

MAT2002	Applications of Differential and Difference Equations	L	T	P	J	C
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Pre-requisite	MAT1011 - Calculus for Engineers	Syllabus Version				
		1.0				
Course Objectives						
The course is aimed at						
[1] Presenting the elementary notions of Fourier series, which is vital in practical harmonic analysis						
[2] Imparting the knowledge of eigenvalues and eigen vectors of matrices and the transform techniques to solve linear systems, that arise in sciences and engineering						
[3] Enriching the skills in solving initial and boundary value problems						
[4] Impart the knowledge and application of difference equations and the Z-transform in discrete systems, that are inherent in natural and physical processes						
Course Outcome						
At the end of the course the student should be able to						
[1] Employ the tools of Fourier series to find harmonics of periodic functions from the tabulated values						
[2] Apply the concepts of eigenvalues, eigen vectors and diagonalisation in linear systems						
[3] Know the techniques of solving differential equations						
[4] understand the series solution of differential equations and finding eigen values, eigen functions of Sturm-Liouville's problem						
[5] Know the Z-transform and its application in population dynamics and digital signal processing						
[6] demonstrate MATLAB programming for engineering problems						
Student Learning Outcomes (SLO):		1, 2, 9				
Module:1	Fourier series:	6 hours				
Fourier series - Euler's formulae - Dirichlet's conditions - Change of interval - Half range series – RMS value – Parseval's identity – Computation of harmonics						
Module:2	Matrices:	6 hours				
Eigenvalues and Eigen vectors - Properties of eigenvalues and eigen vectors – Cayley-Hamilton theorem - Similarity of transformation - Orthogonal transformation and nature of quadratic form						
Module:3	Solution of ordinary differential equations:	6 hours				
Linear second order ordinary differential equation with constant coefficients – Solutions of homogenous and non-homogenous equations - Method of undetermined coefficients – method of variation of parameters – Solutions of Cauchy-Euler and Cauchy-Legendre differential equations						
Module:4	Solution of differential equations through Laplace transform and matrix method	8 hours				
Solution of ODE's - Nonhomogeneous terms involving Heaviside function, Impulse						

function - Solving nonhomogeneous system using Laplace transform – Reduction of n th order differential equation to first order system - Solving nonhomogeneous system of first order differential equations  and 		
Module:5	Strum Liouville's problems and power series Solutions:	6 hours
The Strum-Liouville's Problem - Orthogonality of Eigen functions - Series solutions of differential equations about ordinary and regular singular points - Legendre differential equation - Bessel's differential equation		
Module:6	Z-Transform:	6 hours
Z-transform -transforms of standard functions - Inverse Z-transform: by partial fractions and convolution method		
Module:7	Difference equations:	5 hours
Difference equation - First and second order difference equations with constant coefficients - Fibonacci sequence - Solution of difference equations - Complementary function - Particular integral by the method of undetermined coefficients - Solution of simple difference equations using Z-transform		
Module:8	Contemporary Issues	2 hours
Industry Expert Lecture		
	Total Lecture hours:	45 hours
Text Book(s)		
1.	Advanced Engineering Mathematics, Erwin Kreyszig, 10 th Edition, John Wiley India, 2015	
Reference Books		
1.	Higher Engineering Mathematics, B. S. Grewal, 43 rd Edition, Khanna Publishers, India, 2015	
2.	Advanced Engineering Mathematics by Michael D. Greenberg, 2 nd Edition, Pearson Education, Indian edition, 2006	
Mode of Evaluation		
Digital Assignments (Solutions by using soft skills), Continuous Assessment Tests, Quiz, Final Assessment Test		
1.	Solving Homogeneous differential equations arising in engineering problems	2 hours
2.	Solving non-homogeneous differential equations and Cauchy, Legendre equations	2 hours
3.	Applying the technique of Laplace transform to solve differential equations	2 hours
4.	Applications of Second order differential equations to Mass spring system (damped, undamped, Forced oscillations), LCR circuits etc.	2 hours
5.	Visualizing Eigen value and Eigen vectors	2 hours
6.	Solving system of differential equations arising in engineering	2 hours

	applications	
7.	Applying the Power series method to solve differential equations arising in engineering applications	3 hours
8.	Applying the Frobenius method to solve differential equations arising in engineering applications	3 hours
9.	Visualising Bessel and Legendre polynomials	3 hours
10.	Evaluating Fourier series-Harmonic series	3 hours
11.	Applying Z-Transforms to functions encountered in engineering	3 hours
12.	Solving Difference equations arising in engineering applications	3 hours
Total Laboratory Hours		30 hours
Mode of Evaluation: Weekly Assessment, Final Assessment Test		
Recommended by Board of Studies		
Approved by Academic Council	No. 37	Date 16-06-2015