

A. Course Handout

Institute/School Name	Chitkara University Institute of Engineering and Technology		
Department Name	Department of Computer Science & Engineering		
Programme Name	Bachelor of Engineering (B.E.), Computer Science & Engineering		
Course Name	Discrete Structures	Session	2022-2023
Course Code	22AS003	Semester/Batch	3 rd /2022
L-T-P (Per Week)	4-0-0	Course Credits	04
Course Coordinator	Dr. Krishan Dutt Sharma		

CLO01	To apply the knowledge obtained to investigate and solve a variety of live problems.
CLO02	Analysis of relevance within the context of computer science, in the areas of data structures and algorithms
CLO03	To understand and apply the theory and techniques of Lattice, Logic and Boolean algebra.
CLO04	To comprehend Graph Theory and its relevance within the context of computer science and finding solutions of live problems related to shortest path etc.

1. Objectives of the Course

The course provides the ability to develop the mathematical foundations, abstraction and formalization of reasoning for the problems related to computer science engineering to arrive at substantiated conclusions.

The main objectives of the courses are:

- To understand the theory and techniques of logic, graphs and trees, and algebraic systems.
- To apply the knowledge and skills obtained to investigate and solve a variety of discrete mathematical problems.
- To communicate mathematical ideas and to make effective use of appropriate technology.
- To comprehend discrete structures and their relevance within the context of computer science, in the areas of data structures and algorithms, in particular (Enabling Knowledge).
- To apply discrete structures into other computing problems such as formal specification, verification, databases, and cryptography (Problem Solving).

2. Course Learning Outcomes

After completion of the course, student should be able to:



	Course Outcome	*POs	**CL	***KC	Sessions
CL01	To apply the knowledge obtained to investigate and solve a variety of live problems.	PO1,PO2	K2	Factual Conceptual	04
CL02	Analysis of relevance within the context of computer science, in the areas of data structures and algorithms	PO1,PO2	K3	Conceptual Procedural	04
CL03	To understand and apply the theory and techniques of Lattice, Logic and Boolean algebra.	PO2,PO3	K3	Conceptual Procedural	8
CLO4	To comprehend Graph Theory and its relevance within the context of computer science and finding solutions of live problems related to shortest path etc.	PO1,PO2,P03	K3	Conceptual Procedural	5
Total Contact Hours					42

Revised Bloom's Taxonomy Terminology

* PO's available at (shorturl.at/cryzF)

**Cognitive Level =CL

***Knowledge Categories = KC

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO01	H	H										
CLO02	H	H										
CLO03		H	M									
CLO04	H	M	H									

H=High, M=Medium, L=Low

3. ERISE Grid Mapping

Feature Enablement	Level(1-5, 5 being highest)
Entrepreneurship	1
Research	1
Innovation	3
Skills	5
Employability	4

4. Recommended Books:

Text Books:

- B01: 'Elements of Discrete Mathematics', by C.L.Liu, McGraw-Hill.
 B02: 'Discrete Mathematics' by Babu Ram, Pearson Education India.
 B03: 'Discrete Mathematics' by Lipschutz/Lipson, Schaum Series, 2nd Edition, TMH, Edition.
 B04: 'Discrete Mathematics and its Applications' by Kenneth H. Rosen, McGraw- Hill.

Reference Books:

- B05: 'Logic and Discrete Mathematics' by Trembly/Grassmann, Pearson Education.
 B06: 'The Discrete Mathematics', Chitkara University Publications.

E-Resources:

- <https://library.chitkara.edu.in/subscribed-books.php>
- <http://164.100.247.26/Record/38449930>
- <https://www.sciencedirect.com/science/article/pii/B9780123507723500069?via%3Dihub>

5. Other readings and relevant websites:

Serial No	Link of Journals, Magazines, websites and Research Papers
1	http://download.nos.org/srsec311new/L.No.15-A.pdf
2	http://faculty.simpson.edu/lydia.sinapova/www/cmssc180/LN180_Johnsonbaugh-07/L17-EquivalenceRel.htm
3	http://web.cs.wpi.edu/~cs504/s00m/notes/recurrence/solve/step2/step2.html
4	http://www.iep.utm.edu/prop-log/
5	http://plato.stanford.edu/entries/boolalg-math/
6	http://www.hamilton.ie/oilie/Downloads/Graph.pdf

6. Recommended Tools and Platforms

Basic knowledge of C & C++ for coding large scale problem.

