END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2025

| Paper Code: EEC-208	Subject: Circuits and Systems
Time: 3 Hours	Maximum Marks:60

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit. Assume missing data, if any.

Q1   Attempt any four of the following questions: (4×5=20)
   a)   Define and classify signals with suitable examples.
   b)   State and explain Laplace Transform properties.
   c)   Derive the differential equation of an RLC series circuit.
   d)   Obtain the Laplace transform of $e^{-at}\sin\omega t$ and $1-e^{-at}$ where a is constant.
   e)   Synthesize the waveforms:

(a)   (b)
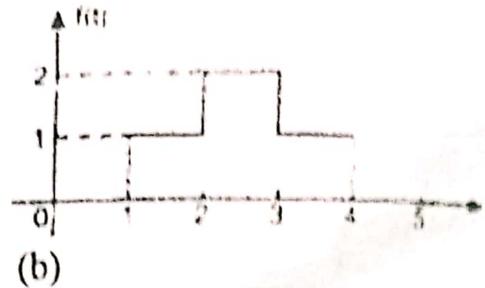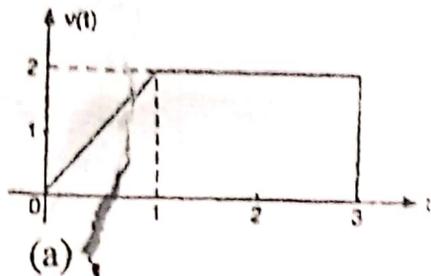
   f)   Define and explain two-port parameters.
   g)   What are the key differences between z-Transform and Laplace Transform?
   h)   Explain any two properties of network functions.

UNIT-I

Q2   a)   Define LTI systems and discuss their characteristics.   (5)
   b)   Consider the R-L circuit with R=4Ω and L=1H excited by a 48V d.c. source as shown in figure. Assume the initial current through the inductor is 3A. Using the Laplace transform determine the current i(t), t≥0. Also draw the s-domain representation of the circuit.   (5)
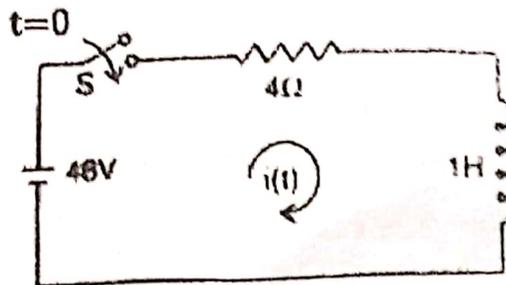
OR

Q3   a)   Explain the concept of state space analysis with an example.   (5)
   b)   Discuss the properties of z-Transform.   (5)

UNIT-II

Q4   a)   Find the transient response of an RLC circuit for a step input using Laplace Transform.   (5)
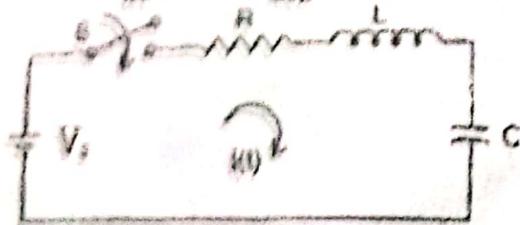   b)   Determine f(0+) and f(∞) for the following function: (5)

$$F(s) = \frac{5s^3 - 1600}{s(s^3 + 18s^2 + 90s + 800)}$$

P.T.O

P-1|2

OR

Q5 a) Consider the RLC series circuit shown in figure. $V_s = 2V$; $R = 6\Omega$; $L = 2H$; $C = 0.25F$. Determine $i(0^+)$; $\frac{di}{dt}(0+)$; $\frac{d^2i}{dt^2}(0+)$ and $i(t)$.
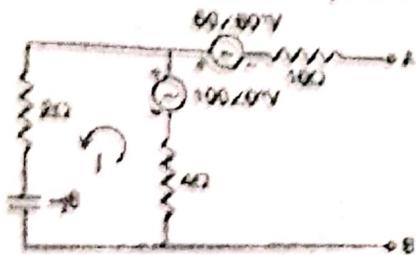
(5)

b) Without finding the inverse Laplace transform of F(s), determine f(0+) and f(∞) for each of the following functions:

(5)

(i) $F(s) = \frac{4e^{-2s}(s+50)}{s}$ (ii) $F(s) = \frac{s^2+6}{s^2+7}$

UNIT-III

Q6 a) Find the Thevenin's equivalent circuit at terminals AB of the given circuit.

(5)

b) Explain the Y-Δ (Star-Delta) and Δ-Y (Delta-Star) transformations. Provide the formulas used for the conversion.

(5)

OR

Q7 a) State and explain Thevenin's and Norton's theorems. How are these theorems applied to simplify complex AC circuits?

(5)

b) Find current I in the circuit using mesh analysis.

(5)
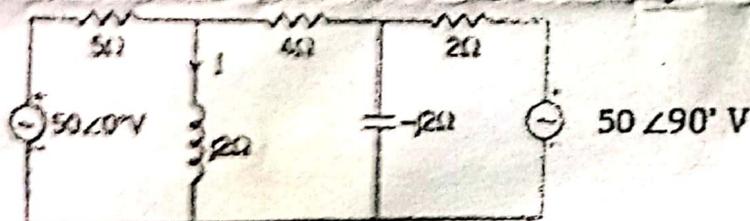
UNIT-IV

Q8 a) Define ABCD parameters and explain their significance.

(5)

b) Derive the condition for reciprocity and symmetry in case of (a) T parameters and (b) h parameters

(5)

OR

Q9 a) Obtain the Z parameters of the network in terms of ABCD and hybrid parameters.

(5)

b) Explain how Hurwitz polynomial is used in network analysis.

(5)

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END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2025

Paper Code: CIC-206	Subject: *Theory of Computation*
Time: 3 Hours	Maximum Marks:60

Note: *Attempt any five questions including Q.No.1 which is compulsory. Select one question from each unit.*

Q1 Attempt all [4x5=20]
- a) Describe the Chomsky Classification of language with example.
- b) Draw the DFA equivalent to the CFG with productions $P = \{S \rightarrow 0S/1A, A \rightarrow 1A/0B, B \rightarrow 1B/\wedge\}$. Here $\wedge$ is used for null.
- c) Prove that if there is a polynomial time reduction from P_1 to P_2 and if P_2 is in P then P_1 will be in P.
- d) Prove that every language accepted by a multi tape TM is acceptable by some single-tape TM.
- e) Define the classes PSPACE and NSPACE complexity classes. Give example problems for both.

