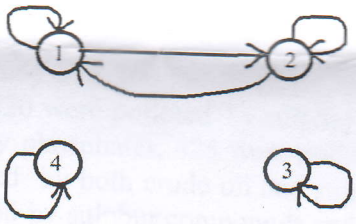
SOMAIYA VIDYAVIHAR UNIVERSITY

Semester: July 2023 – Oct 2023		
Maximum Marks: 30M Examination: In-Semester Examination		Duration :1 Hr. 15 min
Programme code: 01 Programme: UG B.Tech	Class: ~~FY~~/SY/~~TY/LY/MTECH~~	Semester: ~~I/II~~/III/~~IV/V/VI/VII/VIII~~ (SVU 2020)
Name of the Constituent College: K. J. Somaiya College of Engineering	Name of the department: COMP/~~ETRX/EXTC/IT/MECH~~	
Course Code: 116U01C305	Name of the Course: Discrete Mathematics	

Question No.		Max. Marks	CO Mapped	BT Level
Q1	In a pollution study of 1,500 Indian rivers, the following data were reported: 520 were polluted by sulphur compounds, 335 were polluted by phosphates, 425 were polluted by crude oil, 100 were polluted by both crude oil and sulphur compounds, 180 were polluted by sulphur compounds and phosphates, 150 were polluted by both phosphates and crude oil and 28 were polluted by sulphur compounds, phosphates and crude oil. i) How many of the rivers were polluted by at least one of the three impurities? ii) How many rivers were not polluted by exactly one of the three impurities? iii) How many of the rivers were not polluted? Fill in the correct number of Indian rivers in each region of the Venn Diagram.	10	CO1	UN, AN
Q2	**Solve any TWO:** a. Over the universe of animals, let A (x): x is a whale; B (x): x is a fish; C (x): x lives in water. Translate the following into English sentences: (i) $\exists$ x (~ C (x)) (ii) ($\exists$ x) (B (x) $\wedge$ ~ A (x)) (iii) ($\forall$ x) (A (x) $\wedge$ C(x)) $\Rightarrow$ B(x). b. Obtain the principal disjunctive normal form of the following formula using laws of logic: $P \vee (\sim P \rightarrow (Q \vee (\sim Q \rightarrow R)))$ c. Show that the following statements are logically equivalent without using the truth table. i. $(P \rightarrow R) \wedge (Q \rightarrow R) \equiv (P \vee Q) \rightarrow R$ ii. $\sim (P \vee (\sim P \wedge Q)) \equiv \sim P \wedge \sim Q$	10 (5+5)	CO2	UN, AP

Q3	Solve Any **ONE:** For set A = {1, 2, 3, 4}, each of the relations R_1, R_2, R_3 is represented by the following diagraph, matrix form and tabular form respectively. Obtain the relation sets R_1, R_2, R_3. Check whether R_1, R_2, R_3 satisfy properties of reflexive, irreflexive, symmetry, asymmetry, anti-symmetry and transitivity. Justify your answer. **(i) R_1**  **(ii) R_2** $M_R = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ **(iii) R_3** 		1	2	3	4
1	✓			
2		✓		
3			✓	
4				✓ | b. What is the importance of Warshall's algorithm? What is transitive closure? Solve the following example using Warshall's algorithm. Let M_R = 1 1 0 0 0 1 1 0 0 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 and M_S = 1 0 0 0 0 0 1 0 0 0 0 0 1 0 0 0 0 0 1 1 0 0 0 1 1 Find the smallest relation containing R and S both (i.e. $R \cup S)^\infty$	10	CO3	UN, AP