Set: B

Slot: A1

SRM Institute of Science and Technology
College of Engineering and Technology
DEPARTMENT OF MATHEMATICS
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu

Academic Year: 2021-22 (Even)

Test : CLAT- II
Course Code & Title : 18MAB302T-Discrete Mathematics for Engineers
Year/ Sem/Branch : II /IV/NWC

Date : 24/05/2022
Duration: 2 Periods
Max. Marks: 50

Course Articulation Matrix:

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	Enhance the mathematical skills by applying the principles of sets and functions in storage, communication and processing the data	
CLR-2 :	Culminate in extensive use of counting strategies in enumeration of data	Blooms level (1 - 6)
CLR-3 :	Apply the rules of inference theory to design electronic circuits and to verify computer programs	
CLR-4 :	Apply the knowledge of algebraic structures and coding theory to solve problems on detection and correction of errors occurring in binary communication channels	
CLR-5 :	Acquire knowledge to solve problems in communication networks using graph models	
CLR-6 :	Apply the concepts of discrete structures to solve problems in Electrical, Communication and Computer Science Engineering	

Course Learning Outcomes (CO):	At the end of this course, learners will be able to:	Learning	Program Learning Outcomes (PO)											
			1	2	3	4	5	6	7	8	9	10	11	12
			Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt & Finance	Life Long Learning
CO-1 :	Apply the concepts of set theory and its operations in data structures and mathematical modelling languages	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-2 :	Solve problems using counting techniques and understanding the basics of number theory	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-3 :	Comprehend and validate the logical arguments using concepts of inference theory	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-4 :	Inculcate the curiosity for applying the concepts of algebraic structures to coding theory	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-5 :	Apply graph theory techniques to solve wide variety of real world problems	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-6 :	Acquire knowledge in mathematical reasoning, combinatorial analysis and discrete structures	4	3	3	-	-	-	-	-	-	-	-	-	-

Q.No	Part – A(10 x 1 = 10 Marks) Instructions: Answer all Questions	Marks	BL	CO	PO	PI Code
1.	There are 6 boys and 4 girls in a group. In how many ways can they sit in a row? A. 10! B. 2 x 6! x 4! C. 6! x 4! D. 2 x 10!	1	2	2	2	1.1.1
2.	How many permutations of the letters A, B, C, D, E, F, G contains the strings BA and GF? A. 120 B. 720 C. 24 D. 6	1	1	2	2	1.1.1
3.	If $\|A\| = 50$ and $\|B\| = 35, \|A \cap B\| = 7$ then $\|A \cup B\|$ is A. 50 B. 78 C. 35 D. 70	1	2	2	2	1.1.1
4.	The $LCM(a, b)$ is always_____ A. Prime B. Negative C. Neither positive nor negative D. Positive	1	1	2	1	1.1.1

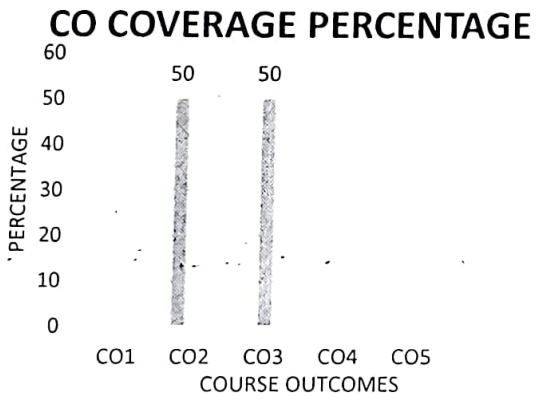
5.	Find m when $512m + 320n = 64$ and $n = -3$. A. 2 B. 3 C. 4 D. 5	1	1	2	2	1.1.1
6.	According to the principle of mathematical induction, if $p(k+1) = 3m^{k+1} + 5$ is true then _____ must be true. A. $p(k) = 3m^{(k)}$ B. $p(k) = 3m^{(k)} + 5$ C. $p(k) = 3m^{(k+2)} + 5$ D. $p(k) = 3m^{(k-1)}$	1	1	3	2	1.1.1
7.	$(p \to q) \wedge p \equiv ?$ A. p B. $p \wedge q$ C. q D. $q \to p$	1	1	3	1	1.1.1
8.	Let P be the given proposition. Then the name of the laws $P \vee \neg P \equiv T$ and $P \wedge \neg P \equiv F$ A. Complement law B. Dominant law C. De Morgan's law D. Commutative law	1	2	3	1	1.1.1
9.	The statement $(p \wedge q) \to p$ is A. Consistent B. Contradiction C. Tautology D. Contingency	1	2	3	1	1.1.1
10.	Which of the following statement not correct A. $p \vee q \equiv \neg q \vee p$ B. $\neg(p \wedge q) \equiv \neg q \vee \neg p$ C. $p \vee \neg p \equiv T$ D. $p \wedge \neg p \equiv F$	1	2	3	1	1.1.1