UNIT-I

Q2 a) Construct a Mealy machine equivalent to the Moore machine given in the table. [3]

Present State	Next State		Output
	a= 0	b=1	
$\rightarrow q_0$	q_1	q_2	0
q_1	q_3	q_2	1
q_2	q_2	q_1	0
q_3	q_0	q_3	1

b) Construct a DFA to accept all strings over $\{0,1\}$ which contains three ~~consecutive zeros.~~ [3]

c) Define NFA with the help of an example. [4]

Q3 a) Minimize the following DFA. [3]
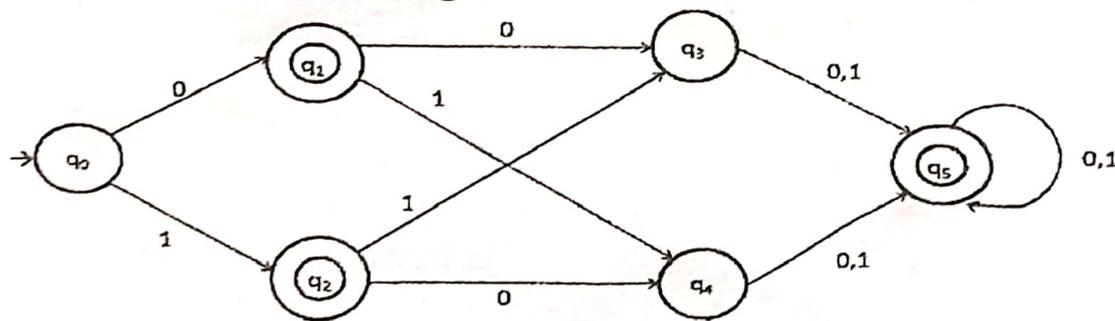
b) i) Find the regular expression for the set $\{a^n b^m : (n+m) \text{ is odd}\}$. [1]
   ii) Find a regular expression over $\{a,b\}$ for all the strings that start and end with the same symbol. [2]

c) Using Pumping Lemma prove that the language $A = \{a^n b^n \mid n \geq 0\}$ is not regular. [4]

P.T.O

P-113

Q3 a) Write down the regular expression for the following diagram. [4]

b) Design a FA that accepts all binary strings where 0's and 1's are alternate. [3]

c) Convert the following NFA (Figure given below) into an equivalent DFA. [3]

UNIT-II

Q4 a) i) What is Context Free Grammar? How it is useful to generate Context Free Language using Push Down Automata? [4]
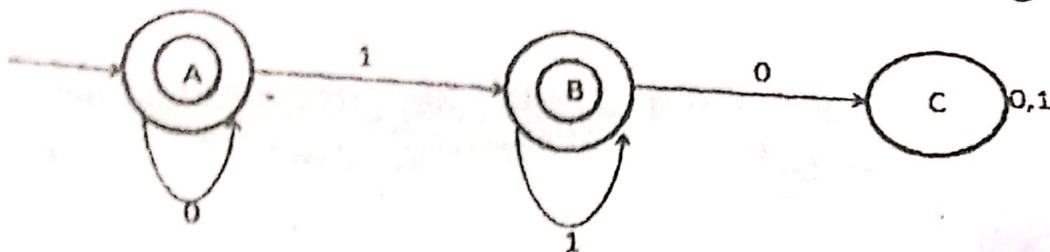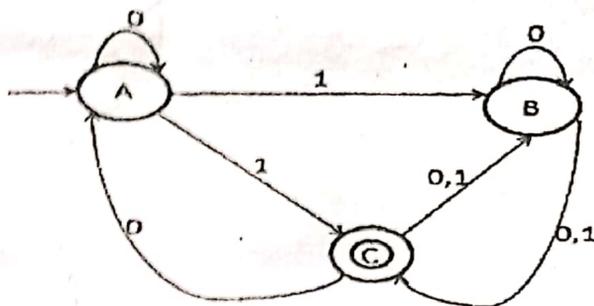
ii) Differentiate between DPDA and NDPDA. [1]

b) Explain the language accepted by Pushdown Automata using final state and empty stack with suitable examples. [2.5]

c) Draw a pushdown automata for the CFG given below [2.5]
$S \rightarrow aSb$; $S \rightarrow a/b/\epsilon$

Q5 a) Define Parsing and Ambiguity. Also explain the Left and Right Derivation tree with the help of an example. [4]

b) Convert the following Context Free Grammar to Chomsky Normal Form [3]
P: $S \rightarrow ASA/aB$, $A \rightarrow B/S$, $B \rightarrow b/\epsilon$

c) Explain Closure properties of Context Free Grammar. [3]

UNIT-III

Q6 a) Give the Formal definition of Turing Machine. [3]

b) Explain the representation of Turing Machine by instantaneous Description using diagram. [3]

c) Consider the Turing machine given by the following table and Draw the transition diagram of the Turing machine, where tape symbols are (1,b) and L,R are R/w head moves. [4]

Present State	Input Type 1	Symbols b
$\rightarrow q_0$	1 R q_0	1 R q_1
q_1	1 R q_1	b L q_2
q_2	b L q_3	—
q_3	1 L q_3	b R q_4
q_4	—	—

P.T.O.

P-2/3

Q7 a) Explain Reducibility and undecidability. How can we use Reducibility to prove undecidability? [4]

b) Explain Universal Turing Machine. Design a Turing Machine that accepts the language denoted by regular expression 11*. [3]

c) Explain Rices Theorem and Recursion Theorem. [3]

UNIT- IV

Q8 a) In context to Computational Complexity Theory, define [4]
i) Solvable and Unsolvable problems
ii) Decidable and Undecidable problems.

b) Explain P and NP problems. When can we call a problem NP-hard and NP-complete? [3]

c) State and prove Cook's Theorem. [3]

Q9 a) In context to Complexity theory explain PSPACE and NSPACE complexity classes. [4]

b) State and Prove Savitch Theorem. [3]

c) What do you mean by Interactive proof systems and IP class. [3]

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END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2025

Paper Code: CIC-212	Subject: Programming in Java
Time: 3 Hours	Maximum Marks:60

Note: Attempt five questions in all including Q.No.1 which is compulsory.
Select one question from each unit.

