Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS101	**Title**	**Batch:**	2021 - 2023
		ALGEBRA	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

This course enable the students to learn several advanced concepts in algebra such as study of Sylow's theorems, polynomial rings, extension and finite fields and Galois Theory.

Course Outcomes(CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	recall the concepts of group, ring, homomorphism and automorphism.	K1
CO2	understand the concepts of polynomial rings and Galois theory and solve related problems.	K2
CO3	applySylow's theorem in subgroups and Einstein criterion for irreducibility of polynomials over rationals.	K3
CO4	analyze the concepts of finite fields, extension of fields, splitting field, normal extension, simple extension and fixed field.	K4
CO5	pursue research in Algebra and interdisciplinary fields.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	H	M	H	H
CO2	H	H	H	H	H	H	M	H	H
CO3	H	H	H	H	H	H	M	H	H
CO4	H	H	H	H	H	H	M	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Group Theory:** Another counting principle - Sylow's theorem. **Chapter 2: Sections: 2.11, 2.12**	16
Unit II	**Ring Theory:** Definitions and Examples of rings - *Some special classes of rings (Self study)* - Polynomial rings - Polynomials over the rational field - Polynomial rings over commutative rings. **Chapter 3: Sections:3.1, 3.2and 3.9 - 3.11.**	16
Unit III	**Fields:** Extension Fields. **Selected Topics**: Finite Fields. **Chapter 5: Section: 5.1. Chapter 7: Section: 7.1.**	15
Unit IV	**Vector Spaces and Modules:** Inner product spaces, *Modules (Self study,Definitions and examples only)* **Fields:** Roots of Polynomials. **Chapter 4: Sections:4.4, 4.5.Chapter 5: Section: 5.3**	16
Unit V	**Fields:** More about roots and The Elements of Galois theory. **Chapter 5: Sections: 5.5, 5.6**	15
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Herstein I. N.,*Topics in Algebra*, 2nd Edition, Wiley India Pvt. Ltd., New Delhi, 2010.

Books for Reference:

1. Bhattarcharya P. B., Jain K, and Nagpaul S.R., *Basic Abstract Algebra*, Cambridge University Press, New York, 2009.
2. John B. Fraleigh, *A First Course in Abstract Algebra*, Narosa Publishing House, New Delhi, 2003.
3. Surjeet Singh, QaziZameeruddin,*Modern Algebra*, Vikas Publishing House Pvt. Ltd., New Delhi., 2006.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/111/106/111106051/
2. https://onlinecourses.nptel.ac.in/noc20_ma31/preview
3. https://onlinecourses.nptel.ac.in/noc20_ma25/preview
4. https://math.libretexts.org/Bookshelves/Abstract_and_Geometric_Algebra
5. https://onlinecourses.nptel.ac.in/noc20_ma25/preview
6. https://onlinecourses.swayam2.ac.in/cec20_ma15/preview

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS102	**Title**	**Batch:**	2021 - 2023
		REAL ANALYSIS	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

This course will help students to understand the basics of real analysis and to reading and writing mathematical proofs. It will lay the foundation for the subsequent study of complex analysis and functional analysis.

Course Outcomes (CO)

On successful completion of this core paper, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand and update the knowledge of Riemann-Stieltjes integrals, sequence and series of functions.	K2
CO2	analyze the importance of uniform convergence with sequence of continuous, differentiable and integral functions.	K4
CO3	analyze the consequences of Inverse function Theorem and the Implicit function Theorem.	K4
CO4	apply the concept of Measure to the set of real numbers R and analyze its properties. Distinguish the concepts of Riemann integral and Lebesgue integral.	K3
CO5	acquire sound knowledge in analysis and lead to pursue research in Mathematical sciences and allied fields.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	H	M	H	M
CO2	H	H	H	H	H	H	M	H	M
CO3	H	H	H	H	H	H	M	H	M
CO4	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Riemann-Stieltjes Integral**: Definition and Existence of the Integral - Properties of the Integral - Integration and Differentiation - Integration of Vector-valued Functions -*Rectifiable Curves (Self study).* **Text Book 1:Chapter 6.**	15
Unit II	**Sequences and Series of Functions**:Uniform convergence - Uniform Convergence and Continuity-Uniform Convergence and Integration-Uniform Convergence and Differentiation- Equicontinuous Families of Functions-The Stone-Weierstrass Theorem. **Text Book 1:Chapter 7.**	16
Unit III	**Functions of Several Variables**: Linear Transformations - The Contraction Principle -The Inverse Function Theorem - The Implicit Function Theorem - Determinants -*Derivatives of Higher Order (Self study).* **Text Book 1: Chapter 9** (Except Differentiation, The Rank Theorem & Differentiation of Integrals).	16
Unit IV	**Lebesgue Measure**: Introduction - Lebesgue Outer Measure - The σ-Algebra of Lebesgue Measurable sets. **Lebesgue Measurable Functions**: Sums, Products, and Compositions - Sequential Pointwise Limits and Simple Approximations. **Text Book 2:Sections:2.1 - 2.3 and 3.1, 3.2.**	15
Unit V	**Lebesgue Integration**: The Riemann Integral - The Lebesgue Integral of Bounded Measurable Function over a Set of Finite Measure - The Lebesgue Integral of a Measurable Nonnegative Function -The General Lebesgue Integral. **Text Book 2:Sections: 4.1 - 4.4.**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Books:

1. Walter Rudin, *Principles of Mathematical Analysis*, McGraw Hill, New York, 2014.
2. Royden H. L. and Fitzpatrick P. M., *Real Analysis*, Fourth Edition, Pearson Education, Inc., Publishing as Prentice Hall, 2013.

Books for Reference:

1. R.G.Bartle, *Elements of Real Analysis*,2nd Edition, John Wiley and Sons, New York, 1976.
2. W. Rudin, *Real and Complex Analysis*, 3rd Edition, McGraw-Hill, New York, 1986.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.classcentral.com/course/swayam-basic-real-analysis-17525
2. https://nptel.ac.in/course.html
3. https://www.adelaide.edu.au/course-outlines/104831/1/sem-2/

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS103	**Title**	**Batch:**	2021 - 2023
		COMPLEX ANALYSIS	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objectives

The main objectives of this course are:

1. It enables the learners to understand and to evaluate the definite integrals in an easy and effective way using calculus of residues.
2. It gives a deeper understanding in the advanced topics such as harmonic functions, Infinite products, canonical products and Normal families.

Course Outcomes (CO)

On successful completion of this core paper, the students will be able to

CO Number	CO Statement	Knowledge level
CO1	understand the concepts and consequences of analyticity and the Cauchy-Riemann equations and the results on harmonic and entire functions including the fundamental theorem of algebra.	K2
CO2	analyze complex contour integrals in several ways directly using parameterization and using Cauchy's theorem.	K4
CO3	represent functions as Taylor, Power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.	K5
CO4	obtain deep knowledge in advanced topics such as infinite products, canonical products and normal families.	K4
CO5	solve the problems using complex analysis techniques applied to different situations in engineering and other mathematical contexts which ensures to do research in this field.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	M	H	M	M	H	M
CO2	M	H	H	H	M	H	H	H	M
CO3	M	H	H	H	H	H	M	H	M
CO4	H	H	H	H	H	H	M	H	M
CO5	M	M	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Complex Integration:The General form of Cauchy's Theorem**:Chains and Cycles - Simple Connectivity - Homology - The General Statement of Cauchy's Theorem - Proof of Cauchy's Theorem -Locally Exact Differentials - Multiply Connected Regions. **Chapter 4 : Sections: 4.1 - 4.7** **The Calculus of Residues**: The Residue Theorem - The Argument Principle - Evaluation of Definite integrals. **Chapter 4 : Sections: 5.1 - 5.3**	16
Unit II	**Complex Integration: Harmonic Functions:** Definition and Basic Properties of Harmonic Functions - The Mean Value Property. **Chapter 4 : Sections : 6.1and 6.2.** **Harmonic Functions:** Poisson's Formula - Schwarz's Theorem - The Reflection Principle . **Chapter 4 : Sections: 6.3- 6.5.**	15
Unit III	**Series and Product Developments**:**Power Series Expansions:**Weierstrass's Theorem -The Taylor Series - The Laurent Series. **Chapter 5: Sections: 1.1- 1.3.** **Partial Fractions and Factorization:**Partial Fractions - Infinite Products - Canonical Products - The Gamma Function. **Chapter 5: Sections: 2.1- 2.4.**	15
Unit IV	**Series and Product Developments**:**Entire Functions**: Zensen's Formula. **Chapter 5: Sections: 3.1.** **Normal Families:**Equi-continuity - Normality and Compactness, Arzela's Theorem -Families of Analytic Functions. **Chapter 5: Sections: 5.1 - 5.4.**	16