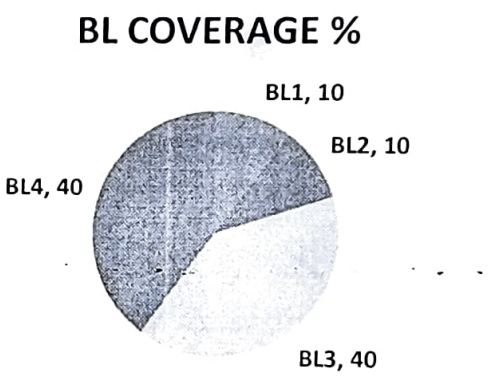
Part – B (4x 10 = 40 Marks)
Answer ANY Four

11.	Use the Euclidean algorithm to find gcd(12345,54321) and also express to gcd as a linear combination of the given numbers.	10	3	2	2	1.1.1
12.	i) If we select 10 points in the interior of an equilateral triangle of side 1, show that there must be at least two points whose distance apart is less than 1/3. ii) If gcd (a,b)=1, show that gcd(2a+b,a+2b)=1 or 3.	5+5	4	2	1	1.1.1
13.	From a club consisting of 6 men and 7 women, in how many ways can we select a committee of i) 3 men and 4 women? ii) 4 persons which has at least one women? iii) 4 persons that has at most one man? iv) 4 persons that has persons of both sexes? v) 4 persons so that two specific members are not included?	10	4	2	2	1.1.1
14.	Construct an argument to show that the following premises implies the conclusion " Radha will not get the job." "If Radha works hard, then she is a dull girl", "If Radha is a dull girl, then she will not get the job" and Radha works hard.	10	4	3	2	1.1.1

15.	i) Using truth table, show that $\big((p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)\big) \rightarrow r$ is tautology. ii) Without using truth table, show that $p \rightarrow (q \rightarrow p) \equiv \neg p \rightarrow (p \rightarrow q)$	5+5	3	3	1	1.1.1
16.	i) Use mathematical induction to show that $n^3 + (n+1)^3 + (n+2)^3$ is divisible by 9, for $n \geq 1$. ii) Prove that the premises $a \rightarrow (b \rightarrow c), d \rightarrow (b \wedge \neg c)$ and $a \wedge d$ are inconsistent.	5+5	3	3	1	1.1.1

Course Outcome (CO) and Bloom's level (BL) Coverage in Questions





18 MAB302T – Discrete Mathematics for Engineers

Answer key

CT II

SET B

24/05/2022

1) A) 101.

2) A) 120

3) B) 78

4) D) Positive

5) A) 2

6) B) $P(k) = 3m^k + 5$

7) B) $P \wedge Q$

8) A) Complement law

9) C) Tautology

10) A) $P \vee Q \equiv \neg Q \vee P$

11)

$54321 = 4 \times 12345 + 4941$

$12345 = 2 \times 4941 + 2463$

$4941 = 2 \times 2463 + 15$

$2463 = 164 \times 15 + 3$

$15 = 5 \times 3 + 0$

$\therefore \gcd(12345, 54321) = 3$ (5M)

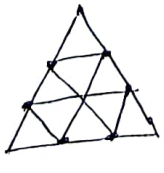
Now $3 = 2463 - 164 \times 15$

$= 329 \times 2463 - 164 \times 4941$

$= 329 \times 12345 - 822 \times 4941$

$= 3617 \times 12345 - 822 \times 54321$. (5M)