Q1 Attempt all   (5x4= 20)
- a) Why java is called a pure object oriented programming language.
- b) Differentiate between grid layout and border layout managers.
- c) What is a thread? Describe the complete life cycle of thread.
- d) Describe the uses of final and super keywords with respect to inheritance.
- e) Differentiate between Array List and Vector.

UNIT-I

Q2
- a) Explain in detail about Garbage Collector in Java.   (5)
- b) Discuss the security architecture of Java in detail.   (5)

Q3
- a) Describe the features of Java Programming Language that justifies its popularity.   (5)
- b) Explain sandbox security model with diagram in detail.   (5)

UNIT-II

Q4
- a) Describe run time polymorphism in java with a suitable example. (4)
- b) Demonstrate the wrapper classes in java.   (3)
- c) Discuss in detail about Abstract Classes in Java.   (3)

Q5
- a) Write a program to illustrate the use of multiple catch blocks for a try block.   (4)
- b) Can we have an empty catch block? Justify.   (3)
- c) What is the use of String Tokenizer class?   (3)

UNIT-III

Q6
- a) Define Daemon Threads? Explain with an example   (5)
- b) Write a java program to develop Login Window using AWT.   (5)

Q7
- a) Write a Java program that creates three threads. First thread displays "Hello!" every one second, the second thread displays "Wear Mask !" every two seconds and "Use Sanitizer !" every 5 seconds   (5)
- b) Discuss the event delegation model in Java. Also explain the basic components of it.   (5)

UNIT-IV

Q8
- a) Describe different types of JDBC drivers.   (5)
- b) Explain the random access file operations with a suitable program.   (5)

Q9
- a) What support is provided by File class for file management? Illustrate with suitable scenarios.   (5)
- b) Write a program to store the names of bank depositors and their current balances using hash tables.   (5)

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END TERM EXAMINATION

Paper Code: BS-202

Subject: Probability Statistics and Linear Programming

Maximum Marks:60

Time: 3 Hours

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit.

Q1 Attempt **all** questions. (4x5=20)

(a) A factory has two plants Records show that the plant A produces 30% of the items of the output whereas plant B produces 70% of the items. Further 5% of the items produced by plant. A are defective while 1% produced by the plant B are defective. If a defective item is drawn at random, find the probability that the defective item was produced by plant B.

(b) The joint P.D.F of random variables (X, Y) is given by
$f(x,y) = 2; \quad 0< x <1, \quad 0< y <x$
$= 0;$ elsewhere,
Are X and Y independent?

(c) Prove that every regression line passes through its mean.

(d) A furniture firm manufactures chairs and tables, each requiring the use of three machines A,B and C. Production of one chair requires 2 hours on machine A, 1 hour on machine B and 1 hour on machine C. Each table requires 1 hour each on machine A and B and 3 hours on Machine C. The profit realized by selling one chair is Rs. 300 while for a table the figure is Rs. 600. The total time available per week on machine A is 70 hours, on machine B is 40 hours and on machine C is 90 hours. How many chairs and tables should be made per week to maximize the profit? Formulate a mathematical model for the problem.

UNIT-I

Q2 (a) Prove that Poisson distribution is a limiting case of Binomial distribution. If the variance of the Poisson distribution is 2. Hence find $p(x) \geq 4$. (5)

(b) The customer accounts of certain department store have an average balance of Rs. 120 and a standard deviation of Rs. 40. Assuming the that the account balances are normally distributed:

(i) What proportion of the account is over Rs. 150?
(ii) What proportion of account is between Rs. 100 and Rs. 15?
(iii) What proportion of account is between Rs. 60 and Rs. 90?
Given that tabulated value of z at 0.5 = 0.1915, at 0.75 = 0.2266 and at 1.5 is 0.4332. (5)

OR

(a) Ten coins are tossed 1024 times and the following frequencies are observed with the expected frequencies. Compare these frequencies with the expected frequencies. (5)

P.T.O.

P-1|3

No. Of heads	0	1	2	3	4	5	6	7	8	9	10
Frequencies	2	10	38	106	188	257	226	128	59	7	3

(b) In a certain city the daily consumption of electric power in millions of kilowatt-hours can be treated as a random variable having a gamma distribution with $\lambda = 3$, $a = 0.5$. If the power plant of this city has a daily consumption of 12 million kilowatt-hours, what is the probability that this power supply will be inadequate on any given day? (5)

UNIT–II

Q3 (a) Three fair coins are tossed. Let X denote the number of heads on the first two coins and let Y denote the number of tails on the last two coins. Find the conditional distribution of Y given that X=1. Comment on the correlation coefficient between X and Y. (5)

(b) Explain sampling distribution. State central limit theorem. The average weight of a water bottle is 30 kg, with a standard deviation of 1.5 kg. If a sample of 45 water bottle is selected at random from a consignment and their weights are measured, find the probability that the mean weight of the sample is less than 28 kg. (5)

OR

An urn contains four balls. Two of the balls are numbered with 1 and the other two are numbered with 2. Two balls are drawn from the urn without replacement. Let X denote the smaller of the numbers on drawn balls and Y the larger.