Unit V	**Elliptic Functions**: **Simply Periodic Functions**: Representation by Exponentials - The Fourier Development **Doubly Periodic Functions***: The Period Module - Unimodular Transformations(Self study)* – The Canonical basis – General properties of Elliptic functions. **Chapter 7: Sections: 1.1-1.2.** **Chapter 7: Sections: 2.1- 2.4.**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Lars V. Ahlfors,*Complex Analysis*, McGraw-Hill International Edition, Third Edition (Indian Edition), 2013.

.Books for Reference:

1. Serge Lang, *Complex Analysis*, Springer International Edition, 2005.
2. Shanti Narayan & Dr. P. K. Mittal, Theory *of Functions of a Complex Variable*, S. Chand & Company Pvt. Ltd, 2014.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/111/103/111103070/
2. https://nptel.ac.in/courses/111/106/111106084/

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS104	**Title**	**Batch:**	2021 - 2023
		ORDINARY DIFFERENTIAL EQUATIONS	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

This course introduces the formulation, classification of differential equations and existence and uniqueness of solutions. It also provides skill in solving initial value and boundary value problems and developing the skill in solving first and second order linear homogeneous and non-homogeneous differential equations using power series method.

Course Outcomes (CO)

On successful completion of this course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	recollect the preliminaries of analysis and calculus and understand the concept of Linear differential equations.	K2
CO2	solve differential equations using power series method and applying the ideas of differential equations in a coherent and meaningful manner for solving real world problems.	K3
CO3	formulate and solve linear systems using fundamental matrix and its properties and apply in the field of industrial organization engineering and research.	K5
CO4	analyze existence, uniqueness, other properties of a solution of differential equations and concepts of boundary value problems.	K4
CO5	determine the real life problems beyond the classroom.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	H	M	H	M
CO2	H	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Linear differential equations of higher order**: Introduction-Linear dependence and Wronskian - Basic theory for linear equations - Method of variation of parameters - Two useful formulae - Homogeneous linear equations with constant co-efficients. **Chapter 2: Sections: 2.1 - 2.6.**	16
Unit II	**Solutions in power series**: Second order linear equations with ordinary points - Legendre equation and Legendre polynomials - Second order equations with regular singular points - Bessel equation. **Chapter 3: Sections : 3.2 - 3.5**	15
Unit III	**Systems of Linear Differential Equations**: Systems of first order equations - Existence and uniqueness theorem - Fundamental matrix - Non-homogeneous linear systems - Linear systems with constant co-efficients-*Linear systems with periodic co-efficients (Self study).* **Chapter 4: Sections : 4.2 - 4.7**	15
Unit IV	**Existence and uniqueness of solutions and Oscillations of second order equations**: Introduction - Preliminaries - Successive approximations- Picard's theorem - Fundamental results - Strum's comparison theorem-Elementary linear oscillations - Comparison theorem of Hille-Wintner - Oscillations of x'' + a(t)x=0 . **Chapter 5 and 6 : Sections : 5.1-5.4 and 6.1- 6.5**	16
Unit V	**Boundary Value problems**: Introduction - Strum-Liouville problem - Green's functions - Picard's theorem. **Chapter 7: Sections : 7.1 - 7.3, 7.5**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Deo S. G. and Raghavendran V, *Ordinary Differential Equations and Stability Theory*, Tata McGraw Hill Publishing company Limited, 1990.

Books for Reference:

1. Coddington E. A and Levinson N., *Theory of Ordinary Differential Equations*, McGraw Hill, New York, 1955.
2. Martin H., *Ordinary Differential Equations*, Tata McGraw Hill Publishing company Limited, 1985.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/111/107/111107111/
2. https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/videolectures/
3. https://nptel.ac.in/courses/122/107/122107037/

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS1E1	**Title**	**Batch:**	2021 - 2023
		MATLAB	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	4		**Credits:**	3

Course Objective

This course ensures the students to learn about the basics of MATLAB programming. It also enables the students to gain knowledge about the use of loops, functions, operators and insertion of plots using MATLAB commands.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	recollect the importance of conditional statements and the looping structure of the programming language.	K1
CO2	understand and apply the basics of MATLAB .	K2
CO3	apply the concepts of polynomials, curve fitting and interpolation in MATLAB.	K3
CO4	apply arithmetic operations, display formats, plotting the curves and the concepts of arrays in MATLAB	K3
CO5	competent in applying MATLAB for various applications	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	M	M	M	M	H	M
CO2	H	H	H	H	M	H	M	H	M
CO3	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	M	H	M	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	Starting with MATLAB - Creating arrays - Mathematical operations with arrays. **Chapter 1: Sections 1.1-1.9.** **Chapter 2: Sections 2.1-2.11.** **Chapter 3: Sections 3.1-3.9.**	11
Unit II	Scripts files - Functions and function files - *Global variables (Self study)* **Chapter 4: Sections 4.1-4.8.** **Chapter 6: Sections 6.1-6.11.**	11
Unit III	Two-dimensional plots - Three dimensional plots - *Polar plots (Self study).* **Chapter 5: Sections 5.1-5.11.** **Chapter 9: Sections 9.1-9.6.**	10
Unit IV	Programming in MATLAB. **Chapter 7: Sections 7.1-7.8.**	10
Unit V	Polynomial - Curve fitting and interpolation. **Chapter 8: Sections 8.1-8.6.**	10
	Total Contact Hrs.	**52**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Amos Gilat, *MATLAB - An Introduction with Application*, John Wiley & Sons, Singapore, Third Edition, 2007.

Books for Reference:

1. Etter D. M., Kuncicky D. C. and Moore H., Introduction to MATLAB 7, Prentice Hall, New Jersy, 2009.
2. Palm W. J., Introduction to MATLAB 7 for Engineers, McGraw-Hill Education, New York, 2005.
3. Prata R. P., Getting Started with MATLAB - A Quick Introduction for Scientist and Engineers, Oxford University Press, New Delhi, 2010.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/103/106/103106118/
2. https://web4.cs.ucl.ac.uk/teaching/3085/archive/2010/matlab_tutorial/matlab_booklet.pdf
3. https://nptel.ac.in/courses/111/102/111102137/

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS1E2	**Title**	**Batch:**	2021 - 2023
		SPECIAL FUNCTIONS	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	4		**Credits:**	3

Course Objective

To enable the learnersto obtain basic knowledge on fundamental properties of several special functions.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of Bessel's functions with its properties like recurrence relations, generating functions, etc.	K2
CO2	Perform operations with Orthogonal polynomials, Legendre's polynomial with their differential equations along with the corresponding recurrence formula.	K3
CO3	Apply these techniques to solve and analyze various mathematical problems.	K3
CO4	Analyze the properties of special functions by their integral representations.	K4
CO5	Demonstrate how physical phenomena are modeled using special functions.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	H	H	M	H
CO2	H	H	H	H	M	H	H	M	H
CO3	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L – LOW.