7. Course Plan:

LectureNumber	Topics	Text Book
1-2	Recurrence relation: Homogeneous and Non-homogeneous recurrence relation with constant coefficients.	B01, B02
3-4	Characteristic polynomial & Introduction to generating functions: Methods of generating functions.	B01, B02
5-6	Logic: Propositions & logical operators, Truth table. Laws of logic & Quantifiers, Validity of arguments, Truth values.	B01, B06
7-8	Lattices: Definition of lattice, Sub lattice, Isomorphic lattices, Bounded lattice, Distributive lattice, Complemented lattice, Modular lattice.	B01, B02
9	Boolean Algebra: Atoms, Boolean expressions, Applications of Boolean algebra to switching theory & Logic Gates.	B01, B06
ST-1 (Syllabus = (Lecture number 1-9) (Offline)		
10-11	Graph Theory: Introduction to graphs & Sub graphs. Directed & Undirected graph, Order & Size of graph, Degree of vertex, Source, sink, Eccentricity, Trail, Walk, Path, Distance, Diameter, Cycle, Wheel.	B02

12-13	Multi graph, Planer graph, Pseudo graph, weighted graph, Regular, Complete and Traversable graph. Isomorphism of graphs,	B06
14-16	Sub graphs, Complement of graph.,Adjacency Matrix, Adjacency List, Incidence Matrix.	B06
17-22	Complete Bipartite graph & Spanning Graph, Cut vertex, Cut edge, Region, Eulerian & Hamiltonian graphs.	B03
23-24	Euler's formula & its applications: Traveling salesman problem, Konigsberg Bridge problem, `	B02
25-28	Chromatic number & Graph coloring by Welsh Powell Algorithm.	B02
29-31	Tree: Binary trees, Traversing binary trees,	B06
32-34	Rooted & spanning tree, Algebraic expression trees,	B06
35-38	Depth-First Search Algorithm, Breadth-First Search Algorithm.	B06
ST-2 (Syllabus = (Lecture numbe 10-38) (Offline)		
39-40	Shortest path algorithm: Kruskal's Algorithm, Dijkstra's Algorithm	B05
41-42	Warshall's Algorithm, Prim's Algorithm	B05
ETE (Syllabus = (Lecture number 1-42) (Offline)		

8. Delivery/Instructional Resources

Lecture No.	Topics	Web References	Audio-Video
1-2	Recurrence relation: Homogeneous and Non-homogeneous recurrence relation with constant coefficients.	https://en.wikipedia.org/wiki/Discrete_mathematics https://www.cs.cornell.edu/~rafael/discmath.pdf	https://nptel.ac.in/courses/106/106/106106183/
3-4	Characteristic polynomial & Introduction to generating functions: Methods of generating functions.	https://web.stanford.edu/class/cs103x/cs103x-notes.pdf https://en.wikipedia.org/wiki/Discrete_mathematics	https://nptel.ac.in/courses/106/106/106106183/
5-6	Logic: Propositions & logical operators, Truth table. Laws of logic & Quantifiers, Validity of arguments, Truth values.	https://en.wikipedia.org/wiki/Discrete_mathematics https://www.cs.cornell.edu/~rafael/discmath.pdf	https://nptel.ac.in/courses/106/106/106106183/
7-8	Lattices: Definition of lattice, Sub lattice, Isomorphic lattices, Bounded lattice, Distributive lattice, Complemented lattice, Modular lattice.	https://web.stanford.edu/class/cs103x/cs103x-notes.pdf https://en.wikipedia.org/wiki/Discrete_mathematics	https://nptel.ac.in/courses/106/106/106106183/
9	Boolean Algebra: Atoms, Boolean expressions, Applications of Boolean algebra to switching theory & Logic Gates.	https://web.stanford.edu/class/cs103x/cs103x-notes.pdf https://en.wikipedia.org/wiki/Discrete_mathematics	https://nptel.ac.in/courses/106/106/106106183/
10-11	Graph Theory: Introduction to graphs & Sub graphs. Directed & Undirected graph, Order & Size of graph, Degree of vertex, Source, sink, Eccentricity, Trail, Walk, Path, Distance, Diameter, Cycle, Wheel.	https://en.wikipedia.org/wiki/Discrete_mathematics https://www.cs.cornell.edu/~rafael/discmath.pdf	https://nptel.ac.in/courses/106/106/106106183/
12-13	Multi graph, Planer graph, Pseudo graph, weighted graph, Regular, Complete and Traversable graph. Isomorphism of graphs,	https://web.stanford.edu/class/cs103x/cs103x-notes.pdf https://en.wikipedia.org/wiki/Discrete_mathematics	https://nptel.ac.in/courses/106/106/106106183/