(i) Find the joint P.M.F of X AND Y.
(ii) Find marginal distribution of Y.
(iii) Find Cov(X,Y). (5)

(b) The joint density of X and Y is given by $\{ f(x,y) = 4xy\, e^{-(x^2+y^2)}, x \geq 0, y \geq 0 \}$
Test whether X and Y are independent. Also find the conditional density of X given Y = y. (5)

UNIT–III

Q4 (a) In a school the heights of six randomly chosen girls are 64,65,68,69,71 and 72 inches and those of nine randomly chosen boys 61,62,65,66,69,70,71, 72 and 73 inches. If the tabulated value of t for 13 D.O.F at 5% level of significance is 1.77 then test if the girls are taller than boys. (5)

(b) Prove that the correlation coefficient ρ_{xy} is a geometric mean of two regression coefficients b_{yx} and b_{xy}. Given the bivariate data. Calculate the Karl Pearson's coefficient of correlation. (5)

x	1	5	3	2	1	1	7	3
y	6	1	0	0	1	2	1	5

OR

(a) Apply x^2 test to ascertain if Poisson distribution can be assumed from the following data. Given that the tabulated value of x^2 at 5% level of significance is 9.49. (5)

No. of defectives	0	1	2	3	4	5
Frequency	6	13	13	8	4	3

P-2/3

(b) Two random samples gave the following results.

Sample	Size	Sample mean	Sum of squares of deviations from mean
1	10	15	90
2	12	14	108

Test whether the samples come from the same normal population. Given that $F_{(9,11)[0.05]} = 2.90$ and $t_{(20)[0.05]} = 2.086$. **(5)**

UNIT–IV

Q5 (a) Use Simplex method to maximize $Z = 5x + 3y$ subject to the constraints $x + y \leq 2$, $5x + 2y \leq 10$ and $3x + 8y \leq 12$, $x, y \geq 0$. **(5)**

(b) Find the optimal solution for the following transportation problem using

Source		A	B	C	D	Availability
	O1	21	16	25	13	11
	O2	17	18	14	23	13
	O3	32	27	18	41	19
	Requirement	6	10	12	15	43

V.A.M. **(5)**

OR

(a) Discuss duality. Obtain the dual problem of the following L.P.P. **(5)**
Maximize $Z = x_1 - 2x_2 + 3x_3$
subject to the constraints
$-2x_1 + x_2 + 3x_3 = 2$,
$2x_1 + 3x_2 + 4x_3 = 1$,
$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$.

(b) What do you mean by an assignment problem? Four jobs are to be done on four different machines. The cost in (rupees) of producing 'i' th job on the 'j' th machine is given below: **(5)**

		Machines			
		M1	M2	M3	M4
Jobs	J1	15	11	13	15
	J2	17	12	12	13
	J3	14	15	10	14
	J4	16	13	11	17

Assign the jobs to different machines so as to minimize the total cost.

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P–3/3

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2024

Paper Code: BS-202   **Subject: Probability, Statistics & Linear Programming**

Time: 3 Hours   **Maximum Marks: 75**

Note: Attempt five questions in all including Q.No1 which is compulsory. Select one question from each unit. Assume missing data if any. (Scientific Calculators are allowed).

Q1. Attempt all Questions:-

a) A batch of 25 injection-molded parts contains 5 that have suffered excessive shrinkage. If two parts are selected at random and without replacement, what is the probability that the second part selected is one with excessive shrinkage?   3

b) State the Central Limit Theorem.   2

c) Find the moment-generating function of a random variable x following an exponential distribution.   3

d) Explain the general procedure for Hypothesis Testing.   2

e) Solve the following LPP graphically.   5

$$Min\ Z = -3x + 2y$$
subject to
$$x + y \le 5$$
$$4 \ge x \ge 0, 6 \ge y \ge 1$$

UNIT I

Q2. a) Let the random variable **X** denote the current measured in a thin copper wire in milliamperes. Assume that the range of **X** is [0, 20 mA], and assume that the probability density function of **X** is $f(x) = 0.05, 0 \le x \le 20$. What is the probability that a measurement of current is between 5 and 10 milliamperes? Also, determine the mean and standard deviation of **X**.   [7+8=15]

b) Customers are used to evaluate preliminary product designs. In the past, 95% of highly successful products received good reviews, 60% of moderately successful products received good reviews, and 10% of poor products received good reviews. In addition, 40% of products have been highly successful, 35% have been moderately successful, and 25% have been poor products.

   i. If a new design attains a good review, then what is the probability that it will be a highly successful product?

Q9. a) Find the initial basic feasible solution of the following transportation problem using Vogel's Approximation method.   [7+8=15]

	I	II	III	IV	Supply
A	21	16	25	13	11
B	17	18	14	23	13
C	32	27	18	41	19
Demand	6	10	12	15	

b) Three food products are available at costs of Rs. 10, Rs. 36 and Rs. 24 per unit, respectively. They contain 1,000, 4,000 and 2,000 calories per unit, respectively and 200, 900 and 500 protein units per unit, respectively. It is required to find the minimum-cost diet containing at least 20,000 calories and 3,000 units of protein. Formulate and solve the given problem as an LP problem. Write the dual and using the final simplex table of primal problem, write the solution to the dual problem.

****

b) Solve the following LPP using Simplex algorithm.

Max Z = -2x +3y

subject to

$x \le 5$

$2x - 3y \le 6$

$x, y \ge 0$

objective?

	Course 1	Course 2	Course 3	Course 4
Prof 1	60	40	60	70
Prof 2	20	60	50	70
Prof 3	20	30	40	60
TA	30	10	20	40

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2024

Paper Code: CIC-206 **Subject: Theory of Computation**
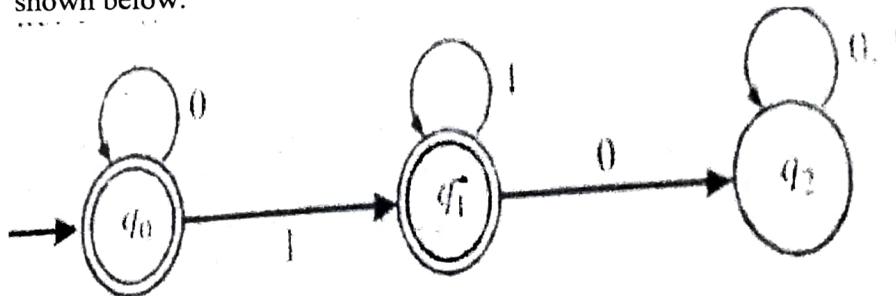
Time: 3 Hours **Maximum Marks: 75**

Note: Attempt five questions in all including Q.No.1 which is compulsory. Assume missing data, if any.

