



# INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

Dundigal, Hyderabad - 500 043

## COMPUTER SCIENCE AND ENGINEERING

### QUESTION BANK

Course Title	MATHEMATICS FOR COMPUTING				
Course Code	AITD01				
Program	B.Tech				
Semester	III	CSE			
Course Type	Core				
Regulation	BT 23				
Course Structure	Theory			Practical	
	Lecture	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Course Coordinator	Mr Roopesh Kumar Thota, Assistant Professor				

### COURSE OBJECTIVES:

The students will try to learn:

I	The fundamental knowledge of statement notations and logical connectives which are used to convert English sentences into logical expressions.
II	The effective use of combinatory principles for calculating probabilities and solving counting problems.
III	Relate practical examples to the functions and relations and interpret the associated operations and terminology used in the context.
IV	The characteristics of generating functions for finding the solution of linear homogeneous recurrence relations.

### COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	<b>Make use of</b> Number system for converting Decimal to binary, octal and hexadecimal and also gray code to binary, Binary to gray code.	Apply
CO 2	<b>Demonstrate</b> notations for reformulating statements in formal logic and validating normal forms.	Understand
CO 3	<b>Demonstrate</b> operations on discrete mathematical structures like sets, functions, lattices for representing the relations among them.	Understand

CO 4	<b>Illustrate</b> rings, integral domains, and field structures with binary operations defined on them.	Apply
CO 5	<b>Apply</b> addition rule and substitution rule for solving the problems of combinatorics.	Apply
CO 6	<b>Develop</b> solutions for recurrence relations and generating functions to obtain terms of equation.	Apply

### QUESTION BANK:

Q.No	QUESTION	Taxonomy	How does this subsume the level	CO's
<b>MODULE I</b>				
<b>NUMBER SYSTEM</b>				
<b>PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS</b>				
1	Explain decimal number system and how to convert decimal numbers to binary, octal and hexadecimal numbers with examples.	Understand	Recall the concept of number system and conversion and explain how to convert decimal number to other formats.	CO 1
2	Explain binary number system and how to convert binary numbers to decimal, octal and hexadecimal numbers with examples.	Understand	Recall the concept of number system and conversion and explain how to convert binary number to other formats.	CO 1
3	Explain octal number system and how to convert octal numbers to binary, decimal and hexadecimal numbers with examples	Understand	Recall the concept of number system and conversion and explain how to convert octal number to other formats.	CO 1
4	Explain hexadecimal number system and how to convert hexadecimal numbers to binary, octal and decimal numbers with examples.	Understand	Recall the concept of number system and conversion and explain how to convert hexadecimal number to other formats.	CO 1
5	Explain gray code and how to convert binary number to gray code and vice versa with neat examples.	Understand	Recall the concept of number system and conversion and explain how to convert binary number to gray code.	CO 1

6	Explain decimal number system and convert following numbers to decimal a) (10101) <sub>2</sub> b) (111.101) <sub>2</sub> c) (4057.06) <sub>8</sub> d) (A0F9.0EB) <sub>16</sub>	Apply	Recall the concept of number system and conversion and apply to convert from one format to other format.	CO 1
7	Explain octal number system and convert following numbers to octal a) (101111010110.110110011) <sub>2</sub> b) (10101111001.0111) <sub>2</sub> c) (378.93) <sub>10</sub> d) (B9F.AE) <sub>16</sub>	Apply	Recall the concept of number system and conversion and apply to convert from one format to other format.	CO 1
8	Explain hexadecimal number system and convert following numbers to hexadecimal a) (1011011011) <sub>2</sub> b) (01011111011.011111) <sub>2</sub> c) (2598.675) <sub>10</sub> d) (756.603) <sub>8</sub>	Apply	Recall the concept of number system and conversion and apply to convert from one format to other format.	CO 1
9	Explain binary number system and convert following numbers to binary a) (52) <sub>10</sub> b) (105.15) <sub>8</sub> c) (367.52) <sub>8</sub> d) (3A9E.B0D) <sub>16</sub>	Apply	Recall the concept of number system and conversion and apply to convert from one format to other format.	CO 1
10	10) Explain gray code representation and convert following binary to gray code a) (10100101) <sub>2</sub> b) (101000101) <sub>2</sub> c) (111000111) <sub>2</sub> d) (100001000) <sub>2</sub>	Apply	Recall the concept of number system and conversion and apply to convert from one format to other format.	CO 1
<b>PART-B LONG ANSWER QUESTIONS</b>				
1	Convert the following binary numbers to decimal numbers. a) 10011 b) 101010 c) 1011011 d) 010001	Understand	Understand the concept of number system and conversion and convert from one format to other.	CO 1

2	Determine whether the following statements are true or false. Show work that supports your answer. a) $(1001)_2 < (5)_{10}$ b) $(0111)_2 = (111)_{10}$ c) $(0011)_2 > 2(10)_d$ d) $(1001)_2 > (1101)_2$	Apply	Recall the concept of number system and conversion and apply to convert from one format to other format.	CO 1
3	Convert the following decimal numbers to hexadecimal numbers. a. 412 b. 93	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
4	Convert the following hexadecimal numbers to decimal numbers. a. 7116 b. DE016 c. ABC16 d. 100116	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
5	Convert the following decimal numbers into positive binary numbers. a. 99 b. 73 c. 213 d. 128	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
6	Convert the following binary numbers into decimal numbers. a. 10101010 b. 11001100 c. 11110000 d. 11111111	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
7	Convert the following hexadecimal numbers into binary numbers. a. AD b. F8 c. C5 d. B9	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
8	Convert the following hexadecimal numbers into decimal numbers. a. A6 b. B0 c. F1 d. E4	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
9	Convert each of the following binary numbers to octal, decimal, and hexadecimal formats. a. $(111011101)_2$ b. $(10101010111)_2$ c. $(111100000)_2$	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1

