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| Department of Applied Mathematics | | LP: MA18354 Rev. No: 00 |
| B.Tech: Artificial Intelligence & Data Science | Regulation: 2018 | Date: 23.08.2021 |
| Sub. Code / Sub. Name : MA18354 / Mathematics for Data Analysis | | |
| Unit 1 : Combinatorics | | |

Unit Syllabus: Sets - Operations - Inclusion and exclusion principle and its applications – Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions.

Objective: Apply the concepts of basic principles of Combinatorics and its Applications.

| Session No * | Topics to be covered | Ref | Teaching Aids |
|--|--|--------------------------------|-----------------|
| 1 | Sets and Operations | R3, Ch 2, Pg. No 115 - 138. | PPT/Black board |
| 2 | Inclusion and exclusion principle | R3, Ch 8, Pg No 552 - 558. | PPT/Black board |
| 3 | Applications of Inclusion and exclusion principle | R3, Ch 8, Pg No 558 - 565. | PPT/Black board |
| 4 | Mathematical induction | R3, Ch 5, Pg No 311 - 332. | PPT/Black board |
| 5 | Strong induction and well ordering | R3, Ch 5, Pg No 333 - 343. | PPT/Black board |
| 6 | Tutorial class | R3, Ch 2, 5, 8. | PPT/Black board |
| 7 | The basics of counting, Pigeonhole principle | R3, Ch 6, Pg No 385 - 406. | PPT/Black board |
| 8 | Permutations and combinations | R3, Ch 6, Pg No 407 - 414. | PPT/Black board |
| 9 | Tutorial class | R3, Ch 6. | PPT/Black board |
| 10 | Recurrence relations and solving linear recurrence relations | R3, Ch 8, Pg No 501 - 526. | PPT/Black board |
| 11 | Generating functions | R3, Ch 8, Pg No 537 - 557. | PPT/Black board |
| 12 | Tutorial class | R3, Ch 8. | PPT/Black board |
| Content beyond syllabus covered (if any): Functions, sequences and summations. | | | |

* Session duration: 50 minutes



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Unit II: Divisibility theory and canonical decompositions

Unit Syllabus: Division algorithm – Base - b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM

Objective: Understand the basic concepts in Number Theory and its Applications in Data Science.

| Session No * | Topics to be covered | Ref | Teaching Aids |
|--|-----------------------------------|-------------------------------|-----------------|
| 13 | Division algorithm | T1, Ch 2, Pg No 69 - 79. | PPT/Black board |
| 14 | Base - b representations | T1, Ch 2, Pg No 80 - 88. | PPT/Black board |
| 15 | Number patterns | T1, Ch 2, Pg No 98 - 102. | PPT/Black board |
| 16 | Tutorial class | T1, Ch 2. | PPT/Black board |
| 17 | Prime and composite numbers | T1, Ch 2, Pg No 103 - 127. | PPT/Black board |
| 18 | GCD | T1, Ch 3, Pg No 155 - 165. | PPT/Black board |
| 19 | Tutorial class | T1, Ch 3. | PPT/Black board |
| 20 | Euclidean algorithm | T1, Ch 3, Pg No 166 - 170. | PPT/Black board |
| 21 | Problems in Euclidean algorithm | T1, Ch 3, Pg No 170 - 172. | PPT/Black board |
| 22 | Fundamental theorem of arithmetic | T1, Ch 3, Pg No 173 - 183. | PPT/Black board |
| 23 | LCM | T1, Ch 3, Pg No 184 - 187. | PPT/Black board |
| 24 | Tutorial class | T1, Ch 3. | PPT/Black board |
| Content beyond syllabus covered (if any): | | | |

* Session duration: 50 mins



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Unit III: Regression analysis

Unit Syllabus: Introduction – The Simple Linear Regression Model – Estimating Model Parameters. Inferences about the Slope Parameter and the Prediction of Future Y Values. Introduction to Non-Linear and Multiple Regression Models.

Objective: Provide the required support to develop regression models which can be used in data analytics.

| Session No * | Topics to be covered | Ref | Teaching Aids |
|--------------|---|----------------------------|-----------------|
| 25 | Introduction | T3, Ch 11, Pg No 324 - 326 | PPT/Black board |
| 26 | The Simple Linear Regression Model | T3, Ch 11, Pg No 327 - 331 | PPT/Black board |
| 27 | Problems involving the Simple Linear Regression Model | T3, Ch 11, Pg No 327 - 331 | PPT/Black board |
| 28 | Tutorial class | T3, Ch 11 | PPT/Black board |
| 29 | Estimating Model Parameters | T3, Ch 11, Pg No 332 - 334 | PPT/Black board |
| 30 | Problems involving estimating model parameters | T3, Ch 11, Pg No 339 - 344 | PPT/Black board |
| 31 | Inferences about the Slope Parameter | T3, Ch 11, Pg No 334 - 338 | PPT/Black board |
| 32 | Prediction of Future Y Values | T3, Ch 11, Pg No 334 | PPT/Black board |
| 33 | Tutorial class | T3, Ch 11 | PPT/Black board |
| 34 | Non-Linear Models | T3, Ch 11, Pg No 346 - 351 | PPT/Black board |
| 35 | Multiple Regression Models | T3, Ch 11, Pg No 352 - 358 | PPT/Black board |
| 36 | Tutorial class | T3, Ch 11 | PPT/Black board |

Content beyond syllabus covered (if any):

* Session duration: 50 mins



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Unit IV: Fundamentals of graph theory

Unit Syllabus: Graphs and Interconnection Networks – Types of Graphs – Trees and Decision Trees – Planar Graphs – Kuratowski's Theorem – Degree Sequence – Matrix Representation of Graphs and Graph Isomorphism, Spectrum of Graphs – Graph Measurements: Length, Distance, Diameter, Eccentricity, Bisection width and Betweenness Centrality - Euler and Hamilton Concepts.