(2.5x10=25)

Q1 Answer the following questions:
   a) Write any five Identity Rules for Regular Expressions?
   b) What is the difference between Deterministic Finite Automata (DFA) and Non-Deterministic Finite Automata (NDFA)?
   c) What is the disadvantages of unambiguous parse tree. Give an example.
   d) Define the term context free grammar with an example?
   e) Define instantaneous description of a PDA
   f) Construct the CFG for generating the language $L=\{a^n b^n /n>=1\}$.
   g) For the grammar S->A1B,A->0A | ε, B-> 0B | 1B| ε, give leftmost and rightmost derivations for the string 00101.
   h) Prove graph coloring problem is NP complete.
   i) Describe the Set of all Strings of 0's and 1's ending in 00 by Regular Expression.
   j) Construct a Regular Grammar G generating the regular expression 0*(0+1)?

Q2 a) Construct a Regular Expression for the FA (Using Method of Eliminate States) the shown below: **(6)**

   b) Explain Pumping lemma for Context Free Languages. **(6.5)**

Q3 a) Find the left most and right most derivation corresponding to the tree. **(6)**
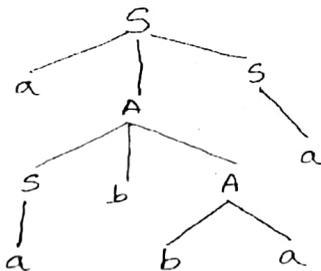
   b) Construct a equivalent grammar G in CNF for the grammar G1 where G1 =({S,A,B},{a,b},{S->bA/aB,A->bAA/aS/a, B->aBB/bS/b},S) **(6.5)**

P.T.O.

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2024

Paper Code: ETCS-206	Subject: Theory of Computation
Time: 3 Hours	Maximum Marks: 75

Note: *Attempt five questions in all including Q.No.1 which is compulsory. Assume missing data, if any.*

Q1 Differentiate between the following: **[5x5=25]**
- a) Regular Language and Context Free language
- b) Recursive and Recursive Enumerable language
- c) Halting Problem & Un-decidable problem of Turing machine
- d) Classify & Differentiate between different types of FA with output.
- e) Dead state and In-accessible state

Q2 a) Explain closure properties of regular sets. Provide at least two closure properties of regular sets and justify their significance in formal language theory. **[4]**

b) Convert the following regular expression to DFA.
ab(a+b)*ab **[4]**

c) Explain the significance of the stack in a Pushdown Automaton with example. **[4.5]**

Q3 a) How the ambiguity of a grammar can be removed? Explain with suitable example. **[6]**

b) How to Convert any CFG to GNF? Explain with suitable example. **[6.5]**

Q4 a) What are Normal Forms in grammar? Explain its importance with example. **[4]**

b) Explain two types of acceptance in pushdown automata for $a^n b^n$. **[4.5]**

c) Define Pushdown Automata and explain its components. **[4]**

Q5 Write a short note on following
- a) Kleen's closure & Positive Closure **[4]**
- b) Undecidability **[4.5]**
- c) SPACE and PSPACE **[4]**

Q6 a) Write the steps and convert the regular grammar into Finite Automata for **[6.5]**
S→0A/1B0/1   A→ 0S/1B/1   B→ 0A/S

b) Construct a TM for $a^n b^n$. **[6]**

Q7 a) Design a Turing machine for string of palindrome (Same machine for even and odd length). **[7.5]**

b) Write a short note on Computability and Intractability. **[5]**

P.T.O.

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2024

Paper Code: *EEC-208*   Subject: *Circuits and Systems*

Time: *3 Hours*   Maximum Marks: 75

Note: *Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit.*

Q1   Attempt all questions:
a)   Find the Fourier transform for $x(t) = \sin(\omega_c t)\, u(t)$ **(3)**
b)   List the properties of ROC.   **(3)**
c)   Determine the impulse response of series and parallel RL circuit.   **(3)**
d)   Explain the AC circuit containing the inductor only.   **(3)**
e)   Explain short circuit and open circuit impedance in terms of ABCD parameters.   **(3)**

UNIT-I

Q2   Examine the following system: Linear/Nonlinear, Causal/Non- Causal, Time Variant/Time-Invariant, and Static/Dynamic with examples.   **(15)**

Q3   Find the laplace transform for following signals if $x(t) = e^{-4t}\, u(t)$. **(5×3=15)**
i) $y(t) = x(t+2)$
ii) $y(t) = t.x(t)$
iii) $y(t) = dx(t)/dt.$

UNIT-II

Q4   a)   Derive the Transient Response in series R-L-C circuit with sinusoidal excitation for second order circuit.   **(7)**
b)   A step voltage of 20 V is applied at $t = 0$ in an R-L-C series circuit where R = 5ohm, L= 1H and C = 1F. Calculate i(t) with and without Laplace Transform.   **(8)**

Q5   a)   Find the step response (by applying a constant voltage source at the close of a switch) of a Parallel RLC circuit.   **(8)**
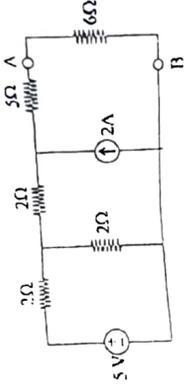b)   Determine the step response of series and parallel RC circuits.   **(7)**

UNIT-III

Q6   For the Circuit shown below, determine the current in each branch using Nodal and Loop analysis.   **(15)**
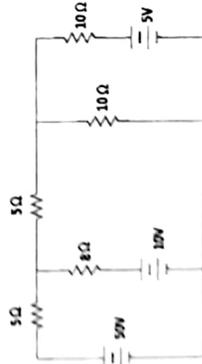
Q7   Determine the value of current in 6Ω resistor using Thevenin's theorem and Norton's theorem.   **(15)**

UNIT-IV

Q8   a)   Explain the term 'tie-set' and 'tie-set matrix' of a network with an illustrative example.   **(5)**
b)   Derive and prove the following Matrix Equation with an appropriate example
$$I_b = B^T I_L$$
Where, B is the Tie-set matrix, I_b and I_L are the branch current respectively   **(10)**

Q9   a)   Derive the transmission parameters of Two-port networks. Also, determine the condition of Reciprocity and symmetry for ABCD parameter.   **(8)**
b)   Explain the parallel and cascade connection of Two-port networks.   **(7)**

