)(z-2)} dz$, Where c is |z|=1.5

(b) Verify Cayley-Hamilton theorem and find A^{-1} for $A = \begin{bmatrix} 1 & 8 \\ 2 & 1 \end{bmatrix}$. Hence, find $2A^3 - A^2 - 35A - 44I$. [6]

(c) Solve by Simplex Method [8]

$$Maximise \quad z = 4x_1 + 10x_2$$
$$\text{Subject to} \quad 2x_1 + x_2 \leq 50$$
$$2x_1 + 5x_2 \leq 100$$
$$2x_1 + 3x_2 \leq 90$$
$$x_1, x_2 \geq 0$$

Q3 a) Based on the following data determine if there is a relation between literacy and smoking

	Smokers	Non-smokers	[6]
Literates	83	57	
Illiterates	45	68	

(Given that Critical value of chi-square 1 d. f and 5% L.O.S is 3.841

b) Obtain Laurent's series expansion of $f(z) = \frac{1}{z^2+4z+3}$ [6]

$when\ \ (i)\ |z| < 1\ \ \ (ii)\ 1 < |z| < 3\ \ \ $ (ii) $|z| > 3$

c) Using the method of Lagrangian multipliers solve the following N.L.P.P [8]

Optimise $z = {x_1}^2 + {x_2}^2 + x_3^2$

Subject to $x_1 + x_2 + 3x_3 = 2$

$5x_1 + 2x_2 + x_3 = 5$

$x_1, x_2, x_3 \geq 0$

Q4a) Using the method of Lagrange's multipliers solve the following N.L.P.P [6]

Optimise $z = {x_1}^2 + {x_2}^2 + {x_3}^2 - 10x_1 - 6x_2 - 4x_3$

Subject to $x_1 + x_2 + x_3 = 7$

$x_1, x_2, x_3 \geq 0$

b) Find the inverse Z-transform of $\frac{1}{z^2-3z+2}$, $if\ ROC\ is\ \ (i)\ \ |z| < 1\ \ \ (ii)\ |z| > 2$ [6]

c) Show that the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ is diagonalizable. Find the transforming matrix and the diagonal matrix. [8]

Q5a) Find $Z\{f(k) * g(k)\}\ \ if\ \ f(k) = \left(\frac{1}{2}\right)^k\ , g(k) = cos\pi k$ [6]

b) Find the Eigen values and Eigen Vectors of the following matrix. [6]

$$A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$$

c) Solve by the dual Simplex Method [8]

$Minimise\ z = x_1 + x_2$

Subject to $2x_1 + x_2 \geq 2$

$-x_1 - x_2 \geq 1$

$x_1, x_2 \geq 0$

Q6a) Find $Z\{2^k \cos(3k+2)\}, k \geq 0.$ [6]

b) If the heights of 500 students is normally distributed with mean 68 inches and standard deviation 4 inches, estimate the number of students having heights (i) greater than 72 inches

(ii) less than 62 inches (iii) between 65 and 71 inches [6]

c) Using Kuhn Tucker conditions, solve the following NLPP [8]

$Maximise \quad z = 2{x_1}^2 - 7{x_2}^2 + 12x_1x_2$

Subject to $2x_1 + 5x_2 \leq 98$

$x_1, x_2 \geq 0$

(3 Hours) **Total Marks: 80**

N.B. 1) Question **no.1 is compulsory**
2) Solve any **Three** questions from remaining five.
3) Assume suitable data and draw diagram wherever required.

			Marks
Q1.		Attempt any **four**	
	a.	What are the various objectives and functions of Operating Systems?	**5**
	b.	Differentiate between process and threads.	**5**
	c.	Explain about Resource Allocation Graph (RAG).	**5**
	d.	Explain about file attributes, file operations, and file types.	**5**
	e.	What is virtual memory? Mention its advantages.	**5**
Q2.	a.	Explain file allocation methods in detail with proper diagram.	**10**
	b.	Consider the following set of processes indicated as **(process name, Arrival time, burst time)** for the following (P1,0,6), (P2,1,4), (P3,3,5), (P4, 5, 3). Draw the Gantt charts illustrating the execution of these processes using preemptive and non-preemptive SJF and FCFS. Calculate average turnaround time, average waiting time in each case.	**10**
Q3.	a.	Give the explanation of necessary conditions for deadlock. Explain how a resource allocation graph determines a deadlock.	**10**
	b.	What is Internal fragmentation? Explain static partitioned allocation with partition sizes 400,180, 100,300,45. Assuming First fit and Best fit method indicate the memory status after memory request for sizes 95, 180, 285, 380, 30.	**10**
Q4.	a.	What is a thread? How multithreading is beneficial? Compare and contrast different multithreading models.	**10**
	b.	Explain paging in detail. Describe how logical address is converted into physical address.	**10**
Q5.	a.	What is semaphore and its types? How the classic synchronization problem -Dining philosopher is solved using semaphores?	**10**
	b.	Explain RAID Level in Details	**10**
Q6.	a.	Consider the page reference string 1,2,3,5,2,4,5,6,2,1,2,3,7,6,3,2,1,2,3,6. Calculate the Page fault using 1. Optimal 2.LRU 3. FIFO algorithms for a memory with three frames.	**10**
	b.	What is open-source operating system? What are the design issues of Mobile operating system and Real time operating system?	**10**
