

DISCRETE MATHEMATICAL STRUCTURES		Semester	IV
Course Code	BCS405A	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		
<b>Course objectives:</b> <ol style="list-style-type: none"> <li>1. To help students to understand discrete and continuous mathematical structures.</li> <li>2. To impart basics of relations and functions.</li> <li>3. To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations.</li> <li>4. To have the knowledge of groups and their properties to understand the importance of algebraic properties relative to various number systems.</li> </ol>			
<b>Teaching-Learning Process</b> <b>Pedagogy (General Instructions):</b> These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none"> <li>1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.</li> <li>2. State the need for Mathematics with Engineering Studies and Provide real-life examples.</li> <li>3. Support and guide the students for self-study.</li> <li>4. You will assign homework, grading assignments and quizzes, and documenting students' progress.</li> <li>5. Encourage the students to group learning to improve their creative and analytical skills.</li> <li>6. Show short related video lectures in the following ways:               <ul style="list-style-type: none"> <li>• As an introduction to new topics (pre-lecture activity).</li> <li>• As a revision of topics (post-lecture activity).</li> <li>• As additional examples (post-lecture activity).</li> <li>• As an additional material of challenging topics (pre-and post-lecture activity).</li> <li>• As a model solution for some exercises (post-lecture activity).</li> </ul> </li> </ol>			
<b>Module-1: Fundamentals of Logic</b> Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems. <b>(8 hours)</b> <b>(RBT Levels: L1, L2 and L3)</b>			
<b>Module-2: Properties of the Integers</b> Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. <b>Fundamental Principles of Counting:</b> The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition. <b>(8 Hours)</b> <b>(RBT Levels: L1, L2 and L3)</b>			
<b>Module-3: Relations and Functions</b> Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions. <b>Properties of Relations,</b> Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. <b>(8 hours)</b> <b>(RBT Levels: L1, L2 and L3)</b>			
<b>Module-4: The Principle of Inclusion and Exclusion</b>			



<p>The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.</p> <p><b>Recurrence Relations:</b> First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients. <b>(8 Hours)</b></p> <p><b>(RBT Levels: L1, L2 and L3)</b></p>
<p align="center"><b>Module-5: Introduction to Groups Theory</b></p> <p>Definitions and Examples of Particular Groups Klein 4-group, Additive group of Integers modulo <math>n</math>, Multiplicative group of Integers modulo <math>p</math> and permutation groups, Properties of groups, Subgroups, cyclic groups, Cosets, Lagrange's Theorem. <b>(8 Hours)</b></p> <p><b>(RBT Levels: L1, L2 and L3)</b></p>
<p><b>Course outcome (Course Skill Set)</b></p> <p>At the end of the course, the student will be able to:</p> <ol style="list-style-type: none"> <li>1. Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements.</li> <li>2. Demonstrate the application of discrete structures in different fields of computer science.</li> <li>3. Apply the basic concepts of relations, functions and partially ordered sets for computer representations.</li> <li>4. Solve problems involving recurrence relations and generating functions.</li> <li>5. Illustrate the fundamental principles of Algebraic structures with the problems related to computer science &amp; engineering.</li> </ol>
<p><b>Assessment Details (both CIE and SEE)</b></p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p>
<p><b>Continuous Internal Evaluation:</b></p> <ul style="list-style-type: none"> <li>• There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.</li> <li>• Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks</li> <li>• Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)</li> </ul> <p>The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.</p>

The Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

**Semester-End Examination:**

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

**Suggested Learning Resources:**

**Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)**

**Text Books:**

1. **Ralph P. Grimaldi, B V Ramana: "Discrete Mathematical Structures an Applied Introduction"**, 5<sup>th</sup> Edition, Pearson Education, 2004.
2. **Ralph P. Grimaldi: "Discrete and Combinatorial Mathematics"**, 5th Edition, Pearson Education, 2004.

**Reference Books:**


1. **Basavaraj S Anami and Venakanna S Madalli: "Discrete Mathematics – A Concept-based approach"**, Universities Press, 2016
2. **Kenneth H. Rosen: "Discrete Mathematics and its Applications"**, 6th Edition, McGraw Hill, 2007.
3. **Jayañt Ganguly: "A Treatise on Discrete Mathematical Structures"**, Sanguine-Pearson, 2010.
4. **D.S. Malik and M.K. Sen: "Discrete Mathematical Structures Theory and Applications"**, Latest Edition, Thomson, 2004.
5. **Thomas Koshy: "Discrete Mathematics with Applications"**, Elsevier, 2005, Reprint 2008.

**Web links and Video Lectures (e-Resources):**

- <http://nptel.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- VTU e-Shikshana Program
- VTU EDUSAT Program.
- <http://www.themathpage.com/>
- <http://www.abstractmath.org/>
- <http://www.ocw.mit.edu/courses/mathematics/>

**Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning**

- Quizzes
- Assignments
- Seminar

  
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