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END TERM EXAMINATION

Paper Code: CIC-210	**Subject: Database Management System**
Time: 3 Hours	**Maximum Marks: 75**

*Note: **Attempt questions in all including Q.No.1 which is compulsory. Select one question from each Unit.***

Q1

a) Give an example of mapping of generalization or specialization into relation schemas Summarize the steps involved in converting the ER constructs to relational schema. **(3)**

b) What is a Weak Entity type? Explain the role of partial key in design of weak entity type. **(3)**

c) Consider a relational schema with the following tables: **(3)**
Employee (EmpID, EmpName, DeptID)
Department (DeptID, DeptName)
Write a relational calculus expression to retrieve the names of all employees who work in the "Sales" department. **(3)**

d) Why is the domain key normal form (DKNF) known as ultimate normal form? **(3)**

e) Compare and contrast heap files and sorted files in terms of storage efficiency and query performance. When would you choose to use a heap file over a sorted file, and vice versa? **(3)**

UNIT-I

Q2

a) Design an ER – Diagram for a UNIVERSITY database schema taking into account at least five entities and indicate all keys and cardinality constraints and assumptions that are made. **(7)**

b) Define the following with examples: **(5)**
(i) Super key   (ii) Candidate key
(iii) Primary key   (iv) Foreign key

c) What do you mean by constraints? Differentiate between table and column constraint. Explain with an example. **(3)**

Q3

a) Consider the following tables: **(8)**
works (Pname, Cname, Salary)
lives (Pname, Street, City)
located-In (Cname, City)
write the following queries in SQL:
i) List the names of the people who work for the company 'Wipro' along with the cities they live in.
ii) Find the names of the persons who do not work for 'Infosys'.
iii) Find the people whose salaries are more than that of all of the 'oracle' employees.
iv) Find the persons who works and lives in the same city.

b) Differentiate between DDL, DML, and DCL in SQL. Provide examples for each category and explain their roles in database management. **(4)**

c) Explain the various inner join operations in relational algebra with examples. **(3)**

P.T.O.

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JUNE 2024

Paper Code: CIC-212   **Subject: Programming in Java**

Time: 3 Hours   **Maximum Marks: 75**

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit.

Q1 Answer the following questions: **(5x3=15)**
a) Discuss any five differences between Interface and Abstract Class.
b) Explain the concept of wrapper classes in Java and discuss their significance?
c) What is remote method invocation? Explain briefly.
d) How to create Inner & Outer Class? How it is helpful for achieving Security.
e) What is the thread's priority? Define the values for different priority in java.

UNIT-I

Q2 a) What is JVM? Explain JVM architecture in detail.   **(8)**

b) What is Sandbox security model? How does it help in providing security to resources? Discuss in detail.   **(7)**

Q3 a) Explain the security promises of the Java Virtual Machine (JVM) and how it achieves them.   **(5)**

b) Write a short note on the following: **(10)**
(i)Various Instructions sets used in Java.
(ii)Garbage Collections
(iii)Class File Format

UNIT-II

Q4 a) Write a Java program demonstrating the implementation of an interface. Define an interface named Shape with methods calculate Area() and calculate Perimeter(). Implement this interface with classes Circle and Rectangle. Test the implementation by creating objects of these classes and invoking the interface methods to calculate their respective areas and perimeters.   **(7)**

b) What is exception handling? Create customized exceptions and make use of all the 5 exception keywords used in exception handling.   **(8)**

Q5. a) Explain the concept of Applet programming in Java and describe the life cycle of an applet. Provide a Java Applet program illustrating the key stages of an applet's life cycle.   **(8)**

b) What is the difference between String Buffer and String Class? Show the use of two methods of String Buffer and String class with the help of example.   **(7)**

P.T.O.

Q6. a) What is thread? Explain the life cycle of a thread with the help of a diagram. What are the various ways to create the thread? Explain to anyone with the help of example.   **(8)**

b) What is thread synchronization? When do we use it? Write a program to illustrate the concept of Thread Synchronization method   **(7)**

Q7. a) Why is event used in Java? What is the difference between adapter class and listener interface? Explain with the help of an example.   **(8)**

b) Discuss various types of layouts used in AWT. Write a program to show the use of Border Layout and Grid Layout with various components.   **(7)**

UNIT-IV

Q8. a) Explain different types of JDBC drivers. Write the steps to connect a Java application to a database? Explain with the help of example.   **(10)**

b) Write a program to sort the content of a given text file.   **(5)**

Q9. a) Write a program to implement the Client -Server Application.   **(7)**

b) Write the short note on: **(8)**
(i)What is JNI and how it works?
(ii)What is object serialization vs deserialization?
(iii)What are Java collections? Give some methods of Collection interface.

****

b) Three jobs A, B, and C are to be assigned to three machines U, V, and W. The processing cost for each job machine combination is shown in the matrix given below. Determine the allocation that minimizes the overall processing cost. (Cost is in Rs. per unit). **(7)**

JOB	MACHINE		
	U	V	W
A	17	25	31
B	10	25	16
C	12	14	11

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END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] JULY 2023

Paper Code: BS-202	Subject: Probability, Statistics and Linear Programming

Time: 3 Hours   **Maximum Marks: 75**

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit.

Q1 Attempt all questions:

a) Three urns contain 6 red, 4 black; 4 red, 6 black, and 5 red, 5 black balls respectively. One of the urns is selected and a ball is drawn from it. If the ball drawn is red, find the probability that it is drawn from the first urn. **(3)**

b) A manufacturer produces two types of models M_1 and M_2. Each M_1 model requires 4 hours of grinding and 2 hours of polishing; whereas M_2 model requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on an M_1 model is ₹3 and on an M_2 model is ₹4. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models so that he may make the maximum profit in a week. Formulate this as a linear programming problem. **(3)**

c) Determine the value of c that makes the function $f(x,y) = c(x+y)$, a joint probability mass function over points $x = 1,2,3$ and $y = 1,2,3$. Find E(X) and E(Y). **(3)**

d) Find the line of regression or line of best fit for the data given below: $n = 18, \sum x = 12, \sum y = 18, \sum x^2 = 60, \sum y^2 = 96, \sum xy = 48.$ **(3)**

e) Find the moment generating function for the distribution defined by $f(x) = \frac{1}{2^x}$, $x = 1,2,3,...\infty$ **(3)**

UNIT-I

Q2 a) Show that Poisson distribution is a limiting case of Binomial distribution when n is very large and p is small such that np is fixed. If X is a Poisson variate such that $P(X = 2) = 9 \, P(X = 4) + 90 \, P(X = 6)$. Find the mean and standard deviation of X. **(8)**

b) In the normal distribution, 31% of the items are under 45 and 8% are over 64. Determine the mean and variance of the distribution? (Given that $P(Z < -1.4) = 0.08$ and $P(Z > 0.5) = 0.31$). **(7)**

P.T.O.

