# B.Tech. Data Science

## COURSE PLAN: THEORY COURSE

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|---|---|---|---|---|---|
| **Department:** | **Mathematics** | | | | |
| **Course Name & code :** | **MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE –III**<br>**MAT 3135** | | | | **Core** |
| **Semester & branch :** | **V & DSE** | | | | |
| **Name of the faculty :** | **Dr. Sandeep E M, Dr. K Arathi Bhat** | | | | |
| **No of contact hours/week:** | **L** | **T** | **P** | **C** | |
| | **2** | **1** | **0** | **3** | |

### Course Outcomes (COs) to PO, PSO, BL Mapping

| **At the end of this course, the student should be able to:** | | **No. of Contact Hours** |
|---|---|---|
| **CO1** | Understand basic concepts of Number Theory | 7 |
| **CO2** | Using basic concepts in understanding Modern number theory | 7 |
| **CO3** | Apply the number theoretic concepts in Cryptography | 4 |
| **CO4** | Understand concepts of Graph theory and apply them. | 9 |
| **CO5** | Apply the measures of centrality and algorithms on graphs | 9 |
| | **Total** | **36** |

**Lesson Plan**

| L No | Topics |
|---|---|
| 0 | *Introduction to the course* |
| 1 | Introduction to number theory |
| 2 | Divisibility, greatest common divisors and Euclidean algorithm. |
| 3 | Prime numbers, Congruences and solutions of congruences |
| 4 | Tutorial |
| 5 | Fermat's little theorem |
| 6 | Chinese remainder theorem |
| 7 | Euler's phi function |
| 8 | Quadratic residues and reciprocity |
| 9 | Jacobi Symbol |
| 10 | Binary quadratic forms |
| 11 | Tutorial |
| 12 | Equivalence and reduction of binary forms |
| 13 | Sums of two squares |
| 14 | Greatest integer function |
| 15 | Arithmetic functions |
| 16 | Combinatorial number theory |
| 17 | Techniques of numerical calculation |
| 18 | Tutorial |
| 19 | Introduction to graphs and basic terminologies - Order, size, degree. |
| 20 | Definition- Subgraphs, cliques, regular, cubic, complete graph. Complement, Isomorphism, self – complementary graphs and related results. |
| 21 | Definition- Walks, paths, cycles. |
| 22 | Definition-Distance, eccentricity, radius, diameter, girth and related results. |
| 23 | Definition- Connectedness and connected components and related results |
| 24 | Definition-Eulerian and Hamiltonian graphs and related results. |
| 25 | Bipartite graphs |
| 26 | Definition- Trees and spanning trees and related results. |
| 27 | Definition-Vertex connectivity, edge connectivity and related results. |
| 28 | Definition-Measures of centrality – degree centrality and related results. |

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| 29 | Definition-closeness centrality, between ness centrality and related results. |
| 30 | Tutorial |
| 31 | Matrices associated with graphs – adjacency, incidence and related results. |
| 32 | Definition-Laplacian and distance matrices and related results. |
| 33 | Definition-Eigenvalues and eigenvectors and related results. |
| 34 | Definition-Directed graphs and related results. |
| 35 | Graph algorithms – spanning tree algorithm and related problems. |
| 36 | Dijkstra's algorithm and related problems. |

**SDL TOPICS**

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|---|
| The inclusion-exclusion principle |
| Public key Cryptography |
| Binary trees |
| Floyd-Warshall algorithm and related problems. |

**Faculty members teaching the course (if multiple sections exist):**

| Faculty | Section |
|---|---|
| **EMS** | **A** |
| **KAB** | **B** |

**References:**


1. **An Introduction to theory of numbers (fifth edition), I. Niven, H.S. Zuckerman, H. L. Montgomery, John Wiley & Sons, Inc.**
1. **Chartrand, Lesniak, and Zhang. Graphs and Digraphs, Fifth Edition. CRC Press. 2010.**

**3. D. Jungnickel. Graphs, Networks and Algorithms, Fourth Edition. Springer. 2013.**

**4. Douglas B. West. Introduction to Graph Theory, Second Edition. Prentice Hall. 2001.**

**5. Frank Harary. Graph Theory**

**6. A course in Number theory and Cryptography (second edition), Neal Koblitz, Springer-Verlag.**

**SDL TOPICS**

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| The inclusion-exclusion principle |
| Public key Cryptography |
| Binary trees |
| Floyd-Warshall algorithm and related problems. |

**FACULTY MEMBERS TEACHING THE COURSE (IF MULTIPLE SECTIONS EXIST):**

**Submitted by: Dr K Arathi Bhat**

**Course Coordinator**