



Sanjay Ghodawat University, Kolhapur

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

2018-19

EXM/P/09/01

Year and Program: 2018-19

School of Science

Department of Mathematics

B.Sc.II

Course Code: MTS 203

Course Title: Logic and Sets

Semester – III

Day and Date:

End Semester Examination

Time: 2:30 to 3:00 pm

Thursday 06 Dec 18

(ESE)

Max Marks: 100

PRN/Exam seat No:

Answer booklet No:

Student's signature:

Invigilator signature:

Instructions:

- 1) All questions are compulsory.
- 2) **Attempt Q.1 within first 30 minutes.**
- 3) Each MCQ type question has four choices out of which only one is correct
- 4) Tick mark (\checkmark) the correct alternative which should be answered in question paper itself and submit to the Jr. Supervisor.
- 5) If you tick more than one option it will not be evaluated
- 6) Figures to the right indicate full marks
- 7) Use **Blue ball pen** only.

Q.1	Choose the correct Alternative for following questions.	Marks	Bloom's Level	CO
i)	What is the Cartesian product of $A = \{1, 2\}$ and $B = \{a, b\}$? a) $\{(1, a), (1, b), (2, a), (b, b)\}$ b) $\{(1, 1), (2, 2), (a, a), (b, b)\}$ c) $\{(1, a), (2, a), (1, b), (2, b)\}$ d) $\{(1, 1), (a, a), (2, a), (1, b)\}$	01	L2	CO1
ii)	What is the cardinality of the set of odd positive integers less than 10? a) 10 b) 5 c) 3 d) 20	01	L2	CO1
iii)	The difference of $\{1, 2, 3\}$ and $\{1, 2, 5\}$ is the set _____ a) $\{1\}$ b) $\{5\}$ c) $\{3\}$ d) $\{2\}$	01	L2	CO1
iv)	Let $A_i = \{i, i+1, i+2, \dots\}$. Then set $\{n, n+1, n+2, n+3, \dots\}$ is the _____ of the set A_i . a) Union b) Intersection c) Set Difference d) Disjoint	01	L2	CO1

v)	Which sets is not empty?	01	L2	CO1
	a) $\{x: x \text{ is a even prime greater than } 3\}$			
	b) $\{x : x \text{ is a multiple of } 2 \text{ and is odd}\}$			
	c) $\{x: x \text{ is an even number and } x+3 \text{ is even}\}$			
	d) $\{x: x \text{ is a prime number less than } 5 \text{ and is odd}\}$			
vi)	If A has 4 elements B has 8 elements then the minimum and maximum number of elements in $A \cup B$ are respectively	01	L2	CO1
	a) 4, 8			
	b) 8, 12			
	c) 4, 12			
	d) None of the mentioned			
vii)	Which of the following statement is a proposition?	01	L2	CO2
	a) God bless you!			
	b) Get me a glass of milkshake			
	c) What is the time now?			
	d) The only odd prime number is 2			
viii)	Let P: We should be honest. Q: We should be dedicated. R: We should be overconfident. Then 'We should be honest or dedicated but not overconfident.' is best represented by:	01	L2	CO2
	a) $\sim P \vee \sim Q \vee R$			
	b) $P \wedge \sim Q \wedge R$			
	c) $P \vee Q \wedge R$			
	d) $P \vee Q \wedge \sim R$			
ix)	Which of the following statements is the negation of the statements "4 is odd or -9 is positive"?	01	L2	CO2
	a) 4 is even or -9 is not negative			
	b) 4 is odd or -9 is not negative			
	c) 4 is even and -9 is negative			
	d) 4 is odd and -9 is not negative			
x)	Negation of statement $(A \wedge B) \rightarrow (B \wedge C)$	01	L2	CO2
	a) $(A \wedge B) \rightarrow (\sim B \wedge \sim C)$			
	b) $\neg (A \wedge B) \vee (B \vee C)$			
	c) $\sim(A \rightarrow B) \rightarrow (\sim B \wedge C)$			
	d) None of the mentioned			
xi)	The compound propositions p and q are called logically equivalent if _____ is a tautology.	01	L2	CO2
	a) $p \leftrightarrow q$			
	b) $p \rightarrow q$			
	c) $\neg (p \vee q)$			
	d) $\neg p \vee \neg q$			