Units	Content	Hrs.
Unit I	**Legendre's Equation :** Definition of Legendre's Equation -Solution of Legendre's Equation-Definition of $P_n(x)$ and $Q_n(x)$-General Solution of Legendre's Equation.	10
Unit II	To show that $P_n(x)$ is the coefficient of h^n in the expansion of $(1-2xh+h^2)^{-1/2}$ - Laplace Definite integral for $P_n(x)$-Orthogonal properties of Legendre's polynomials.	11
Unit III	**Bessel's Equation :** Definition of Bessel's Equation- Solution of Bessel's general differential equation- General solution of Bessel's Equation-Integration of Bessel's equation Using power series method	11
Unit IV	Definition of $J_n(x)$,Recurrence formulae for$J_n(x)$- Generating function $J_n(x)$ -A second solution of Bessel's Equation -**Beta and Gamma Functions :** -Principal and general values of an improper integral	10
Unit V	Infinite limits- To find the value of $\int f(x)/F(x)\,dx$ - To find the value of $\int x^{2m}/1+x^{2n}dx$- To find the value of $\int x^{2m}/1+x^{2n}dx$- Deductions from $\int x^{2m}/1+x^{2n}dx$ and $\int x^{2m}/1+x^{2n}dx$	10
	Total Contact Hrs.	**52**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

J.N. Sharma and R.K.Gupta, Special Functions,Krishna PrakashanPublisher, Meerut, 1991.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

https://www.youtube.com/watch?v=iuKJHKu2KPI

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS1E3	**Title**	**Batch:**	2021 - 2023
		PROGRAMMING LAB IN MATLAB	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	2		**Credits:**	2

Course Objective

This course ensures a practical knowledge for creating the various types of 2D and 3D plots and computing the sub matrices from the existing matrix.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	apply the knowledge gained to create matrices and graphics.	K3
CO2	apply the plotting commands in creating and editing 2D and 3D plots.	K3
CO3	apply the concept of matrix operations in MATLAB	K3
CO4	evaluate the roots of the polynomial and the best fit of the function.	K5
CO5	calculate distance of projectile using element by element calculation.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	M	H	H	M	H
CO2	H	H	H	H	M	H	H	M	H
CO3	H	H	H	H	M	H	H	M	H
CO4	H	H	H	H	M	H	M	M	H
CO5	H	H	H	H	H	H	H	M	H

H - HIGH; M - MEDIUM; L - LOW.

List of Programs

1. Program to solve geometry and trigonometry problem.
2. Program to illustrate the row vector operations in a given matrix.
3. Program to illustrate the column vector operations in a given matrix.
4. Program to illustrate the creation of sub matrix form a given matrix.
5. Program for friction experiment.
6. Program to analyze the electrical resistive network.
7. Program to calculate distance of projectile by, element by element calculation.
8. Program to create vertical bar, horizontal bar, stairs, stem plots of a function.
9. Program to formatting a plot using commands.
10. Program to create plot of a function using the given data and fplot function.
11. Program to create mesh and surface plots for a given function.
12. Program to create various views of 3D plots.
13. Program for creating a matrix.
14. Program to plot a function and curve corresponds to the interpolation method.
15. Program to calculate value and finding roots of a polynomial.
16. Program to determine a function that best fits the given data.

Text Book:

Amos Gilat, *MATLAB - An Introduction with Application*, John Wiley & Sons, Singapore, Third Edition, 2007.

Books for Reference:

1. Etter D. M., Kuncicky D. C. and Moore H., Introduction to MATLAB 7, Prentice Hall, New Jersy, 2009.
2. Palm W. J., Introduction to MATLAB 7 for Engineers, McGraw-Hill Education, New York, 2005.
3. Prata R. P., Getting Started with MATLAB - A Quick Introduction for Scientist and Engineers, Oxford University Press, New Delhi, 2010.

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name with Signature	CDC	COE
Name:Dr. N. SELVANAYAKI Signature	Name: Dr. V. INTHUMATHI Signature	Name: Signature	Name: Signature

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS205	**Title**	**Batch:**	2021 - 2023
		LINEAR ALGEBRA	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

To make the student understand the concept of linear algebra in detail and by this student can crack the linear algebra part in competitive examination and CSIR/NET examination.

Course Outcomes (CO)

On successful completion of this course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	remember the concept which are basic to analysis of a single linear transformation on a finite dimensional vector space.	K1
CO2	understand and get the idea of diagonalizable and nilpotent part of a more general transformation, the rational and Jordan Canonical formula.	K2
CO3	arrive the primary and cyclic decomposition theorems and apply to study of admissible subspaces.	K3
CO4	analyze the concepts of matrices over a polynomial domain and a concept of bilinear forms.	K4
CO5	enrich knowledge of problem solving and pursue further research.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	M	H	H	M	H	M
CO2	M	H	H	H	H	M	M	H	M
CO3	M	H	H	H	H	H	M	H	M
CO4	H	H	H	H	H	H	M	H	M
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Elementary Canonical Forms**:Introduction - Characteristic Values - Annihilating Polynomials, Invariant Subspaces. **Chapter 6:Sections: 6.1 - 6.4.**	16
Unit II	**Elementary Canonical Forms**:Direct Sum Decompositions - Invariant Direct Sums - The Primary Decomposition Theorem. **Chapter 6: Sections: 6.6 - 6.8.**	16
Unit III	**The Rational and Jordan Forms**:Cyclic Subspaces and Annihilators - Cyclic Decompositions and the Rational Form. **Chapter 7: Sections: 7.1, 7.2.**	16
Unit IV	**The Rational and Jordan Forms**:The Jordan Form - Computations of Invariant Factors. **Chapter 7: Sections: 7.3, 7.4.**	15
Unit V	**Bilinear Forms**:Bilinear Forms - Symmetric Bilinear Forms **Chapter 10: Sections: 10.1, 10.2.**	15
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Kenneth Hoffman and Ray Kunze ,*Linear Algebra*, PHI learning Private Ltd., New Delhi, Second Edition, 2010.

Books for Reference:

1. Herstein I. N, *Topics in Algebra*, Wiley India pvt. Ltd., New Delhi, 2010.
2. Kumaresan S, *Linear Algebra*, Prentice-Hall of India, 2001.
3. Serge Lang, *Introduction to Linear Algebra*, Springer, 2005.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

https://nptel.ac.in/courses/111/104/111104137/

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS206	**Title**	**Batch:**	2021 - 2023
		MATHEMATICAL STATISTICS	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

The objective of this syllabus is to give a systematic introduction to modern probability theory and mathematical statistics.

