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| **Course Handout- Discrete Mathematics** | | | |
| **1** | **Course details** | | |
| **Faculty name** | | Dr Pradeep Kumar |
| **Programme** | | B.Tech |
| **Semester** | | II |
| **Section** | |  |
| **Course code** | |  |
| **Course title** | | Discrete Mathematics |
| **2** | **Vision of the Department** | | |
| To be known widely as a premier department of Computer Science and Engineering for value-based education, multidisciplinary research and innovation. | | |
| **3** | **Mission of the Department** | | |
|  | The mission of the Computer Science and Engineering Department is   * Create a strong foundation on fundamentals of CSE through OB-TLP. * Establish state-of-the-art facilities for Analysis, Designand Implementation to develop sustainable ethical solutions. * Conduct multidisciplinary research for developing innovative solutions. * Involve the students in group activity including that of professional bodies to develop leadership and communication skills. | |
|  | **Programme educational objectives (PEOs)** | | |
| **PEO1** | Graduates of Computer Science and Engineering will be globally competent and provide sustainable solutions for interdisciplinary problems as team players. | |
| **PEO2** | Graduates of Computer Science and Engineering will engage in professional activities with ethical practices in the field of Computer Science & Engineering to enhance their own stature to contribute society | |
| **PEO3** | Graduates of Computer Science and Engineering will acquire  specialize knowledge in trending technologies for research, innovation and product development | |

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| **5** | **Programme outcomes** | | | | | | |
| **PO1** | Engineering Knowledge | | | | | |
| **PO2** | Problem analysis | | | | | |
| **PO3** | Design/development of solutions | | | | | |
| **PO4** | Conduct investigations of complex problems | | | | | |
| **PO5** | Modern tool usage | | | | | |
| **PO6** | The engineer and society | | | | | |
| **PO7** | Environment and sustainability | | | | | |
| **PO8** | Ethics | | | | | |
| **PO9** | Individual or team work | | | | | |
| **PO10** | Communication | | | | | |
| **PO11** | Project management and finance | | | | | |
| **PO12** | Life-long Learning | | | | | |
| **6** | **Programme specifics outcome(PSO) (if any)** | | | | | | |
| **PSO1** | To analyze, design and implement sustainable and ethical solutions in the field of computer science | | | | | |
| **PSO2** | To use problem solving skills to develop efficient algorithmic solutions | | | | | |
| **7** | **Course outcomes (COs)** | | | | | | |
| **CO1** | Apply rule of inference for connecting and validating logical statements and use proof techniques. | | | | | |
| **CO2** | Use counting techniques to solve various counting problems. | | | | | |
| **CO3** | Apply the concepts of sets, relation, functions and mathematical induction. | | | | | |
| **CO4** | Classify the algebraic structures as Group, Ring, field. | | | | | |
| **CO5** | Classify the structures of graph and tree and use them to simplify various problem. | | | | | |
| **CO6** | Define terminology of Lattice. | | | | | |
| **8** | Evaluation Component | | Duration | Marks  (50) | Date &Time | Nature of Component | Evaluation Component |
| CAT-1 | | 75 minutes | 30 (10) |  | Closed Book | CAT-1 |
| CAT-2 | | 75 minutes | 30 (10) |  | Closed Book | CAT-2 |
| CAT-3 | | 75 minutes | 30 (10) |  | Closed Book | CAT-3 |
| Quiz-for every unit | | 15 mins each | 5 marks |  | Closed Book | Quiz- |
|  | Evaluation Component | | Duration | Marks  (50) | Date &Time | Nature of Component | Evaluation Component |

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| **9** | **Teaching Pedagogy:** Major part of the course shall be delivered using markers on White board. Some part may be delivered using PPT’s for Graphical representations /reviews of prerequisite topics/revision of current topics etc (Optional). |
| **10** | Day(s) :  Email [: pradeep.kumarsbas@galgotiasuniversity.edu.in](mailto::%20pradeep.kumarsbas@galgotiasuniversity.edu.in)  Cabin : B-119  Course Coordinator: Dr Pradeep Kumar Room No: B-119 |
| **11** | RF- Campus |
| **12** | <https://nptel.ac.in> |
| **14** | Recommended list of mini projects / projects/ technical training etc. |
| **15** | Students’ Presentation-Mentioned |
| **16** | List of e-books: [www.mhhe.com/rosen](http://www.mhhe.com/rosen) |
| **17** | List of NPTEL/MOOCS/SWAYAM/Courses/Video- <https://nptel.ac.in> |
| **18** | Content beyond Syllabus- |
| **19** | List of mini projects/projects-NA |

