Duration: 3 Hrs   **Max. Marks: 80**

NB:

1. Question No. 1 is compulsory and solve any THREE questions from remaining questions
2. Assume suitable data if necessary
3. Draw clean and neat diagrams

			Marks
Q1.		Answer the following questions	
	a.	Explain any 5 closure properties of Regular Languages	5
	b.	Convert the given grammar Right Linear Grammar to Left Linear Grammar $S \to bB,\ B \to bC \mid aB \mid b,\ C \to a$	5
	c.	Construct Right linear grammar for RegEx- $00^* (01+0)^*$	5
	d.	Write RegEx and draw FA for all strings over $\{0, 1\}$ containing the sequence 011	5
Q2.	a.	Construct NFA for accepting the input string that contains either the keyword 000 / 010 and convert this to equivalent DFA .	10
	b.	Design a Moore machine that will read the sequence made up of letters $\Sigma=\{a,e,i,o,u\}$ it will give same sequence except in those sequence where 'i' is directly follow 'e', it will give output 'u'. hint [a e i e $\to$ a e i u]	10
Q3.	a.	Construct NFA with ε moves for "zero or more number of 0's followed by zero or more number of 1's followed by zero or more number of 2's . Convert this DFA.	10
	b	Convert the following CFG to CNF	10

$$G: \quad S \to ABA,\ A \to aA \mid bA \mid \lambda,\ B \to bB \mid aA \mid \lambda$$

Q4	a.	What is Ambiguous Grammar. Explain with example .	10
	b.	Let G be the grammar. Find the leftmost derivation, rightmost derivation and parse tree for the string 001222.	10

$$S \to 0S \mid 1A \mid 2B \mid \varepsilon$$
$$A \to 1A \mid 2B \mid \varepsilon$$
$$B \to 2B \mid \varepsilon$$

Q5	a.	Design PDA for odd length palindrome, let $\sum =\{0,1\}$,L= $\{W X W^R\}$	10
	b.	Design Turing Machine for $L=\{0^n 1^n$ where n>=1 $\}$	10
Q6		Write short notes on (any Four)	20

                  a) Applications of Automata Theory
                  b) Chomsky Hierarchy
                  c) Power and limitations of PDA
                  d) Halting Problem.
                  e) Variations of Turing machine

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Time: (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. Solve any four
   a. Compare Twisted pair cable, Coaxial cable and Fiber optics cable.   05 M
   b. Explain Ethernet Protocol.   05 M
   c. Explain Repeater, Hub, Bridge, Switch, and Gateway.   05 M
   d. Compare lossy with lossless data compression technique.   05 M
   e. How many networks and hosts are possible using 'Class B' IP addressing?   05 M
      What is subnet mask

Q.2.
   a. Draw and Explain OSI reference model with functions of each layer.   10 M
   b. Explain the difference between static and dynamic routing. Explain distance vector
      routing   10M

Q3.
   a) Explain in Detail TCP Header with Diagram.   10 M
   b) Explain Classful and Classless IP Address.   10 M

Q4.
   a) Generate the CRC code for a data word 110010101. The divisor 10101. Check whether
      there are errors in the received code word. 10M
   b) Explain the different classes of IP address. If the given IP address is 201.20.31.65,
      then find out the following parts:i) Class ii) Subnet Mask iii) Network ID iv) First and
      Last IP of the network v) First and Last Host ID in a network.   10M

Q5.
   a) Explain in detail Go-Back -N Protocol.   10M
   b) Explain in Detail CSMA Protocol.   10M

Q6. Write a short note on.(Any Four)

   a) FTP
   b) VPN
   c) RPC
   d) Image Compression

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TIME:03 HRS   **MARKS:80**

N.B.   1. Question No 1 is compulsory.
          2. Solve any **three** questions out of the remaining five questions.
          3. Assume suitable data if necessary.
          4. Figures to the right indicate marks.

Q. 1. Solve any **four** out of five.   (4*5=20)

    a.   Discuss Six Stage Instruction pipeline with diagram.

    b.   Explain the full adder with a diagram.

    c.   Discuss any five arithmetic instructions of 8086 with examples.

    d.   Convert $(-185.120)_{10}$ in the IEEE 754 single precision standard format .

    e.   Explain Memory hierarchy with diagram.

Q. 2. a) Explain concept of DMA in detail with diagram   (10)

      b) Discuss various cache memory mapping techniques with diagram   (10)

Q. 3. a) Draw Flowchart of Restoring division technique and divide 11 by 3 using

        same technique.   (10)

      b) Discuss Various Key Characteristics of Computer memory.   (10)

Q. 4. a) Explain architecture of 8086 microprocessor with diagram   (10)

      b) Explain Encoder and Decoder with diagram   (10)

Q. 5. a) Draw flowchart of Booth's algorithm. Using same algorithm perform

        multiplication of (-12)*(5).   (10)

      b) Explain addressing modes of the 8086 microprocessor with example.   (10)

Q. 6. a) Write short note on any two types of Flip Flops   (10)

      b)Minimize the following boolean function using K map

        $F(A, B, C, D) = \Sigma m (0,1, 2, 3, 8, 9, 10, 11,) + \Sigma d (12, 13)$ (10)

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(03 HOURS)   **(MAX. MARKS : 80)**

Note:
1. Question **No. 1** is compulsory.
2. Attempt **any three** questions out of remaining **five** questions.
3. Assume suitable data wherever necessary.
4. Figures to right indicate full marks.

