

**K. J. Somaiya Institute of Technology, Sion, Mumbai-22**  
**(Autonomous College Affiliated to University of Mumbai)**

Subject Code: AIC302

Subject Name: Discrete Structure & Graph Theory

Date: 6/12/2023

Nov – Dec 2023	
(B.Tech) Program: Artificial Intelligence & Data Science	
Examination: SY Semester: III	
Course Code: AIC 302	Course Name: Discrete Structure & Graph Theory
Duration: 02 Hours	Max. Marks: 45

<p>Instructions:</p> <p>(1) All questions are compulsory.</p> <p>(2) Draw neat diagrams wherever applicable.</p> <p>(3) Assume suitable data, if necessary.</p>				
		Max. Marks	CO	BT level
Q 1	Solve any 5 questions out of six.	15		
i)	Using laws of logic, show that : $\neg(p \vee (\neg p \wedge q))$ and $\neg p \wedge \neg q$ are logically Equivalent by developing a series of logic equivalences	3	CO1	Apply
ii)	Test whether the following function is on-to-one, onto or both. $f: Z \rightarrow Z, f(x) = x^2 + x + 1$	3	CO2	Understand
iii)	Draw the Hasse diagram of the set $\{1, 2, 3, 4, 12\}$ under partial order relation divides.	3	CO3	Apply
iv)	Explain Extended Pigeonhole principle. How many friends you must have to guarantee that at least five of them will have birthdays in the same month.	3	CO4	Apply
v)	Prove that the set Q of rational numbers with binary operation * defined by $a * b = a + b - ab$ ; is a semi-group, where $a, b \in Q$ .	3	CO5	Evaluate
vi)	Explain the terms following terms giving examples: (a) Group (b) Poset	3	CO6	Understand
Q.2	Solve any three questions out of four.	15		
i)	Prove by Mathematical Induction that $1 + 2 + 2^2 + \dots + 2^n = 2^{n+1} - 1$ .	5	CO1	Apply



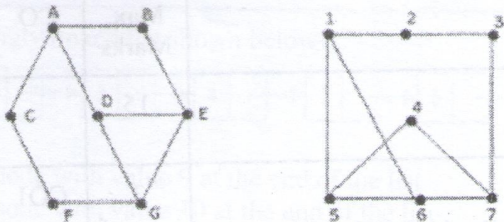
**K. J. Somaiya Institute of Technology, Sion, Mumbai-22**  
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ii)	Show that the set of all divisors of 70 form a lattice.	5	CO3	Apply
iii)	Determine if the following graphs (G1 & G2 respectively) are isomorphic or not.	5	CO6	Evaluate
				
iv)	Is every Eulerian graph a Hamiltonian? Is every Hamiltonian graph a Eulerian? Explain with necessary graphs.	5	CO6	Understand
Q.3	Solve any three questions out of four.	15		
i)	Let $A = \{1, 2, 3, 4, 5\}$ , and let $R = \{(1,1), (1,3), (1,4), (2,2), (2,5), (3,1), (3,3), (3,4), (4,1), (4,3), (4,4), (5,2), (5,5)\}$ . Is R an equivalence relation?	5	CO2	Evaluate
ii)	solve $a_n - 7a_{n-2} + 6a_{n-3} = 0$ where $a_0 = 8, a_1 = 6$ and $a_2 = 22$ .	5	CO4	Evaluate
iii)	Let $A = \{1, 2, 3, 4\}$ and let $R = \{(1, 1), (1, 2), (1, 4), (2, 4), (3, 1), (3, 2), (4, 2), (4, 3), (4, 4)\}$ . Find transitive closure of R using Warshall's algorithm.	5	CO2	Evaluate
iv)	Consider the $(2, 5)$ group encoding function $e : B^2 \rightarrow B^5$ defined by $e(00) = 00000, e(01) = 01110, e(10) = 10101, e(11) = 11011$ . Decode the following words relative to maximum likelihood decoding function.  a) 11110 b)10011	5	CO5	Evaluate

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