ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : B.Sc. (Hons.) Electronics						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
I	32511104	Mathematics Foundation for Electronics (Theory)	4			4
Teacher/Instructor(s)		Mr. Arun Kumar				
Session		2022-23				

Course Objective:

The purpose of this course is to provide students with the skills and knowledge to perform calculations for solution of problems related to various topics they would study in their program, particularly the use of ordinary differential equations. The course aims to prepare students with the mathematical tools they would require while solving transient circuits in power electronics and problem solving in Electromagnetic Theory.

Course Learning Outcomes:

At the end of this course, Students will be able to

CO1 Use mathematics as a tool for solving/modelling systems in electronics

CO2 Solve non-homogeneous linear differential equations of any order using a variety of methods, solve differential equations using power series and special functions

CO3 Understand methods to diagonalize square matrices and find eigenvalues and corresponding eigenvectors for a square matrix, and check for its diagonalizability

CO4 Familiarize with the concept of sequences, series and recognize convergent, divergent, bounded, Cauchy and monotone sequences.

CO5 Perform operations with various forms of complex numbers to solve equations

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.	**Ordinary Differential Equations**	1	Order Ordinary Differential Equations, Basic Concepts,
		2-3	Separable Ordinary Differential Equations, Exact Ordinary Differential Equations,
		4	Linear Ordinary Differential Equations
		5-6	Second Order homogeneous Differential Equations.
		7-9	Second Order homogeneous Differential Equations.
	Series solution of	10-11	Power series method, Legendre Polynomials

	differential equations and special functions	12-13	Frobenius Method, Bessel‘s equations
		14-15	Bessel‘s functions of first and second kind, Error functions
		16	Gamma function
2	**Matrices**	17	Introduction to Matrices, System of Linear Algebraic Equations
		18-19	Gaussian Elimination Method, Gauss-Seidel Method
		20	LU decomposition, Solution of Linear System by LU decomposition.
		21-23	Eigen Values and Eigen Vectors, Linear Transformation, Properties of Eigen Values and Eigen Vectors,
		24-25	Cayley-Hamilton Theorem, Diagonalization, Powers of a Matrix.
		26	Real and Complex Matrices,
		27-28	Symmetric, Skew Symmetric, Orthogonal Quadratic Form,
		29-30	Hermitian, Skew Hermitian, Unitary Matrices.
3	**Sequences and series**	31	Sequences, Limit of a sequence
		32	Convergence, Divergence and Oscillation of a sequence,
		33-34	Infinite series, Necessary condition for Convergence
		35-36	Cauchy‘s Integral Test, D‘ Alembert‘s Ratio Test
		37	Cauchy‘s nth Root Test,
		38-39	Alternating Series, Leibnitz‘s Theorem,
		40-42	Absolute Convergence and Conditional Convergence
		43-44	Power Series
4	**Complex Variables and Functions**	45	Complex Variable, Complex Function, Continuity,
		46	Differentiability, Analyticity
		47	Cauchy-Riemann (C- R) Equations
		48	Harmonic and Conjugate Harmonic Functions
		49	Exponential Function,
		50-51	Trigonometric Functions, Hyperbolic Functions.
		52	Line Integral in Complex Plane, Cauchy‘s Integral Theorem
		53	Cauchy‘s Integral Formula, Derivative of Analytic Functions
		54	Sequences, Series and Power Series, Taylor‘s Series,
		55-56	Laurent Series, Zeroes and Poles.
		57-58	Residue integration method
		59-60	Residue integration of real Integrals.

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Quiz		
	• Class Test		
	• Attendance		
	• Assignment		
2.	End Semester Examination	3 hour	75

Details of the Course		
Unit	**Contents**	**Contact Hours**
1	**Ordinary Differential Equations:** First Order Ordinary Differential Equations, Basic Concepts, Separable Ordinary Differential Equations, Exact Ordinary Differential Equations, Linear Ordinary Differential Equations. Second Order homogeneous and non-homogeneous Differential Equations. **Series solution of differential equations and special functions:** Power series method, Legendre Polynomials, Frobenius Method, Bessel's equations and Bessel's functions of first and second kind. Error functions and gamma function.	16
2	**Matrices:** Introduction to Matrices, System of Linear Algebraic Equations, Gaussian Elimination Method, Gauss-Seidel Method, LU decomposition, Solution of Linear System by LU decomposition. Eigen Values and Eigen Vectors, Linear Transformation, Properties of Eigen Values and Eigen Vectors, Cayley-Hamilton Theorem, Diagonalization, Powers of a Matrix. Real and Complex Matrices, Symmetric, Skew Symmetric, Orthogonal Quadratic Form, Hermitian, Skew Hermitian, Unitary Matrices.	14
3	**Sequences and series:** Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for Convergence, Cauchy's Integral Test, D'Alembert's Ratio Test, Cauchy's nth Root Test, Alternating Series, Leibnitz's Theorem, Absolute Convergence and Conditional Convergence, Power Series.	14
4	**Complex Variables and Functions:** Complex Variable, Complex Function, Continuity, Differentiability, Analyticity. Cauchy-Riemann (C- R) Equations, Harmonic and Conjugate Harmonic Functions, Exponential Function, Trigonometric Functions, Hyperbolic Functions. Line Integral in Complex Plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivative of Analytic Functions. Sequences, Series and Power Series, Taylor's Series, Laurent Series, Zeroes and Poles. Residue integration method, Residue integration of real Integrals.	16
	Total	**60**

Suggested Books:

Sl. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1	E. Kreyszig, advanced engineering mathematics, Wiley India (2008)	2008
2	Murray Spiegel, Seymour Lipschutz, John Schiller, Outline of Complex Variables, Schaum Outline Series, Tata McGraw Hill (2007)	2008

3	R. K. Jain, and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007).	2007
4	C .R. Wylie and L. C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill (2004)	2004
5	B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited	2013
Mode of Evaluation:	Internal Assessment / End Semester Exam	