

## HS202 COMPLEX VARIABLES AND SPECIAL FUNCTIONS

### **Objective of the Course :**

To extend the ideas developed in Analysis from real to complex numbers, and to apply this theory to understand problems arising in real analysis or calculus. to understand path and contour integrals, Cauchy's theorem and integral formula, and Taylor's theorem; to evaluate some standard integrals using contour integrals.

### **UNIT – I**

**Complex Analysis :** Introduction to complex functions, Analytical Functions, Cauchy-Riemann equations in Cartesian and polar form, Harmonic Function, Harmonic conjugate, construction of harmonic conjugate.

### **UNIT – II**

**Complex Integration :** Line integral, properties of contour integrals, Cauchy's Integral theorem, Cauchy's integral formula, Generalized integral formula.

**Series of functions of a complex variables :** Radius of convergence, Taylor series, Maclaurin's series and Laurent series.

### **UNIT – III**

**Theory of Residues :** Singular points of an analytic function, types of singularity, Residue, Evaluation of residues, Cauchy's Residue theorem, Evaluation of real integral of type : , , , , .

### **UNIT – IV**

**Conformal Mappings :** Definition, conformal mapping by elementary functions, Mapping , transformations , , , Joukowski's transformation, Bilinear transformation.

### **UNIT - V**

**Special Functions :** Gamma and Beta Functions: Properties, Evaluation of improper integrals. Bessel functions: Properties, Recurrence relations, Orthogonality.

**Legendre polynomials :** Properties, Rodrigue's formula, Recurrence relations, Orthogonality.

### **TEXT BOOKS :**

1. T. K. V. Iyengar, B. Krishna Gandhi, S. Ramanadham, M.V.S.S.N. Prasad, "A text Book of Engineering Mathematics Vol-III", 1<sup>st</sup> ed., S. Chand & Company, 2001.
2. C. Sankaraiah, "A text Book of Engineering Mathematics", 1<sup>st</sup> ed., V. G. S. Publications, 2007.
3. P. Nageswara Rao, Y. Narasimhulu & N. Prabhakar Rao, "A text Book of Engineering Mathematics Vol.-III", 1<sup>st</sup> ed., Deepthi Publications, 2002.
4. Shanaz Bathul, "Engineering Mathematics Vol.-I", 4<sup>th</sup> ed., Overseas, 2008.

### **REFERENCE BOOKS :**

1. V. Sundaram, R. Balasubramanian and K.A. Lakshminarayanan, "Engineering Mathematics", 6<sup>th</sup> ed., Vikas Publishing House Pvt. Ltd., 2007.
2. B. V. Raman, "A text Book of Engineering Mathematics", 3<sup>rd</sup> ed., Tata McGraw-Hill, 2008.
3. Irvin Kreyszig, "Advanced Engineering Mathematics", Wiley India Pvt. Ltd.