Course Outcomes (CO)

On successful completion of this core paper, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	recall the concepts of undergraduate algebra and calculus applied in the theory of probability.	K1
CO2	understand the concepts of random variables, characteristic functions, probability distributions, samples and statistics.	K2
CO3	calculate expected value and higher moments of the distribution functions and probabilities associated with the distributions (normal, t, χ^2 and F) of random variable. Analyze the central limit theorem.	K3
CO4	formulate statistical hypothesis for small and large samples, parametric tests and apply to analyze real-life problem construct confidence intervals for unknown parameters.	K4
CO5	evaluate the properties of point estimators (consistency, efficiency, sufficiency) and their goodness to decision making problems.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	H	M	H	H	M	H	M
CO2	H	H	H	M	H	H	M	H	M
CO3	H	H	H	H	H	H	M	H	M
CO4	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Random events:** Preliminary remarks - Random events and operations performed on them -The system of axioms of the theory of probability - Conditional probability -Bayes theorem - Independent events. **Random variables:** The concept of a random variable - The distribution function- Random variables of the discrete type and the continuous type - Functions of random variables - Multidimensional random variables - Marginal distributions - Conditional distributions - Independent random variables. **Parameters of the distribution of a random variable:** Expected values-Moments - The Chebyshev inequality - absolute moments. **Chapter 1: Sections : 1.1 - 1.3, 1.5 - 1.7.** **Chapter 2 :Sections : 2.1 - 2.8** **Chapter 3: Sections : 3.1 - 3.4.**	15
Unit II	**Characteristic functions:** Properties of characteristic functions - The characteristic function and moments - Semi invariants - The characteristic function of the sum of independent random variables - Determination of the distribution function by the characteristic function - The characteristic function of multidimensional random vectors -Probability generating functions. **Some probability distributions:** The Poisson distribution – The uniform distribution. **Chapter 4: Sections: 4.1 - 4.7.** **Chapter 5:Sections: 5.5, 5.6**	16
Unit III	**Some probability distributions:**The normal distribution - The gamma distribution - *The beta distribution (Self study)*- The Cauchy and Laplace distributions. **Limit theorems:**Preliminary remarks - Stochastic convergence - Bernoulli's law of large numbers - The Levy-Cramer theorem - The De Moivre - Laplace theorem. **Chapter 5: Sections: 5.7 - 5.10.** **Chapter 6 :Sections: 6.1 - 6.3, 6.6, 6.7.**	15
Unit IV	**Sample moments and their functions:**The notion of a sample - The notion of a Statistic- the distribution of the arithmetic mean of independent normally distributed random variables - The χ^2 distribution - The distribution of the statistics($\bar{X}$'S) - Student's t-distribution -Fisher's Z-distribution. **Significance tests:**The concept of a statistical test - Parametric tests for small samples -Parametric tests for large samples. **Chapter 9 : Sections : 9.1 - 9.7.** **Chapter 12 : Sections : 12.1 - 12.3.**	16
Unit V	**The theory of estimation:** Preliminary notions - Consistent estimates - Unbiased estimates - The sufficiency of an estimate - The efficiency of an estimate - Method of finding estimates - Confidence intervals. **Chapter13: Sections :13.1 - 13.8.**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

MarekFisz, Probability theory and Mathematical Statistics, John Wiley & sons, Inc./ Third Edition, 1980.

Books for Reference:

1. Gupta S. C. Kapoor V. K., Fundamentals of Mathematical Statistics a Modern Approach, Sultan Chand & Sons/10th Edition, 2000.
2. Irwin Miller and Marylees Miller, Mathematical Statistics, Pearson Prentice Hall Pvt Ltd/7th Edition, 2011.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/111/106/111106150/
2. https://nptel.ac.in/courses/111/106/111106112/
3. https://www.youtube.com/watch?v=G_RDxAZJ-ug
4. https://www.youtube.com/watch?v=hcDb12fsbBU
5. https://www.youtube.com/watch?v=MOy2gcCkcRY
6. https://nptel.ac.in/courses/111/105/111105124/

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS207	**Title**	**Batch:**	2021 - 2023
		PARTIAL DIFFERENTIAL EQUATIONS	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	5		**Credits:**	4

Course Objective

This course helps the students to understand linear and nonlinear partial differential equations and solving those using Charpit's and Jacobi's methods, methods of separation of variables and by method integral transforms. This course includes the study of Laplace equation, wave equation and diffusion equation and their classifications.

Course Outcomes (CO)

On successful completion of this course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand and classify partial differential equations to transform into canonical form.	K2
CO2	gain good knowledge in applying Charpit's and Jacobi's methods, method of separation of variables and the method of integral transforms to obtain solutions of partial differential equations.	K3
CO3	determine the canonical forms of second order PDEs and boundary value problems by Dirichlet and Neumann and apply the techniques to predict the behavior of certain phenomena.	K5
CO4	evaluate the elementary solutions of Laplace equations and explain the problems with axial symmetry and demonstrate the ability to think critically by developing appropriate mathematical models of physical systems .	K5
CO5	analyze linear partial differential equations with constant and variable coefficients, boundary value problems and apply specific methodologies to conduct research and produce innovative results.	K4

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	H	M	H	M
CO2	H	H	H	H	H	H	M	H	H
CO3	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Partial Differential Equations of the First Order:**Partial Differential Equations - *Origins of First-order Partial Differential Equations (Self study)* - Nonlinear Partial Differential Equations of the First Order - Compatible Systems of First-order Equations - Charpit's Method - Special Types of First-order Equations - Jacobi's Method. **Chapter 2:Sections:1, 2, 7, 9, 10, 11 and 13.**	14
Unit II	**Partial Differential Equations of the Second Order:**The Origin of Second-order Equations - Linear Partial Differential Equations with Constant Coefficients - Equations with Variable Coefficients. **Chapter 3:Sections:1,4 and 5.**	13
Unit III	**Partial Differential Equations of the Second Order:**Separation of variables - The Method of Integral Transforms- Nonlinear Equations of Second Order. **Chapter 3:Sections: 9, 10 and 11.**	13
Unit IV	**Laplace's Equation:** Elementary Solutions of Laplace's Equations - Families of Equipotential Surfaces - *Boundary Value Problems(Self study)* - Separation of Variables - Problems with Axial Symmetry. **Chapter 4 :Sections: 2 - 6.**	12
Unit V	**The Wave Equation:**Elementary Solutions of the One-dimensional Wave Equation - Vibrating Membranes: Application of the Calculus of Variations. **The Diffusion Equation:**Elementary Solutions of Diffusion Equation - Separation of Variables. **Chapter 5: Sections: 2 and 4** **Chapter 6: Sections: 3 and 4.**	13
	Total Contact Hrs.	**65**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Ian N. Sneddon, *Elements of Partial Differential Equation, Dover Publication*, New York, 2006.

Books for Reference:

1. Michael Renardy and Robert C. Rogers, *An Introduction to Partial Differential Equations.* Second Edition. Springer, 2004.
2. Robert C. Mc Owen, *Partial Differential Equations, Methods and Applications,* Second Edition. Pearson Education, Inc., 2004.
3. SankaraRaoK., Introduction *to Partial Differential Equations, Second Edition,* PHI Learning Pvt.Ltd, New Delhi, 2009.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/111/107/111107111/
2. https://nptel.ac.in/courses/122/107/122107037/
3. https://ocw.mit.edu/courses/mathematics/18-152-introduction-to-partial-differential-equationsfall-2011/lecture-notes/

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name with Signature	CDC	COE
Name:Dr. S. KALEESWARI  Signature	Name: Dr. V. INTHUMATHI  Signature	Name:  Signature	Name:  Signature

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS208	**Title**	**Batch:**	2021 - 2023
		MECHANICS	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

This course deals with some of the key ideas of classical mechanics. The concepts covered in the course include generalized coordinates, Lagrange's equations, Hamilton's equations and Hamilton - Jacobi theory.

Course Outcomes (CO)

On successful completion of this core paper, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	demonstrate the knowledge of core principles in mechanics	K2
CO2	analyze the motion of mechanical systems with constraints using Lagrangian description.	K2
CO3	apply Hamilton's principle and gain proficiency in solving equations of motions.	K3
CO4	analyze and apply the Hamilton-Jacobi theory in identifying conserved quantities.	K4
CO5	identify the existing symmetries and the corresponding integrals of motion andanalyze the qualitative nature of dynamics	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	H	H	M	M	H	M	H	M
CO2	M	H	H	H	H	H	M	H	M
CO3	M	H	H	H	H	H	M	H	M
CO4	M	H	H	H	H	H	M	H	M
CO5	M	H	H	H	H	H	H	H	M

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Introductory concepts**:Mechanical system- *Generalized Coordinates(Self study)*- Constraints - Virtual Work - Energy and Momentum. **Chapter 1: Sections: 1.1 - 1.5.**	16
Unit II	**Lagrange's equations**:Derivations of Lagrange's Equations -*Examples(Self study)*- Integrals of Motion. **Chapter 2: Sections 2.1 - 2.3.**	15
Unit III	**Hamilton's equations**: Hamilton's Principle - Hamilton's Equations. **Chapter 4: Sections: 4.1 - 4.2.**	16
Unit IV	**Hamilton - Jacobi theory**:Hamilton's Principle function - Hamilton-Jacobi Equation. **Chapter 5: Sections: 5.1 - 5.2.**	15
Unit V	**Canonical transformations**:Differential forms and Generating Functions - Lagrange and Poisson Brackets. **Chapter 6: Sections: 6.1, 6.3.**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Donald T. Greenwood, C*lassical Dynamics, Dover Publication,*New York, 2014.

