Set: A

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 Blooms level (1 - 6)	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
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													
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:**													
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	-	-	-	-	-	-	-	-	-	-

Part – A(10 x 1 = 10 Marks) **Instructions: Answer all Questions**

Q.No	Question	Marks	BL	CO	PO	PI Code
1.	Assuming that repetitions are not permitted, how many four digit numbers can be formed from the six digits 1, 2, 3, 5, 7, 8? A. 360 B. 300 C. 280 D.340	1	2	2	2	1.1.1
2.	For a committee consisting of six men and seven women, in how many ways can be select a committee of three men and four women? A. 600 B. 650 C.700 D.750	1	1	2	2	1.1.1
3.	If GCD of $(a, u) = 2$, then a is A. An even number B. One always C. Odd number D. Zero only	1	2	2	1	1.1.1
4.	If $a\|bc$, a and b are co-prime then A. $a\|b$ B. $a\|(b-c)$ C. $a\|c$ D. $a\|(b+c)$	1	2	2	1	1.1.1

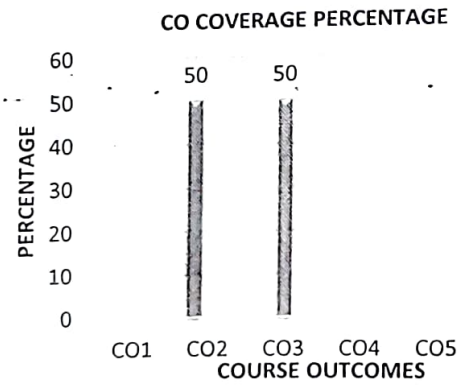
5.	The number of primes less than or equal to 20 is A. 4 B. 8 C. 12 D. 16	1	1	2	2	1.1.1
6.	$p \rightarrow \neg q$ is equivalent to A. $p \vee q$ B. $p \vee \neg q$ C. $\neg p \vee q$ D. $\neg (p \wedge q)$	1	1	3	1	1.1.1
7.	$p \rightarrow (p \vee q)$ is A. Tautology B. Contradiction C. Negation D. bi conditional proposition	1	1	3	1	1.1.1
8.	A statement formula which is always false is called A. Tautology B. Contradiction C. Contingency D. Valid formula	1	2	3	2	1.1.1
9.	$p \rightarrow (q \rightarrow p)$ is A. F B. T C. $p \vee q$ D. $p \wedge q$	1	2	3	1	1.1.1
10.	Write the following in symbolic form. A: Radha works hard B: Radha is bright girl "If Radha works hard, then she is a dull girl" A. $A \wedge B$ B. $A \vee \neg B$ C. $A \rightarrow \neg B$ D. $A \rightarrow B$	1	1	3	2	1.1.1

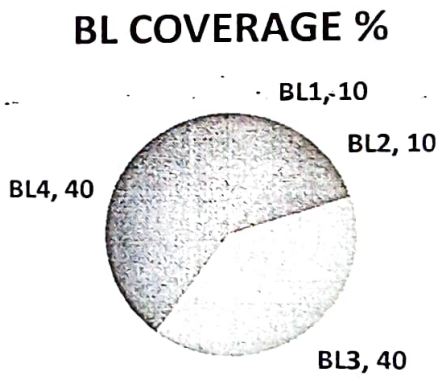
Part – B (4x 10 = 40 Marks)
Answer ANY Four

11.	i) Assuming that repetitions are not permitted, how many four digit numbers can be formed from six digits 1,2,3,5,7,8? ii) How many of those numbers are less than 4000? iii) How many of the numbers in (i) are even? iv) How many of the numbers in (i) are multiples of 5? v) How many of the numbers in (i) contain both the digits 3 and 5?	10	4	2	2	1.1.1
12.	Use the Euclidean algorithm to find gcd (1819,3587) and also express the gcd as a linear combination of the given numbers.	10	3	2	1	1.1.1
13.	i) If there are 5 points inside a square of side length 2. Show that two of the points are within a distance of $\sqrt{2}$ of each other ii) If gcd(a,4)=gcd(b,4)=2, show that gcd(a+b,4)=4	5+5	4	2	1	1.1.1

14.	Test the validity of the argument. "It is not sunny this afternoon and it is colder than yesterday", " If we go to play cricket then it is sunny", " If we donot play cricket then we will go to a movie" and " If we go to movie then we will go home by sunset". Therefore we will go home by sunset.	10	4	3	2	1.1.1
15.	i) Using truth table, show that $\neg(q \rightarrow r) \wedge r \wedge (p \rightarrow q)$ is contradiction. ii) Without using truth table, show that $(\neg p \vee q) \wedge (p \wedge (p \wedge q)) \equiv p \wedge q$.	5+5	3	3	1	1.1.1
16.	i) Use mathematical induction to show that $n! \geq 2^{n-1}$, for $n = 1,2,3, \ldots$ ii) Using indirect method of proof, derive $p \rightarrow \neg s$ from the premises $p \rightarrow (q \vee r),\ q \rightarrow \neg p,\ s \rightarrow \neg r,\ p$	5+5	3	3	1	1.1.1

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





Discrete Mathematics for Engineers

Answer key

CT II

SET: A

24/05/22.

