Semester 6

Core Course (Major)

Course Code: 6MTMMJC1 (Credit: 4, Hours: 60; Full Marks: 100)

Course Name: Topology and Complex Analysis 1

<u>Marks and Credit distribution:</u>

Theory: 3 Credits, Tutorial: 1 Credit

End Semester exam: 50 Marks, Continuous Assessment: 20 Marks, Attendance: 5 Marks, Tutorial: 25 Marks

Course Outcome: The student will learn about basics of topological spaces, countability axioms, continuous functions and homeomorphisms, separation axioms, compactness, local compactness and one point compactification, connectedness. This will enable the student for any course requiring basic topology, such as algebraic topology, multivariable analysis, differential geometry, partial differential equations, fluid mechanics, mechanics of continua. In the Complex Analysis portion students will also learn about stereographic projection; they will know about limit, continuity and differentiability of a complex valued function.

Course Content:

Group A: Topology 1 (Marks assigned for end semester: 38, 45 Hours)

1. Definition and examples of topological spaces, Closed sets, Closure, Dense subsets, Neighbourhoods, Interior, exterior and boundary. Accumulation points and derived sets. Bases and sub-bases. Subspaces and relative topology.
2. Continuous functions and homeomorphisms.
3. First and Second Countable spaces. Lindelof's theorem. Separable spaces. Second Countability and Separability.
4. Separation axioms T_0, T_1, T_2, T_3, $T_{3½}$, T_4 ;, their Characterizations and basic properties , Zariski topology as an example of T_0. Urysohn's lemma, . Tietze extension theorem.
5. Compact spaces. Continuous functions and compact sets. Basic properties of compactness.
   Compactness and finite intersection property. Local compactness and one point compactification.
6. Connected spaces. Connectedness on the real line. Components, path-connectedness.

<u>References</u>

l. James R. Mukres, Topology, A First Course, Prentice Hall of India Pvt. Ltd., New Delhi, 2000
2. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.)
3. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company, 1963.
4. J.L. Kelley, General topology, Van Nostrand, Reinhold Co., New York, 1995.
5. L. Steen and J. Seebach, Counter examples in Topology , Holt, Rinehart and Winston, New York, 1970.
6. S. Willard, General Topology, Addison-Wesley, Reading, 1970.

Group B: Complex Analysis 1 (Marks assigned for end semester: 12, 15 Hours)

1. Geometric interpretation of complex numbers, stereographic projection.
2. Limits, limits involving the point at infinity, continuity of functions of complex variable.
3. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability, analytic functions, Singularities.
4. Analytic properties of exponential function, logarithmic function, trigonometric functions, inverse circular and hyperbolic functions.
5. Harmonic functions, harmonic conjugates and related theorems.

<u>References:</u>

[1] Functions of one Complex Variable – J. B. Conway.
[2] Complex Analysis – L. V. Ahlfors.
[3] Complex Variables and Applications-James Ward Brown and Ruel V. Churchill
[4] Complex Variables for Scientists and Engineers-John D. Paliouras and Douglas S. Meadows.
[5] Complex Analysis- Joseph Bak and Donald J. Newman
[6] Complex Analysis - E. M. Stein and R. Shakrachi
[7] Complex Variables with Applications- S. Ponnusamy and Herb Silverman