Books for Reference :

1. Goldstein H., *Classical Mechanics*. Addison Wesley Press, Inc, 1950.
2. Synge J.L. and Griffith B.A, *Principles of Mechanics*. Third Edition. McGraw-Hill company, 1959.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://youtu.be/J1XbWrcoiCA
2. https://youtu.be/tUaLxI2C1Cc

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS209	**Title**	**Batch:**	2021 - 2023
		NUMERICAL ANALYSIS	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	4		**Credits:**	3

Course Objective

This course enables the students to gain knowledge in solving Non-linear equations, Boundary value problems and characteristic value problems using MATLAB functions. It also provides the techniques to find the numerical solutions for ordinary differential equations using MATLAB.

Course Outcomes(CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	recall the various numerical techniques in solving set of equations using MATLAB	K1
CO2	apply iterative methods to compute the solutions of non-linear equations using MATLAB within a specified tolerance.	K3
CO3	analyze the concepts of interpolation to obtain difference table and to construct the polynomial for available data.	K4
CO4	calculate the eigen values and eigen vectors of matrix using power method.	K5
CO5	compute the solutions of ordinary differential equations by various numerical methods using MATLAB.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	H	H	M	H	H	M	H
CO2	H	H	H	H	H	H	H	M	H
CO3	H	H	H	H	H	H	H	M	H
CO4	H	H	H	H	M	H	H	M	H
CO5	H	H	H	H	H	H	H	M	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Solving Nonlinear Equations:** Linear interpolation methods - Newton's method - Muller's method - Newton's method for polynomials (excluding Horner's methods, Parallel processing) - Bairstow's method for quadratic factors - *Internal halving(Self study)*. **Chapter 1: Sections: 1.3 - 1.5, 1.7, 1.8, 1.11.**	11
Unit II	**Solving Sets of Equations:**The Elimination method - Gaussian Elimination and Gauss-Jordan methods - LU decomposition method - Matrix inversion by Gauss-Jordan method -Methods of iteration - Gauss Jacobi and Gauss Seidal iteration - Relaxation method -Systems of nonlinear equations- *Relaxation method(Self study)*. **Chapter 2: Sections: 2.3 - 2.5, 2.7, 2.10 - 2.12.**	10
Unit III	**Numerical Differentiation And Integration:** Derivatives from differences tables - Higher-order derivatives - Divided difference, Central difference formulas – The trapezoidal rule - A composite formula - Romberg integration - Simpson's rules. **Chapter 5: Sections: 5.2, 5.3, 5.6 and 5.7.**	11
Unit IV	**Numerical Solution of Ordinary Differential Equations:**Taylor-series method – Euler and modified Euler methods - Runge-Kutta methods - Multistep methods - Milne's method - Adams-Moulton method. **Chapter 6: Sections: 6.2 - 6.7.**	10
Unit V	**Boundary Value Problems and Characteristic Value Problems:** The shooting method - Solution through a set of equations - Derivative boundary conditions – Characteristicvalue problems - Eigen values of a matrix by iteration - The power method. **Chapter 7: Sections: 7.2 - 7.5.**	10
	Total Contact Hrs.	**52**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Gerald C.F. and Wheatley P.O., Applied *Numerical Analysis,* Sixth Edition, Addison-Wesley, Reading, 2005.

Books for Reference:

1. R.L. Burden and J. Douglas Faires, Numerical Analysis, 9th ed., Boston: Cengage Learning, 2011.
2. S.S. Sastry, Introductory Methods of Numerical Analysis, 4th ed., New Delhi:Prentice-Hall of India, 2006.

Related Online Contents[MOOC, SWAYAM,NPTEL, Websites etc.,]

1. https://nptel.ac.in/courses/111/102/111102137/
2. https://nptel.ac.in/courses/111/106/111106101/
3. https://nptel.ac.in/courses/103/106/103106118/

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS210	**Title**	**Batch:**	2021 - 2023
		PROGRAMMING LAB IN NUMERICAL ANALYSIS USING MATLAB	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	2		**Credits:**	2

Course Objective

This course enables a practical knowledge for finding the numerical solutions of a system of non-linear equations and first order ordinary differential equations using MATLAB.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	apply MATLAB to solve problems in numerical analysis.	K3
CO2	findthe solutions of first order ordinary differential equations in numerical analysis using MATLAB.	K4
CO3	solvea system of linear equations using MATLAB and find the inverse matrix by Gauss Jordan method.	K4
CO4	calculateeigen values and eigen vectors of the matrix using MATLAB.	K5
CO5	evaluate numerical derivatives and numerical integrals using MATLAB.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	M	H	M	M	H
CO2	H	H	H	H	M	H	H	M	H
CO3	H	H	H	H	M	H	H	M	H
CO4	H	H	H	H	M	H	H	M	H
CO5	H	H	H	H	M	H	H	M	H

H - HIGH; M - MEDIUM; L - LOW.

List of Programs:

1. Newton Raphson Method to find the roots.
2. Gauss elimination Method for solving a system of linear equations.
3. Matrix inverse by Gauss Jordan Method.
4. Gauss Jacobi's Method for solving a system of linear equations.
5. Gauss Seidal Method for solving a system of linear equations.
6. Numerical integration by Trapezoidal rule.
7. Numerical integration by Simpon's 1/3 rule.
8. Euler's Method for solving first order ODE.
9. Second order Runge-Kutta Method for solving first order ODE.
10. Fourth order Runge-Kutta Method for solving first order ODE.
11. Milne's Predictor-Corrector Method for solving first order ODE.
12. Eigen values and Eigen vectors by Power Method.

Text Book:

Gerald C.F. and Wheatley P.O., Applied *Numerical Analysis,* Sixth Edition, Addison- Wesley, Reading, 2005.

Books for Reference:

1. R.L. Burden and J. Douglas Faires, Numerical Analysis, 9th ed., Boston: Cengage Learning, 2011.
2. S.S. Sastry, Introductory Methods of Numerical Analysis, 4th ed., New Delhi:Prentice-Hall of India, 2006.

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Dr. R.MANICKA CHEZIAN, M.Sc.,M.S.,Ph.D.,
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS2N1	**Title**	**Batch:**	2021 - 2023
		NME - MATHEMATICAL STATISTICS AND TECHNIQUES	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	1		**Credits:**	2

Course Objective

The aim of this paper is to train the students to improve the basic knowledge relevant to their major subjects. This syllabus enables students to learn about the concept of Analysis and Testing of Hypothesis**.**

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand the concepts of Mean, Median and Standard deviation.	K2
CO2	applythe concept of simple and rank correlation to real life problems.	K3
CO3	apply the testing of hypothesis to Z test, t-test, chi square and F test.	K3
CO4	analyze the concepts of chi-square test and apply the result in various field.	K4
CO5	evaluate the concepts of Regression Analysis.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	M	M	M	H	M	H	M
CO2	H	M	H	H	M	H	M	H	M
CO3	H	M	H	H	M	H	M	H	M
CO4	H	M	H	H	M	H	M	H	M
CO5	H	M	H	H	M	H	M	H	M

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Measures of central value:** Mean- Median- Standard deviation-Coefficient of variation. **Volume I: Chapter 7.**	03
Unit II	**Correlation Analysis**: Simple and Rank Correlation. **Volume I: Chapter 10.**	02
Unit III	**Regression Analysis**: Simple Linear Regression. **Volume I: Chapter 11.**	02
Unit IV	**Testing of Hypothesis**: Z Test - t Test. **Volume II: Chapter 3.**	03
Unit V	**Testing of Hypothesis**: Chi square Test - F Test. **Volume II: Chapter 4,5.**	03
	Total Contact Hrs.	**13**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Gupta S. P., *Statistical Methods*, Sultan chand& sons, New Delhi, 2006.

