Reg. No.: .....

Name: .....

University of Kerala

U9201

Second Semester FYUGP Degree Examination, April 2025

Discipline Specific Core Course

MATHEMATICS

UK2DSCMAT106 - Linear Algebra and Graph Theory

Academic Level: 100-199

Time: 2 Hours(120 Mins) **Max. Marks: 56**

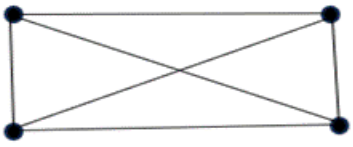
Part A.6 Marks:Time 5 Minutes.(Cognitive Level :Remember(RE)/Understand(UN)) Objective Type.1 mark each, Answer all questions

Qn No.	Question	CL	CO
1	Define spanning tree.	RE	4
2	Define degree of a vertex	RE	3
3	Draw a Graph having 4 vertices and 2 edges.	UN	3
4	Identify the rank of the given matrix $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$	UN	1
5	Find $3A$ if $A = \begin{bmatrix} 1 & 4 \\ 7 & -6 \end{bmatrix}$	UN	2
6	Give an example for null graph with 6 vertices	UN	3

Part B.10 Marks.Time:20 Minutes (Cognitive Level:Understand(UN)/Apply(AP))Two-three sentences.2 marks each.Answer all questions

Qn No.	Question	CL	CO
7	Show that distance between vertices of a connected graph is a metric.	UN	3
8	Write a row equivalent system of the following system of equations $$2x + 3y = 7$$ $$3x - 2y = 4$$	UN	1
9	Explain Konisgberg bridge problem and its solution.	AP	1
10	Find the characteristic equation of the matrix $$\begin{pmatrix} 1 & 2 & 3 \\ 2 & -7 & 1 \\ 0 & 6 & 5 \end{pmatrix}$$	AP	2
11	Verify whether the following set of vectors is linearly independent or not. $(0, 2, 1), (1, 3, 1), (0, 0, 2)$.	AP	4

Part C.16 Marks.Time:35 Minutes.(Cognitive Level :Apply(AP)/Analyse(AN))Short Answer.4 marks each, Answer all 4 questions,choosing among options * within each question

Qn No.	Question	CL	CO
12	A) Compute the Eigen values of the matrix $\begin{bmatrix} 3 & 4 \\ 5 & 2 \end{bmatrix}$ OR B) Define spanning tree. Prove that every connected graph has at least one spanning tree.	AP	2, 4
13	A) Find the rank of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 2 & -7 & 3 \\ 0 & 6 & 5 \end{bmatrix}$ OR B) Draw all the possible spanning trees of the given graph G 	AP	2, 3
14	A) Show that the number of vertices of odd degree in a graph is always even OR B) Explain the algorithm for shortest spanning tree with example	AN	3, 4
15	A) Express the matrix $A = \begin{bmatrix} 2 & 3 & -2 \\ 1 & 3 & 4 \\ -1 & -2 & 3 \end{bmatrix}$ as a sum of symmetric and skew symmetric matrics OR B) Show that if a graph has exactly two vertices of odd degree, then there must be a path joining these two vertices.	AN	1, 3

Part D.24 Marks.Time: 60 Minutes.(Cognitive Level :Analyse(AN)/Evaluate(EV)/Create(CR)) Long Answer 6 Marks each.Answer all 4 questions choosing among options * within each question

Qn No.	Question	CL	CO
16	A) Define path matrix. Draw a graph having 4 vertices and find its path marix. OR B) Show that a connected graph with n vertices is a tree if and only if it has $n-1$ edges.	AN	2, 4
17	A)	EV	2, 4

Qn No.	Question	CL	CO
	Calculate the eigen value and eigen vectos of the matrix $\begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$ OR B) Explain adjacency matrix of a graph and list its properties.		
18	A) Solve the following using Gauss elimination method $$3x + 2y + z = 3$$ $$2x + y + z = 0$$ $$6x - 2y + 4z = 6.$$ OR B) Find the characteristic equation of the matrix $A = \begin{bmatrix} 2 & -1 & 3 \\ 1 & 4 & 2 \\ 3 & -1 & 2 \end{bmatrix}$. What is the characteristic equation of A^T.	EV	2, 2
19	A) If $A(G)$ is an incidence matrix of a connected graph G with n vertices, then prove that the rank of $A(G)$ is $n - 1$. OR B) Compute the Eigen value and its multiplicity for the matrix B = $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$	CR	4, 2