



BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Hyderabad Campus

SECOND SEMESTER 2024-2025
Course Handout (Part-II)

06-01-2025

In addition to Part-I (General Handout for all Courses appended to the time table) this portion gives further specific details regarding the Course.

Course No.: MATH F112

Course Title: MATHEMATICS-II

Instructor-In charge : SHARAN GOPAL

Instructors: Sharan Gopal, Manish Kumar, Debopam Chakraborty, Deepika, Pratyusha Chattopadhyay, Jhuma Sen Gupta, N Anil, Rahul Vijay Bhagat, Bhawna, Sushil Pathak, Komal Kumar, Jahir Abbas Sardar, Dheeraj Singh Rana, Mayuri Verma, Priyanka Vishwakarma, Subhendu Paul, Suman Prabha Yadav, Naorem Priyobarta Singh

1. Scope and Objective of the Course: The course is meant as an introduction to Linear Algebra and Theory of Functions of Complex Variable and their applications.

2. Course Description: System of linear equations, Eigenvalues and eigenvectors, Vector spaces, Basis and dimension of vector spaces, Linear transformations, Range and kernel. Function of complex variables and their analyticity, Elementary functions, Integration, Taylor and Laurent series expansions, Calculus of residues and its applications.

3. Text Books:

- (i) Linear Algebra with applications by G. Williams, 9th Edition, Jones & Bartlett Learning.
- (ii) Complex Variables and Applications by R.V. Churchill and J.W. Brown, 8th Edition, McGraw-Hill Education.

4. Reference Books:

- (i) Elementary Linear Algebra by Stephen Andrilli and David Hecker, 4th Edition, Elsevier
- (ii) Elementary Linear Algebra, Applications version by H. Anton and C. Rorres, 10th Edition, John Wiley.
- (iii) A First Course in Complex Analysis with Applications by Dennis G. Zill & Patrick Shanahan, 2nd Edition, 2009, Jones & Bartlett.



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5. Course Plan:

Lec. No.	Learning Objectives	Topics to be covered	Chapter in the Text Book
A. LINEAR ALGEBRA (Text Book (i))			
1	Introduction to the Course and introduction to system of linear equations	Elementary row operations and Echelon form	1.1
2-3	Inverse of a matrix, Solving system of linear equations and computing Eigenvalues and Eigenvectors	Solutions of linear systems of equations by Gauss Elimination, Gauss-Jordan method. RREF, Eigenvalues and Eigenvectors	1.1-1.2 2.4,3.4
4-12	Introduction to abstract vector spaces, finite and infinite dimensional vector spaces and related concepts.	Vectors in \mathbb{R}^n , linear combination, linear independence, Vector spaces, *Examples of unusual Vector spaces, subspaces, basis and dimension, **Shrinking a linearly dependent set to a Basis, **Extending a linearly independent set to a Basis, Rank of a matrix	4.1-4.5 *R1 : 4.1 **R1: 4.6
13-14	Understanding the change of basis	Coordinate vectors and change of Basis	5.1
15-17	Introduction to linear transformations, examples of linear transformations..	Linear transformations, kernel and range of linear transformation, Isomorphism, Some matrix transformations	4.8- 4.10 2.5, 2.6
18-19	Understanding the link between linear transformations and matrices.	Matrix of a Linear Transformation	5.2
B. COMPLEX VARIABLES (Text Book (ii))			
	Revision of complex numbers and their properties.	Review (Self Study)	1-9
20-21	Introduction to functions of a complex variable. Evaluation of limits in complex plane. Testing continuity of complex valued functions.	Functions of a complex variable. Limit and continuity	10-12, 15-18
22-25	Introduction to analytic functions. Singular points of a complex valued function.	Derivative, CR-equations, analytic functions, Harmonic functions	19-26
26-29	Study of elementary functions. These functions occur frequently all through the complex variable theory. Understanding multiple valued function, branch cut and branch point	Exponential, trigonometric, hyperbolic and Logarithmic functions, complex exponents, inverse functions.	29-36





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30-31	Integrating along a curve in complex plane.	Contour integrals, anti-derivatives.	37-44
32-33	Techniques to find integrals of different functions over particular contours.	Cauchy-Goursat Theorem, Cauchy Integral Formula, Morera's Theorem, Liouville's Theorem.	46,48-52
	Application of complex variable theory in Abstract Algebra.	Fundamental Theorem of Algebra (Self Study)	53
34-35	Series expansion of a complex function, To study different types of singular points.	Taylor Series and Laurent series.	57,59, 60,62
36-38	Calculating residues at isolated singular points.	Residues, Residue Theorem.	68-76
39-40	Application of complex integration to evaluate improper real integral.	Improper real integrals.	78-79

6. Evaluation Scheme:

EC No.	Evaluation Component	Duration	Weightage (%)	Date	Nature of Component
1.	Classroom Participation tests	To be announced later	10	To be announced later	Open Book
2.	Assignment I	To be announced later	10	To be announced later	Open Book
3.	Mid Semester Exam	90 min.	30	05/03 9.30 - 11.00AM	Closed Book
4.	Assignment II	To be announced later	10	To be announced later	Open Book
5.	Comprehensive Exam	180 min.	40	06/05FN	Closed Book

Very important note about minimum performance: A student should obtain 30% of the average of the top 50% performers in the class, or 40% of the median marks of the class, whichever is lower to clear the course. If any student gets the marks lower than the prescribed standard mentioned above, he/she may be awarded NC.

7. Notices: All notices about the course will be displayed on LMS.

8. Chamber Consultation Hour: To be announced in the class by the respective Instructors.

9. Make-up Policy: Prior permission is needed for makeup; makeup will be given only for genuine cases.

10. Total marks: 300

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.



Instructor-In-Charge



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