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| **Course Code**<br>**Course Title**<br>**No. of Credits**<br>**Pre-requisites**<br>**Compulsory/Optional** | **EM 505**<br>**Complex Analysis**<br>**3**<br>**EM212**<br>**Optional** |

**Aim(s):**To provide a thorough knowledge of fundamental and advanced concepts in complex analysis for applications.

**Intended Learning Outcomes :**

At the end of the course, students should be able to;

- Evaluate contour integrals by use of Cauchy's Integral theorems.
- Represent complex functions in Taylor and Laurent Series and identify domains of convergence.
- Classify singularities of a complex function.
- Evaluate real integrals using residue calculus and apply these methods in finding integral transforms such as Inverse Laplace, Fourier and Hilbert transforms.
- Apply the Argument Principle and Roche's theorem to locate roots of polynomial equations.
- To construct simple conformal mappings and apply conformal mapping to solve problems from engineering.

**Time Allocation (Hours):** Lectures 36 Tutorials 09 Assignments

**Course content/Course description:**

- **Complex Series** Convergence, Tests for convergence, Power series, Taylor series, Laurent series.
- **Theory of Residues** Singularities and classification, Residue theorem, Calculation of residues.
- **Calculus of Residues Evaluation** of real definite integrals (trigonometric, improperIntegrals, poles on the real line, principal values, integration on branch cuts).

- **Applications of Calculus of Residues** Applications to integral transforms (Fourier, Laplace and Hilbert transforms).
- **Principle of the Argument:** Argument principle, Rouche's theorem, and stability of systems.
- **Conformal Mappings:** Complex mapping functions, Riemann's mapping theorem, general transformations, linear transformation, bilinear transformation, selected special transformations, inverse transformations, Schwarz-Christoffel transformation and applications.

**Recommended Texts:**

- E.B.Staff and A.D.Snider, Fundamentals of Complex Analysis with applications to engineering and science, Pearson 3rd edition.
- Elias Stein & Rami Shakarchi, ComplexAnalysis (2003), Princeton (2003).
- R.V.Churchill&J.W.Brown, Complex variables and applications, 9th edition, McGraw-Hill.
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| **Assessment** | **Percentage Mark** |
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| **In-course**<br>Tutorials/Quizzes<br>Mid Semester Examination | <br>20<br>30 |
| **End-Semester** | 50 |