14-16	Sub graphs, Complement of graph.,Adjacency Matrix, Adjacency List, Incidence Matrix.	https://en.wikipedia.org/wiki/Discrete_mathematics https://www.cs.cornell.edu/~rafael/discmath.pdf	https://nptel.ac.in/courses/106/106/106106183/
17-22	Complete Bipartite graph & Spanning Graph, Cut vertex, Cut edge, Region, Eulerian & Hamiltonian graphs.	https://web.stanford.edu/class/cs103x/cs103x-notes.pdf https://en.wikipedia.org/wiki/Discrete_mat	https://nptel.ac.in/courses/106/106/106106183/
23-24	Euler's formula & its applications: Traveling salesman problem, Konigsberg Bridge problem, `	https://en.wikipedia.org/wiki/Discrete_mathematics https://www.cs.cornell.edu/~rafael/discmath.pdf	https://nptel.ac.in/courses/106/106/106106183/
25-28	Chromatic number & Graph coloring by Welsh Powell Algorithm.	https://web.stanford.edu/class/cs103x/cs103x-notes.pdf https://en.wikipedia.org/wiki/Discrete_mat	https://nptel.ac.in/courses/106/106/106106183/
29-31	Tree: Binary trees, Traversing binary trees,	https://en.wikipedia.org/wiki/Discrete_mathematics https://www.cs.cornell.edu/~rafael/discmath.pdf	https://nptel.ac.in/courses/106/106/106106183/
32-34	Rooted & spanning tree, Algebraic expression trees,	https://web.stanford.edu/class/cs103x/cs103x-notes.pdf https://en.wikipedia.org/wiki/Discrete_mat	https://nptel.ac.in/courses/106/106/106106183/
35-38	Depth-First Search Algorithm, Breadth-First Search Algorithm.	https://en.wikipedia.org/wiki/Discrete_mathematics https://www.cs.cornell.edu/~rafael/discmath.pdf	https://nptel.ac.in/courses/106/106/106106183/

39-40	Shortest path algorithm: Kruskal's Algorithm, Dijkstra's Algorithm	https://web.stanford.edu/class/cs103x/cs103x-notes.pdf https://en.wikipedia.org/wiki/Discrete_mathematics	https://nptel.ac.in/courses/106/106/106106183/
41-42	Warshall's Algorithm, Prim's Algorithm	https://en.wikipedia.org/wiki/Discrete_mathematics https://www.cs.cornell.edu/~rafael/discmath.pdf	https://nptel.ac.in/courses/106/106/106106183/

9. Action plan for different types of learners

Slow Learners	Average Learners	Fast Learners
Remedial Classes, Doubt Sessions, Guided Tutorials	Practice and Doubt Session	Assignments and Extra Questions

10. Evaluation Scheme & Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment
Component 2	Sessional Tests (STs)	02**	30%	Offline
Component 3	End Term Examination	01***	50%	Offline
Total		100%		

**Out of 02 STs, the ERP system automatically picks the best 01 ST.

***As per Academic Guidelines minimum 75% attendance is required to become eligible for appearing in the End Semester Examination.

11. Syllabus of the Course:

Subject: Discrete Structures	
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S.No.	Topic (s)	No. of Sessions	Weightage %
1	<p>Recurrence relation: Homogeneous and Non-homogeneous recurrence relation with constant coefficients.,Characteristic polynomial & Introduction to generating functions: Methods of generating functions. Logic: Propositions & logical operators, Truth table. Laws of logic & Quantifiers, Validity of arguments, Truth values. Lattices: Definition of lattice, Sub lattice, Isomorphic lattices, Bounded lattice, Distributive lattice, complemented lattice, Modular lattice. Boolean Algebra: Atoms, Boolean expressions, Applications of Boolean algebra to switching theory & Logic Gates, Tree: Binary trees, Traversing binary trees,</p> <p>Boolean expressions, Applications of Boolean algebra to switching theory & Logic Gates Applications of Boolean algebra to switching theory & Logic Gates.</p>	4.5	20%
ST-1 (Covering 35% syllabus)			
2	<p>Graph Theory: Introduction to graphs & Sub graphs. Directed & Undirected graph, Order & Size of graph, Degree of vertex, Source, sink, Eccentricity, Trail, Walk, Path, Distance, Diameter, Cycle, Wheel., Multi graph, Planar graph, Pseudo graph, weighted graph, Regular, Complete and Traversable graph. Isomorphism of graphs, Sub graphs, Complement of graph.,Adjacency Matrix, Adjacency List, Incidence Matrix, Complete Bipartite graph & Spanning Graph, Cut vertex, Cut edge, Region, Eulerian & Hamiltonian graphs, Euler's formula & its applications: Traveling salesman problem, Konigsberg Bridge problem, Chromatic number & Graph coloring by Welsh Powell Algorithm, Rooted & spanning tree, Algebraic expression trees, Depth-First Search Algorithm, Breadth-First Search Algorithm.</p>	13.5	60%
ST-2 (Covering 50% syllabus)			
3	2D Arrays, Introduction to recursion, Recursion basic programs like: factorial, Fibonacci, sum of digits Warshall's Algorithm, Prim's Algorithm	2	20%
End Term (Covering (35%+ 50%+ 15%=)100% syllabus)			

This Document is approved by:

Designation	Name	Signature
Course Coordinator	Dr. Krishan Dutt Sharma	
Assistant Dean	Dr. Mohit Kumar Kakkar	
Date (DD/MM/YYYY)	29.6.2023	