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

Note:- 1) Question No. 1 is Compulsory.
2) Solve any three out of remaining questions.

Q.1) Answer any **Four**.

a) Describe Moore machine with all tuples in detail. **(05)**

b) Find the Regular Expression corresponding to the grammar **(05)**

$S \rightarrow AB / AS$
$A \rightarrow a / aA$
$B \rightarrow b$

c) Construct mealy machine to accept all strings ending with 00 or 11. **(05)**

d) Write a note on Universal Turing Machine. **(05)**

e) Draw diagram for Chomsky hierarchy and Show all the types with proper explanation. **(05)**

Q.2)

a) Design NFA for accepting input strings that contain either the keyword 000 or the keyword 010 and convert it into an equivalent DFA . **(10)**

b) Design a DFA corresponding to regular expression (a+b)*aba (a+b)* **(10)**

Q.3)

a) What are Moore and Mealy machines? **(10)**
Design a Moore and Mealy machines to convert all occurrences of '1110' to '1011' over Σ {0, 1}.

b) Define CFG, obtain CFG for the following grammar **(10)**
(110+11)*(10)*

Q.4)

a) Construct a Turing machine accepting palindromes over ∑={a,b} **(10)**

b) Discuss power and limitations of PDA. Compare it with FA and TM. **(10)**

Q.5)

a) i) Define CFG. **(02)**

ii) Find the leftmost derivation, rightmost derivation and parse trees for the string " aaabbabbba" using CFG: **(08)**

$S \rightarrow aB / bA$
$A \rightarrow aS / bAA / a$
$B \rightarrow bS / aBB / b$

b) Construct NFA for Binary strings that begin with 11 and end with 11 or begin with 00 and end with 00 **(10)**

Q.6) Write short notes on any **TWO** **(20)**

i. Halting Problem in TM
ii. Greibach Normal Form (GNF)
iii. Applications of FM, PDA and Turing Machine with example

(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. Explain Repeater, Hub, Bridge, Switch, and Gateway. 05 M

b. Explain Token passing controlled access protocol. 05 M

c. Explain in detail Network Address Translation. 05 M

d. Compare connection oriented and connectionless lossy protocols. 05 M

e. Explain Image compression GIF and JPEG. 05 M

Q.2.a. Draw and Explain OSI reference model with neat diagram. 10 M

Q.2. b. Explain IPv4 header format with diagram. 10 M

Q.3.a. Explain CSMA protocols. Explain how collisions are handled in CSMA /CD. 10 M

Q.3.b. A bit stream 10110 is transmitted using the standard CRC method.
The generator polynomial is x^3+x^2+1.What is the actual bit string transmitted?
How will the receiver detect data received without any error? 10 M

Q.4.a.Explain following transmission media - Twisted pair, Coaxial Cable, Fiber Optic. 10 M

Q.4.b.Explain concept of sliding protocol? Compare the performance of Go-back-N and Selective Repeat protocol. 10 M

Q.5.a.What is IP addressing? Explain in detail Classful and Classless IP addresses. 10 M

Q.5.b. Explain in detail TCP congestion control mechanism. 10 M

Q.6.Write a short note on (Any four) 20 M

a. RPC
b. DNS
c. VLAN
d. SNMP
e. OSPF

(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 matrix A = $\begin{bmatrix} -1 & 2 & 3 \\ 0 & 3 & 5 \\ 0 & 0 & -2 \end{bmatrix}$ find Eigen values of A^3 +5A + 8I. [5]

(b) Evaluate the integral $\int_0^{1+i} (x - y + i\,x^2)$ dz along the parabola $y^2 = x$. [5]

(c) Find the z-transform of f (k) = a^k, $k \geq 0$. [5]

(d) Maximise z = $x_1 + 3\,x_2 + 3x_3$

Subject to $x_1 + 2\,x_2 + 3x_3 = 4$

$2\,x_1 + 3x_2 + 5x_3 = 7$ find all basic solutions. Which

of them are basic feasible, And optimal basic feasible solutions. [5]

Q2 (a) Verify Cayley- Hamilton theorem for the matrix A where A = $\begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$

And hence find A^{-1} *and* A^{-2}. [6]

(b) The means of two random samples of size 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 considered to have been drawn from same population? [6]

(c) Solve the L.P.P by using simplex method.

