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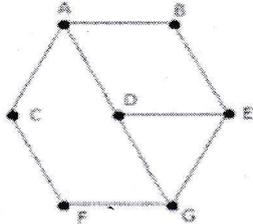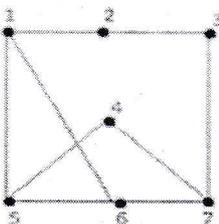### (Autonomous College Affiliated to University of Mumbai)

Jan.- Feb ~~Nov~~ – ~~Dec~~ 2026
(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: ~~25/11/2025~~ 31/01/26   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)	Show that $((p \wedge -q) \wedge (- p \vee - q)) \vee q$ is a Tautology.	3	1	Ap

ii)	Let S = { 1,2,3,4,5,6,7,8,9 }. Determine whether or not each of the following is a partition of S.
	  i) {{ 1,3,5}, {2,6},{4,8,9}}
	  ii) {{ 1,3,5}, {2,4,6,8 },{5,7,9}}
		3	2	Ap

iii)	Apply the steps for constructing a Hasse diagram to draw the Hasse diagram for a given partially ordered set (poset)."	3	3	Ap
iv)	Using the Extended Pigeonhole Principle, determine the minimum number of friends required to ensure that at least five of them have birthdays in the same month.	3	4	Ap
v)	Consider the encoding function e: $B^2 \rightarrow B^6$ define as follows e(00) = (001000) e(01) = (010100) e(10) = (100010) e(11) = (110001) How many error it can detect and correct?	3	5	Ap
vi)	Apply the formula for the maximum number of edges in a simple graph to verify whether a simple graph with 4 vertices and 7 edges is possible.	3	6	Ap
Q.2	**Solve any three questions out of four.**	15		
i)	Prove by Mathematical Induction that $2 + 5 + 8 + ... + (3n - 1) = n (3n+1)/2$	5	1	Ap
ii)	Find the complement of each element in D_{42}.	5	3	Ap

iii)	Determine if the following graphs (G1 & G2 respectively) are isomorphic or not.	5	6	Ap	
iv)	Define Planar Graphs. A connected planar graph has 10 vertices each of degree 3. Into how many regions does a representation of this planar graph split the plane?	5	6	Ap	
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	2	Ap	
ii)	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	2	An	
iii)	Solve $a_n - 7a_{n-2} + 6a_{n-3} = 0$ where $a_0 = 8$, $a_1 = 6$ and $a_2 = 22$.	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	

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