LOK JAGRUTI UNIVERSITY (LJU)

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Artificial Intelligence and Machine Learning (704)

Bachelor of Engineering (B.E.) – Semester – II

Course Code:	**017041291**
Course Name:	**Mathematics - II**
Category of Course:	Basic Science Course (BSC)
Prerequisite Course:	Mathematics - I (017041191)

Teaching Scheme				
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**Total Hours**
3	**2**	**0**	**5**	**50**

Syllabus

Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	**Matrices**			**7 (14%)**
	1.1 Elementary row operations of matrices	---	Divide & Conquer (017043591-Unit-3)	
	1.2 Row and reduced row echelon form	---		
	1.3 System of linear equations	---		
	1.4 Homogeneous system of linear equations	---		
	1.5 Non-homogeneous system of linear equations	---		
	1.6 Inverse of Matrix (Using Gauss-Jordan Method)	---	Cryptography(017043791-Unit-2)	
	1.7 Eigen values & vectors	Factorization(017041191-Unit-1)	---	
	1.8 Diagonalization of matrix (Only for Non-symmetric Matrix)		---	
	1.9 Cayley-Hamilton theorem		---	
02	**Fourier Series**			**5 (10%)**
	2.1 Periodic function	Basic integration (017041191-Unit-3)	---	
	2.2 Dirichlet's condition		---	
	2.3 Trigonometric series of sine and cosine function		---	
	2.4 Fourier series of a function of period 2L		---	
	2.5 Fourier series of even and odd function		---	
	2.6 Half range expansions		---	
03	**Some Special Functions**			**4 (8%)**
	3.1Gamma function, Beta function. (And its Properties)	---	---	
	3.2 Bessel function, Dirac's Delta function (Definition only)	---	---	
	3.3 Error function and complementary Error function (Definition only)	---	---	
	3.4 Heaviside's function, pulse unit height and duration function (Definition only)	---	---	
	3.5 Rectangle function, Gate function (Definition only)	---	---	
	3.6 Signum function, Saw tooth wave function (Definition only)	---	---	
	3.7 Triangular wave function, Halfwave rectified sinusoidal function, Full rectified sine wave, Square wavefunction. (Definition only)	---	---	
04	**Fourier Integral and Fourier Transform**			**4 (8%)**
	4.1 Define Fourier integral	Basic integration (017041191-Unit-3)	---	
	4.2 Cosine and sine integral		---	
	4.3 Define Fourier transform		---	
	4.4 Cosine and sine transform		---	
05	**First Order Ordinary Differential Equations**			**5 (10%)**
	5.1 Geometric meaning of $y' = f(x, y)$ direction fields	---	---	
	5.2 Exact differential equations and integrating factor	Basic differentiation & integration(017041191-Unit-3)	---	
	5.3 Linear differential equations		---	
	5.4 Bernoulli equations		---	
06	**Higher Order Ordinary Differential Equations**			**7 (14%)**
	6.1 Linear differential equations of second and higher order	---	---	
	6.2 Homogeneous linear differential equations of higher order	Factorization(017041191-Unit-1)	---	
	6.3 Higher order non-homogeneous equations		---	
	6.4 Solution by undetermined coefficients		---	
	6.5 Solution by variation of parameters		---	
	6.6 Solution by [1/f(D)] r(x) method for finding particular integral.		---	
	6.7 Ordinary differential equations with variable coefficient (Reducible to constant coefficient) (Cauchy-Euler's & Legendre's Equation)	Solution by undetermined coefficients (017041291-Unit-6), Solution by [1/f(D)] r(x) method for finding particular integral (017041291-Unit-6)	---	

