Course Syllabi: UMA064 Advanced Engineering Mathematics (L : T : P :: 3 : 1 : 0)

1. **Course number and name:** UMA064; Advanced Engineering Mathematics

2. **Credits and contact hours:** Credits: 3.5; Hours: 4

3. **Text book, title, author, and year**

   - *Simmons, G. F., Differential equations with applications and Historical Notes, Tata Mc Grow Hill (2009), second edition.*
   - *Kasana, H. S., Complex Variables, Theory and Applications, PHI (2004), second edition.*
   - *Kreyzig Erwin, Advanced Engineering Mathematics, John Wiley and Sons (2006), eigth edition.*
   - *Ram, Babu, Engineering Mathematics, Pearson Education (2009)*
   - *Ross Shepley L., Differential Equations, Johan and Wiley and Sons (2007), third edition.*
   - *Krishnamurthy V. K., Mainra, V. P., and Arora, J. L., An Introduction to Linear Algebra, Associated East West Press (2007).*

   a. Other supplemental materials
      - Nil

4. **Specific course information**

   a. Brief description of the content of the course (catalog description)

   Special Functions: Power series solution of differential equations, Frobeniuous method, Legendre's equation, Legendre's polynomial. Bessel's equation, Bessel functions of the first and second kind. Recurrence relation, equations reducible to Bessel's equation. Error function and its properties, complete solution of Gauss's hyper geometric and Chebyshev's differential equation, the generating functions and recurrence relations.
   Matrix Algebra: Review of complex numbers, Eigen values, eigenvectors and diagonalization for complex matrices. Orthogonal, unitary matrices and their properties. Linear transformation, rank and nullity, composition of linear maps, Matrix associated with linear maps.
   Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and higher order derivatives. Morera's theorem, Cauchy's inequality and Liouville's theorem, Taylor's and Laurent's expansions, singular points and poles, residues, Cauchy's residue theorem, complex integration using the method of residues, evaluation of real integrals by contour integration.
   Conformal mapping: Definition and examples of conformal mapping, bilinear transformations, their properties and classifications, Schwarz's Christoffel transformations.

5. **Specific goals for the course**

   After the completion of the course, the students will be able to:

   - Use power series solution method to solve the ordinary differential equations having various types of singularities. Students can understand how these solutions which later known as special functions in different forms and their properties may be useful for finding solutions of various electric circuit problems (LCR/LC), mechanical (vibration) and electrostatic potential problems.
   - Evaluate complex integration by using various theorems and their properties. They will understand the importance of bilinear, conformal and Schwartz – Christoffel

transformations. These techniques would be useful for solving the problems of electric circuit, electromagnetic field theory, equipotential surface etc.

- Apply the concepts of linear algebra and properties of matrices to real word phenomenon such as electrical networks, population movement, communication networks. Students will be able to apply these concepts in higher level courses like numerical and optimization techniques.

6. **Brief list of topics to be covered**
    - Special Functions
    - Matrix Algebra
    - Complex integration
    - Conformal mapping