P-1/4
BS-202

Q3 a) There is an 85% chance that a student w[ ] pass a Statistics course. A random sample of 120 students taking the Statistics course is selected. Using Normal approximation (using continuity correction), find the probability that
(i) atleast 110 students will pass.
(ii) atmost 105 students will pass.
(Given that $P(Z > 1.92) = 0.0274$ and $P(Z > 0.89) = 0.1867$). **(8)**

b) If X follows uniform distribution in $[-2, 2]$, find $P(X < 0)$ and $P\left(|X - 1| < \frac{1}{2}\right)$. **(7)**

UNIT-II

Q4 a) Find covariance and correlation for joint probability density function of the two random variables X and Y:
$$f(x, y) = e^{-x-y} \text{ over range } 0 < x, 0 < y.$$
Are X and Y independent random variables? **(8)**

b) A random sample of size $n_1 = 16$ is selected from a normal population with mean 75 and standard deviation 8. A second random sample of size $n_2 = 9$ is taken from another normal population with mean 70 and standard deviation 12. Let $\overline{X}_1$ and $\overline{X}_2$ be the sample mean of the first and second sample respectively. Find the probability that $\overline{X}_1 - \overline{X}_2$ exceeds 4. (Given $P(Z > -0.2236) = 0.5871$). **(7)**

Q5 a) Suppose that a random variable X has a continuous uniform distribution
$$f(x) = \begin{cases} \frac{1}{2}, & 4 \leq x \leq 6 \\ 0, & \text{otherwise.} \end{cases}$$

(i) State Central Limit Theorem and use it to find the approximate probability distribution of the sample mean of a random sample of size $n = 40$.
(ii) Find the mean and variance of the sample mean. **(10)**

b) You are given a bag of marbles. Inside the bag are 5 red, 4 white and 3 blue marbles. Using the concept of multinomial probability distribution, calculate the probability that with 6 trials, you choose 3 marbles that are red, 1 marble that is white, and 2 marbles that are blue, replacing each marble after it is chosen. **(5)**

UNIT-III

Q6 a) In one sample of 8 observations, the sum of squared of deviations of the sample values from the sample mean was 84.4 and in the other sample of 10 observations it was 102.6. Test whether the difference is significant at 5% level of significance? (Given $F_{0.05}(7, 9) = 3.29$). **(8)**

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b) Following are the responses to the question "How many hours do you study before a major Statistics test?"

6 5 1 2 2 5 7 5 3 7 4 7

Use the Wilcoxon test to test the hypothesis at the 5% level of significance that the median number of hours a student studies before a test is 3. (Given that, the critical value of T for $n = 11$ at 5% level of significance for a two-tailed test is 10). **(7)**

Q7 a) The theory predicts the proportion of beans in the four groups should be in the ratio 9:3:3:1. In an experiment with 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support theory? (Given $\chi^2_{0.05}$ for 3 $d.f. = 7.815$). **(8)**

b) The means of samples of sizes 1000 and 2000 are 67.5 and 68.0 cm respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 cm. (Given $Z_{0.025} = 1.96$). **(7)**

UNIT-IV

Q8 a) Solve the following L.P.P by Simplex method:
$$\text{Maximize } Z = 5x_1 + 3x_2$$
subject to $x_1 + x_2 \leq 2, 5x_1 + 2x_2 \leq 10, 3x_1 + 8x_2 \leq 12, x_1, x_2 \geq 0$. **(8)**

b) Construct the dual of the following L.P.P and solve the dual using graphical method:
$$\text{Minimize } W = 2y_1 + 4y_2 + 3y_3$$
subject to $-y_1 + y_2 + y_3 \geq 2, 2y_1 + y_2 \geq 1, y_1, y_2, y_3 \geq 0$. **(7)**

Q9 a) Using VAM method, find basic feasible solution of the following transportation problem. Check optimality and hence find the optimal solution. **(8)**

MARKET	PLANT				
	P1	P2	P3	P4	Requirement
M1	19	14	23	11	11
M2	15	16	12	21	13
M3	30	25	16	39	19
Availability	6	10	12	15	43

END TERM EXAMINATION

FOURTH SEMESTER [B.TECH] July 2023

Paper Code- ETCS 206	Subject: Theory of Computation
Time: 3 Hours	Maximum Marks:75

**Note: Attempt five questions in all including Q.No.1 which is compulsory.
Select one question from each unit.**

Q1   Attempt all questions: **(5x5=25)**
  (a)   State the differnces between a NFA and DFA?
  (b)   Differentiate between Moore and Melay Machines?
  (c)   Find a regular expression corresponding to the language of all strings
         over the alphabet { a, b } that contain exactly two a's.
  (d)   State Church's hypothesis about compuitability of a machine
  (e)   Prove that the graph coloring problem is NP-complete