Books for Reference:

1. Gupta S. C. and Kapoor V. K., *Fundamentals of Mathematical Statistics*, S. Chand & Sons, 2009.
2. Vital P. R., *Mathematical Statistics*, Margham publications, 2004.

Related Online Contents[MOOC, SWAYAM,NPTEL, Websites etc.,]

1. https://www.youtube.com/watch?v=zjHfAhcU6kE
2. https://nptel.ac.in/courses/111/105/111105042/

3. https://www.youtube.com/watch?v=VudrNXCYJt4
4. https://www.youtube.com/watch?v=NmgbFJ4UwPs

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name with Signature	CDC	COE
Name:Dr. M. MAHESWARI Signature	Name: Dr. V. INTHUMATHI Signature	Name: Signature	Name: Signature

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS2N2	**Title**	**Batch:**	2021 - 2023
		NME - MATHEMATICS IN FINANCE	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	1		**Credits:**	2

Course Objective

The objective of this paper is to introduce the concepts of financial statement analysis which help the students to develop their financial skills.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	recollect the concept of ratio analysis.	K1
CO2	get the idea of liquidity ratio and capital structure ratio.	K2
CO3	implement the concepts of return on investments.	K3
CO4	analyze the basic concept of financial statement analysis.	K4
CO5	apply the concept of profitability related to investment	K3

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	H	M	L	M	M	M	M
CO2	H	M	H	M	L	M	M	L	M
CO3	M	M	M	M	M	M	M	M	M
CO4	H	M	H	M	M	H	M	M	M
CO5	H	M	M	M	M	M	M	M	M

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Financial statement analysis**: Introduction - Ratio analysis -Meaning and Rationales - Basis of comparison. **Chapter 4:Sections: 4.1, 4.2.**	03
Unit II	**Financial statement analysis:** Types of ratios - Liquidity ratio - Net working capital - Current ratios - Acid test/Quick ratios. **Chapter 4:Sections: 4.3, 4.4.**	03
Unit III	**Financial statement analysis:** Turnover ratio – Defensive - Interval ratio - Leverage/Capital structure ratio – Debt - Equity Ratios - Debt to total capital ratio. **Chapter 4: Sections: 4.5.**	03
Unit IV	**Financial statement analysis:** Coverage ratios - Profitability ratios - profitability ratios related to sales - Profit margin - Expenses ratio. **Chapter 4:Sections: 4.6, 4.7**.	02
Unit V	**Financial statement analysis:** Profitability ratios related to investments: Return on investment - Importance of ratio analysis. **Chapter 4: Section: 4.9.**	02
	Total Contact Hrs.	**13**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Khan M.Y and Jain P. K, *Financial Management,* Tata McGraw Hill Publishing Company Ltd, New Delhi, 1990.

Books for Reference:

1. Aswath damodaran, Corporate Finance Theory and Practice,John Wiley and Sons, Inc.
2. Prasanna Chandra, Managing Investments, Tata McGraw - Hill Publishing Company Ltd, New Delhi, 1998.

Related Online Contents[MOOC, SWAYAM,NPTEL, Websites etc.,]

https://www.youtube.com/watch?v=IrWeySxY9OA

Course Designed by	Verified by HOD	Checked by	Approved by
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VALUE ADDED COURSE

Programme Code:	M.Sc.	**Programme Title:**	Mathematics	
Course Code:	21PMS2VA	**Title**	**Batch:**	2021 - 2023
		INTERNET OF THINGS	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	2		**Credits:**	2*

Course Objectives

This course highlights on physical design, logical design, enabling technologies of IoT, IoT system management and design methodology.

Course outcomes (CO)

At the end of this course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To understand the basics of Internet of Things and design of IoT	K1,K2
CO2	To learn the IoT Technologies	K2,K3
CO3	To learn IoT deployment Templates	K3,K4
CO4	To understand the design methodology and level specification of IoT	K3,K4,K5
CO5	To learn about the physical devices such as Raspberry Pi	K3,K5

Units	Content	Hrs.
Unit I	Introduction to Internet of Things: Introduction – Definition and Characteristics of IoT – Physical design of IoT – Things in IoT - IoT Protocols.	6
Unit II	Logical Design of IoT – IoT Functional Blocks – IoT communication Models – IoT Communication APIs – IoT Enabling Technologies – Wireless Sensor Networks – Cloud Computing –Big Data Analytics – Communication Protocols – Embedded Systems.	6
Unit III	IoT Levels and Deployment Templates: IoT Level 1 - IoT Level 2 - IoT Level 3 - IoT Level 4 - IoT Level 5 - IoT Level 6 – Case Study on IoT System for Weather Monitoring.	6
Unit IV	IoT Platform Design Methodology: Purpose and Requirement Specification – Process Specification – Domain Model Specification – Information Model Specification – Service Specification – IoT Level Specification – Functional View Specification – Operational View Specification – Device and Component integration – Application Development.	6
Unit V	IoT physical devices and End Points – IoT Devices – Exemplanary Device: Raspberry Pi – About Board – Linux on Raspberry Pi – Raspberry Pi interfaces – Serial – SPI – I2C.	6
	Total Contact Hrs.	**30**

Text Book:

Arshdeep Bahga, Vijay Madisetti, Internet of Things – A hands on Approach, Orient Blakswan Provate Limited, 2014 , Ist Edition

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS311	**Title**	**Batch:**	2021 - 2023
		TOPOLOGY	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

This course deals with the essentials of topological spaces and their properties in terms of continuity, connectedness, compactness etc.

Course Outcomes (CO)

After successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand the concepts of topological spaces, continuity, homeomorphism, connectedness and compactness.	K2
CO2	generate different topologies (product topology, metric topology, usual topology) and analyze the properties and inter relationships between them.	K2,K4
CO3	generalize the concepts like continuity, reconstruct homeomorphisms between topological spaces and solved related problems.	K4
CO4	analyze separation axioms and the impact of metrization theorems in topology.	K4
CO5	pursue research in different areas of topological spaces and find applications in the field of Engineering, Medicine, Agriculture and social studies.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	H	M	H	M
CO2	H	H	H	H	M	H	M	H	M
CO3	H	H	H	H	H	H	M	H	M
CO4	M	H	H	H	M	M	H	H	M
CO5	M	M	H	H	H	H	H	M	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Topological Spaces and Continuous Functions:** Topological Spaces-Basis for a topology - The order topology - *The Product topology on X×Y (Self study)* - The Subspace topology - Closed sets and Limit points. **Chapter 2: Sections: 12 – 17.**	16
Unit II	**Topological Spaces and Continuous Functions:** Continuous functions - The metric topology - The metric topology (Continued) . **Chapter 2: Sections: 18, 20, 21.**	15
Unit III	**Connectedness and Compactness:** Connected spaces - Connected subspaces of the real line - Components and Local Connectedness - Compact spaces. **Chapter 3: Sections: 23 - 26.**	15
Unit IV	**Countability and Separation Axioms:** The Separation axioms - Normal spaces - The Urysohn lemma - The UrysohnMetrization Theorem - The Tietze Extension theorem. **Chapter 4 : Sections : 31 - 35.**	16
Unit V	**The Tychonoff Theorem:** The Tychonoff theorem - The Stone-CechCompactification. **Metrization Theorems and Paracompactness:** The Nagata-Smirnov Metrization theorem - The Smirnov Metrization Theorem. **Chapter 5:Sections:37, 38,** **Chapter 6: Sections:40, 42.**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Munkres J. R., Topology, Pearson Education, Inc/Second Edition, 2000.