10	Convert each of the following octal numbers to binary, decimal, and hexadecimal formats. a. (3754) <sub>8</sub> b. (7777) <sub>8</sub> c. (247) <sub>8</sub>	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
11	Convert each of the following decimal numbers to binary, octal, and hexadecimal formats. a. (3479) <sub>10</sub> b. (642) <sub>10</sub> c. (555) <sub>10</sub>	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
12	Convert each of the following hexadecimal numbers to binary, octal, and decimal formats. a. (4FB2) <sub>16</sub> b. (88BAE) <sub>16</sub> c. (DC4) <sub>16</sub>	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
13	Convert each of the following binary numbers to octal, decimal, and hexadecimal formats. a. (111011101) <sub>2</sub> b. (10101010111) <sub>2</sub> c. (111100000) <sub>2</sub>	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
14	Convert each of the following octal numbers to binary, decimal, and hexadecimal formats. a. (3754) <sub>8</sub> b. (7777) <sub>8</sub> c. (247) <sub>8</sub>	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
15	Convert each of the following decimal numbers to binary, octal, and hexadecimal formats. a. (3479) <sub>10</sub> b. (555) <sub>10</sub> c. (642) <sub>10</sub>	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
16	Convert each of the following hexadecimal numbers to binary, octal, and decimal formats. a. (4FB2) <sub>16</sub> b. (88BAE) <sub>16</sub> c. (DC4) <sub>16</sub>	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1

17	Convert the following binary numbers to decimal numbers a. 0.1101 b. 0.11001 c. 0.00111 d. 0.01011	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
18	Convert the following binary numbers to decimal numbers: a. 11010.11 b. 10111.011 c. 110101.0111 d. 11010101.10111	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
19	Convert the following decimal numbers to binary numbers: a. 0.25 b. 0.21875 c. 0.28125 d. 0.59375	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
20	Convert the following binary number to gray code: a. 0100011110 b. 1001111111 c. 010100010 d. 00011101001	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
<b>PART-C SHORT ANSWER QUESTIONS</b>				
1	Define Number System	Remember	Recall the concept of number systems.	CO 1
2	Describe Decimal Number System	Remember	Recall the concept of decimal number systems.	CO 1
3	Describe Binary Number System.	Remember	Recall the concept of binary number systems.	CO 1
4	Define Octal Number System	Remember	Recall the concept of octal number systems.	CO 1
5	Define Hexadecimal Number System	Remember	Recall the concept of hexadecimal number systems.	CO 1
6	Describe Gray code	Remember	Recall the concept of gray code.	CO 1
7	Convert binary number to decimal number with an example.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
8	Convert binary number to octal number with an example.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1

9	Convert binary number to hexadecimal number with an example.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
10	Convert the decimal number to hexadecimal number with an example.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
11	Convert the decimal number into octal number with an example.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
12	Convert the decimal number into binary number with an example.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
13	Convert the hexadecimal number into binary number with an example.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
14	Convert the hexadecimal number into octal number with an example.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
15	Convert the hexadecimal number into decimal number with an example.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
16	Convert the binary number to gray code with an example	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
17	Convert the gray code to binary number with an example	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
18	Convert each of the following octal numbers to binary, decimal, and hexadecimal formats.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1
19	Convert each of the following decimal numbers to binary, octal, and hexadecimal formats.	Understand	Understand the concept of number system and conversion and convert form one format to other.	CO 1

20	Convert each of the following hexadecimal numbers to binary, octal, and decimal formats.	Understand	Understand the concept of number system and conversion and convert from one format to other.	CO 1
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MODULE II				
MATHEMATICAL LOGIC				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	Determine the negations of the following statements, a) Jan will take a job in industry or go to graduate school b) James will bicycle or run tomorrow. c) If the processor is fast then the printer is slow	Evaluate	Recall and relate the concept of statements and notations Apply the negation on the given statements and simplify compound statement to determine negation connective.	CO 2
2	Express the pdnf of $(p \wedge q) \vee (\sim p \vee r) \vee (q \vee r)$ using truth table.	Remember	—	CO 2
3	Show that: a) $R \wedge (P \vee Q)$ is a valid conclusion from premises $P \vee Q, Q \rightarrow R, P \rightarrow M$ and $\sim M$ . b) $R \rightarrow S$ can be derived from the premises, $P \rightarrow (Q \rightarrow S), \sim R \vee P$ and $Q$	Understand	Recall the statements/propositions/premises. Then demonstrate the derivation of compound Premises.	CO 2
4	Show that the following premises are inconsistent. (a) If jack misses many classes through illness, then he fails high school (b) If jack fails high school, then he is uneducated. (c) If jack reads lot of books, then he is not uneducated. Jack misses many classes through illness and lot of books	Understand	Recall the statements/propositions/premises. Then demonstrate the derivation of compound Premises.	CO 2
5	Select p,q and r be the propositions p: you have the flee q: you miss the final examination r: you pass the course. Translate the following propositions into statement form. (i) $p \rightarrow q$ (ii) $\sim p \rightarrow r$ (iii) $q \rightarrow \sim r$ (iv) $p \vee q \vee r$ (v) $(p \rightarrow \sim r) \vee (q \rightarrow \sim r)$ . (vi) $(p \wedge q) \vee (\sim q \wedge r)$ .	Understand	Recall the statements/propositions/premises. Then demonstrate Translating propositions into statement form.	CO 2

6	Translate the following proposition in symbolic form, and find its negation: “If all triangles are right angled, then no triangle is equiangular”	Understand	Recall the state-ments/propositions/premises. Then demonstrate Translating proposition into symbolic form.	CO 2
7	Rephrase an equivalent formula $\sim(p \leftrightarrow (q \rightarrow (r \vee p)))$ which does not contain any conditional ( $\rightarrow$ ) and biconditional ( $\leftrightarrow$ )	Understand	Recall the normal forms. Then demonstrate of give statement with basic connectives	CO 2
8	Demonstrate principle conjunctive normal form and principle disjunctive normal form with its procedural steps. Obtain the principal disjunctive normal form of $P \rightarrow ((P \rightarrow Q) \wedge \sim(\sim Q \vee \sim P))$ .	Remember	—	CO 2
9	Show the following implication without constructing the truth table: $(P \rightarrow Q) \rightarrow Q \Rightarrow P \vee Q$	Understand	Recall the Logical connectives. Then explain the concept by Constructing truth table.	CO 2
10	Explain the validity of the argument: $[(P \rightarrow Q) \wedge (\sim R \vee S) \wedge (P \vee R)] \rightarrow [\sim Q \rightarrow S]$ Using the rule of contradiction.	Understand	Recall the concept of rule of Contradiction. Then find the valid argument.	CO 2
<b>PART-B LONG ANSWER QUESTIONS</b>				
1	Define conditional proposition and logical equivalence with suitable examples.	Remember	—	CO 2
2	a. Explain the term tautology? Show that $[(p \rightarrow q) \rightarrow r] \rightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$ is tautology. b. Define the converse, inverse and contra positive of the following propositions: I. $P \rightarrow (Q \rightarrow R)$ II. $(P \wedge (P \rightarrow Q)) \rightarrow Q$ .	Understand	Recall and match the given statement is a tautology. summarize rules of implication and logical connectives to construct truth tables.	CO 2

