5 Years Integrated M.C.A.

DSE2 Advanced Mathematics for Computer Applications
(060060209)

2nd Semester

EFFECTIVE FROM JANUARY-2016
Course Code: 0600060209  Course Title: DSE2 Advanced Mathematics for Computer Applications
Course Credits: 4  [Lectures: 04, Tutorial: 00, Practical: 00]
Prerequisites:  Mathematics for Computer Applications
Prerequisites By Topics:  Mathematical Logic, Set Theory, Elementary Combinatories, Analytical Geometry, and Determinants

Objectives:  Apply mathematical knowledge of Algebra, Group Theory and Discrete Mathematics, to problem solving skills necessary to succeed in design and analysis of algorithms, software engineering and computer networks.

1  Matrix Algebra  [14 %]
1.1. Definition and Types
1.2. Operations on Matrices
1.3. Adjoint and Inverse
1.4. Solution of System of Equations by Matrix Inversion Method
1.5. Applications of Matrix

2  Group Theory  [15 %]
2.1. Binary and n-Ary Operations
2.2. Algebraic System: Definition and Properties
2.3. Semi-Groups and Monoids
2.4. Sub Semi-Groups and Sub-Monoids
2.5. Group, Order of a Group, Order of an Element, Properties of Group
2.6. Permutation Group, Dihedral Group, Cyclic Group, Subgroups
2.7. Applications of Group Theory

3  Basics of Graph Theory  [20 %]
3.1. Basic Terminologies of Directed and Undirected Graphs
3.2. Special Simple Graphs
3.3. Operations on Graphs
3.4. Matrix Representation of Graphs(Adjacency Matrix and Incidence Matrix)

4  Graphs Isomorphism, Path and Circuits  [18 %]
4.1. Graphs Invariants and Isomorphism
4.2. Walk, Path, Circuit
4.3. Connectedness in Undirected Graphs
4.4. Euler Path and Circuit
4.5. Hamiltonian Path and Circuit
4.6. Shortest Path in Graph: Dijkstra’s Algorithm
4.7. Applications of Graph

5  Trees  [21 %]
5.1. Introduction of a Tree, Properties of Tree
5.2. Distance and Center in a Tree
5.3. Rooted Tree, Height of a Vertex, Height of a Tree, Descendant and Children of a Vertex, Leaf, Internal Vertex
5.4. Binary Tree, Properties of Binary Tree
5.5. Preorder, Inorder and Postorder Tree Traversal
5.6. Applications of Trees

6  Spanning Trees  [12 %]
6.1. Spanning Tree
6.2. DFS and BFS Algorithm
6.3. Minimum Spanning Tree, Prim's and Kruskal's Algorithms
6.4. Applications of Spanning Tree

Course Outcomes:
CO1: Determine need of matrices in image processing, computer graphics and cryptography.
CO2: Apply knowledge of group theory for data encryption.
CO3: Design and use foundational concepts of notations and results of graph theory in information storage and retrieval.
CO4: Apply the basic concepts of spanning tree algorithm namely DFA, BFS, Prim’s and Kruskal’s in design of networks.

Course Objectives and Course Outcomes Mapping:

Apply mathematical knowledge of Algebra, Group Theory and Discrete Mathematics – CO1, CO2, CO3
To problem solving skills necessary to succeed in design and analysis of algorithms, software engineering and computer networks – CO2, CO3, CO4

Course Units and Course Outcomes Mapping

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Unit</th>
<th>Course outcome</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>CO1</td>
</tr>
<tr>
<td>1</td>
<td>Matrix Algebra</td>
<td>✓</td>
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<tr>
<td>2</td>
<td>Group Theory</td>
<td>✓</td>
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<tr>
<td>3</td>
<td>Basics of Graph Theory</td>
<td>✓</td>
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<tr>
<td>4</td>
<td>Graphs Isomorphism, Path and Circuits</td>
<td>✓</td>
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<tr>
<td>5</td>
<td>Trees</td>
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<tr>
<td>6</td>
<td>Spanning Trees</td>
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Modes of Transaction (Delivery):

- Lecture method shall be used but along with it, as and when required, discussion method would be fruitful. It may be supplemented with various appropriate audio-visual aids.
- Assignment activity should be designed and given to group of student for solution.