Maximise $z = 3\,x_1 + 2\,x_2$
Subject to $3\,x_1 + 2\,x_2 \leq 18$;
$0 \leq x_1 \leq 4$;
$0 \leq x_2 \leq 6$;
$x_1, x_2 \geq 0$. [8]

Q3 (a) Find the Laurent's series for

F (z) = $\frac{4z+3}{(z-3)\,z\,(z+2)}$ valid for $2 < |z| < 3$. [6]

(b) Using the method of Lagrange's multiplier solve the N.L.P.

Optimise $z = 12\,x_1 + 8\,x_2 + 6x_3 - x_1^2 - x_2^2 - x_3^2 - 23.$

Subject to $x_1 + x_2 + x_3 = 10.$ $x_1, x_2, x_3 \geq 0.$ [6]

(c) Marks obtained by students in an examination follow normal distribution. If 30 % Of the students got below 35 marks and 10 % got above 60 marks. Find the mean and standard deviation. [8]

Q4 (a) Find the Eigen values and Eigen vectors of matrix $A = \begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$ [6]

(b) Find inverse z- transform of $F(z) = \frac{3z^2 - 18z + 26}{(z-2)(z-3)(z-4)}$ $3 < |z| < 4.$ [6]

(c) Using the Kuhn –Tucker conditions solve the N.L.P.P [8]

Maximise $z = 12\,x_1x_2 + 2\,x_1^2 - 7\,x_2^2$

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

$x_1, x_2 \geq 0.$

Q5 (a) Show that the matrix $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is diagonalisable. Find the diagonal form D and the Diagonal zing matrix M. [6]

(b) Find the relative maximum or minimum of the function

$z = x_1^2 + x_2^2 + x_3^2 - 4x_1 - 8x_2 - 12x_3 + 100.$ [6]

(c) Evaluate $\oint \frac{2z-1}{(2z+1)\,z\,(z+2)}$ dz using Cauchy's residue theorem, where C is the circle $|z| = 1.$ [8]

Q6 (a) The number of car accidents in a metropolitan city was found to be 20, 17, 12, 6, 7, 15, 8, 5, 16 and 14 per month respectively. Use χ^2- test To check whether these frequencies are in agreement with that occurrence was The same during 10 months period. Test at 5 % level of significance. [6]

(b) Find z – transform of [2^k cos (3k + 2)] , k $\geq$ 0 . [6]

(c) Use the dual simplex method to solve the L.P.P. [8]

Minimise $z = 2x_1 + x_2$

Subject to $3x_1 + x_2 \geq 3;$

$4x_1 + 3x_2 \geq 6;$

$x_1 + 2x_2 \leq 3;$

$x_1, x_2 \geq 0.$

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

N.B.: (1) **Question No.1 is Compulsory**.
(2) Attempt any three Questions out of remaining five questions.
(3) Figures to the right indicate full marks.
(4) Assume any suitable data if necessary and justify the same.

Q1 Solve any **FOUR**

A) Define Boundary layer and explain briefly boundary layer formation. 5

B) Explain the concept of control volume, control surface and importance of Reynolds Transport theorem (RTT) 5

C) What is dimensional analysis? State the uses and advantages of dimensional analysis? 5

D) A wooden block of 4 m x 1 m x 0.5 m in size and its specific gravity 0.75 is floating in water. Find the weight of concrete of specific weight 24 kN/m^3 that may be placed on the wooden block, which will immerse the wooden block completely. 5

E) Explain Newton Law of Viscosity? Define Poise and stoke? 5

Q2 A) A square aperture in the vertical side of a tank has one diagonal vertical and is completely covered by a plane plate hinged along one of the upper sides of the aperture. The diagonals of the aperture are 2 m long and the tank contains a liquid of specific gravity 1.15. The centre of aperture is 1.5 m below the free surface. Calculated the thrust exerted on the plate by the liquid and position of its centre of pressure. 10

B) Find the velocity and acceleration at the point (1, 2, 1) for t = 2 sec for a three – dimensional flow field given by (u = 3 + yz + t), (v = xz - t -1), (w = xy + 1). 10

Q3 A) A pipeline carrying oil of relative density 0.8 changes its diameter from 200 mm to 400 mm, which is 5 m at a higher level. If the pressures at these two points are 100 kN/m^2 and 50 kN/m^2 respectively and the discharge is 250 liter/sec, determine direction of flow and loss of head. 10