3	Show that $S \vee R$ is a tautologically implied by $(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow s)$	Understand	Recall and relate the concept of connectives and outline the required expression from the compound statement	CO 2
4	Show that $R \vee S$ is valid conclusion from the premises: $C \vee D, (C \vee D) \rightarrow \sim H$ , $\sim H \rightarrow (A \wedge \sim B)$ , $(A \wedge \sim B) \rightarrow R \vee S$	Remember	—	CO 2
5	a) Prove that i) $\sim (P \uparrow Q) \leftrightarrow \sim P \downarrow \sim Q$ ii) $\sim (P \downarrow Q) \leftrightarrow \sim P \uparrow \sim Q$ Without using truth table. b) Express $p \rightarrow (\sim p \rightarrow q)$ i) in terms of ' $\uparrow$ ' only. ii) in terms of ' $\downarrow$ ' only.	Evaluate	Recall and relate rules of logical connectives. apply the rules of logical connectives and analyze the given proposition. Prove the given statements	CO 2
6	(a) Evaluate the proposition $(p \wedge q) \sim (p \vee q)$ is a contradiction? (b) Evaluate the following statements in symbolic form? i. all men are good ii. no men are good iii. some men are good some men are not good	Evaluate	Recall and Relate rules of Logical connectives. Apply the rules of logical connectives and analyze the truth values of the preposition .justify whether the preposition is either tautology .	CO 2
7	Demonstrate the disjunctive normal form o the formula: $P \rightarrow ((P \rightarrow Q) \wedge \sim (\sim Q \vee \sim P))$ ?	Understand	Recall and relate Normal Forms ,define those forms to find the solution for given Compound Statement.	CO 2
8	Define free and bounded variables with an example?	Remember	—	CO 2
9	(a) Show that if m is an even integer then m+7 is an odd integer by using direct proof? (b) Show each of the following in symbolic form i. all monkeys have tails ii. no monkey has tail iii. some monkey has tails iv. some monkey has no tails	Understand	Recall the Methods of proof. Then explain Concept with given example statements.	CO 2
10	Demonstrate proof by contradiction with example.	Understand	Recall the Methods of proof. Then explain Concept with given example statements.	CO 2

11	i. Explain the direct proof of the statement “The square of an odd integer is an odd integer”. ii. Explain the indirect proof of the statement. “If $n^2$ is odd, then $n$ is odd”	Understand	Recall the Methods of proof. Then explain Concept with given example statements.	CO 2
12	Define the converse for the statement “If a quadrilateral is a parallelogram, then its diagonals bisect each other”.	Understand	Recall the Methods of proof. Then explain Concept with given example statements.	CO 2
13	Define the inverse for the statement “If a triangle is not isosceles, then it is not equilateral”.	Apply	Recall and relate the rules of inverse. Choose appropriate rule to obtain conclusion.	CO 2
14	What is principal disjunctive normal form for $(p \wedge q) \vee (\sim p \wedge r) \vee (q \wedge r)$ ?	Remember	—	CO 2
15	What is PCNF of $(P \vee R) \wedge (P \vee \sim Q)$ Also find its PDNF, with using truth table.	Remember	—	CO 2
16	Show that the following argument is valid: $p \rightarrow q, r \rightarrow q, r \Rightarrow p$	Understand	Relate the rules of inference. And outline given example statements as a valid statement	CO 2
17	Show that the hypothesis, “It is not sunny this afternoon and it is colder than yesterday”, “we will go swimming only if it is sunny”, “If we do not go swimming, then we will take a canoe trip” and “If we take a canoe trip, then we will be home by sunset” lead to the conclusion “We will be home by sunset”	Understand	Relate the rules of inference. And outline given example statements as a valid statement	CO 2
18	Determine the validity of the following argument: If 7 is less than 4, then 7 is not a prime number, 7 is not less than 4. Therefore 7 is a prime number.	Evaluate	Recall and relate the rules of inference. apply the rules of inference and then analyze the validity of the statement. And determine the given argument	CO 2

19	Apply rules of inferences to obtain the conclusion of the following arguments: “Babu is a student in this class, knows how to write programs in JAVA”. “Everyonewho knows how to write programs in JAVA can get a high-paying job”. Therefore, “someone in this class can get a high- paying job”.	Apply	Recall and relate the rules of inference. Choose appropriate rule to obtain conclusion.	CO 2
20	Use the indirect method to prove that the conclusion $\exists zQ( z )$ follows form the premises $\forall x (P (x) Q (x) )$ and $\exists yP ( y )$ .	Analyze	Recall and relate the type of quantifier Make use of indirect method to find the solution	CO 2
<b>PART-C SHORT ANSWER QUESTIONS</b>				
1	Define statement and atomic statement.	Remember	—	CO 2
2	Explain logical equivalence with an example.	Understand	Recall logical equivalence and Then Demonstrate equivalence with an example.	CO 2
3	Define the identity ,Inverse and domination laws through truth tables.	Understand	Recall identity, inverse and Then Demonstrate equivalence with a truth table.	CO 2
4	Write the converse, inverse and contra positive for the following Proposition : $P \rightarrow (Q \rightarrow R)$ .	Remember	—	CO 2
5	Illustrate NAND and NOR with examples.	Apply	Define NAND and NOR. relate those concepts to construct truth tables.	CO 2
6	Demonstrate conditional and biconditional statements.	Understand	Recall logical connectives and demonstrate rules of conditional And biconditional with an example	CO 2
7	Define contradiction and tautology with examples.	Remember	—	CO 2