1) A) 360

2) C) 700

3) A) An even number

4) c) a|c

5) B) 8

6) D) ¬(P∧Q)

7) A) Tautology

8) B) Contradiction

9) B) T

10) C) A → ¬B.

11) (i) $P(6,4) = 6\times5\times4\times3 = 360$ (2M)

(ii) $3\times P(5,3) = 3\times5\times4\times3 = 180$ (2M)

(iii) $2\times P(5,3) = 2\times5\times4\times3 = 120$ (2M)

(iv) $1\times P(5,3) = 1\times5\times4\times3 = 60$ (2M)

(v) $P(4,2)\times P(4,2) = 12\times12 = 144$ (2M)

12)

$3587 = 1\times1819 + 1768$

$1819 = 1\times1768 + 51$

$1768 = 34\times51 + 34$

$51 = 1\times34 + 17$

$34 = 2\times17 + 0$

$\therefore \gcd(1819, 3587) = 17$ (5M)

$17 = 51 - 1\times34$

$= 51 - 1\times(1768 - 34\times51)$

$= 35\times51 - 1\times1768$

$= 35\times(1819 - 1\times1768) - 1\times1768$ (5M)

$= 35 \times 1819 - 36 \times 1768$

$= 35 \times 1819 - 36 \times (3587 - 1 \times 1819)$

$= 71 \times 1819 - 36 \times 3587$

13)

(i)

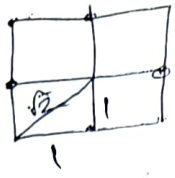


figure 3M

Argument 2M

(ii) $\gcd(a,4) = 2 \Rightarrow a = 2m$, m is odd int. } (2M)

and $b = 2n$, for some odd int. n.

$a + b = 2(m+n)$ } (2M)

$= 2 \times 2r$, since $m+n$ is even

$\therefore \gcd(a+b, 4) = \gcd(4r, 4)$, r is an int. } (1M)

$= 4.$

14)

p: It is sunny this afternoon q: It is colder than yesterday

r: we will go to play cricket s: we will go to movie

t: we will go home by sunset } (2M)

The premises are

$\neg p \wedge q,\ r \to p,\ \neg r \to s,\ s \to t \Rightarrow t$ } (2M)

Step no.	Statement	Reason
1.	$\neg p \wedge q$	P
2.	$\neg p$	T, 1 and simplification
3.	$r \to p$	P
4.	$\neg r$	T, 2, 3 and modus tollens
5.	$\neg r \to s$	P
6.	s	T, 4, 5 and modus ponens
7.	$s \to t$	P
8.	t	T, 6, 7 and modus ponens.

(6 M)

(i)

p	q	r	(a) $p \to q$	$q \to r$	(b) $\neg(q \to r)$	$\neg(q \to r) \wedge r \wedge (p \to q)$
T	T	T	T	T	F	F
T	T	F	T	F	T	F
T	F	T	F	T	F	F
T	F	F	F	T	F	F
F	T	T	T	F	F	F
F	T	F	T	F	F	F
F	F	T	T	T	F	F
F	F	F	T	T	F	F

5M

(ii) $(\neg p \vee q) \wedge (p \wedge (p \wedge q)) \equiv (\neg p \vee q) \wedge (p \wedge p) \wedge q$, by associative law

$\equiv (\neg p \vee q) \wedge (p \wedge q)$, by idempotent law

$\equiv (p \wedge q) \wedge (\neg p \vee q)$, by commutative law

$\equiv [(p \wedge q) \wedge \neg p] \vee [(p \wedge q) \wedge q]$, distributive law

$\equiv [\neg(p \wedge p) \wedge q] \vee [p \wedge (q \wedge q)]$ comm & asso. law

$\equiv (F \vee q) \vee (p \wedge q)$, complement and idempotent law

$\equiv F \vee (p \wedge q)$, dominant law

$\equiv p \wedge q$, dominant law.

16)

(i) Let $S_n : n! \geq 2^{n-1}$

$S_1 : 1! \geq 2^0$ which is true. (1M)

Let S_k be true i.e $k! \geq 2^{k-1}$ (1M)

Now $(k+1)! = (k+1)k! \geq (k+1)2^{k-1} \geq 2 \cdot 2^{k-1} = 2^k$ (2M)

$\therefore S_{k+1}$ is true. Hence S_n is true for $n = 1, 2, 3, \ldots$ (1M)

16)

(ii) Consider $\neg(p \rightarrow \neg s) \equiv \neg(\neg p \vee \neg s) = p \wedge s$ as additional premise.

Step no.	Statement	Reason
1.	p	P
2.	$p \rightarrow (q \vee r)$	P
3.	$q \vee r$	T, 1, 2 and modus ponens.
4.	$p \wedge s$	P (additional)
5.	s	T, 4 and Simplification
6.	$s \rightarrow \neg r$	P
7.	$\neg r$	T, 5, 6 and modus ponens
8.	q	T, 3, 7 and disjunctive Syllogism
9.	$q \rightarrow \neg p$	P
10.	$\neg p$	T, 8, 9 and modus ponens
11.	$p \wedge \neg p$	T, 1, 10 and Conjunction
12.	F	T, 11 and negation law.