K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109
DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
I SESSIONAL TEST QUESTION PAPER
SET-A

USN | | | | | | | | | |

Degree	:	B.E	Semester	: IV
Branch	:	CSE, CSBS, AI&DS	Course Code	: BCS405A
Course Title	:	Discrete Mathematical Structures	Date	: 30/5/2024
Duration	:	75 Minutes	Max Marks	: 25

Note: Answer ONE full question from each part.

Q No.	Question	Marks	K-Level	CO mapping
	PART-A			
1(a)	**Prove** that the following compound proposition is tautology or not using truth table. a). $[(p \vee q) \wedge \{(p \rightarrow r) \wedge (q \rightarrow r)\}] \rightarrow r$	5	Applying K3	CO1
(b)	**Prove** the following by using the laws of logic: $(p \rightarrow q) \wedge [\neg q \wedge (r \vee \neg q)] \Leftrightarrow \neg(q \vee p)$	5	Applying K3	CO1
(c)	**Explain** the following with their truth table i).Conjunction, ii)Disjunction, iii) Conditionl iv)Biconditional with truth table	5	Understanding K2	CO1
	OR			
2(a)	Let p, q, r be the propositions having truth values 0,0, and 1 respectively. **Find** the truth values of the following's propositions: a $(p \vee q) \vee r$ b. $(p \wedge q) \rightarrow r$ c. $p \wedge (r \rightarrow q)$ d. $p \rightarrow (q \rightarrow \neg r)$	5	Applying K3	CO1
(b)	**Prove** the validity of the following arguments: If Ravi studies, then he will pass in DMS If Ravi does not play cricket, then he will study Ravi failed in DMS ∴ Ravi played cricket	5	Applying K3	CO1
(c)	**Explain** the following with their truth table i)Tautology ii) Contradiction iii)Contingency	5	Understanding K2	CO1
	PART-B			

3(a)	Let A = {1,2,3,4} and B={1,2,3,4,5,6} **(a)Find** how many functions are there from A to B. How many of these are one to one? How many are onto? **(b)Find** how many functions are there from B to A. How many of these are one to one? How many are onto?	5	Applying K3	CO2
(b)	Let $f: R \rightarrow R$ be defined by $f(x) = \begin{cases} 3x - 5 \text{ for } x > 0 \\ -3x + 1 \text{ for } x \leq 0 \end{cases}$ **Determine** f(-1), f(5/3), $f^{-1}([-5, 5])$, $f^{-1}(-6)$, $f^{-1}(-1)$	5	Applying K3	CO2
	OR			
4(a)	Let A={1,2,3} and B={2, 4, 5}.**Determine** the following. (a) $\lvert AXB \rvert$ (b) Number of relation from A to B (c) Number of relation from B To A (d) Number of relation from A to B that contains (1,2) &(1,5)	5	Applying K3	CO2
(b)	Let f,g,h be functions from Z to Z defined by $f(x) = x - 1, \quad g(x) = 3x, \quad h(x) = \begin{cases} 0, \text{if } x \text{ is even} \\ 1, \text{if } x \text{ is odd} \end{cases}$ **Determine** $(f \circ (g \circ h))(x)$ and $((f \circ g) \circ h)(x)$ and verify that $f \circ (g \circ h) = (f \circ g) \circ h$	5	Applying K3	CO2

Course Incharge

HOD

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
School of Engineering & Management
Bangalore - 560 109

IQAC Coordinator

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU-560109
DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
I SESSIONAL TEST SCHEME & SOLUTION(SET A)

Degree	:	**B.E**	**Semester**	:	**IV**
Branch	:	**CSBS**	**Date**	:	**30/05/2024**
Course Title	:	**Discrete Mathematical Structures**	**Course Code**	:	**BCS401A**
Duration	:	**75 Minutes**	**Max Marks**	:	**25**

Note: Answer ONE full question from each part

Q. No.	Questions with Scheme & Solution	Marks
	PART-A	
1(a)	**Prove** that the following compound proposition is tautology or not using truth table. a). $[(p \vee q) \wedge \{(p \to r) \wedge (q \to r)\}] \to r$	5
(b)	**Prove** the following by using the laws of logic: $(p \to q) \wedge [\neg q \wedge (r \vee \neg q)] \Leftrightarrow \neg(q \vee p)$	5
(C)	**Define** the following with their truth table i).Conjunction, ii)Disjunction, iii)Conditionl iv)Biconditional with truth table	