8	Recall the definition for contradiction and provide a proof by contradiction of the following statement: For every integer “n“, if $n^2$ is odd then “n“ is odd.	Apply	Recall and Relate contradiction and proof by contradiction with the given statement	CO 2
9	Define converse, contra-positive and inverse of implication.	Understand	Recall the concepts of converse, inverse and contrapositive	CO 2
10	Translate the following statements in to symbolic form: a) all men are good; no men are good	Understand	Recall Statements, Notations and define symbolic forms to rephrase compound statements.	CO 2
11	Write the disjunctive normal form of the formula: $P \leftrightarrow Q$ .	Remember	—	CO 2
12	Show the value of: $P \leftrightarrow Q$ in terms of $\{\sim, \vee\}$ only.	Understand	Recall Statements, Notations and define symbolic forms to rephrase compound statements.	CO 2
13	Define free and bound variables with examples.	Remember	—	CO 2
14	Explain about the statement “if “m“ is an even integer then $m+7$ is an odd integer” by indirect proof.	Understand	Recall Methods of proof. Then Explain Concept of validity of statement with an example.	CO 2
15	Find the truth table for conjunction and conditional statements?	Understand	Recall and relate connectives concept. Then demonstrate Constructing truth table with an example.	CO 2
16	Find the truth table for $p \rightarrow (q \rightarrow r)$ ?	Understand	Recall Implication connectivity rule. Then demonstrate Implication for constructing truth table	CO 2
17	show whether $p \vee [\sim (p \wedge q)]$ is tautology or not.	Understand	Recall and relate the concepts of Connectives to find the Tautology for given compound Statement.	CO 2

18	R: Mark is rich. H:Mark is happy Translate the statements into symbolic form a) mark is poor but happy b) mark is poor but not happy	Understand	Recall the concepts of Statements and notations and relate symbolic forms to translate the statements into compound statements.	CO 2
19	Translate the following statement into symbolic form: “the crop will be destroyed if there is a flood”.	Understand	Recall Statements and notations and relate symbolic forms to translate the statements into compound statements	CO 2
20	show whether $(p \vee q) \vee \sim p$ is a tautology or not.	Understand	Recall the basic connectives and relate the concept to solve the given compound Statement.	CO 2

MODULE III				
RELATIONS, FUNCTIONS AND LATTICES				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1	How many relations are there on a set with 'n' elements? If a set A has 'm' elements and a set B has 'n' elements, how many relations are there from A to B? If a set A = 1, 2, Find all relations from A to A.	Understand	Relate the concept of Relations and show to write the pairs in the relation	CO 3
2	Consider sets A=a,b,c B=1,2,3,R=(a,1),(b,1),(c,2),(c,3) and s=(a,1),(a,2),(b,1),(b,2) from A to B. Define (i) $\bar{R}$ (ii) $\bar{S}$ (iii) $R \cup S$ (iv) $R \cap S$ (v) $R^c S^c$	Understand	Recall the concepts of set and functions	CO 3
3	Let A={1,2,3,4,6,12} on set A define the relation A to B, iff A divides B.. Show that R is partial order relation and draw the Hasse diagram form this relation.	Remember	—.	CO 3
4	define a relation R by $aRb$ if and only $a^2 = b^2$ verify that R is an equivalence relation.Determine the partition induced by its relation on the set Z of all integers.	Understand	Recall types of lattices and explain each type with an example.	CO 3
5	Explain with reasons whether the following functions are bijective or not. Find also the inverse of each of the functions. (i) $f(x) = 4x+2$ , A = set of real numbers $f(x) = 3+1/x$ , A= set of non- zero real numbers	Understand	Recall the concept of Function and their types and find the functions on given sets.	CO 3



6	a. function $f: Z \times Z \rightarrow Z$ is defined by $f(x,y)=4x+5y$ . Show that $f$ is not one-to-one, but not onto? b. Let $f(x) : x^2 - 3x + 2$ . Find $f(x^2)$ and $f(x+3)$ ?	Understand	Relate the concept of Function and their types and find functions for given equations	CO 3
7	Explain in brief about Inversive and Recursive functions with examples?	Understand	Relate the concept of Inverse Function and Recursive Function and explain with an example	CO 3
8	Let $A=\{1,2,3,4\}$ , $B=\{a,b,c\}$ , $C=\{w,x,y,z\}$ with $f:A \rightarrow B$ and $g:B \rightarrow C$ given by $f=\{(1,a),(2,a),(3,b),(4,c)\}$ and $g=\{(a,x),(b,y),(c,z)\}$ Find $g \circ f$ and $f \circ g$ .	Understand	Recall the types of Functions and Demonstrate the composite function.	CO 3
9	If $(A, \leq)$ , and $(B, \leq)$ , are posets, then Show that $(A \times B, \leq)$ is a poset with partial order $\leq$ defined as $(a, b) \leq (a', b')$ , if $a \leq a'$ in $A$ , if $b \leq b'$ in $B$ .	Understand	Recall relations and demonstrate concept of Partial order sets.	CO 3
10	Consider the following relations on $\{1, 2, 3, 4\}$ : $R_1 = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 1), (4, 4)\}$ , $R_2 = \{(1, 1), (1, 2), (2, 1)\}$ , $R_3 = \{(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 1), (4, 4)\}$ , $R_4 = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$ , $R_5 = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)\}$ , $R_6 = \{(3, 4)\}$ . Show that the relations are reflexive?	Understand	Recall the concept of properties and the operations on relations and find the type of relations.	CO 3
<b>PART-B LONG ANSWER QUESTIONS</b>				
1	Define a relation? Explain the properties of relations and the operations on relations?	Remember	—	CO 3