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| **S.N.** | **Date** | **Learning outcome of each topic** | **Topics to be covered** | **Chapter/page/books** | **Teaching Methodology** | **Remark** |
| **UNIT- I Hours: 8** | | | | | | |
| 1 |  | Explain proposition, logical operators, Truth table | Proposition, logical operators, Truthtables  (TT) | 1.1/1/T1 | Lecture |  |
| 2 |  | Explain Conditional statements, converse, contrapositive inverse, biconditionals | Conditional statements, converse, contrapositive inverse, biconditionals | 1.1/6/T1 | Lecture |  |
| 3 |  | Illustrate TT of compound propositions, precedence of logical operators | TT of compound propositions, precedence of logical operators | 1.1/10/T1 | Lecture |  |
| 4 |  | Explain Tautology, contradiction, logical equivalence, laws, Satisfiability | Tautology, contradiction, logical equivalence, laws, Satisfiability | 1.3/25/T1 | Lecture |  |
| 5 |  | Explain Predicate and quantifiers | Predicates, quantifiers | 1.4/36/T1 | Lecture |  |
| 6 |  | Apply rules of inference | Rules of Inference | 1.6/69/T1 | Lecture |  |
| 7 |  | Develop normal form | Normal form- CNF, DNF |  | Lecture |  |
| 8 |  | Make use of Proof Techniques | Some terminologies, Forward proof, Proof by contradiction, Proof by contraposition, Proof of necessity and sufficiency. | 1.6/80/T1 | Lecture |  |
| **UNIT- II Hours- 6** | | | | | | |
| 9 |  | Apply basics technique of counting | Basic counting techniques, | 6.1/385/T1 | Lecture |  |
| 10 |  | Solve problems using inclusion and exclusion rule | inclusion and exclusion rule | 6.1/392/T1 | Lecture |  |
| 11 |  | Apply pigeonhole principle | pigeon-hole principle | 6.2/399/T1 | Lecture |  |
| 12 |  | Apply generalized pigeonhole principle | generalized pigeon-hole principle | 6.2/401/T1 | Lecture |  |
| 13 |  | Apply permutation | permutation | 6.3/408/T1 | Lecture |  |
| 14 |  | Apply combination | Combination | 6.3/409/T1 | Lecture |  |
| **UNIT- III Hours- 12** | | | | | | |
| 15 |  |  | Set, Venn diagram, Subsets, size of the set, power set, Cartesian Product | 2.1/115/T1 | Lecture |  |
| 16 |  |  | Set operations, set identities, Generalized Unions and Intersections, Computer Representation of Sets | 2.2/127/T1 | Lecture |  |
| 17 |  | Relation | Relations, properties of relations, Combining Relations | 9.1/573/T1 | Lecture |  |
| 18 |  | Relation | Equivalence Relation and Classes, partition | 9.5/607/T1 | Lecture |  |
| 19 |  | Function | Functions, one-one, onto, bijection | 2.3/138/T1 | Lecture |  |
| 20 |  | Set | Inverse and composition functions, floor & ceiling function | 2.3/145/T1 | Lecture |  |
| 21 |  | Set | Cardinality of the Set, Countable and Uncountable set, Cantor’s diagonal theorem the power set theorem, Schroeder-Bernstein theorem | 2.5/170/T1 | Lecture |  |
| 22 |  | Principal of Mathematical Induction | Mathematical Induction,Strong induction, the well ordering Principle | 5.1/311/T1  5.2/333/T1 | Lecture |  |
| 23 |  | Recursive Relation | Recursive Relation | 5.3/344/T1 | Lecture |  |
| 24 |  | Prime Number and Greatest common divisor | Prime Number and Greatest common divisor of two numbers | 4.3/257/T1 | Lecture |  |
| 25 |  | Euclidean algorithm | Euclidean algorithm | 4.3/267/T1 | Lecture |  |
| 26 |  | The fundamental theorem of arithmetic | The fundamental theorem of arithmetic | 4.3/258/T1 | Lecture |  |
| **UNIT- IV Hours- 10** | | | | | | |
| 27 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Introduction of Algebraic Structures, Semigroup, Monoid | 11.2/724/T1  11.3/728/T1 |  |  |
| 28 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Introduction of Algebraic Structures, Semigroup, Monoid | 11.2/724/T1  11.3/728/T1 |  |  |
| 29 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Groups, Subgroups,  Congruence relation | 11.3/729/T1 |  |  |
| 30 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Groups, Subgroups,  Congruence relation | 11.3/729/T1 |  |  |
| 31 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Coset, Lagrange's theorem. | 11.3/732/T1 |  |  |
| 32 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Coset, Lagrange's theorem. | 11.3/732/T1 |  |  |
| 33 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Normal Subgroups,  Permutation & Symmetric groups, Group Homomorphism | 11.4/750/T1  11.4/744/T1 |  |  |
| 34 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Normal Subgroups,  Permutation & Symmetric groups, Group Homomorphism | 11.4/750/T1  11.4/744/T1 |  |  |
| 35 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Algebraic structures with two binary operation: Ring, Integral domain, Field. | 11.5/753/T1 |  |  |
| 36 |  | Algebraic structures concept.  Group and its properties.  Algebraic structures with two binary operations | Algebraic structures with two binary operation: Ring, Integral domain, Field. | 11.5/753/T1 |  |  |
| **UNIT- V Hours- 09** | | | | | | |
| 37 |  | Basic Terminology of Graphs | Graph & graph models | 10.1/641/T1 |  |  |
| 38 |  | Basic Terminology of Graphs | Graph Terminology and Special Types of Graphs | 10.2/651/T1 |  |  |
| 39 |  | Basic Terminology of Graphs | Representing Graphs and Graph Isomorphism | 10.3/668/T1 |  |  |
| 40 |  | Basic Terminology of Graphs | Connectivity, Euler and Hamilton Paths | 10.4/678/T1  10.5/693/T1 |  |  |
| 41 |  | Basic Terminology of Graphs | Planar Graphs, Graph Coloring | 10.7/718/T1  10.8/727/T1 |  |  |
| 42 |  | Concepts of Trees. | Introduction to Trees& applications | 11.1/745/T1  11.2/757/T1 |  |  |
| 43 |  | Concepts of Trees. | Tree Traversal | 11.3/772/T1 |  |  |
| 44 |  | Concepts of Trees. | Spanning Trees | 11.4/785/T1 |  |  |
| 45 |  | Concepts of Trees. | Minimum Spanning Trees | 11.5/797/T1 |  |  |
| **UNIT- VI Hours- 4** | | | | | | |
| 46-47 |  | Partial ordered set, Definition, Partial order sets, Combination of partial order sets, Hasse diagram | Partial ordered set, Definition, Partial order sets, Combination of partial order sets, Hasse diagram |  |  |  |
| 48-49 |  | Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. | Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. |  |  |  |