Books for Reference :

1. Dugundji J, *Topology*, Prentice Hall of India, 1975.
2. John Kelly L, *General Topology*, Dover Publications, Inc., New York, 2017.
3. Simmons G. F, *Introduction to topology and modern analysis*, Tata McGraw Hill book company, Inc, Ninth reprint, 2004.

4. Sundaram P., A Text Book of Topology, KedarNath Ram Nath Publishers, 2017.

Related Online Contents[MOOC, SWAYAM,NPTEL, Websites etc.,]

1. **https://nptel.ac.in/content/storage2/courses/111106054/Topology%20complete%20course.pdf**
2. **https://www.youtube.com/playlist?list=PLbMVogVj5nJRR7zYZifYopb52zjoScx1d**
3. **http://www.math.iitb.ac.in/~ronnie/Fall2019/Lecture-Notes.pdf**
4. **https://www.uio.no/studier/emner/matnat/math/MAT4500/h18/dokumenter/topology.pdf**

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name with Signature	CDC	COE
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS312	**Title**	**Batch:**	2021 - 2023
		FUNCTIONAL ANALYSIS	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

This course will enable the students to learn about the essentials of functional analysis. The course imparts an in-depth analysis of normed linear spaces, Banach spaces, Hilbert spaces etc. Further the course analyzes various properties of continuous linear functional, continuous linear operators and closed linear operators.

Course Outcomes (CO)

On successful completion of this core paper, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	have a clear understanding of Normed linear spaces, Banach spaces, Hilbert spaces and B(X,Y) and to give appropriate illustrations.	K2
CO2	cherish how functional analysis uses and unifies ideas from Linear Algebra and Analysis to handle infinite dimensional linear spaces and linear mappings defined on them.	K4
CO3	apply some important, but simple to follow theorems such as the best approximation theorems, projection theorem and Riesz representation theorem.	K3
CO4	have full grasp over important theorems of functional analysis namely Hahn-Banach theorem, the uniform boundedness principle ,closed graph theorem, open mapping theorem and their applications.	K3
CO5	apply the concepts and results covered in the course to numerical analysis & operator equations and also can pursue their research.	K4

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	M	H	M	H	M
CO2	M	H	H	H	H	M	M	H	M
CO3	H	H	H	H	H	H	M	H	M
CO4	H	H	H	H	H	H	M	H	M
CO5	M	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Normed Linear Spaces:**Norm on a Linear Space - Examples of Normed Linear Spaces - Seminorms and Quotient Spaces - Product Space and Graph Norm - Semi-inner Product and Sesquilinear Form - Banach Spaces. **Chapter 2: Sections: 2.1, 2.1.1, 2.1.2, 2.1.4, 2.1.6, 2.2.**	15
Unit II	**Normed Linear spaces:**Completion of Normed Linear Spaces - Some Properties of Banach Spaces - Baire Category Theorem (Statement only) - Schauder Basis and Separability - Heine-Borel Theorem and Riesz Lemma - Best Approximation Theorems - Projection Theorem. **Chapter 2: Sections: 2.2.2, 2.2.3, 2.3 - 2.6.**	16
Unit III	**Operators on Normed Linear Spaces:** Bounded Operators - Some Basic Results and Examples - *The Space ß(X, Y) (Self study)* - Norm on ß(X,Y) - Riesz Representation Theorem - Convergence of Sequence of Operators - *Completeness of ß(X, Y) (Self Study).* **More about Hilbert Spaces:** Bessel's Inequality - Fourier Expansion and Parseval's Formula - Riesz-Fischer Theorem. **Chapter 3: Sections: 3.1, 3.1.1, 3.2,3.2.1, 3.3,3.4, 3.4.1.** **Chapter 4: Sections: 4.2 - 4.4.**	16
Unit IV	**Hahn-Banach Theorem and its Consequences:**The Extension Theorem - Consequences - On Uniqueness of Extension - Separation Theorem. **Chapter 5: Sections: 5.1 - 5.4.**	15
Unit V	**Uniform Boundedness Principle:**The Theorem and Its Consequences **Closed Graph Theorem and Its Consequences:** Closed Graph Theorem - Bounded Inverse Theorem - Open Mapping Theorem -A Stability Result for Operator Equations. **Chapter 6: Section: 6.1.** **Chapter 7: Sections: 7.1 - 7.3, 7.3.1.**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Thamban Nair M, *Functional Analysis - A First Course*, Prentice Hall of India Pvt. Ltd, New Delhi, 2010.

Books for Reference:

1. Limaye B. V, *Functional Analysis*,Wiley Eastern, New Delhi, 1981.
2. Simmons G. F, *Introduction to Topology and ModernAnalysis*, McGraw Hill Kogakusha, Tokyo, 1963.
3. G. Bachman and L. Narici, *Functional Analysis*, Dover Publications, 2000.
4. Kreyszig E., *IntroductoryFunctional Analysis with Applications*, Johan-Wiley & Sons, NewYork, 2007.

Related Online Contents[MOOC, SWAYAM,NPTEL, Websites etc.,]

1. **https://nptel.ac.in/courses/111/106/111106147/#**
2. **https://www.youtube.com/watch?v=M1h9l5p95Yk&list=PL5022A32B9BCFE3E4&index=9**
3. **https://www.youtube.com/watch?v=pd3jUcTA5pA&list=PL5022A32B9BCFE3E4&index=10**
4. **https://www.youtube.com/watch?v=88yGQpNf0_Q&list=PL5022A32B9BCFE3E4&index=14**
5. **https://www.youtube.com/watch?v=AlomQplmmdc&list=PL5022A32B9BCFE3E4&index=32**

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS313	**Title**	**Batch:**	2021 - 2023
		COMBINATORICS	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

Combinatorial mathematics is concerned with counting the number of ways of arranging given objects in a particular way. Generating functions are used to solve a variety of Combinatorial problems.

Course Outcomes (CO)

On successful completion of the course student will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand a working knowledge of the basic ideas and techniques	K2
CO2	derive the various aspects of assignment problems, beginning with the famous result of Philip Hall, and its applications.	K2
CO3	understand and applythe Steiner systems S(5, 8, 24) and the construction of Leech Lattice in 24 dimensions.	K3
CO4	analyze the concept of block designs and its applications to error correcting codes in computer applications.	K4
CO5	evaluate the Rook polynomial in various boards.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	M	M	H	M	H	M
CO2	M	H	H	H	H	H	M	H	M
CO3	M	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	H	H	H	H
CO5	M	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Introduction to basic ideas and Selections and Binomial coefficients**: Permutations - Ordered selections - Unordered selections - Further remarks on the binomial theorem - Miscellaneous. **Chapter 1, Chapter 2 : Sections: 2.1-2.5**	16
Unit II	**Pairings problems:** Pairings within a set - Pairings between sets - An optimal assignment problem - Gale's optimal assignment problem. **Chapter 3 :Sections : 3.1-3.4**	15
Unit III	**Recurrence:** Some miscellaneous problems - Fibonacci type relations - Using Generating Functions - Miscellaneous methods - Counting simple electrical networks. **Chapter 4 : Sections: 4.1-4.5**	16
Unit IV	**The Inclusion-Exclusion Principle:** The Principle- *The Rook Polynomials (Self study)* **Block Designs and Error correcting codes:***Block designs (Self study)* - Square block designs - Hadamard configurations - Error correcting codes. **Chapter 5:Sections: 5.1, 5.2** **Chapter 6:Sections: 6.1-6.4.**	15
Unit V	**Steiner Systems and Sphere Packings** - Introductory remarks - Steiner Systems -S(5,8,24) . **Chapter 7:Sections : 7.1-7.3**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Ian Anderson, *A first course in Combinatorial Mathematics*, Oxford University press, 1974.New Delhi, 2010.