UNIT-I

Q2   a)   Let Σ = {a, b} and let L = { w $\in$ Σ^* | w $\neq$ ε and the first and last
            character of w are the same }. Design aDFA for L   **(6)**
      b)   For the following NFA. Convert it into its equivalent DFAwhere Q0 is
            the initial state and Q2 is the final state.   **(6.5)**

	a	b
Q0	{Q0}	{Q0,Q1}
Q1	ε	{Q2}
Q2	ε	ε

Q3   a)   Prove the pumping lemma for regular lanuages with examples.   **(6)**
      b)   Minimize the following DFA over alphates as 0,1   **(6.5)**
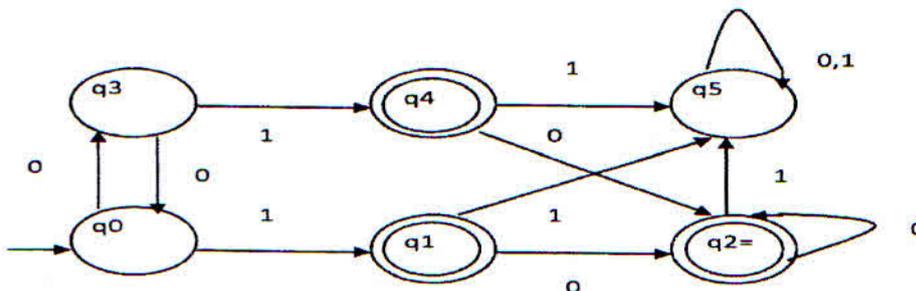
UNIT-II

Q4   a)   What are inherently ambiguous languages. Check whether the
            folllowing Grammar is Ambiguous or not-S->A/B, A->aAb /ab, B-
            >abB/ ε **(6)**

                                                                      P.T.O.

P-1/2
ETCS -206

b) What are the steps to simplify a Context Free Grammar. Simplify the following CFG:
S->AbaC, A->BC, B->b/€, C->D/€, D->d **(6.5)**

Q5 a) What is PDA. Construct a pda to find 2's complemet of a binary number. **(6)**

b) Covert the following grammar into Chomsky Normal Form:
S->ABCa, A->aAbb, A->e, B->bB, B->b, B->AC, C->aCa, C->e **(6.5)**

UNIT- III

Q6 a) Design a Turing Machine for the language { $a^n b^n c^n$ | n>=1 } **(6)**

b) Design a Turing Machine to check if a set of parenthesis is well formed. **(6.5)**

Q7 a) State and prove the halting problem of Turing Machines **(6)**

b) Explain the Closure properties of Recursive Languages **(6.5)**

UNIT- IV

Q8 a) State and prove the Savitch theorem. **(6)**

b) Differentiate between P, NP, NP-hard and NP-complete problems with examples. **(6.5)**

Q9 a) State and prove the Cook's theorem. **(6)**

b) Is PSPACE harder than NP? How can you show a problem in PSPACE. **(6.5)**

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END TERM EXAMINATION

Note: Attempt five questions in all including Q.No.1 which is compulsory. Select one question from each unit.

Answer the following: **(4x5=20)**

a) What is a foreign key? Explain the difference between unique and primary key constraint.

b) What is the difference between left outer join and right outer join in SQL? Give example.

c) Explain the difference between 3NF and 4NF with example.

d) Explain log-based recovery. How is it different from shadow paging?

e) Differentiate between the following:
   i)   Primary index and secondary index
   ii) Dense index and sparse index

UNIT-I

Q2 a) Mention any three differences between DBMS and typical file processing systems? Discuss two situations in which DBMS should not be used.   **(4)**

b) Explain the 3-tier architecture of DBMS. How does DBMS provide users with considerable degree of data independence? Why is logical data independence difficult to achieve than physical data independence?   **(3)**

c) Differentiate between the following: **(3)**
   - Primary key and super key
   - Weak and strong entity set
   - Generalization and Specialization

Q3 a) Design a database for a bike manufacturing company to provide to maintain the buyer and employee details. Each bike has unique a vehicle id and company sell bikes of various models. Each employee can be salaried or hourly and must work for a department in the company. The employee caters to the need of buyers. For the sale of each bike, the details of order and date of sale are also maintained. Design an ER model for the same. Also perform ER to Relational mapping.   **(7)**

b) What is recursive relationship? Explain with an example.   **(1)**

c) Mention any three responsibilities of DBA?   **(2)**

UNIT-II

Q4 a) Consider the following relational schema:

Employee(Emp_number, Emp_name, Salary)

Project(Proj_number, Proj_name, Proj_location)

Works_on(Emp_number, Proj_number)

For each of the following queries give an expression in Relational Algebra: **(5)**
   i)   Find the name of the projects at Delhi.
   ii) Find the name and salary of all employees working on Proj number 10 at Noida.

P.T.O.

P-1/2

CIC-210

iii)   Find the number of employees working on each project.

b)   Select in SQL is analogous to which operator in relational algebra?
Suppose A={a,b} and B={a,b} then what will be A X B in relational
algebra?   (1)

c)   What is entity integrity and referential entity constraint in a
relational model?   (2)

d)   What is the difference between Tuple Relational Calculus (TRC)
and Domain Relational Calculus (DRC)?   (2)

Q5 a)   Consider the following relational schema:
Dealer (dno, dname,   daddress)
Tractor (tid, model, price)
Orders (dno,tid)
Write the following queries in SQL: (4)
    i)   Find the name of dealers who have ordered all tractors of
          price less than Rs. 3, 50,000.
    ii)   For each model, find the name and dno of dealers who have
          ordered less than six tractors of that model.
    iii) Find the dealer that has the ordered the tractor with the
          lowest price.
    iv)   Find the dealer that has the ordered the most number of
          tractors.

b)   Explain the difference between generalization and specialization?
What   are   the   different   constraints   on   generalization/
specialization? Explain with the help of example.   (4)

c)   Consider the following relational schema: (2)
Student(Rollno, Sname, Marks, Branch)
Subject(Subject_code, Subject_name)
Studies(Rollno, Subject_code).
Find the name of students studying 'DBMS'. Write this query in
SQL and relational algebra.

UNIT-III

Q6 a)   Consider a relation R ={A,B,C,D,E,F,G,H,I} and the following
functional dependencies:
{A,B}->C
A->D,E
B->F F->G,H
D->I,J
Find the key for R and normalize till BCNF.   (4)

b)   What is the difference between immediate and deferred database
modification with respect to recovery?   (1)

c)   Consider the schema with attributes (P, Q, R, S, T, U) with
following functional dependencies:
P->R
RQ->S
RQ->T
U->S
    i)   Is P->S implied?
    ii)   Find {PQ}+   (3)

d)   Explain the ACID properties of a transaction.   (2)