Activities/Practicum:

The following activities shall be carried out by the students.
- To operate matrix and its operations as array form in programming.
- To correlate the concept of Matrices multiplication with cryptography.
- To identify the use of Group Theory in data encryption.

The following activities shall be carried out by the teacher.
- To demonstrate how every element in computer graphics is represented by a matrix.
- To demonstrate applications of Graph Theory in Computer networks.
- To demonstrate implementation of basic algorithms of spanning tree in MATLAB.

Text Books:


References:

1. NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science, PHI.
2. J. P. Singh, Calculus, Ane Books Pvt. Ltd.
4. UditAgarwal, Umesh Pal Singh, Graph Theory, University Science Press.
Concept Map:
It is a hierarchical / tree based representation of all topics covered under the course. This gives direct / indirect relationship / association among topics as well as subtopics.

Unit-1: Matrix Algebra

Unit-2: Group Theory
Unit-3: Basics of Graph Theory

Basics of Graph Theory
- Basic Terminologies of Directed and Undirected Graphs
- Special Simple Graphs

Operations on Graphs

Matrix Representation of Graphs
- Adjacency Matrix
- Incidence Matrix

Unit-4: Graphs Isomorphism, Path and Circuits

Graphs Isomorphism, Path and Circuits
- Graphs Invariants and Isomorphism
- Walk, Path, Circuit
- Connectedness in Undirected Graphs

Applications of Graph
- Shortest Path in Graph: Dijkstra’s Algorithm
- Hamiltonian Path and Circuit
- Euler Path and Circuit
Unit-5: Trees

Introduction
Rooted Tree
Binary Tree
Distance
Properties
Center
Height of Vertex and Tree
Descendent and Children of a Vertex
Leaf
Internal Vertex
Properties
Applications of Tree

Unit-6: Spanning Trees

Spanning Trees
DFS and BFS Algorithm
Minimum Spanning Tree
Prim's Algorithms
Kruskal's Algorithms
Applications of spanning tree

Assessment:
- The weightage of CIE and University examination shall be as per the University regulations.
- At the institute level the structure of CIE for a course may comprise of Quizzes, Unit Test, Assignments, Mini Projects, and Self-Creation Parameters applicable to both theory and practical courses.
The frequency and weightage of each assessment parameter may vary from time to time to satisfy courses objectives and outcomes so as to achieve programme educational objectives and its outcomes.

The courses teacher is free to decide the number of assessment parameters for a course subject to prior approval of the authority.

The assessment policy document should be uploaded on the web before the commencement of the semester.

Syllabus for each CIE parameter shall be covered by the date of the corresponding test.

No make-up work shall be accepted for missed or failed tests.

Question Bank:

Question Bank shall consist of Multiple Choice Questions, Fill in the blanks, Short type questions, long type questions and comprehensive exercises. Comprehensive exercises shall be applicable for units 1, 2, 4, 5 and 6.

Academic Honesty:

Coursework is assumed to be accomplished individually (otherwise stated). Any portion of submission taken directly from anywhere (like statements in assignment/report etc.) without modification must be accompanied with the properly formatted reference giving credit to the author and to the source.

UFM:

- If two or more submitted papers are too similar for coincidence, a penalty shall be imposed that shall usually be the same for the student who did the original as for the one copying from it.
- Any ascertained fact of breaking institute policy shall be associated with one or all of the following: (i) zero marks for the work; (ii) report to the programme coordinator; (iii) report to the Director.

Discussion Group:

Students are welcome to post on the Course Discussion Board available on SRIMCA View Course Webpage. It is responsibility of the concern Course teacher to maintain Discussion Board.

Attendance:

- Attendance means being present for the entire class session. Those arriving significant late or leaving significantly early without prior permission shall be counted as ABSENT for the entire class session.
- Concern teacher must clearly state his/her attendance policies at the first class meeting.