1. Conjunction :- Inserting the word and
2. Disjunction :- Inserting the word or

	③ conditional :- denoting the word of then ④ Biconditional :- denoting the word if and only if	
	OR	
2(a)	Let p, q, r be the propositions having truth values 0,0, and 1 respectively. **Find** the truth values of the following's propositions: a $(p \vee q) \vee r$ b. $(p \wedge q) \rightarrow r$ c. $p \wedge (r \rightarrow q)$ d. $p \rightarrow (q \rightarrow \neg r)$	
	a. $(p \vee q) \vee r = (0 \vee 0) \vee 1 = 0 \vee 1 = 1$ b. $(p \wedge q) \rightarrow r = (0 \wedge 0) \rightarrow 1 = 0 \rightarrow 1 = 1$ c. $p \wedge (r \rightarrow q) = 0 \wedge (1 \rightarrow 0) = 0 \wedge 0 = 0$ d. $p \rightarrow (q \rightarrow \neg r) = 0 \rightarrow (0 \rightarrow 0) = 0 \rightarrow 1 = 1$	
(b)	**Prove** the validity of the following arguments: If Ravi studies, then he will pass in DMS If Ravi does not play cricket, then he will study Ravi failed in DMS ∴ Ravi played cricket	
	p : Ravi studies q : He will pass in DMS r : Ravi play cricket $p \rightarrow q$, $\neg r \rightarrow p$, $\neg q$ / ∴ r $p \rightarrow q$, $\neg q$ / $\neg p$ $\neg p$, $\neg r \rightarrow p$ / ∴ r ∴ It is valid	
(C)	**Define** the following with their truth table i).Tautology ii).Quantifier iii)Contradiction iv)Contingency	

Tautology :- True for all the truth values

Contradiction :- A compound proposition which is false for all possible truth values.

Contingency :- true or false for truth values.

PART-B

3(a) **(i)Let A = 1,2,3,4 and B=1,2,3,4,5,6**
(a)Find how many functions are there from A to B. How many of these are one to one? How many are onto?
(b)Find how many functions are there from B to A. How many of these are one to one? How many are onto?

(a) The number of functions from A to B is $n^m = 6^4 = 1296$

(b) The number of one-to-one function from A to B = $\frac{n!}{(n-m)!} = 360$

There is no on to function.

(b) $m^n = 4^6 = 4096$
number of onto function = $P(6,4) = 1560$

(b) Let $f: R \to R$ be defined by

$$f(x) = \begin{cases} 3x - 5 & for\ x > 0 \\ -3x + 1 & for\ x \leq 0 \end{cases}$$

Determine f(-1), f(5/3), $f^{-1}([-5, 5])$, $f^{-1}(-6)$, $f^{-1}(-1)$

$f(-1) = -3(-1)+1 = 5$

$f(5/3) = 3(5/3) - 5 = 0$

$f^{-1}([-5,5]) = \cancel{0 \leq x \leq 10}$ $[-4/3 \ 10/3]$

$f^{-1}(-6) = \phi$

$f^{-1}(-1) = 4/3$

$f^{-1}([-5,5] = [-4/3 , 10/3$

$f^{-1}(-6) = \phi$

OR

4(a) Let A={1,2,3} and B={2, 4, 5}.**Determine** the following.

(a) $|AXB|$

(b) Number of relation from A to B

(c) Number of relation from B To A

Number of relation from A to B that contains (1,2) &(1,5)

(a) $|A \times B| = 3 \times 3 = 9$

(b) $ARB = 2^{mn} = 2^9 = 512$

(c) $R_1 = \{(1,2),(1,5)\} = 2$

no. of relation $= 9 - 2 = 7$

$2^7 = 218$

5

(b) Let f, g, h be functions from Z to Z defined by $f(x) = x - 1$, $g(x) = 3x$, $h(x) = \begin{cases} 0, if\ x\ is\ even \\ 1, if\ x\ is\ odd \end{cases}$

Determine $(f \circ (g \circ h)(x))$ and $((f \circ g) \circ h)(x)$ and verify that $f \circ (g \circ h) = (f \circ g) \circ h$

$[f \circ (g \circ h)](x) = f[g \circ h(x)] = f[g(h(x))]$

$= f[3h(x)]$

$= 3h(x) - 1$

$= -1$ if x even

2 if x odd.

5

Vinutha. S.V
Course In charge

Head of the Department
Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109
DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
I SESSIONAL TEST QUESTION PAPER
SET-B

USN | | | | | | | | | |

Degree	:	B.E	Semester	:	II
Branch	:	CSE, CS&BS, AI&DS	Course Code	:	BCS405A
Course Title	:	Discrete Mathematical Structures	Date	:	30/5/2024
Duration	:	60 Minutes	Max Marks	:	25

Note: Answer ONE full question from each part.