12. (i)



assignment

(3M)

(2M)

12)

(ii) Let $\gcd(2a+b, a+2b) = d$

Then $2a+b = k_1 d$ and $a+2b = k_2 d$

$\Rightarrow 3a = (2k_1 - k_2)d$ and $3b = (2k_2 - k_1)d$ (2m)

$\Rightarrow d \mid 3a$ and $d \mid 3b$

$\Rightarrow d \leq \gcd(3a, 3b) = 3\gcd(a,b) \leq 3 \quad \because \gcd(a,b) = 1$

$\therefore d = 1$ or 2 or 3. (3m)

But d cannot be 2, since $2a+b$ and $a+2b$ are not both even

$\therefore d = 1$ or 3

13) (i) $^6C_3 \times {}^7C_4 = 700$ (2m)

(ii) $^6C_3 \times {}^7C_1 + {}^6C_2 \times {}^7C_2 + {}^6C_1 \times {}^7C_3 + {}^6C_0 \times {}^7C_4$ (2m)

$= 700$

(iii) $^6C_0 \times {}^7C_4 + {}^6C_1 \times {}^7C_3 = 245$ (2m)

(iv) $^6C_1 \times {}^7C_3 + {}^6C_2 \times {}^7C_2 + {}^6C_3 \times {}^7C_1 = 665$ (2m)

(v) $^{13}C_4 - {}^{11}C_2 = 660$. (2m)

14)

p: Radha works hard

q: Radha is a dull girl

r: Radha will not get the job. (2m)

The premises are

$p \to q, q \to r, p \Rightarrow r$ (2m)

Step No.	Statement	Reason.
1.	p	P
2.	$p \to q$	P
3.	q	T, 1, 2 and modus ponens
4.	$q \to r$	P
5.	r	T, 3, 4 and modus ponens.

15) (i)

p	q	r	p∨q (a)	p→r (b)	q∧b	q→r (c)	a∧b∧c	(a∧b∧c)→r
T	T	T	T	T	T	T	T	T
T	T	F	T	F	F	F	F	T
T	F	T	T	T	F	T	F	T
T	F	F	T	F	F	T	F	T
F	T	T	T	T	T	T	T	T
F	T	F	T	T	T	F	F	T
F	F	T	F	T	F	T	F	T
F	F	F	F	T	F	T	F	T

(ii) $P \to (Q \to P) \equiv \neg P \vee (\neg Q \vee P)$

$\equiv \neg Q \vee (P \vee \neg P)$

$\equiv T$ (3M)

$\neg P \to (P \to Q) \equiv P \vee (\neg P \vee Q)$

$\equiv (P \vee \neg P) \vee Q$

$\equiv T$ (2M)

16) (i) Let $S_n : n^3 + (n+1)^3 + (n+2)^3$ is divisible by 9

$S_1 : 1^3 + 2^3 + 3^3 = 36$ is divisible by 9, is true (1M)

Let $S_k : k^3 + (k+1)^3 + (k+2)^3$ is divisible by 9 (1M)

Now $(k+1)^3 + (k+2)^3 + (k+3)^3 = k^3 + (k+1)^3 + (k+2)^3 + 9k^2 + 27k + 27$

$= 9t + 9(k^2 + 3k + 3)$ (2M)

$\therefore S_n$ is true for all $n \geq 1$.

(ii)

Step No.	Statement	Reason.
1.	a∧d	P
2.	a	T, 1 and simplification
3.	d	"
4.	a→(b→c)	P
5.	b→c	T, 2, 4 and Modus Ponens.
6.	¬b∨c	T, 5 and equivalence
7.	d→b∧c	P

8.	$\neg(b \wedge \neg c) \rightarrow \neg d$	T, 7 and contrapositive
9.	$\neg b \vee c \rightarrow \neg d$	T, 8 and equivalence
10.	$\neg d$	T, 6, 9 and modus ponens
11.	$d \wedge \neg d$	T, 3, 10 and conjunction
12.	F	T, 11 and negation law.