**Text Books**

T1: *Kenneth H. Rosen*, **Discrete Mathematics and Its Applications**,McGraw-Hill.

T2: Susanna S Epp, **Discrete Mathematics with Applications,** 4th edition, Wadsworth

Publishing Co.Inc

T3: *C L Liu and Mohapatra*, **“Elements of Discrete Mathematics”,** a computer oriented

approach, 3rd edition, McGrawHill.

**Reference Books**

R1: *J P Trembley, R Manohar,* **Discrete Mathematical Structures and its Application**

**toComputer Science,** TMG Edition, TataMcGraw-Hill.

R2: *Norman L Biggs*, **Discrete Mathematics,** 2nd Edition, Oxford UniversityPress.

R3: *Semyour, Lipschutz and Marc Lipson*, **Schaum’s OutlinesSeries**

## Appendix 4.3: Compliance report

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| School of Computer Science | | | | | | | | |
| Programme | | B.Tech | | | | | | |
| Programme Chair | |  | | | | | | |
| Compliance report of course handout | | | | | | | | |
| Sl No | Course code | | Course title | Section | Taught by faculty | Course coordinator | Course handout Submission  date | Remarks by PC if any |
| 1 | MATH 2007 | | Discrete Mathematics | 6 | Dr Pradeep Kumar | 1. Dr Pradeep Kumar 2. Dr Vimal Kumar Joshi |  |  |
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**Signature of PC:**

**Signature of Dean:**

**Review by IQAC:**