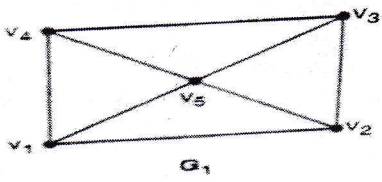
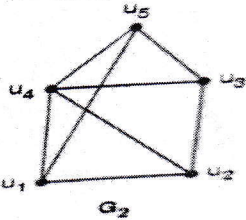


K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

Nov – Dec 2025 (B. Tech / M. Tech.) Program: <u>Artificial Intelligence & Data Science</u> Scheme :-IIB Supplementary Examination: SY Semester: III Course Code: AIC302 and Course Name: Discrete structure & Graph Theory Date of Exam: 27/11/2025 Duration: 02 Hours Max. Marks: 45				
Instructions: (1) All questions are compulsory. (2) Draw neat diagrams wherever applicable. (3) Assume suitable data, if necessary.				
Q. No.	Question	Max. Marks	CO	BT level
Q.1	Solve any 5 questions out of six.	15		
i)	Prove induction to show that $n! \geq 2^{n-1}$ for $n=1, 2, \dots$	3	1	Ap
ii)	Let $f: R \rightarrow R$ where $f(x) = 2x - 1$ and $f^{-1}(x) = (x+1)/2$. Find $(f \circ f^{-1})(x)$.	3	2	Ap
iii)	Draw the Hasse diagram of the following set under the Partial ordering relation divide and indicate those which are chains $A = \{1, 3, 5, 15, 30\}$.	3	3	Ap
iv)	Apply the principle of inclusion and exclusion to determine how many integers between 1 and 2000 are divisible by 2, 3, 5, or 7?	3	4	Ap
v)	Consider $(2, 6)$ the encoding function $e: B^2 \rightarrow B^6$ define as follows $e(00) = (000000)$ $e(01) = (011110)$ $e(10) = (101010)$ $e(11) = (111000)$ How many error it can detect and correct.	3	5	Ap
vi)	1) Is every Eulerian graphs a Hamiltonian? 2) Is every Hamiltonian graph an Eulerian? Draw with necessary graph.	3	6	Ap
Q.2	Solve any three questions out of four.	15		
i)	Prove by Mathematical Induction that $1+2+2^2+2^3+\dots+2^n = 2^{n+1} - 1$	5	1	Ap
ii)	Find the complement of each element in D_{42} .	5	3	Ap
iii)	Determine if the following graphs (G_1 & G_2 respectively) are isomorphic or not.	5	6	Ap

	 (a)  (b)			
iv)	Apply the formula for the maximum number of edges in a simple graph to determine whether a graph with 8 vertices can have 40 edges (excluding self-loops). Show your calculation and justify your answer.	5	6	Ap
Q.3	Solve any three questions out of four.	15		
i)	Let $A = \{a, b, c, d\}$, and let $P = \{ \{a, b\}, \{c\}, \{d\} \}$ Find the equivalence relation induced by P and construct its diagram	5	2	Ap
ii)	Let $A = \{1, 2, 3, 4\}$ and $R = \{(1, 1), (1, 2), (1, 4), (2, 4), (3, 1), (3, 2), (4, 2), (4, 3), (4, 4)\}$. Find transitive closure of R using Warshall's algorithm.	5	2	Ap
iii)	What is the solution of the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$ with the initial condition $a_0 = 1$ and $a_1 = 6$?	5	4	Ap
iv)	Prove that the set $G = \{0, 1, 2, 3, 4, 5\}$ is a finite abelian group of order 6 with respect to addition modulo 6	5	5	Ap