Objective: Understand the fundamental concepts of graph theory.

| Session No * | Topics to be covered | Ref | Teaching Aids |
|--------------|--|-----------------------------|-----------------|
| 37 | Graphs and Interconnection Networks | T2, Ch 1, Pg No 1 - 4 | PPT/Black board |
| 38 | Types of Graphs | T2, Ch 1, Pg No 4 - 14 | PPT/Black board |
| 39 | Trees and Decision Trees | T2, Ch 2, Pg No 25 - 27 | PPT/Black board |
| 40 | Tutorial class | T1, Ch 1, 2 | PPT/Black board |
| 41 | Planar graphs and Kuratowski's Theorem | T2, Ch 9, Pg No 135 -151 | PPT/Black board |
| 42 | Degree Sequence | T2, Ch 1, Pg No 11. | PPT/Black board |
| 43 | Matrix Representation of Graphs and Graph Isomorphism | T2, Ch 1, Pg No 4 - 8 | PPT/Black board |
| 44 | Tutorial class | T1, Ch 1, Ch 9. | PPT/Black board |
| 45 | Length, Distance, Diameter, Eccentricity, Bisection width and Betweenness Centrality | T1, Ch 1, Pg No 14. | PPT/Black board |
| 46 | Eulerian graphs | T2, Ch 4, Pg No 51 - 53 | PPT/Black board |
| 47 | Hamiltonian graphs | T2, Ch 4, Pg No 53 - 60 | PPT/Black board |
| 48 | Tutorial class | T1, Ch 4. | PPT/Black board |

Content beyond syllabus covered (if any):
Finding the shortest path in a directed graph.

* Session duration: 50 mins



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Unit V: Applications of graph theory

Unit Syllabus: Connectivity and Paths: Cuts and Connectivity, Menger's Theorem, k -Network Flow – Ford-Fulkerson Algorithm, Max-Flow Min-cut Theorem – Labeling: Graceful and Cordial – Domination: Independent and Connected, Matching: Matching and Perfect Matching applications to optimal assignment problem- Colorings and Vizing's Theorem – Timetabling Problem

Objective: Understand the advanced concepts of graph theory and its applications to computer science.

| Session No * | Topics to be covered | Ref | Teaching Aids |
|--------------|---|----------------------------|-----------------|
| 49 | Connectivity and Paths, Cuts and Connectivity | T2, Ch 3, Pg No 42 - 44 | PPT/Black board |
| 50 | Max-Flow Min-cut Theorem | T2, Ch 11, Pg No 196 - 198 | PPT/Black board |
| 51 | Ford-Fulkerson Algorithm | T2, Ch 11, Pg No 198 - 200 | PPT/Black board |
| 52 | Menger's Theorem | T2, Ch 11, Pg No 203 - 205 | PPT/Black board |
| 53 | Tutorial class | T2, Ch 3 and Ch 11 | PPT/Black board |
| 54 | Graceful and Cordial Labelling | Appendix IV, Pg No 248. | PPT/Black board |
| 55 | Matching and perfect matching | T2, Ch 5, Pg No 70 – 78. | PPT/Black board |
| 57 | Optimal assignment problem | T2, Ch 5, Pg No 86 - 90 | PPT/Black board |
| 56 | Tutorial class | T2, Ch 5 | PPT/Black board |
| 58 | Colorings and Vizing's Theorem | T2, Ch 6, Pg No 91 – 95. | PPT/Black board |
| 59 | Timetabling Problem | T2, Ch 6, Pg No 96 – 100. | PPT/Black board |
| 60 | Tutorial class | T2, Ch 6 | PPT/Black board |

Content beyond syllabus covered (if any):

* Session duration: 50 mins



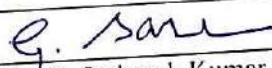
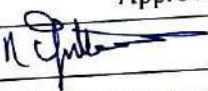
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TEXT BOOKS:

1. Koshy, T., "Elementary number theory with applications", Elsevier Publications. New Delhi. 2002.
2. Bondy, J. A and Murty, U. S. R., "Graph theory and Applications", The Macmillan Press Limited, New York, 1982.
3. Johnson, R. A., and Gupta, C. B., "Miller and Freund's Probability and Statistics for Engineers", Pearson education, Asia, 7th edition, 2007.

REFERENCE BOOKS:

1. Devore, J. L., "Probability and statistics for engineering and the sciences", Cengage learning, New Delhi, 8th edition, 2012.
2. Niven, I., Zuckerman, H.S., and Montgomery, H.L., "An introduction to theory of numbers", John Wiley and Sons, Singapore, 2004.
3. Kenneth Rosen, H., and Krithivasan, K., "Discrete mathematics and its applications with Combinatorics and graph theory", McGraw Hill companies, 7th edition, 2012.

| | Prepared by | Approved by |
|-------------|---|--|
| Signature |  |  |
| Name | Dr. G. Satheesh Kumar | Dr. R. Muthucumarswamy |
| Designation | Assistant Professor | Professor and Head |
| Date | 23.08.21 | 23.08.21 |
| Remarks *: | | |
| Remarks *: | | |

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD