



C.V. Raman Global University

Bhubaneswar - 752 054 (Odisha)

Department of Mathematics	
SUBJECT: MATHEMATICS-II	
Course Code	MA102
Teaching Hours/Week (L-P-T-E)	(3-0-1-0)
Credits	03
Total Contact Hours	42+14
Course objectives: 1) To find rank, eigen values, eigen vectors of matrix. 2) To solve a given system of linear equations. 3) To analyze vector space, its dimension and basis. 4) To solve first order and second order ordinary differential equations. 5) To formulate models of electric circuits [LC, CR, LR, LCR CIRCUITS], mass spring systems, forced oscillations. 6) To apply Laplace transform to solve initial value problems involving ordinary linear differential equations.	
Module – 1 (9 hrs.)	
Matrix Algebra: Basic concepts of Matrices and Determinants, Symmetric, skew-symmetric matrices, orthogonal matrices, Complex matrices, Hermitian and Skew-Hermitian matrices, unitary matrices, triangular and diagonal matrices, Rank of a Matrix. Linear systems of equations – Existence and uniqueness of solutions, Gauss Elimination, Cramer's Rule, Matrix Inversion Method, Gauss Jordan elimination, LU factorization of matrices.	
Module – 2 (9 hrs.)	
Vector Space and Eigen Values: Basic concept involving Vector space, Dimension and Basis, Orthogonal bases and Gram-Schmidt Orthogonalization. Eigen values and Eigen vectors of matrices, Similarity of matrices and Diagonalization.	
Module – 3 (7 hrs.)	
Ordinary Differential Equations of First Order: First order differential equations, Separable equation, exact differential equation, linear differential equation, Bernoulli's equation, application to electrical circuits and orthogonal trajectories, system of differential equations.	
Module – 4 (8 hrs.)	
Ordinary Differential Equations of Second Order: Linear differential equation of second and higher order, Homogeneous equation with constant co-efficient, Euler-Cauchy equations, Solution by undetermined co-efficient, Solutions by variation of parameters, Modeling of electric circuits.	
Module-5 (9 hrs.)	
Laplace Transforms: Definition, Basic properties of Laplace transforms – Linearity property, Scaling, Shifting property, Derivative and Integral of Laplace transform and Transform of derivative and Integral of a function, Convolution Theorem. Applications of Laplace transforms in solving initial value problems involving ordinary differential equations, Integral equations.	
Course outcomes: After going through this course the student will be able to CO1: Find rank of a matrix and solve a given system of linear equations. CO2: Determine eigenvalues, eigenvectors of matrix, and analyze the characteristics of the vector space. CO3: Solve first order ordinary differential equations and apply it to LC, CR, LR circuits. CO4: Solve Second order differential equations and apply it to LCR circuits.	



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CO5: Apply Laplace transform to solve initial value problems involving ordinary linear differential equations.

Text Books:

T1. “Linear Algebra and Its Applications”, Gilbert Strang, Cengage Learning, Fourth Edition, 2004. Chapters: 1 (1.3 – 1.6), 2(2.1 – 2.4), 3(3.1, 3.4), 4(4.1 – 4.4), 5(5.1, 5.2, 5.5, 5.6)

T2 Advanced Engineering Mathematics, Erwin Kreyszig, John Willy and Sons, 8th Edition, 1999. Chapters: 1 (1.1, 1.3 – 1.7, 1.8), 2(2.1 - 2.4, 2.6 – 2.10, 2.12), 3(3.1, 3.3), 5(5.1 – 5.6).

Reference Books:

R1. “A First course in Differential Equations with Modelling Applications”, Dennis G.Zill, Cengage Learning, 10th Edition, 2013.

R2. “Higher Engineering Mathematics”, B. S. Grewal, Khanna Publishers, 43rd Edition, 2014.

R3. “Higher Engineering Mathematics”, B. V. Ramana, TMH, 1st Reprint, 2007.

Open Sources:

1) Dr. Prof. Gilbert Strang, “Linear Algebra”, MITOPENCOURSEWARE.

<https://ocw.mit.edu/18-06SCF11>

2) Prof. Jitender Kumar, “Engineering mathematics-1”, IIT Kharagpur-
<https://www.youtube.com/watch?v=4QFsiXfgbzM&list=PLbRMhDVUMngeVrxtbBzn8HvP8KAWBp15>

COURSE OUTCOME:

Outcome	At the end of the course, the learner will be able to	Bloom's Level	Expected proficiency percentage	Expected Attainment percentage
CO-1	Find rank of a matrix and solve a given system of linear equations.	2, 3	70%	65%
CO-2	Determine eigenvalues, eigenvectors of matrix, and analyze the characteristics of the vector space.	2	70%	60%
CO-3	Solve first order ordinary differential equations and apply it to LC, CR, LR circuits.	2, 3	70%	65%
CO-4	Solve Second order differential equations and apply it to LCR circuits.	2, 3	60%	50%
CO-5	Apply Laplace transform to solve initial value problems involving ordinary linear differential equations.	2, 3	60%	50%