MATH20-R04: TOPICS IN ANALYSIS

Total Marks: **100 (Theory: 70, Internal Assessment: 30)**
Duration of Examination: **3 Hrs.**
Workload: **4 Lectures per week.** Credits: **4**

Uniform convergence and differentiation, Stone–Weierstrass theorem, Contraction principle, Non-expansive maps and Browder fixed point theorem; Integration of vector functions—Bochner integrability.

Differential calculus in normed linear spaces, Gâteaux and Fréchet derivative of functions, Mean value theorems, Chain rule, Higher order derivatives, Taylor's formula, Local and global inverse function theorems, Implicit function theorem, Extremum problems and Lagrange multipliers.

Spherical distance in the extended complex plane, Uniform convergence and local uniform convergence with respect to this metric for sequence of meromorphic functions, Normality of families of meromorphic functions and various characterizations.

Criterions for normality of families of holomorphic functions and their applications to Montel's theorem, Miranda's theorem and Bloch's theorem; Criterions for normality of families of meromorphic functions and their applications to Montel's theorem, Zalcman's theorem and Gu's theorem.

References

1. **Ward Cheney**, *Analysis for Applied Mathematics*, Springer-Verlag, 2013.
2. **Chi-Tai Chuang**, *Normal Families of Meromorphic Functions*, World Scientific, 1993.
3. **John B. Conway**, *Functions of One Complex Variable*, Narosa, New Delhi, 2002
4. **Pavel Drábek & Jaroslav Milota**, *Methods of Nonlinear Analysis: Applications to Differential Equations*, Birkhäuser, Berlin 2013.
5. **Walter Rudin**, *Principles of Mathematical Analysis*, McGraw Hill, 1976.

MATH20-R05: ADVANCED FUNCTIONAL ANALYSIS

Total Marks: **100 (Theory: 70, Internal Assessment: 30)**
Duration of Examination: **3 Hrs.**
Workload: **4 Lectures per week.** Credits: **4**

Topological Vector Spaces. Types of topological vector spaces, Separation properties, Linear mappings, boundedness and continuity, Quotient spaces, Examples, Banach–Steinhaus theorem, Open mapping theorem, Closed graph theorem, Hahn–Banach Theorem on topological vector spaces, Weal topologies, Weak*-topology of a dual space, Compact convex sets, Extreme points, Milman's theorem, vector-valued integration, Vector-valued holomorphic functions.

Banach Algebras. Definition and examples of Banach algebras and *-Banach algebras, Complex homomorphisms, Spectrum, Symbolic calculus, Group of invertible elements, Ideals and quotient algebras, Gelfand transform, Applications to non-commutative Banach algebras, Spectral theorem, Symbolic calculus for normal operators, Characterization of C^*-algebras, Unbounded operators.

References

1. **Eberhard Kaniuth**, *A Course in Commutative Banach Algebras*, Springer, 2009.
2. **Walter Rudin**, *Functional Analysis*, Tata McGraw-Hill Education, 2006.
3. **H. H. Schaefer & M. P. Wolf**, *Topological Vector Spaces*, Springer, 2012.