Q No.	Question	Marks	K-Level	CO mapping
	PART-A			
1(a)	**Prove** that the following compound proposition is tautology using truth table. $\{p \rightarrow (q \rightarrow r)\} \rightarrow \{(p \rightarrow q) \rightarrow (p \rightarrow r)\}$	5	Applying K3	CO1
(b)	**Prove** the following by using the laws of logic: $[(p \vee q) \wedge (p \vee \neg q) \vee q] \Leftrightarrow p \vee q$	5	Applying K3	CO1
(c)	**Explain** the following with an example each (a) Proposition (b) Tautology (c) Contradiction (d)Contingency (e) logical connectives	5	Understanding K2	CO1
	OR			
2(a)	Let p. q. r be the propositions having truth values 0,0, and 1 respectively. **Find** the truth values of the following's propositions: a) $(p \vee q) \vee r$ b) $(p \wedge q) \rightarrow r$ c) $p \wedge (r \rightarrow q)$ d) $p \rightarrow (q \rightarrow \neg r)$	5	Applying K3	CO1
(b)	**Prove** the validity of the following arguments: If Sachin hits a century, then he gets a free car. Sachin hits a century. $\therefore$ Sachin gets a free car	5	Applying K3	CO1
(c)	**Explain** the following with their truth table i) Negation ii) Conjunction iii) Disjunction iv) Conditional v) Bi-conditional	5	Understanding K2	CO1
	PART-B			

3(a)	Let f: Z→Z defined by f(a)=a+1 for all a∈Z. Find whether f is one-one or onto.	5	Applying K3	CO2
(b)	The function f: R→R and g: R→R are defined by f(x)=3x+7 for all x∈R and g(x) = x(x²-1) for all x∈R. Verify that f is one-one but g is not.	5	Applying K3	CO2
	OR			
4(a)	Let A= {1,2,3} and B= {2, 4, 5}. Determine the following. (a) n(A×B) (b) Number of relation from A to B (c) Number of relations from A to B that contains (1,2) and (1,5)	5	Applying K3	CO2
(b)	Let $f: R \to R$ be defined by $f(x) = \begin{cases} 3x - 5 \text{ for } x > 0 \\ -3x + 1 \text{ for } x \leq 0 \end{cases}$ a) Determine $f(0), f(-1), f(5/3), f(-5/3)$. b) Find $f^{-1}(0), f^{-1}(1), f^{-1}(-1), f^{-1}(3), f^{-1}(-3), f^{-1}(-6)$	5	Applying K3	CO2

(5)

Course Incharge

HOD 24/5/22

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

IQAC- Coordinator

Principal

Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU-560109

DEPARTMENT OF APPLIED SCIENCE

SESSION: 2023-2024 (EVEN SEMESTER)

I SESSIONAL TEST SCHEME & SOLUTION (SET B)

Degree	:	B.E	Semester	:	IV
Branch	:	CSE, AI&DS, CSBS	Course Code	:	BCS405A
Course Title	:	Discrete Mathematical Structures	Date	:	30/05/2024
Duration	:	75 Minutes	Max Marks	:	25

Note: Answer ONE full question from each part

Q. No.	Questions with Scheme & Solution	Marks
	PART-A	
1(a)	**Prove** that the following compound proposition is tautology using truth table. $\{p \rightarrow (q \rightarrow r)\} \rightarrow \{(p \rightarrow q) \rightarrow (p \rightarrow r)\}$	8
(b)	**Prove** the following by using the laws of logic: $[(p \vee q) \wedge (p \vee \neg q) \vee q] \Leftrightarrow p \vee q$	8

p	q	r	$q \rightarrow r$	$p \rightarrow (q \rightarrow r)$	$p \rightarrow q$	$p \rightarrow r$	$(p \rightarrow q) \rightarrow (p \rightarrow r)$	$p \rightarrow (q \rightarrow r) \rightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$
0	0	0	1	1	1	1	1	1
0	0	1	1	1	1	1	1	1
0	1	0	0	1	1	1	1	1
0	1	1	1	1	1	1	1	1
1	0	0	1	1	0	0	1	1
1	0	1	1	1	0	1	1	1
1	1	0	0	0	1	0	0	1
1	1	1	1	1	1	1	1	1

$[(p \vee q) \wedge (p \vee \neg q)] \vee q$

$\Leftrightarrow [p \vee (q \wedge \neg q)] \vee q$ $\quad \because p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$ Distri. prop.