2	Let $A=\{1,2,3,4,6\}$ and $R$ be a relation on $A$ defined by $aRb$ if and only if $a$ is multiple of $b$ represent the relation $R$ as a matrix and construct its digraph.	Understand	Recall the concepts of relations and functions	CO 3
3	Let $A=\{1,2\}$ and $B=\{p,q,r,s\}$ and let $R$ be a relation from $A$ to $B$ defined by $R=\{(1,q),(1,r),(2,p),(2,q),(2,s)\}$ Find the matrix and digraph of $R$	Understand	Recall the concepts of digraph and relation	CO 3
4	Consider the set $A=\{\text{ball,bed,dog,let,egg}\}$ and define the relation $R$ on $A$ by $R=\{(x,y) \mid x,y \in A \text{ and } x R y \text{ if } x \text{ and } y \text{ contain some letter}\}$ . Show $R$ is a compatibility relation which is not transitive.	Understand	Relate the properties of relations to prove that $R$ is a compatibility relation.	CO 3
5	Find the sets $A$ and $B$ given that $A - B = \{1,2,4\}$ $B - A = \{7,8\}$ and $A \cup B = \{1,2,4,5,7,8,9\}$ .	Understand	Recall the concepts of sets	CO 3
6	Construct the hasse diagram for the divisibility relation i) $A=\{3,6,12,36,72\}$ ii) $A=\{1,2,3,5,6,10,15,30\}$	Apply	Recall and relate the concept of Lattice and make use of divisibility relation to construct the hasse diagram for the given sets.	CO 3
7	Let $A$ be a given finite set and $p(\theta)$ its power set. Let $\leq$ be the inclusion relation on the elements $p(\theta)$ Construct the hasse diagram of $(P(A), \subseteq)$ i) $A=\{a\}$ ii) $B=\{a,b\}$ iii) $C=\{a,b,c\}$ iv) $D=\{a,b,c,d\}$	Apply	Recall and Relate the concept of Lattice and make use of subset to construct the hasse diagram for the given sets.	CO 3
8	Construct the hasse diagram represented with positive divisors of 36?	Apply	Recall and Relate the concept of Lattice and make use of subset to construct the hasse diagram for the given relation	CO 3

9	Define a) onto function. b) one to one function. Bijective function. c) constant function with suitable examples.	Remember	—	CO 3
10	Find the inverse of the function of the following: i) $f(x) = 10/5\sqrt{7} - 3x$ ii) $4.e^{(6x+2)}$	Apply	Recall and Relate the concepts of functions and apply on the given statements	CO 3
11	If A is finite set and P(A) is Power set then Show that $(P(A), \subseteq)$ is a lattice for i) $A = \{a\}$ ii) $A = \{a, b\}$	Apply	Recall and Relate the concept of lattices and apply on set	CO 3
12	What are the differences between bounded lattice and distributive lattice? Justify with an example.	Remember	—	CO 3
13	Explain the relation $a R b$ if $a \leq b$ in $\{1, 2, 3, 4\}$ in by their matrix and digraph.	Understand	Recall Types of relations and show its matrix representation.	CO 3
14	Find the recurrence relation satisfying the equation: $y_n = A(3)^n + B(-4)^n$	Understand	Recall the recurrence relations and find the solution for the given equation	CO 3
15	(a) Define binary relation? Give properties of binary relation. (b) Let P(A) be the power set of any non empty set A, then Find that the relation $\subset$ of set inclusion is not an equivalence relation.	Understand	Recall the concept of relations	CO 3
16	Show that every chain is a distributive Lattice. Justify with an example	Understand	Recall the concept of Lattice and the types of lattices explain with an example.	CO 3
17	Illustrate Hasse diagram for $(\{3, 4, 12, 24, 48, 72\}, \mid)$ List out the steps in evaluating Hasse diagram	Understand	Recall concepts of Lattice, divisibility relation to illustrate the hasse diagram for the given sets.	CO 3
18	Illustrate Hasse diagram for $(D\{12\}, \mid)$ , define minimal, maximal, Greatest, Least elements	Understand	Recall the concept of Lattice, divisibility relation to find minimal, maximal, Greatest, Least elements.	CO 3

19	Recall greatest and least elements and explain complemented lattice with an example.	Remember	—	CO 3
20	Find the differences between bounded lattice and complemented lattice?	Understand	Recall the concepts of lattices	CO 3
<b>PART-C SHORT ANSWER QUESTIONS</b>				
1	Define relation and digraph of a relation.	Remember	—	CO 3
2	List the operations on relations?	Remember	—	CO 3
3	What is Reflexive,symmetric and irreflexive relation?	Remember	—	CO 3
4	Explain Union,complement,converse and intersection of relation.	Understand	Recall the properties of relations and show the Symmetric relation with an example.	CO 3
5	Define Irreflexive relation.	Remember	—	CO 3
6	What is Compatibility relation?	Remember	—	CO 3
7	Explain Transitive relation.	Understand	Recall the properties of relations and show the Transitive relation with an example.	CO 3
8	Define a partial order relation.	Remember	—	CO 3
9	What is meant by equivalence relation?	Remember	—	CO 3
10	Find In degree and Out degree for digraph.	Remember	—	CO 3
11	Find $A \times B$ and $B \times A$ where $A = \{1,2,3\}$ , $B=\{4,5\}$ ?	Remember	—	CO 3
12	Define onto function and one to one function	Remember	—	CO 3
13	What is bijective and constant function?	Remember	—	CO 3
14	Define identity and constant function.	Remember	—	CO 3

15	Prove that if R satisfies any two of the properties: irreflexive, symmetric and transitive. Let R be a non-empty relation on set A, then it can not satisfy the third?	Remember	—	CO 3
16	Prove that R is an equivalent relation on set A, then so is $R^c$ ?	Remember	—	CO 3
17	Find inverse of f(x) and g(x) where $f(x) = x^3, g(x) = 2x + 3$ ?	Remember	—	CO 3
18	Explain about lattice. If A is finite set and P(A) is power set then prove that $(P(A), \subseteq)$ is a lattice for $A = \{a\}$	Remember	—	CO 3
19	List the properties of lattice with example.	Remember	—	CO 3
20	Demonstrate about distributive lattice with example.	Remember	—	CO 3

#### MODULE IV

#### ALGEBRAIC STRUCTURES AND COMBINATORICS

#### PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS

1	Solve whether the following algebraic systems satisfy the properties under binary operations * and + (a) Odd integers. (b) All the positive integers.	Apply	Recall and recall algebraic structures Then solve the problem using binary operators.	CO 4
2	Solve that $(Z, *)$ is an abelian group where Z is a set of integers and the binary operations * is defined as $a*b = a+b-3$	Apply	Recall and relate the concept of groups Then identify the structure to which it belongs to	CO 4
3	If o is an operation on Z defined by $xoy = x+y+1$ , Prove that $(Z, o)$ is an abelian group.	Evaluate	Recall and relate the concept of groups Then conclude the group is an abelian structure	CO 4

