II B. Tech I Semester Regular/Supplementary Examinations, December-2023
MATHEMATCIAL FOUNDATIONS OF COMPUTER SCIENCE
(Com to CSE, CST,CSE(AI),CSE(AIML),AI,DS,CSE(AIDS),CSE(CS), CSE(DS), CSE(IOTCSBT), CSBS,CSE(IOT),AIDS,AIML, CS(CSD))

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) Obtain the conjunctive normal form of the formula [7M]
$(\sim P \vee \sim Q) \rightarrow (P \leftrightarrow \sim Q)$

b) "If there was a ball game, then travelling was difficult. If they arrived on time, then travelling was no difficult. They arrived on time. Therefore, there was no ball game." Show that these statements constitute a valid argument. [7M]

OR

2 a) Obtain the PDNF for $(P \wedge Q) \vee (\neg P \wedge R) \vee (Q \wedge R)$ [7M]

b) Symbolize the expressions [7M]
i) All the world loves a lover
ii) All men are giants

UNIT-II

3 a) Define the following terms (i) Abelion Group (ii) Sub Group [7M]

b) Let X={1,2,3,4} if R={(x,y)|(x-y) is integer non zero multiple of 2} and S={(x,y)|(x-y) is integer non zero multiple of 3} find R U S and R ∩ S. [7M]

OR

4 a) If R be an equivalence relation in a set A, then R^{-1} is also an equivalence relation in A. [7M]

b) Prove that A= (A∩B)U (A-B) for any two sets A and B [7M]

UNIT-III

5 a) In how many ways can 23 different books be given to 5 students so that 2 of the students will have books each and other 3 will have 5 books each. [7M]

b) Find the greatest common divisors of the following pairs of integers 81 and 36. [7M]

OR

6 a) How many ways can we distribute 14 indistinguishable balls in 4 numbered boxes so that each box is non empty? [7M]

b) How many integral solutions are there $x_1 + x_2 + x_3 + x_4 + x_5 = 20$ where each $x_1 \geq 3$, $x_2 \geq 2$, $x_3 \geq 4$, $x_4 \geq 6$, and $x_5 \geq 0$ [7M]

UNIT-IV

7 a) Solve $a_n+7a_{n-1}+8a_{n-2}=0$ for $n \geq 2$, $a_0=1$, $a_1=-2$ using generating functions. [7M]

b) Solve the recurrence relation $a_n - 6\, a_{n-1} + 9\, a_{n-2} = 0$ [7M]

OR
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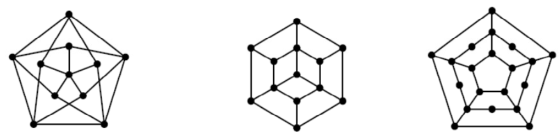
8 a) Solve $a_n = (a_{n-1})^2(a_{n-2})^3$ where $a_0=4$ and $a_1=4$ [7M]

b) Solve the recurrence relation of Fibonacci series with $F_0 = 1$, $F_1 = 1$ [7M]

UNIT-V

9 a) Explain Kruskal's algorithm to find the minimal spanning tree with an example. [7M]

b) Show that the graph on the left is Hamiltonian, but that the other two are not. [7M]



OR

10 a) Suppose that G is a non directed graph with 12 edges. Suppose that G has 6 vertices of degree 3 and the rest have degree less than 3. Determine the minimum number of vertices G can have. [7M]

b) Explain Breadth First Search Algorithm with suitable example. [7M]

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UNIT-I

1 a) Obtain the principal disjunctive forms of the formula [7M]
$(\sim P \vee \sim Q) \rightarrow (P \leftrightarrow \sim Q)$

b) Prove or disprove the validity of the following arguments [7M]
Some dogs are animals.
Some cats are animals.
Therefore, some dogs are cats

OR

2 a) What is propositional logic? List and explain laws of propositional logic. [7M]

b) Show that $(x)\ (P(x) \rightarrow Q(x)) \wedge (Q(x) \rightarrow R(x)) \Rightarrow (P(x) \rightarrow R(x))$ [7M]

