Unit IV - Galois Theory:

Automorphisms and Fixed Fields, Galois Extensions, The Main Theorem of Galois Theory, Illustrations of the Main theorem, Cubic Equations, Quadratic Equations, Roots of Unity, Quintic Equations. (12 Hours)

References

[1] Michael Artin, *Algebra,* 2nd Ed., Prentice Hall of India, 2013.

[2] J. B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Addison Wesley, 2003.

[3] I. N. Herstein, *Topics in Algebra*, 2nd Ed., John Wiley & Sons, 2006.

[4] Joseph A. Gallian, *Contemporary Abstract Algebra*, 8th Ed., Cengage Learning India, 2013.

[5] Paul B. Garrett, *Abstract Algebra*, CRC press, 2007.

[6] Thomas W. Hungerford, *Algebra*, Springer, 2004.

[7] David S. Dummit and Richard M. Foote, *Abstract Algebra*, 3rd Ed., Wiley, 2004.

[8] Serge Lang, *Algebra,* 3rd Ed., Springer, 2005.

MTH 453	Real Analysis - II	4 Credits (48 hours)

Course Objectives

1. **Understand Riemann-Stieltjes Integral**: Learn definitions, existence, properties, and applications of the Riemann-Stieltjes integral, including integration of vector-valued functions and rectifiable curves.
2. **Explore Sequences and Series of Functions**: Analyze point-wise and uniform convergence, Cauchy criterion for uniform convergence, and their implications for continuity, integration, and differentiation.
3. **Study Functions of Several Variables**: Master differentiation techniques, partial derivatives, directional derivatives, and key theorems such as the Contraction Principle, Inverse Function Theorem, and Implicit Function Theorem.
4. **Analyze Special functions and Function Spaces**: Understand special functions like exponential, trigonometric functions, gamma functions and their properties, and explore spaces of continuous functions, equicontinuous families, and approximation theorems.

Course Outcomes

Upon successful completion of this course, students will be able to:

1. Compute and analyze Riemann-Stieltjes integrals, understanding their properties and applications to vector-valued functions and rectifiable curves.
2. Assess point-wise and uniform convergence of function sequences, and understand their effects on continuity, integration, and differentiation.
3. Use partial derivatives, directional derivatives, and apply the Inverse Function and Implicit Function Theorems to functions of multiple variables.
4. Analyze and work with special functions, including exponential, logarithmic, and trigonometric functions.

5. Work with spaces of continuous functions, equicontinuous families, and apply Weierstrass polynomial approximation to solve related problems.

Contents

Unit I - The Riemann-Stieltjes Integral:
Definition and existence of integrals, Properties of integral, Integration and differentiation, Integration of vector-valued functions, Rectifiable curves. (12 Hours)

Unit II - Sequences and Series of Functions:

Discussion of main problem, Point-wise Convergence and Uniform convergence, Cauchy criterion for Uniform Convergence, Uniform convergence and continuity, Uniform convergence and integration, Uniform convergence and differentiation. (12 Hours)

Unit III – Special Functions and Weierstrass Theorem
The spaces $C(X)$ and $B(X)$, Equicontinuous families of functions, Weierstrass Polynomial approximation theorem and its applications.
Some Special Functions: Power series, The exponential and logarithmic functions, The trigonometric functions, The Gamma function. (12 Hours)

Unit IV - Functions of Several Variables:
Differentiation, Partial Derivatives, Directional derivatives, The Contraction Principle, The Inverse Function Theorem, The Implicit Function Theorem. (12 Hours)

References

[1] Walter Rudin, *Principles of Mathematical Analysis*, 3rd Ed., McGraw Hill, 1976.

[2] Robert. G. Bartle, *The Elements of Real Analysis*, 2nd Ed., Wiley International Ed., New York, 1976.

[3] Ajith Kumar and S. Kumaresan, *A Basic Course in Real Analysis*, CRC Press, 2014.

[4] Serge Lang, *Analysis* I, Addison Wesley Publishing Company, 1968.

[5] T. M. Apostol, *Mathematical Analysis*, 2nd Ed., Narosa Publishers, 1985.

[6] R. R. Goldberg , *Methods of Real Analysis*, 2nd Ed., Oxford & I. B. H. Publishing Co., New Delhi, 1970.

[7] N. L. Carothers, *Real Analysis*, Cambridge University Press, 2000.

[8] Russel A. Gordon, *Real Analysis - A First Course*, 2nd Ed., Pearson, 2011.

MTH 454	Topology	4 Credits (48 hours)

Course Objectives