ARSD College, University of Delhi

Lesson Plan

Course Name : B.Sc. (Prog.) Physical Sciences-Mathematics						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
I	42351101	Calculus And Matrices	5	1	0	6
Teacher/Instructor(s)		Vinit Chauhan				
Session		January -May 2022				

Course Objective:

The primary objective of this course is to gain proficiency in differential calculus, and introduce the basic tools of matrices and complex numbers which are used to solve application problems in a variety of settings ranging from chemistry and physics to business and economics. Differential calculus develops the concepts of limit, continuity and derivative, and is fundamental for many fields of mathematics.

Course Learning Outcomes: This course will enable the students to:

(i) Define and use fundamental concepts of calculus including limits, continuity and differentiability.

(ii) Solve systems of linear equations and find eigenvalues and corresponding eigenvectors for a square matrix, and check for its diagonalizability.

(iii) Perform operations with various forms of complex numbers to solve equations.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.	Calculus	1-4	Graphs of simple basic functions such as: Polynomial, Trigonometric, Inverse trigonometric, Exponential and logarithmic functions
		5-8	Limits and continuity of a function including $\in -\delta$ approach
		9-12	Properties of continuous functions including Intermediate value theorem

		13-16	Differentiability, Successive differentiation, Leibnitz theorem
		17-20	Recursion formulae for higher derivatives;
		21-23	Rolle's theorem, Lagrange's mean value theorem with geometrical interpretations and simple applications
		24-25	Taylor's theorem, Taylor's series and Maclaurin's series
		26-28	Maclaurin's series expansion of functions such as e^x, $\sin x$, $\cos x$, $\log(1+x)$, and $(1+x)^m$; their use in polynomial approximation and error estimation
		29-30	Partial differentiation up to second order.
2.	Matrices	31-34	Elementary row operations, Row reduction and echelon forms
		35-38	Solution of systems of linear equations in matrix form
		39-41	Linear independence and dependence, Rank of a matrix and applications
		42-46	Elementary linear transformations like shear, translation, dilation, rotation, refection, and their matrix form
		47-49	The matrix of a general linear transformation
		50-53	Eigenvectors & eigenvalues of square matrices up to order 3
		54-55	Diagonalization
3.	Complex numbers	56-58	Geometrical representation of addition, subtraction, multiplication and division of complex numbers
		59-62	Lines, circles, and discs in terms of complex variables
		63-66	Statement of the Fundamental Theorem of Algebra and its consequences
		67-70	De Moivre's theorem and its application to solve simple equations in complex variables.

Evaluation Scheme:

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

Details of the Course

Unit	Contents	Contact Hours
1	Graphs of simple basic functions such as: Polynomial, Trigonometric, Inverse trigonometric, Exponential and logarithmic functions; Limits and continuity of a function including $\in -\delta$ approach, Properties of continuous functions including Intermediate value theorem; Differentiability, Successive differentiation, Leibnitz theorem, Recursion formulae for higher derivatives; Rolle's theorem, Lagrange's mean value theorem with geometrical interpretations and simple applications, Taylor's theorem, Taylor's series and Maclaurin's series, Maclaurin's series expansion of functions such as e^x, $\sin x$, $\cos x$, $\log(1+x)$, and $(1+x)^m$; their use in polynomial approximation and error estimation; Functions of two or more variables, Graphs and level curves of functions of two variables, Partial differentiation up to second order.	30
2	Elementary row operations, Row reduction and echelon forms, Solution of systems of linear equations in matrix form, Linear independence and dependence, Rank of a matrix and applications; Elementary linear transformations like shear, translation, dilation, rotation, refection, and their matrix form, The matrix of a general linear transformation; Eigenvectors & eigenvalues of square matrices up to order 3 and diagonalization.	25
3	Geometrical representation of addition, subtraction, multiplication and division of complex numbers; Lines, circles, and discs in terms of complex variables; Statement of the Fundamental Theorem of Algebra and its consequences; De Moivre's theorem and its application to solve simple equations in complex variables.	15
	Total	**70**

Suggested Books:

Sl. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1	Andreescu, Titu & Andrica Dorin. (2014). Complex umbers from A to...Z. (2nd ed.). Birkhäuser.	2014
2	Anton, Howard, Bivens, Irl, & Davis, Stephen (2013). Calculus (10th ed.). John Wiley & Sons Singapore Pvt. Ltd. Reprint (2016) by Wiley India Pvt. Ltd. Delhi.	2016
3	Lay, David C., Lay, Steven, R., & McDonald Judi, J. (2016). Linear Algebra and its Applications (5th ed.). Pearson.	2016

Mode of Evaluation:	Internal Assessment / End Semester Exam

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