UNIT-II

3 a) Define a Monoid ? Give an example of a Monoid which is not group. [7M]

b) Show that $R \cap S$ is reflexive if R and S are reflexive on a set A. [7M]

OR

4 a) Show that the relation $R=\{(a,b) \mid a-b$ is divisible by $n\}$ is an equivalence relation on the set of integers where n be a positive integer greater than 1. [7M]

b) What are the identity and inverse elements under * defined by [7M]
$a*b= ab/2 \quad \forall a,b \in R$

UNIT-III

5 a) What is the coefficient of x^3y^7 in $(x+y)^{10}$ [7M]

b) In how many ways can 14 people be partitioned into 6 teams when the first and second have 3 members each and third, fourth, fifth and sixth teams have 2 members each [7M]

OR

6 a) How many ways can the letters of the word ALGORITHM be arranged in a row if A and L must remain together as a unit [7M]

b) How many integral solutions are there $x_1 + x_2 + x_3 + x_4 + x_5 = 20$ where each $x_i \geq 2$ [7M]

UNIT-IV

7 a) Solve $a_n-9a_{n-1}+26a_{n-2} -24a_{n-3} =0$ for $n\geq 3$ by generating functions. [7M]

b) Solve the recurrence relation $a_n - 8 a_{n-1} + 21 a_{n-2} - 18 a_{n-3} =0$ for $n \geq 3$ [7M]

OR
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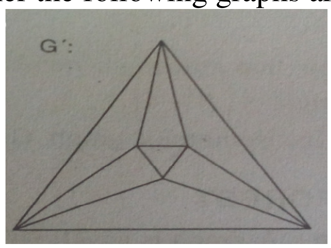
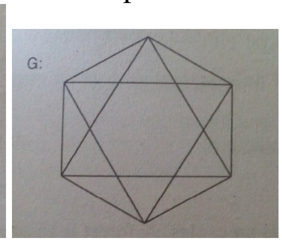
8 a) Solve $na_n + (n-1)a_{n-1} = 2^n$ where $a_0=1$ [7M]

b) Solve $a_n - 2a_{n-1} - 3a_{n-2} = 0$, $n \geq 2$, given $a_0 = -2$, $a_1 = 1$ [7M]

UNIT-V

9 a) Determine whether the following graphs are isomorphic or not. [7M]





b) Draw the binary tree whose level order indices are { 1,2,4,5,8,10,11,20 } [7M]

OR

10 a) What is Planar Grpah? Find whether K_5 is planar or not. [7M]

b) How many different non-isomorphic trees are there of order [7M]

i) 2 ii) 5

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UNIT-I

1 a) Obtain the principal conjunctive normal forms of the formula $Q \wedge (P \vee \sim Q)$ [7M]

b) Without using the truth table, prove that $\neg p \rightarrow q \rightarrow r \equiv q \rightarrow p \vee r$ [7M]

OR

2 a) Express $P \uparrow Q$ in terms of $\downarrow$ only. [7M]

b) Show that $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \rightarrow R) \wedge (Q \rightarrow S)$ using Automatic Theorem Proving [7M]

UNIT-II

3 a) Let A= {2,4,6,8,10,12}, show that the relation 'divides' is a partial ordering on A and draw Hassie diagram [7M]

b) Show that $R \cap S$ is symmetric if R and S are symmetric on a set A. [7M]

OR

4 a) If (G, *) is an abelian group, show that $a * b^2 = a^2 * b^2$ [7M]

b) Let X={1,2,3,4} if R={(x,y)|(x-y) is integer non zero multiple of 2} and S={(x,y)|(x-y) is integer non zero multiple of 5} find R U S and $R \cap S$ [7M]

UNIT-III

5 a) Find the number of non negative integral solutions to $X_1+X_2+X_3+X_4+X_5=10$ [7M]

b) Find the coefficient of $x_1^4x_2^5x_3^6x_4^3$ in $(x_1 + x_2 + x_3 + x_4)^{18}$ [7M]

OR

6 a) How many integral solutions are there of $x_1 + x_2 + x_3 + x_4 + x_5 = 30$ where for each i, $x_i \geq 1$ [7M]

b) In how many ways can 14 people be distributed into 6 teams where in some order 2 teams have 3 each and 4 teams have 2 members each [7M]