$\Leftrightarrow (p \vee F_0) \vee q$

$\Leftrightarrow p \vee q$

(c)	**Explain** the following with an example each (a) Proposition (b) Tautology (c) Contradiction (d)Contingency (e) logical connectives
	(a) Proposition is a statement which in a given context can be said to be either true or false but not both. (b) A compound proposition which is true for possible truth values of its components : Definition

OR

2(a)	Let p, q, r be the propositions having truth values 0,0, and 1 respectively. **Find the** truth values of the following's propositions: a) $(p \vee q) \vee r$ b) $(p \wedge q) \rightarrow r$ c) $p \wedge (r \rightarrow q)$ d) $p \rightarrow (q \rightarrow \neg r)$
	(a) $(p \vee q) \vee r = (0 \vee 0) \vee 1 = 0 \vee 1 = 1$ (b) $(p \vee q) \rightarrow r = (0 \vee 0) \rightarrow 1 = 0 \rightarrow 1 = 1$ (c) $p \wedge (r \rightarrow q) = 0 \wedge (1 \rightarrow 0)$ $= 0 \wedge 0$ $= 0$. (d) $p \rightarrow (q \rightarrow \sim r) = 0 \rightarrow (0 \rightarrow 0)$ $= 0 \rightarrow 1$ $= 1$

(b)	**Prove** the validity of the following arguments: If Sachin hits a century, then he gets a free car Sachin hits a century $\therefore$ Sachin gets a free car	
	Let P : Sachin hits a century q : Sachin gets a free car The given argument is of the form $P \to q$ P $\therefore q$ $[(P \to q) \wedge P] \Rightarrow q$ $\Leftrightarrow [P \wedge (P \to q)] \Rightarrow q$ $\because$ modus ponens This is a Valid Argument.	5
(c)	**Explain** the following with their truth table i) Negation ii) Conjunction iii) Disjunction iv) Conditional v) Bi-conditional	
	Definition.	5

3(a)	Let f: Z→Z defined by f(a)=a+1 for all a∈Z. **Find** whether f is one-one or onto	
	$f(a) = a+1$, $a \in Z$ Take $a_1, a_2 \in Z$ $f(a_1) = f(a_2)$ $a_1+1 = a_2+1$ $a_1 = a_2$ ∴ f is one-one ⇒ $f(a) = b$ $a+1 = b$ $a = b-1$ ∵ $b \in Z$, $b-1 \in Z$ ∴ f is onto.	
(b)	The function f: R→R ang g: R→R are defined by f(x)=3x+7 for all x∈R and g(x) = x(x³-1) for all x∈R. **Verify** that f is one-one but g is not.	
	$f(x) = 3x+7$, $x \in R$ Take x_1 & $x_2 \in R$ $f(x_1) = f(x_2)$ $3x_1+7 = 3x_2+7$ $3x_1 = 3x_2$ $x_1 = x_2$ ∴ f is one-one ⇒ $g(x) = x(x^3-1)$, $x \in R$ Let $x=0$, $g(0)=0$ $x=1$, $g(1)=0$ ∴ g is not ~~onto~~ one-one.	
	OR	
4(a)	Let A= {1,2,3} and B= {2, 4, 5}. **Determine** the following. (a) $\|AXB\|$ (b) Number of relation from A to B (c) Number of relations from A to B that contains (1,2) and (1,5)	

(i) $|A \times B| = m \times n = 3 \times 3 = 9$

(ii) $A R B = 2^{mn} = 2^9 = 512$

(iii) Let $R_1 = \{(1,2)(1,5)\} = 2$

$|A \times B| = 9$

no. of relation in $= 9 - 2 = 7$

$2^7 = 128$ no. of relation from A to B contain the element (1,2) & (1,5)

(b) Let $f: R \to R$ be defined by

$$f(x) = \begin{cases} 3x - 5 & for\ x > 0 \\ -3x + 1 & for\ x \le 0 \end{cases}$$

a) Determine $f(0), f(-1), f(5/3), f(-5/3)$.

b) Find $f^{-1}(0), f^{-1}(1), f^{-1}(-1), f^{-1}(3), f^{-1}(-3), f^{-1}(-6)$

(i) $f(0) = -3(0) + 1 = 1$

$f(-1) = -3(-1) + 1 = 5$

$f(5/3) = 3(5/3) - 5 = 0$

$f(-5/3) = -3(-5/3) + 1 = 6$

(ii) $a = f^{-1}(b)$

$f(x) = 0$

$3x - 5 = 0$, $-3x + 1 = 0$

$x = 5/3$ $x = 1/3$

$f^{-1}(0) = 5/3$

$\Rightarrow f(x) = 1$

$x = 2$, $x = 0$.

$f^{-1}(1) = \{2, 0\}$

$\Rightarrow f(x) = -1$

$x = 4/3$, $x = 2/3$

$f^{-1}(-1) = 4/3$

$\Rightarrow f(x) = 3$

$x = 8/3$, $x = -2/3$

$f^{-1}(3) = \{-2/3, 8/3\}$

$\Rightarrow f(x) = -6$

$x = -1/3$, $x = +1/3$

$f^{-1}(-6) = \phi$

5

Course In charge

Head of the Department
Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109