Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech (Full Time) - END SEMESTER EXAMINATIONS, APRIL/MAY 2024

INFORMATION TECHNOLOGY

V Semester

IT5004 – Graph Theory

(Regulation 2019)

Time: 3hrs | Max. Marks: 100

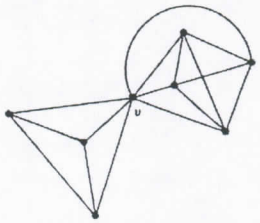
CO 1	To comprehend graphs as modeling and analysis tools.
CO 2	To introduce various data structures with graph theory.
CO 3	To learn graph theoretic algorithms.
CO 4	To understand graph coloring and covering.
CO 5	To learn the usage and applications of graphs in social networking and media.

BL – Bloom's Taxonomy Levels

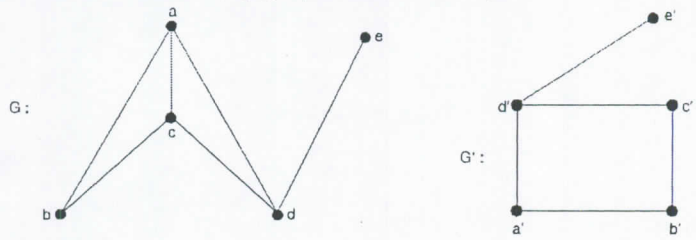
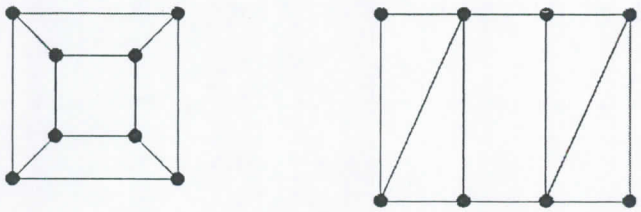
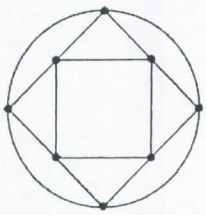
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analyzing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	Differentiate between walk and path in a graph.	2	CO1	L2
2	Draw a graph that has a Hamiltonian path but does not have a Hamiltonian circuit.	2	CO1	L3
3	What is a fundamental circuit?	2	CO2	L1
4	Prove whether the graph given below is separable or not. 	2	CO2	L3
5	Apply the chromatic coloring for the graph given in question 4.	2	CO3	L4
6	Draw a flowchart for testing whether a digraph is strongly connected or weakly connected.	2	CO3	L3
7	Prove the relation between the Euler graph and the unicursal graph.	2	CO4	L3
8	Draw a symmetric digraph and state why.	2	CO4	L4
9	Mention the challenges in data collection from social media sites.	2	CO5	L1
10	What is a covert network? Give examples.	2	CO5	L1

PART- B (5 x 13 = 65 Marks)

Q. No	Questions	Marks	CO	BL
11 (a)	(i) Show that the following graphs are isomorphic:  (ii) Show that the following graphs are Hamiltonian but not Eulerian. 	6 7	CO1	L4
	(OR)			
11 (b)	i. Prove that the maximum degree of any vertex in a simple graph with n vertices is n – 1. ii. Show that the maximum no of edges in a simple graph with n vertices is n(n-1)/2. iii. Prove that a connected graph G remains connected after removing an edge e_i from G, if and only if e_i is in some circuit in G.	4 4 5	CO1	L4
12 (a)	(i) Sketch all the spanning trees for the graph G and G' given in question 11a (i). (ii) Show a tree in which its diameter is not equal to twice the radius. Under what condition does this inequality hold? Elaborate.	7 6	CO2	L3
	(OR)			
12 (b)	Pick an arbitrary spanning tree from the graph given below and do the following: (i) List all seven fundamental cutsets for this tree. (ii) By taking the ring sum of the seven fundamental cutsets obtained in (i) list all other cutsets of the graph. 	7 6	CO2	L3

13 (a)	(i) Prove that the complete graph of five vertices is nonplanar and Kuratowski's second graph is nonplanar. (ii) Brief the differences between combinatorial versus geometric graphs with suitable examples and graphs.	7 6	CO3	L2
	(OR)			
13 (b)	(i) Let a and b be two nonadjacent vertices in a graph G. Let G′ be a graph obtained by adding an edge between a and b. Let G″ be a simple graph obtained from G by fusing the vertices a and b together and replacing sets of parallel edges with single edges. Then prove that P n(λ) of G = Pn(λ) of G′ + Pn - 1(λ) of G″. (ii) Explain the four-color problem with suitable examples and proofs.	7 6	CO3	L2
14 (a)	(i) Prove that in any digraph the sum of the in-degrees of all vertices is equal to the sum of their out-degrees, and this sum is equal to the number of edges in the digraph. (ii) Sketch all distinct (non-isomorphic) orientations of a complete graph of four vertices. Characterize each of the resulting digraphs in terms of binary relations.	6 7	CO4	L4
	(OR)			
14 (b)	(i) Use an algorithm to find the fundamental circuits in the graph given in question 4. Apply the procedure and analyze the graph for the fundamental circuits present in that graph.	13	CO4	L4
15 (a)	(i) Discuss about the various graph storage formats and visualizations with suitable examples and diagrams.	13	CO5	L2
	(OR)			
15 (b)	(i) Explain how any four applications of graph analysis with suitable case studies.	13	CO5	L2

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16.	(i) Name 5 situations (games, activities, real-life problems, etc.) that can be represented using graphs. Explain what the vertices and the edges denote.	10	CO1	L6
	(ii) You are given a 10-piece domino set whose titles have the following set of dots: (1, 2); (1, 3); (1, 4); (1, 5); (2, 3); (2, 4); (2, 5); (3, 4); (3, 5); (4, 5). Represent the above scenarios using a five-vertex complete graph and discuss the possibility of arranging the tiles in a connected series such that one number on a title always touches the same number on its neighbor.	5	CO5	L5

----------ALL THE BEST----------