			Marks
Q.1		Answer the following **(Any four)**	
	a.	If $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ Find the characteristic roots of $A^3 + I$.	05
	b.	Evaluate $\int f(z)\, dz$ along the parabola $y = 2x^2$ from $z = 0$ to $z = 3 + 18i$ Where $f(z) = x^2 - 2iy$.	05
	c.	Determine all basic solutions and optimal basic feasible solution to the following problem. Max. $z = x_1 + 3x_2 + 3x_3$ Subject to $x_1 + 2x_2 + 3x_3 = 4$, $2x_1 + 3x_2 + 5x_3 = 7$, $x_1, x_2, x_3 \geq 0$.	05
	d.	Find the z-transform of $f(k) = 3^k$, $k \geq 0$.	05

Q.2	a.	Find the Eigenvalues and Eigenvectors of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$.	06
	b.	The heights of six randomly chosen sailors are in inches: 63, 65, 68, 69, 71 and 72. The heights of ten randomly chosen soldiers are: 61, 62, 65, 66, 69, 69, 70, 71, 72, and 73. discuss in the light that these data throw on the suggestion that the soldiers on an average are taller than sailors.	06
	c.	Use the dual simplex method to solve the L.P.P. Maximize $z = -3x_1 - 2x_2$ Subject to $x_1 + x_2 \geq 1$; $x_1 + x_2 \leq 7$; $x_1 + 2x_2 \geq 10$; $0 x_1 + x_2 \leq 3$; $x_1, x_2 \geq 0$	08

Q.3	a.	Find the relative maximum or minimum of the function $Z = x_1^2 + x_2^2 + x_3^2 - 8x_1 - 10x_2 - 12x_3 + 100.$.	06
	b.	If $f(k) == 4^k U(K)$ and $g(k) == 5^k U(k)$, then find the Z-transform of $\{f(k) * g(k)\}$.	06
	c.	Find all possible Laurents expansion of $f(z) = \frac{z}{(z-1)(z-2)}$ about $z = -2$.	08

Q.4 a. Verify Cayley-Hamilton theorem for the matrix A and hence find the matrix represented by   **06**

by $A^6 - 6A^5 + 9A^4 + 4A^3 - 12A^2 + 2A - I$ where $A = \begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$.

b. In a survey of 200 boys of which 75 were intelligent ,40 had educated fathers, while 90 of the unintelligent boys had uneducated fathers. Do these figures support the hypothesis that educated fathers have intelligent boys.   **06**

c. Using the Kuhn –Tucker conditions to solve the N.L.P.P   **08**
Maximize $z = 8 x_1 + 10 x_2 - x_1^2 - x_2^2$
Subject to $3 x_1 + 2 x_2 \leq 6;$
         $x_1, x_2 \geq 0$

Q.5 a. Evaluate $\oint \frac{3z^2+z}{z^2-1}$ dz using Cauchy's residue theorem,   **06**

where C is the circle $|z| = 2$.

b. Using the method of Lagrange's multiplier solve the N.L.P.   **06**

Optimize $z = 10 x_1 + 8 x_2 + 6 x_3 + 2 x_1^2 + x_2^2 + 3 x_3^2 - 100.$

Subject to $x_1 + x_2 + x_3 = 20.$
       $x_1, x_2, x_3 \geq 0.$

c. The marks obtained by 1000 students in an examination are found to be normally   **08**
Distributed with mean 70 and s. d. 5. Estimate the number of students whose marks Will be (i) between 60 and 75 (ii) more than 75.

Q.6 a. Find the inverse z- transform of $F(z) = \frac{1}{(z-3)(z-2)}$ if ROC is $2 < |z| < 3$.   **06**

b. Show that the matrix $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is diagonalisable. find the diagonal   **06**
form D and diagonalizing matrix M.

c. Solve the L.P.P by simplex method.   **08**

Maximize $z = 4 x_1 + 3 x_2 + 6 x_3$

Subject to $2 x_1 + 3 x_2 + 2 x_3 \leq 440;$

        $4 x_1 + 0 x_2 + 3 x_3 \leq 470;$
        $2 x_1 + 5 x_2 + 0 x_3 \leq 430;$
        $x_1, x_2, x_3 \geq 0.$

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Time :(3Hours)   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.

Q1.		Attempt **any four**	Marks
	a.	What are various objectives and functions of Operating System?	**5**
	b.	Differentiate between Thread and Process.	**5**
	c.	Write short note on Distributed Operating System.	**5**
	d.	Explain Paging with the help of diagram and example	**5**
	e.	Explain Race condition with example.	**5**

Q2.	a.	Compare and contrast allocation methods: Contiguous allocation, Linked allocation and Indexed Allocation.	**10**
	b.	Assume the following processes arrive for execution at the time indicated and length of cpu burst time given in msec.	**10**

Process name	Burst Time(ms)	Priority	Arrival Time
P1	8	3	3
P2	1	1	1
P3	3	2	2
P4	2	3	3
P5	6	4	4

For the above process parameters, find average waiting time and average turnaround time for following scheduling algorithms
  1. FCFS
  2. SJF
  3. Non-preemptive priority
  4. Round Robin (Quantam 2units)

1.Draw the Gantt chart for FCFS, SJF, Priority(preemptive) , Round Robin(quantum=4)scheduling
2. Calculate average waiting time for each of the above algorithm.

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, and 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 RAID? What are the different RAID levels?   **10**

b. What is a thread? How multithreading is beneficial? Compare and contrast different multithreading models.   **10**

Q5. a. What is open-source operating system? What are the design issues of Mobile operating system and Real time operating system?   **10**

b. What is semaphore and its types? How the classic synchronization problem - Dining philosopher is solved using semaphores?   **10**

Q6. a. Consider the reference string7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1 and four free frames which are empty initially. How many page faults would occur for replacement by   **10**
1. LRU   2. FIFO   3. Optimal page replacement algorithms.

b. Write short note on Swapping and also explain how logical address is converted into physical address?   **10**