07	**Modeling of Ordinary Differential Equations**			
	7.1 Orthogonal trajectories of curves (Only Cartesian Curves)	First order ordinary differential equations (017041291-Unit-5)	---	**3 (6%)**
	7.2 Oscillations and resonance (For undamped Forced Oscillations)	Higher order ordinary differential equations (017041291-Unit-6)	---	
	7.3 Modeling: Electric Circuits (Only RLC-Circuit)		---	
08	**Power Series**			
	8.1 Classification of singularities	---	---	**5 (10%)**
	8.2 Series solution near ordinary points	---	---	
	8.3 Series solution near regular singular points (Frobenius Method)	---	---	
09	**Laplace Transform**			
	9.1 Laplace transform of elementary functions	Basic differentiation & integration(017041191-Unit-3)	---	**7 (14%)**
	9.2 Differentiation of Laplace transform		---	
	9.3 Integration of Laplace transform		---	
	9.4 Laplace transform of derivatives		---	
	9.5 Laplace transform of integrals		---	
	9.6 Unit step function and Dirac's delta function		---	
	9.7 Inverse Laplace transform		---	
	9.8 Convolution theorem		---	
10	**Application of Laplace Transform**			
	10.1 Solution of linear ordinary differential equation	Laplace transform of elementary functions, Laplace transform of derivatives, Unit step function and Dirac's delta function, Inverse Laplace transform, Convolution theorem(017041291-Unit-9)	---	**3 (6%)**
	10.2 Solution of simultaneous equations		---	

Proposed Theory + Practical Evaluation Scheme by Academicians (% Weightage Category Wise and it's Marks Distribution)					
L:	**3**	**T:**	**2**	**P:**	**0**
Note: In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject. Each Test will be of 25 Marks. Each Test Syllabus Weightage: Range should be 20% - 30%					
Group (Theory or Practical)	**Group (Theory or Practical) Credit**	**Total Subject Credit**	**Category**	**% Weightage**	**Marks Weightage**
Theory	**5**	**5**	MCQ	15%	15
Theory			Theory Descriptive	0%	0
Theory			Formulas and Derivation	10%	10
Theory			Numerical	75%	75
Expected Theory %	**100%**		**Calculated Theory %**	**100%**	**100**
Practical	**0**		Individual Project	0%	0
Practical			Group Project	0%	0
Practical			Internal Practical Evaluation (IPE)	0%	0
Practical			Viva	0%	0
Practical			Seminar	0%	0
Expected Practical %	**0%**		**Calculated Practical %**	**0%**	**0**
Overall %	**100%**			**100%**	**100**

Course Outcome	
	Upon completion of the course students will be able to
CO1	Understand and apply matrix operation and properties, solve systems of linear equations using matrices, analyze systems using eigen values and eigne vectors, apply matrices in signal processing tasks, Explain the concept of Fourier series and its properties, Apply Fourier series in digital communications and image processing also in control system analysis.
CO2	Design filter and modulation schemes and Implement algorithms like FFT for efficient computation of Fourier transforms, Apply Bessel functions and other special function to solve engineering problems. Solve first order & first degree ODEs using various methods.
CO3	Solve higher order linear ODEs using various methods such as undetermined coefficients, variation of parameters. Formulate ODEs from real-world engineering problems. Apply knowledge of ODEs to design and analyze systems in computer engineering domains. Apply orthogonal trajectories in edge detection algorithms for image processing and utilize for curve fitting and surface modeling in computer graphics. Understand the significance of ordinary and singular points in ODEs.
CO4	Understand and apply Laplace transforms to solve linear ODEs with constant coefficients. Apply knowledge to real-world engineering problems, especially in signal processing, circuit analysis, control system and system modeling.
Suggested Reference Books	
1	Elementary Linear Algebra, Applications version, Anton and Rorres, Wiley India Edition.
2	Advanced Engineering Mathematics, Erwin Kreysig, Wiley Publication.
3	Advanced Engineering Mathematics, Dennis G. Zill, 4th edition, Jones and Bartlett Publishers.
4	Higher Engineering Mathematics, B.S.Grewal, Khanna Publishers.

List of Open Source Software/Learning website	
1	https://nptel.ac.in