Course code: MTH 603

Course Name: General Mathematics-I

Credit: 03

Course Objective: The course aims at providing the knowledge pertaining to Metric Spaces, Functions Spaces and Measure Theory.

Course Outcomes:

CO1: The students will be able to explore metric spaces with examples.
CO2: The students will be able to correlate these concepts to their counter parts in calculus;
CO3: The students will be able to explore some function spaces and basics of measure theory.

Unit-I

Metric Spaces, Normed Vector Spaces, Limits in Metric Spaces, Open Sets, Closed Sets, Continuous Functions, Homeomorphisms, Connectedness, Complete Metric Spaces, Contraction Mapping Principle, Compact Metric Spaces.

Unit-II

Sequences of Functions, Pointwise and Uniform Convergence, The Space of Bounded Functions, The Space of Continuous Functions, The Weierstrass Theorem, Bernstein's Theorem, The Space of Functions of Bounded Variation, Helly's First Theorem, The Riemann-Stieltjes Integral, The Space of Integrable Functions.

Unit-III

Measurable Sets, Measurable Functions, Extended Real-Valued Functions, Sequences of Measurable Functions, Simple Functions, Nonnegative Functions, Monotone Convergence Theorem, Fatou's Lemma, Lebesgue's Dominated Convergence Theorem.

Reference:

1. N. L. Carothers, Real Analysis, Cambridge University Press, 2000.

Additional readings:

1. C. D. Aliprantis, O. Burkinshaw, Principles of Real Analysis, Academic Press Inc, 1998.

General Mathematics-II

Course Code: MTH 604 **Credits: 03**

Course Outcome:

CO1: The students will be able to apply Sylow's theorem for finding subgroups of a finite group.

CO2: The students will be able to construct Green's function for differential equations.

CO3: The students will be able to solve the mathematical models of the real-world problems arising in natural, biological, and technological systems.

Unit I: Maximal subgroups, composition series of groups and Jordan -Holder Theorem, solvable groups, Sylow's theorems, free groups, Representation theory of finite groups. Polynomial rings and irreducibility criteria, Fields, finite fields, and field extensions.

(15 Hours)

Unit II: General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

(15 Hours)

Unit III: Method of separation of variables, solution of Laplace equation, heat equation and wave equation, weak solutions, system of PDE, Linear PDE: dimensional analysis and self-similarity, regular and singular perturbation, asymptotic and complete solution, Conversion of non-linear PDE into linear PDE. **(15 Hours)**

Suggested readings

1. M. Artin, Algebra, PHI Publ.
2. I. N. Herstein. Topics in Algebra. Willey Publ.
3. Shepley L. Ross, Differential Equations, Wiley, 2007
4. George Simmons, Differential Equations with Applications and Historical Notes, McGraw Hill Education, 2017.
5. A. H. Nayfeh, Introduction to Perturbation methods, John Wiley, 1981.
6. F. Verhulst, Non-linear Differential Equations and Dynamical Systems, Springer, 1990.
7. P. Prasad and R. Ravindran, Partial Differential Equations, Wiley Eastern, 1985.
8. W. E. Williams, Partial Differential Equations, Oxford Univ. Press, 1980.
9. H. Levine, Partial Differential Equations, Amer. Math. Soc. Intl. Press, 1997.
10. L. Debnath, Non-linear Partial Differential Equations for Scientists and Engineers, Birkhauser, 1997.