UNIT-IV

7 a) What are second order linear homogeneous recurrence relations? Give the general solution for them. [7M]

b) Solve the recurrence relation $a_n + a_{n-1} - 6a_{n-2} = 0$ for $n \geq 2$. Given $a_0=-1$ and $a_1=8$ [7M]

OR
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8 a) Solve $a_n - 4a_{n-1} + 4a_{n-2} = 4^n$ [7M]

b) Solve the following recurrence relation [7M]
$a_n + 6a_{n-1} + 8a_{n-2} = 0$, $n \geq 2$, $a_0 = 2$, $a_1 = -7$

UNIT-V

9 a) Explain the Prim's algorithm for finding Minimal Cost Spanning Tree with an example. [7M]

b) Draw the binary tree for the sequence of numbers {2,1,5,6,8,9,7,3,4} [7M]

OR

10 a) What are the rules for constructing a Hamiltonian path and Hamiltonian cycle. [7M]

b) Let C_n be a Cycle graph with n vertices. Prove that C_5 is the only cycle graph isomorphic to its complement [7M]

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UNIT-I

1 a) Obtain the principal disjunctive normal forms of the formula [7M]
$P \rightarrow (P \wedge (Q \rightarrow P))$

b) Prove or disprove the validity of the following arguments [7M]
Some rational numbers are powers of 3.
All integers are rational numbers.
Therefore, some integers are powers of 3.

OR

2 a) Express $P \leftrightarrow Q$ using $\downarrow$ only. [7M]

b) Prove that $\exists x(P(x) \wedge S(x), \forall x(P(x) \rightarrow R(x) \Rightarrow \exists x(R(x) \wedge S(x))$ [7M]

UNIT-II

3 a) Let X = {1, 2, 3, 4, 5, 6, 7} and R= {(x,y)/ x-y is divisible by 3} in X. show that R is an Equivalence Relation. [7M]

b) Draw Hasse diagram representing the partial ordering on {(a,b) : a | b} on {1,2,3,4,6,12,24,36,48}. [7M]

OR

4 a) Let A be a set with n elements and P(A) is its power set. Show that cardinality of P(A) is 2^n [7M]

b) Determine whether the binary * defined as commutative and whether it is associative on the set Z where a*b=a-b [7M]

UNIT-III

5 a) In how many ways can you select at least one king, if you choose five cards from a Deck of 52 cards [7M]

b) Write short notes on following w.r.to number theory. [7M]
- divisibility theorem, GCD, Fundamental theorem of Arithmetic

OR

6 a) Define binomial theorem? What is the coefficient of $x^{101} y^{99}$ in the expansion of $(2x-3y)^{200}$ [7M]

b) In how many ways can 23 different books be given to 5 students so that 2 of the students will have 4 books each and the other 3 will have 5 books each [7M]
~~~~~~~~~~~~~~~~~~~~~~~~~

UNIT-IV

7 a) Solve the recurrence relation $a_n - 7a_{n-1} + 10a_{n-2} = 0$ for $n \geq 2$ using generating functions. [7M]

b) Solve the recurrence relation $a_n^2 - 2\,a_{n-1}^2 = 0$ for $n \geq 1$ where $a_0 = 2$ [7M]

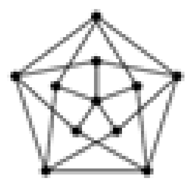
OR

8 a) Solve $a_n - 7a_{n-1} + 10a_{n-2} = 4^n$ [7M]

b) Solve the recurrence relation $a_n - 6a_{n-1} + 12a_{n-2} - 8a_{n-3} = 0$ for $n \geq 3$ [7M]

UNIT-V

9 a) Explain Depth First Search algorithm with the following graph [7M]



b) Prove that in any non directed graph there is an even number of vertices of odd degree [7M]

OR

10 a) What is the chromatic number of the following [7M]
i) C_n ii) K_n iii) $K_{m,n}$ iv) tree with n vertices

b) Find whether $K_{3,3}$ is planar or not. [7M]