4	On the set $Q$ of all rational numbers, the operation $*$ is defined by $a * b = a + b - ab$ . Show that, under this operation $Q$ forms a commutative monoid.	Understand	Recall binary operations Then demonstrate it is commutative monoid	CO 4
5	Show that a group $G$ is abelian iff $(ab)^{-1} = a^{-1}b^{-1}$ for all $a, b \in G$ .	Understand	Recall the concept of groups Then show $ab=ba$ and the group belongs to abelian	CO 4
<b>CIE-II</b>				
6	Choose the number of rows of 6 Americans, 7 Mexicans and 10 Canadians in which an American invariably stands between a Mexican and a Canadian never stand side by side.	Understand	Recall the concept of probability and combinotrics	CO 5
7	From the words. (a) TALLAHASSEE (b) MISSISSIPPI How many arrangements can be made such that, (a) No two letters A of TALLAHASSEE appear together Number of 4 letter words for both the given words.	Understand	Recall the concept of probability and combinotrics	CO 5
8	Find in how many integers between 1 and 104 contain exactly one 8 and one 9.	Remember	—	CO 5
9	Choose in how many integers between $10^5$ and $10^6$ , (i) Have no digit other than 2,5 or 8 Have no digit other than 0,2,5 or 8.	Apply	Recall and Relate the concept of probability and combinotrics and apply on the given problem	CO 5
10	How many arrangements are there for the word 'MISSISSIPPI' with no two pair of consecutive same letters?	Understand	Recall the concept of probability and combinotrics	CO 5
<b>PART-B LONG ANSWER QUESTIONS</b>				
1	Define Ring. Explain Commutative ring and ring with unity.	Remember	—	CO 4

2	Let $G$ be the set of all non-zero real numbers and let $a*b = \frac{1}{2}ab$ . Show that $(G, *)$ is an abelian Group.	Understand	Recall the algebraic structures their conditions Then show given abelian structure as a group	CO 4
3	Let $G$ be the set of real numbers not equal to -1 and $*$ be defined by $a*b = a+b+ab$ . Show that $(G, *)$ is an abelian Group.	Understand	Recall the algebraic structures their conditions Then show given abelian structure as a group	CO 4
4	Show that in a group $(G, *)$ for every $a, b \in G$ $(a*b)^2 = a^2 * b^2$ if $(G, *)$ is an abelian.	Understand	Recall the algebraic structures their conditions Then show given abelian structure as a group	CO 4
5	Show that If $A = \{1, -1, i, -i\}$ are the fourth roots of unity. Show that $(A, *)$ forms a group.	Remember	—	CO 4

CIE-II				
6	Solve that the number of ways we can select the counting rules from the class which having 6 boys and 5 girls?	Apply	Recall and relate permutations and combinations Then identify number of possibilities to obtain required solution.	CO 5
7	If a person is having 4 trousers and 3 shirts then Find the number of ways of selecting a pair?	Understand	Relate permutations and combinations Then find number of possibilities to obtain required solution.	CO 5
8	Find, If a person has four transport modems for travelling from(Hyd to Chennai) and three transport modems travelling from(Chennai to Bangalore) then find the no of ways of the person travelling from (Hyd-Bangalore) via Chennai	Understand	Relate permutations and combinations Then find number of possibilities to obtain required solution.	CO 5
9	a) Select the number of ways of forming threedigit numbers from 5elements? Find thenumber of ways of selecting 9 members committee with 7 persons?	Understand	Relate permutations and combinations Then find number of possibilities to obtain required solution.	CO 5
10	Solve that the number of ways of arranging 5 boys and 4 girls in a line and the line can start with boy and end with boy also?	Understand	Relate permutations and combinations Then find number of possibilities to obtain required solution.	CO 5
11	Find the number of ways of forming committee of 5 persons from a group of 5 Indians 4 Russians such that three are at least 3 Indians committee.	Understand	Relate permutations and combinations Then find number of possibilities to obtain required solution.	CO 5
12	Solve that the number of ways forming a 4 letter word from the word MIXTURE in which at least one letter is repeated?	Understand	Relate permutations and combinations Then find number of possibilities to obtain required solution.	CO 5



13	Find the number of ways we can distribute 12 identical pencils to 4 children such that every children get at least one pencil?	Understand	Relate permutations and combinations Then find number of possibilities to obtain required solution.	CO 5
14	Explain in how many ways we can distribute 12 identical pencils to 4 children such that every child get at least one pencil?	Understand	Recall permutations and combinations Then Find number of possibilities to obtain required solution.	CO 5
15	Let $(S, \subseteq)$ be a semi group, then Show that there exists a homomorphism $g : S \rightarrow S^S$ where $\langle S^S, \circ \rangle$ is a semi group of a function from S to S under the operation of the Composition.	Understand	Relate the concept of Abelian structures. Then Find homomorphism existence.	CO 5
16	Explain Groups, Subgroups and Normal Subgroups.	Understand	Recall Abelian structures. compare the difference between them.	CO 5
17	Let G be a group and let $Z = \{a : ax = xa \text{ for all } x \in G\}$ is a centre of the group G. Then Show that “Z” is a normal subgroup of G	Understand	Relate the concept of abelian structures. Then demonstrate subgroup	CO 5
18	a. Explain that if 8 cars 26 passengers at least one car has 4 or more passengers. b. A library contains 30 books whose total number of pages are 2560 show that one of the books must have at least 86 pages.	Understand	Recall permutations and combinations Then find number of possibilities to obtain required solution.	CO 5
19	A person writes letters to five friends and addresses on the corresponding envelopes. How many ways can the letters be placed in the envelopes so that: (i) All the letters are in the wrong envelopes. (ii) At least two of them are in the wrong envelopes.	Apply	Recall and Relate the concepts of permutations and combinations	CO 5