- xii) "The product of two negative real numbers is not negative." Is given by? 01 L2 CO2
- a) $\exists x \forall y ((x < 0) \wedge (y < 0) \rightarrow (xy > 0))$
b) $\exists x \exists y ((x < 0) \wedge (y < 0) \wedge (xy > 0))$
c) $\forall x \exists y ((x < 0) \wedge (y < 0) \wedge (xy > 0))$
d) $\forall x \forall y ((x < 0) \wedge (y < 0) \rightarrow (xy > 0))$
- xiii) Let $P(S)$ denote the power set of set S . Which of the following is always TRUE? 01 L2 CO3
- a) $S \notin P(S)$ b) $P(P(S)) = P(S)$
c) $P(S) \cap S = P(S)$ d) $P(S) \cap P(P(S)) = [\varnothing]$
- xiv) A relation R is defined on the set of positive integers as xRy if $2x + y \leq 5$. The relation R is 01 L2 CO3
- a) reflexive b) transitive
c) symmetric d) None of these
- xv) Let $n(A)$ denotes the number of elements in set A . If $n(A) = p$ and $n(B) = q$, then how many ordered pairs (a, b) are there with $a \in A$ and $b \in B$? 01 L2 CO3
- a) pq b) $p + q$
c) $2pq$ d) $4pq$
- xvi) Let R be a relation " $(x - y)$ is divisible by m ", where x, y, m are integers and $m > 1$, then R is 01 L2 CO3
- a) partial order b) symmetric but not transitive
c) equivalence relation d) anti symmetric and not transitive



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(ESE)

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Instructions:

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary.
- 3) Figures to the right indicate full marks.

Q.2	Solve any Two.	Marks	Bloom's Level	CO
a)	Develop the truth tables for following compound statements, if p, q, r are primitive statements. i) $(p \rightarrow q) \rightarrow r$ ii) $q \rightarrow (\sim p \vee \sim q)$	08	L3	CO1
b)	Develop the truth tables for following compound statements, if p, q, r are primitive statements. $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$	08	L3	CO1
c)	Use truth table to verify the following logical equivalence. $[p \rightarrow (q \vee r)] \Leftrightarrow [\sim r \rightarrow (p \rightarrow q)]$	08	L3	CO1
Q3	Solve any Two.			
a)	Let $p(x), q(x), r(x)$ denotes the following open statements. $p(x): x \leq 3$, $q(x): x+1$ is odd and $r(x): x > 0$. If the universe consists of all integers. What are the truth values of following statements? i) $\sim p(3) \wedge (q(3) \vee r(3))$ ii) $[p(2) \wedge q(2)] \rightarrow r(2)$	08	L3	CO1

b) Without using truth table show that the following logical equivalence. $[(p \vee q) \rightarrow \wedge \sim (\sim p \wedge q)] \Leftrightarrow p$ 08 L3 CO1

c) Let U be the universal set and $A, B, C \subseteq U$ then show that 08 L4 CO2

i) $A \subseteq B$ and $B \subseteq C$ then $A \subseteq C$ ii) $A \subset B$ and $B \subseteq C$ then $A \subseteq C$

d) Define power set of A . If set A contains n number of elements then power set of A contains how many elements? Let $A = \{1, 2, 3, 4\}$ then write power set of A and $|A|$. 08 L3 CO2

Q4 Solve any Two.

a) For any universe U and for any sets $A, B \subseteq U$ the following statements are equivalent. 08 L4 CO2

i) $A \subseteq B$ ii) $A \cup B = B$ iii) $A \cap B = A$ iv) $\bar{B} \subseteq \bar{A}$

b) Simplify the expression. $\overline{(A \cup B) \cap C \cup \bar{B}}$ 08 L3 CO2

c) Prove that, for any universe U and $S, T \subseteq U$, then S and T disjoint if and only if $S \cup T = S \Delta T$. 08 L4 CO2

Q5 Solve any Two.

a) If \mathcal{R} is relation on \mathbb{Z}^+ where $a \mathcal{R} b$ if $\gcd(a, b) = 1$. Determine whether the given relation \mathcal{R} is reflexive, symmetric, antisymmetric or transitive. 08 L3 CO3

b) If $A = \{1, 2, 3, 4\}; B = \{2, 5\}; C = \{3, 4, 7\}$, determine 08 L3 CO3

i) $(A \times C) \cup (B \times C)$ ii) $(A \cup B) \times C$

- c) If \mathcal{R} is relation on \mathbb{Z} where $a\mathcal{R}b$ if $a|b$. Determine whether the given relation \mathcal{R} is reflexive, symmetric, antisymmetric or transitive. 08 L3 CO3

Q.6 **Solve any Two.**

- a) Determine whether each of the following collections of sets is a partitions for given set $A = \{1, 2, 3, 4, 5, 6, 7, 8\}$. If the collection is not partition, explain why it fails to be partition? 08 L3 CO3
- i) $A_1 = \{4, 5, 6\}; A_2 = \{1, 8\}; A_3 = \{2, 3, 7\}$
- ii) $A_1 = \{1, 3, 4, 7\}; A_2 = \{2, 6\}; A_3 = \{5, 8\}$
- b) If \mathcal{R} is an equivalence relation on A and $x, y \in A$ then 08 L4 CO3
- i) $x \in [x]$ ii) $x\mathcal{R}y \Leftrightarrow [x] = [y]$ and iii) $[x] = [y]$ or $[x] \cap [y] = \emptyset$
- c) If $A = \{1, 2, 3, 4, 5, 6, 7\}$ define \mathcal{R} by $(x, y) \in \mathcal{R}$ if $x - y$ is multiple of 3, show that \mathcal{R} is an equivalence relation on A . 08 L3 CO3
