University of Kerala

Discipline	Mathematics				
Course Code	UK2DSCMAT106				
Course Title	Linear Algebra and Graph Theory				
Type of Course	DSC				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical	Total Hours per week
	4	4	-	-	4
Pre-requisites	1. Matrices 2. Linear equations				
Course Summary	This course aims to solve systems of linear equations and to understand the basic concepts of graph theory				

Detailed Syllabus

Module	Unit	Contents	Hrs
I	**Matrices and Systems of linear equatios**		**12**
	1	Linear systems of equations, Gauss elimination, linear Independence, rank of a matrix. *(Chapter7: Sections 7.2, 7.4 of Text [1] (vector space is not included))*	
	2	Solutions of linear systems: existence, uniqueness *(Chapter 7: Section 7.5 of Text [1] (proofs of theorems are not required))*	
II	**Eigenvalues and Eigenvectors**		**12**
	3	The Matrix Eigenvalue Problem. Determining Eigenvalues and Eigenvectors *(Chapter 8: Section 8.1 of Text [1])*	
	4	Symmetric, Skew-Symmetric, and Orthogonal Matrices *(Chapter 8: Section 8.3 of Text [2])*	

Module	Unit	Contents	Hrs
III	**Graphs**		**12**
	5	Basic Concepts of graph theory, Graph terminology and special types of graphs Representation of graphs, *(Chapter 1: Sections 1.1 to 1.5 of Text [2])*	
	6	Graph isomorphism, connected graphs, disconnected graphs, definitions and examples of Euler's path, circuits, *(Chapter 2: Sections 2.1, 2.5, 2.6 of Text [2])*	
IV	**Trees and Spanning Trees**		**12**
	7	Trees, properties, pendant vertices, distance and centers, spanning trees, *(Chapter 3: Sections 3.1 to 3.5 and 3.7 of Text [2])*	
	8	Fundamental circuits, finding all spanning trees in a graph, spanning trees in a weighted graph *(Chapter 3: Section 3.8, 3.9, 3.10 of Text [2] (proofs of theorems are not required))*	
	9	Incidence matrices, path matrices and adjacency matrices of graphs (definitions and examples only) *(Chapter 7: Sections 7.1, 7.8, 7.9 of Text [2] (proofs of theorems are not required))*	
V	**Suggestions for teacher designed topics**		**12**
	For internal assessment examinations only.		
	10	Determinants Cramer's Rule Diagonalization Quadratic Forms Hamiltonion Path, Hamiltonian circuits Rooted and binary trees	
	The topics can be found on Chapter 7: Section 7.7 of Text [1] , Chapter 8: Section 8.4 of Text [1] (eigen bases is not included), Chapter 2: Section 2.9 of Text [2], Chapter 3: Section 3.5 of Text [2]		

Textbook

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, Wiley Publishers, 10^{th} Edition, 2018.

2. Narasingh Deo, *Graph Theory with Applications to Engineering and Computer Science*, PHI, 1974.

References

1. R. Balakrishnan, K. Ranganathan, *A Text book of Graph Theory*, Second Edition, Springer, 2012.

2. T S Blyth, E F Robertson, *Linear Algebra*, Second Edition, Springer, 2013.

3. David C Lay, *Linaer algebra*, Pearson, 2003.

4. Gary Chartrand and Ping Zhang, *Introduction to Graph Theory*, New Delhi, New York: Tata McGraw-Hill Pub. Co., 2006.

5. Lee W. Johnson, R Dean Riess, Jimmy T. Arnold, *Introduction to Linear Algebra*, Fifth Edition, Addison Wesley, 2019.

6. Robin J. Wilson, *Introduction to Graph Theory*, Pearson Education Asia, 5^{th} Edition, 2010.

7. Thomas Banchoff, John Wermer, *Linear Algebra Through Geometry*, 2^{nd} Edition, Springer, 2003.

Course Outcomes

CO No.	Upon completion of the course the graduate will be able to	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L) Tutorial (T)	Practical (P)
CO 1	Understand the concepts of Matrix operations their algebraic properties, System of linear equations and their Matrix representation, Gauss Elimination	PSO 1	U	F, C	L	
CO 2	Able to find the eigen values, powers of matrices and diagonalization of matrices	PSO 2, 4	Ap, An	P	L	
CO 3	To define and understand the fundamental concepts of graph theory	PSO 1	U	F, C	L	
CO 4	To apply the concepts and theorems that are treated in the course for problem-solving	PSO 2, 4	Ap, An	P	L	

(R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create)
(F-Factual, C-Conceptual, P-Procedural, M-Metacognitive)

Mapping of CO with PSOs and POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	-	-	-	-	1	1	-	-	1	2	-	-
CO2	-	2	-	2	-	-	2	2	-	-	-	2	-	-
CO3	2	-	-	-	-	-	1	1	-	-	1	1	-	-
CO4	-	2	-	3	-	-	2	1	1	-	-	-	-	-

(- -Nill, 1-Slightly/Low, 2-Moderate/Medium, 3-Substantial/High)

Assessment Rubrics

- Quiz/Assignment/Discussion/Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics

	Internal Examination	Assignment	Project Evaluation	End Semester Exam
CO1	✓			✓
CO2	✓	✓		✓
CO3	✓			✓
CO4	✓	✓		✓