20	How many arrangements can be made out of the letters of the word “ENGINEERING”? (b) 25 buses are running between two places P and Q. In how many ways can a person go from P to Q and return by a different bus?	Remember	—	CO 5
<b>PART-C SHORT ANSWER QUESTIONS</b>				
1.	Define group and semi group.	Remember	—	CO 4
2.	Explain monoid and sub group.	Understand	Recall binary operations and then Explain abelian structures	CO 4
3.	What is homomorphism?	Remember	—	CO 4
4.	Define isomorphism.	Remember	—	CO 4
5.	Show if a, b are elements of M and $a*b=b*a$ , then $(a*b)*(a*b)=(a*a)*(b*b)$ where $(M,*)$ is an algebraic system.	Understand	Recall the properties of binary operations and Then find whether it is an algebraic structure or not	CO 4
6.	Explain whether the given table with respect to operation * on the set $A=a,b$ is a semi group or monoid	Understand	Recall the properties of binary operation, concept of monoid and semi group Then find whether it is semi group or monoid	CO 4
7.	Let $(G,*)$ be a group and let $a,b \in G$ , then Identify $(a^{-1})^{-1}=a$	Apply	Recall and relate the concept of groups make use of different operations to identify abelian structure.	CO 4
8.	Show that the function from ${}_iZ, +_i$ to ${}_iE, +_i$ defined by $f(x)=x^2$ for all $x \in Z$ is not a homomorphism.	Understand	Recall the homomorphism and its functions Then demonstrate concept with given example equation	CO 4
9.	Consider the semi groups ${}_iZ, +_i$ and ${}_iE, +_i$ . Show the function $f:Z \rightarrow E$ by $f(x)=2x$ for all $x \in Z$ is a isomorphism.	Understand	Recall the isomorphism and its functions Then demonstrate concept with given example equation	CO 4
10.	Define Subgroup.	Remember	—	CO 4

11.	Explain Submonoid with examples.	Understand	Recall the abelian structures Then demonstrate submonoid with an example	CO 4
<b>CIE-II</b>				
1.	Explain the number of ways we can select the counting rules from the class Which having 6 boys and 5 girls	Understand	Relate the concept of permutations and combinations Then find number of possibilities	CO 5
2.	If a person having 4 trousers and 3 shirts then find the number of ways of selecting a pair?	Understand	Relate the concept of permutations and combinations Then find number of possibilities	CO 5
3.	Find the number of ways of forming three-digit number from 5 elements?	Understand	Relate the concept of permutations and combinations Then find number of possibilities	CO 5
4.	Explain the number of ways of selecting 9 committees with 7 persons.	Understand	Relate the concept of permutations and combinations Then find number of possibilities	CO 5
5.	Choose the number of ways forming a 4-letter word from the word MIXTURE in which at least one letter is repeated.	Remember	—	CO 5
6.	Find that if there are 8 cars and 26 passengers at least one car has 4 or more passengers?	Remember	—	CO 5
7.	A library contains 30 books whose total number of pages is 2560. Show that one of the books must have at least 86 pages.	Understand	Relate the concept of permutations and combinations Then find number of possibilities	CO 5
8.	Explain how many words of three distinct letters can be formed from the letters of the word MAST.	Understand	Relate the concept of permutations and combinations Then find number of possibilities	CO 5
9.	Explain, that in how many different outcomes are possible by tossing 10 similar coins?	Understand	Relate the concept of permutations a combinations Then find number of possibilities	CO 5

10.	How many different 8digit numbers can be formed by arranged digits 1, 1,1,1,2,3,3,3.	Remember	—	CO 5
11.	How many numbers can be formed using the digits 1, 3, 4,5,6,8 and 9 if no repetitions are allowed?	Remember	—	CO 5
12.	Find number of ways to seat 10 boys and 10 girls around a circular table, if boys and girls seat alternatively?	Remember	—	CO 5
13.	How many ways can the digits 0,1,2,3,4,5,6,7,8,and 9 be arranged so that 0 and 1 are adjacent and in the order of 01?	Remember	—	CO 5
14.	How many ways two slices of pizza can be chosen from a plate containing one slice each of pepperoni, sausage, mushroom, and cheese pizza?	Remember	—	CO 5
15.	Find the number ways for five letter passwords can be generated using first three letters as any of the English alphabets and last two being any digit from 0 to 9?(repetition is allowed)	Remember	—	CO 5
16.	Explain sum rule and product rule with suitable examples.	Understand	Relate the concept of sum and product rule and demonstrate with an example	CO 5
17.	If a person is having 3 shirts and 5 ties then Identify the number of ways of selecting a pair.	Apply	Recall and relate the concept of permutations and combinations Then identify number of possibilities	CO 5

MODULE V				
RECURRENCE RELATION				
PART A-PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS				
1.	Solve the recurrence relation $a_n - 4a_{n-1} + 4a_{n-2} = 0, n \geq 2, a_0 = 5/2, a_1 = 8$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by generating function	CO 6
2.	Find the general solution of the recurrence relation $a_n + a_{n-3} = 0, n \geq 3$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by generating function	CO 6
3.	Solve the recurrence relation $a_{n+2} + 3a_{n+1} + 2a_n = 3a_n$ for $n \geq 0$ , given $a_0 = 0, a_1 = 1$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by generating function	CO 6
4.	Identify the co-efficient of $x^{52}$ of $(x^4 + x^5 + x^6)^5$ $(x^4 + 2x^5 + 3x^6)^5$	Apply	Recall and relate series expansion. Then solve the given equation to find the co-efficient	CO 6
5.	Solve the recurrence relation $a_n - 3a_{n-1} - 2a_{n-2} = 0$ , $n \geq 2$ where $a_0 = 5, a_1 = 3$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
6.	Solve the recurrence relation $a_{n+3} - 3a_{n+2} + 3a_{n+1} - a_n = 3 + 5n, n \geq 0$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
7.	Solve the recurrence relation $a_n + 4a_{n-1} + 4a_{n-2} = 8$ , for $n \geq 2$ , and $a_0 = 1, a_1 = 2$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
8.	Find the general solution of recurrence relation $S_{(k)} - 3s_{(k-1)} - 4s_{(k-2)} = 4^k$ , $k \geq 2$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
9.	Find a generating function for the recurrence relation $a_{n+1} - a_n = n^2, n \geq 0$ and $a^0 = 1$ hence solve it	Remember	Recall the concept of recurrence relation. Then solve the given equation by generating function	CO 6