B) Derive Darcy Weisbach equation and state its utility? 10

Q4 A) The velocity distribution in the boundary layer is given by 10

$$\frac{u}{U} = \left(\frac{y}{\delta}\right)^{\frac{1}{7}}$$

Calculate:
(i) Displacement thickness (ii) Momentum thickness (iii) Shape factor
(iv) Energy thickness

B) Derive the continuity equation for three dimensional, steady and incompressible flow. 10

Q5 A) A converging pipe bend with its centreline in a horizontal plane, changes the direction of pipeline by 60^o in the clockwise direction and reduces the pipeline diameter from 30 cm to 20 cm in the direction of flow. If the pressure indicate by Bourdon gauge at the centre line of the 30 cm diameter entrance to the bend is 140 kN/m^2 and the flow of water through the pipeline is 0.10 m^3/sec. Determine the magnitude and direction of force on the bend due to moving water. 10

B) Two parallel plate kept 100 mm apart have laminar flow of oil between them, maximum velocity of flow is 1.5 m/s. Assume viscosity of oil 24.5 poise. 10

Calculate :

(i) Discharge per metre width

(ii) Shear Stress at the plate

(iii) The difference in pressure between two points 20 m apart

(iv)Velocity gradient of plates

(v) Velocity at 20 mm from the plate

Q6 A) Determine the rate of flow of water through a pipe diameter 20 cm and length 50 m when one end of pipe is connected to a tank and other end of pipe is open to atmosphere. The pipe is horizontal and height of water in the tank is 4 m above the center of pipe. Consider all minor losses. Take friction factor f = 0.04. Draw TEL and HGL 10

Solve any **TWO**

B) (i) Define Reynold's number, its significance and application 10

(ii) Streamlined and Bluff body.

(iii)State and prove Pascal Law and give some application

[Time: 3 Hours] **[Total 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. Explain the working of D flip-flop.
b. With the help of a diagram, explain Von-Neumann's architecture.
c. Convert $(-20.25)_{10}$ in the IEEE 754 single precision floating point standard.
d. Describe the six stage instruction pipeline.
e. Draw the memory hierarchy and explain the same.

Q. 2. a) Draw the flowchart of Booth's Algorithm and multiply (-5) and (6) using the same. (10)

b) Explain half subtractor and full subtractor using truth table and circuit diagram. (10)

Q. 3. a) Reduce given Boolean expression using K-Map method.

$f(A,B,C,D) = \sum (0, 1, 2, 4, 5, 7, 8, 10, 11, 13, 15)$ (10)

b) Write an assembly language program for an 8086 microprocessor to find the even and odd numbers from the list of given ten, 8 bit binary numbers. (10)

Q. 4. a) Explain Set associative cache mapping technique with example. (10)

b) Describe Flynn's classification in detail. (10)

Q. 5. a) Discuss the various characteristics of Memory. (10)

b) Explain design of control unit w.r.t. microprogrammed and hardwired approach. (10)

Q. 6. a) Explain different addressing modes of 8086 microprocessors with examples. (10)

b) Discuss the need of I/O module and explain its various I/O techniques in brief. (10)

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.

			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 Race condition with example.	5
	d.	What is Demand Paging? What are its advantages?	5
	e.	What are features of Mobile and Real Time Operating Systems?	5
Q2.	a.	Give the explanation of necessary conditions for deadlock. Explain how a resource allocation graph determines a deadlock.	10
	b.	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 1. LRU 2. FIFO 3. Optimal page replacement algorithms.	10
Q3.	a.	Explain RAID Level in Details	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 thememory status after memory request for sizes 95, 180, 285, 380, 30.	10
Q4.	a.	Explain file allocation methods in detail with proper diagram.	10
	b.	What is a thread? How multithreading is beneficial? Compare and contrast different multithreading models.	10
Q5.	a.	Explain paging in detail. Describe how logical address is converted into physical address.	10
	b.	What is semaphore and its types? How the classic synchronization problem -Dining philosopher is solved using semaphores?	10

Q6. a. Consider the following set of processes with their burst times given below: 10

Process name	Burst Time(ms)	Arrival Time(ms)	Priority(smaller no=higher priority)
P1	24	0	5
P2	7	3	3
P3	6	5	2
P4	10	10	1

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.

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