15.2 Semester II

Code: BCA-2001 T	CC-III	Mathematical Foundation to Computer Science – II	3L+T: 0P	3 Credits (45 hours theory)

Max Marks: 100; Theory: 100 (Int: 25; Ext: 75)

Course Outcomes: Upon completion of the course, students will be able to

CO1: understand correct lines of arguments and proofs.

CO2: Understand mathematical techniques that are foundations for understanding advanced computational methods, including numerical methods and optimization.

CO3: understand various problem-solving strategies and methods to tackle both theoretical and practical challenges in computer science.

Unit	Topics	Purposed lectures
I	**Logic and Methods of Proofs** Propositions, logical operations (basic connectives), compound statements, construction of truth table, quantifiers, conditional statements, tautology, contradiction, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF). **Methods of Proofs:** Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Mathematical Induction.	11
II	**Algebraic Structures** Semi-group, Monoid, Group, Abelian Group, Subgroup, Properties of Subgroup, Cyclic group.	11
III	**Numerical Methods** Concept and importance of errors in numerical methods. **Solution of algebraic and transcendental equations:** Bisection method and Newton-Raphson methods. **Numerical Interpolation:** Newton's Forward and Newton's Backward interpolation formula and Lagrange's formula. **Numerical Integration:** Quadrature Formula, Trapezoidal rule, Simpson's 1/3 rule and Simpson's 3/8 rule (only formulae and applications for all the topics mentioned in this unit)	11
IV	**Optimization Techniques** **Linear programming:** Introduction, LP formulation, Graphical method for solving LPs with two variables, Special cases in graphical methods, Simplex method, Duality. **Transportation problem:** Definition, Linear form, North-west corner method, least cost method, Vogel's approximation method for finding feasible solution, MODI method for finding optimum solution.	12

Text Books:

1. Kolman B., Busby R. and Ross S., *Discrete Mathematical Structures*, 6th Edition, Pearson Education, 2015.
2. Sastry S. S., *Introductory Methods of Numerical Analysis*, Fifth Edition, PHL, 2022.
3. Taha Hamdy A., *Operations Research: An Introduction*, Eighth Edition, Pearson Prentice Hall, 2003.

Reference Books:

1. Rosen Kenneth H. and Krithivasan Kamala, *Discrete Mathematics and its Applications*, McGraw Hill, India, 2019.
2. Chakravorty J. G. and Ghosh P. R., *Linear Programming and Game Theory*, Moulik Library, 2017.
3. Sharma J. K., *Operations Research: Theory and Applications*, Fourth Edition, Macmillan Publishers, 2007.
4. S.D. Sharma, *Operations Research (Theory Methods & Applications)*, 2014.
5. Discrete Mathematics and Structures, Satinder Bal Gupta, McGrawHill, 2010.