10.	Using Generating function solve the recurrence relation $a_n - a_{n-1} - 6a_{n-2} = 0$ and given $a_0 = 2, a_1 = 1$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods.	CO 6
<b>PART-B LONG ANSWER QUESTIONS</b>				
1.	Write the generating functions for the following sequences i)1,2,3,4 ii)1,-2,3,-4 iii)0,1,2,3 iv)0,1,-2,3,-4	Understand	Recall and relate series expansion. Then solve the given sequence to find a generating function	CO 6
2.	Write the generating function for the following sequence i) $1^2, 2^2, 3^2, \dots$ – ii) $0^2, 1^2, 2^2, 3^2, \dots$	Understand	Recall and relate series expansion. Then solve the given sequence to find a generating function	CO 6
3.	Write the generating function for the following sequence i) $1^3, 2^3, 3^3, \dots$ — ii) $0^2, 1^3, 2^3, 3^3, \dots$	Understand	Recall and relate series expansion. Then solve the given sequence to find a generating function	CO 6
4.	write the generating function for the following sequence 1,1,0,1,1,1	Understand	Recall and relate series expansion. Then solve the given sequence to find a generating function	CO 6
5.	Find the co-efficient of $x^{12}$ of $x^3(1-2x)^{10}$ ?	Remember	—	CO 6
6.	Find the co-efficient of $x^5$ of $(1-2x)^{-7}$ ?	Remember	—	CO 6
7.	Write the co-efficient of $x^{27}$ of i) $(x^4 + x^5 + x^6)^5$ ii) $(x^4 + 2x^5 + 3x^6)^5$	Understand	Recall and relate series expansion. Then solve the given equation to find the co-efficient	CO 6
8.	Solve the recurrence relation $a_n = a_{n-1} + n^3, n \geq 1$ where $a_0 = 5$ by using substitution method?	Remember	—	CO 6
9.	Solve the recurrence relation $a_n = a_{n-1} + 3a_{n-2} + 3n, n \geq 1$ where $a_0 = 5$ by using substitution method?	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6

10.	Solve the recurrence relation $a_{n+1} = 8a_n, n \geq 0$ where $a_0=4$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
11.	Solve the recurrence relation $a_n + a_{n-1} + 10a_{n-2} - 7=0$ $n \geq 2, a_0=10, a_1=41$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
12.	Solve the recurrence relation $a_n - 9a_{n-1} + 26a_{n-2} + 24a_{n-3} = 0, n \geq 3$ $a_0 = 0, a_1 = 1, a_2 = 10$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
13.	Solve the recurrence relation $a_n = 3a_{n-1} + 2n, a_1 = 3$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
14.	Solve the recurrence relation $a_n - 3a_{n-1} = n, n \geq 1$ $a_0 = 1$ by using generating function ?	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by generating function	CO 6
15.	Solve the recurrence relation $a_{n+1} - a_n = 3^n, n \geq 0$ $a_0 = 1$ by using Generating function?	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by generating function	CO 6
16.	Identify the co-efficient of $X^{15}$ of $x^3(1+x)^4(1-x)^4$ ?	Apply	Recall and relate series expansion. Then solve the given equation to find the co-efficient	CO 6
17.	Identify the co-efficient of $X^{10}$ of $(x^3 - 5x)/(1-x)^3$	Apply	Recall and relate series expansion. Then solve the given equation to find the co-efficient	CO 6
18.	Solve the recurrence relation $a_n + a_{n-1} - 6a_{n-2} = 0, n \geq 2$ $a_0 = -1, a_1 = 8$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6

19.	Find a generating function for each of the following sequences (i) 1,1,0,1,1,1,... (ii) 0,2,6,12,20,30,42,... (iii) 8,26,54,92,....	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
20.	Solve recurrence relation $a_n = a_{n-1} + n$ , $n \geq 1$ where $a_0 = 2$ by using substitution method ?	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
<b>PART-C SHORT ANSWER QUESTIONS</b>				
1.	Write the generating function for the following sequence 1,2,3, 4,.....	Understand	Recall and relate the concept of series expansion. Then solve the given sequence to identify a generating function	CO 6
2.	Find the generating function for the following sequence 1, -2,3, - 4,...	Remember	—	CO 6
3.	Demonstrate the generating function for the following sequence 0,1,2,3...	Understand	Recall the series expansion and find Generating function using the given sequence.	CO 6
4.	Write the generating function for the following sequence 0, 1,2,3, -4,...	Understand	Recall and concept of series expansion. Then solve the given sequence to identify a generating function	CO 6
5.	Find the co-efficient of $X^{12}$ of $x^3(1-2x)^{10}$ ?	Remember	—	CO 6
6.	Find the co-efficient of $x^5$ of $(1-2x)^{-7}$	Remember	—	CO 6
7.	Find the co-efficient of $x^{27}$ of $(x^4 + x^5 + x^6 + \dots)^5$	Remember	—	CO 6
8.	What is the generating function for the following sequence $1^2, 2^2, 3^2, \dots$	Remember	—	CO 6
9.	Write the generating function for the following sequence $0^2, 1^2, 2^2, 3^2, \dots$	Understand	Recall and relate the concept of series expansion. Then solve the given sequence to identify a generating function	CO 6



10.	Find the co-efficient of $x^{27}$ of $(x^4 + 2x^5 + 3x^6)^5$	Remember	—	CO 6
11.	Write the generating functions for the following sequence $1^3, 2^3, 3^3, \dots$	Understand	Recall and relate the concept of series expansion. Then solve the given sequence to identify a generating function	CO 6
12.	Solve the recurrence relation $a_n = a_{n-1} + n^3, n \geq 1$ where $a_0 = 5$ by using substitution method ?	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
13.	Solve the recurrence relation $a_n = a_{n-1} + 3n^2 + 3n + 1, n \geq 1$ where $a_0 = 5$ by using substitution method ?	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
14.	Identify the generating function for the following sequence $0^3, 1^3, 2^3, 3^3, \dots$	Apply	Recall and relate series expansion. Then solve the given sequence to find a generating function	CO 6
15.	Solve the recurrence relation $a_{n+1} = 8a_n, n \geq 0$ where $a_0 = 4$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
16.	Solve the recurrence relation $a_{n+1} = 8a_n, n \geq 0$ where $a_0 = 6$	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
17.	Find the generating function for the following sequence $1, 1, 0, 1, 1, 1, \dots$	Remember	—	CO 6
18.	Find the generating function for the following sequence $1, 1, 1, 1, 1, \dots$	Remember	—	CO 6
19.	Find the generating function for the following sequence $1, -1, 1, -1, \dots$	Remember	—	CO 6
20.	Identify the co-efficient of $x^{27}$ of $(x^4 + x^5 + x^6)^5$	Apply	Recall and Relate series expansion. Then solve the given equation to find the co-efficient	CO 6

21.	Solve recurrence relation $a_n = a_{n-1} + n^3, n \geq 1$ where $a_0=5$ by using substitution method ?	Apply	Recall and relate the concept of recurrence relation. Then solve the given equation by substitution methods	CO 6
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**HOD CSE**