Books for Reference:

1. Balakrishnan V. K and Balakrishnan V, *Schaum's outline ofCombinatorics*, McGraw Hill Publishers, 1984.

2. Krishnamurthy V, *Combinatorics,* Affiliated East West Press Pvt Ltd, New Delhi, 1986.

Related Online Contents[MOOC, SWAYAM,NPTEL, Websites etc.,]

1. **https://youtu.be/2CpODfjud3o**
2. **https://youtu.be/kd3gkcloXzo**

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS314	**Title**	**Batch:**	2021 - 2023
		GRAPH THEORY	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

Graph theory is major area of Combinatorics. In this course we introduce basic concept of graph theory and analyze some important concepts and make themto crack CSIR / NET examination graph theory which comes in discrete mathematics.

Course Outcomes (CO)

On successful completion of the course student will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand the preliminaries of both undirected graphs and directed graphs.	K2
CO2	visualize the concept of planar graph and connectivity and applying it.	K3
CO3	apply the concept of Eulerian graph and Hamiltonian graph.	K3
CO4	analyze both vertex colouring and edge-colouring as well as matchings in graphs.	K4
CO5	enrich knowledge of problem solving and pursue further research.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	M	H	H	M	H	M
CO2	H	H	H	H	H	H	M	H	M
CO3	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Graphs and Subgraphs**: Graphs and simple graphs - Graph Isomorphism - The Incidence and Adjacency matrices - Subgraphs - Vertex degrees - Path and Connection and Cycles. Trees: Trees - Cut edges and bonds - Cut vertices and Cayley's formula. **Chapter 1: Sections : 1.1 - 1.7** **Chapter 2: Sections : 2.1 - 2.4.**	16
Unit II	**Connectivity:** Connectivity and Blocks. **Euler Tours and Hamilton cycles**: Euler tours and Hamilton cycles. **Chapter 3: Sections: 3.1, 3.2** **Chapter 4: Sections : 4.1, 4.2.**	16
Unit III	**Matchings**: Matchings - Matchings and coverings in bipartite graphs and perfect matchings. **Independent sets and Cliques**: Independent sets. **Chapter 5: Sections : 5.1 - 5.3** **Chapter 7: Sections : 7.1.**	16
Unit IV	**Edge Colorings**: Edge chromatic number and Vizing's theorem. **Vertex Colorings**: Chromatic number - Brooks' theorem - Dirac's Theorem, Chromatic polynomials- Girth and chromatic number. **Chapter 6: Sections : 6.1, 6.2** **Chapter 8:Sections : 8.1,8.2,8.4,8.5**.	15
Unit V	**Planar Graphs**: Plane and planar graphs, Dual graphs - Euler's formula and Kuratowski's theorem. **Directed Graphs**: Directed graphs - Directed paths - Directed cycles. **Chapter 9: Sections : 9.1 -9.3, 9.5** **Chapter 10: Sections : 10.1 - 10.3.**	15
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Bondy J. A and Murty U. S. R, *Graph Theory with Applications*, Macmillan Company, 1976.

Books for Reference:

1. Balakrishnan R and Ranganathan K , *A Text Book on Graph Theory*, Springer Verlog, New York, 2000.

2. Gould R, *Graph Theory*, The Benjamin/Cummings Publishing Company, Inc, California,1988.
3. Hartsfield N and RingelG ,*Pearls in Graph Theory*, Academic Press,1990.

Related Online Contents[MOOC, SWAYAM,NPTEL, Websites etc.,]

https://nptel.ac.in/courses/111/106/111106102/

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name with Signature	CDC	COE
Name: Dr. S. SIVASANKAR Signature	Name: Dr. V. INTHUMATHI Signature	Name: Signature	Name: Signature

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS3E1	**Title**	**Batch:**	2021 - 2023
		LATEX	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	4		**Credits:**	3

Course Objective

This course provides students with an introduction to technical writing and computer presentation with LATEX, which is the de-facto standard in computer science, mathematics and many of sciences**.**

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand the basicsofLaTeXand its usage.	K1
CO2	understand and apply how to use various mathematical symbols and mathematical expressions, also how to insert figures and tables in document preparation.	K2
CO3	apply the concepts of LaTex commands in files.	K3
CO4	prepare documents, reports and books for different environment**.**	K4
CO5	enrich the knowledge of LaTex and also how to use a various latex packages.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	L	M	H	H	M	M	L	L
CO2	H	M	M	M	H	M	M	L	L
CO3	H	M	M	H	H	M	M	L	L
CO4	H	M	H	H	M	M	M	L	L
CO5	H	M	H	H	H	M	M	M	M

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Introduction:**Text formatting - TEX and its offspring - what's new in LATEX 2ε? - How to use this book - Basics of LATEX file. **Chapter 1: Sections: 1.1 - 1.5.**	11
Unit II	**Commands and Environments**: Command names and arguments - Environments - Declarations - *Lengths (Self study)* - Special characters - Fragile Commands. **Chapter 2: Sections: 2.1 - 2.6.**	11
Unit III	**Document layout and Organization**: Document class - Page style - Parts of the document - Table of contents - Fine-tuning text - Word division. **Chapter 3: Sections: 3.1 - 3.6**.	10
Unit IV	**Displayed Text:**Changing font - *Centering and indenting* (*Self study*)- Lists - Generalized lists - Theorem like declarations - Tabulator stops - Boxes - Tables - Printing source text- Footnotes and marginal notes - Comments within Latex. **Chapter 4: Sections: 4.1 - 4.11.**	10
Unit V	**Mathematical Formulas:**Mathematical environments - Main elements of math mode - Mathematical symbols - Additional elements - Fine-tuning mathematics. **Chapter 5: Sections: 5.1 - 5.5.**	10
	Total Contact Hrs.	**52**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Kopka H and Daly P. W., *A Guide to Latex,* Third Edition, Addison Wesley, London, 1999.

Books forReference:

1. George Gratzer, *More Math into Latex,* Fourth Edition, Springer, 2007.
2. www.tug.org.in/tutorials.html,*A Latex primer*

Related Online Contents[MOOC, SWAYAM,NPTEL, Websites etc.,]

1. **https://swayam.gov.in/nd2_aic20_sp17/**
2. **https://www.mooc-list.com/tags/latex**
3. **https://www.classcentral.com/course/edx-latex-for-students-engineers-and-scientists-15**

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS3E2	**Title**	**Batch:**	2021 - 2023
		MATHEMATICAL MODELLING	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	4		**Credits:**	3

Course Objective

To enable the learners to obtain basic knowledge in Mathematical Modelling.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	represent the real world systems from Science and Technology in a mathematical frame work.	K1
CO2	acquire basic mathematical modeling skills to carry out simple tasks.	K2
CO3	apply the mathematical techniques of Differential Equations in dynamics and Epidemics to analyze specific problems and identify the appropriate solutions.	K3
CO4	formulate and qualitatively analyze mathematical models of a wide range of systems and processes in Engineering and the natural sciences	K4,K5
CO5	develop the experience of working both independently and collaboratively within the discipline to other contexts.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	H	H	M	H
CO2	H	H	H	H	H	H	H	M	H
CO3	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L – LOW.

Units	Content	Hrs.
Unit I	Mathematical Modelling through Ordinary Differential Equations of First order- Mathematical-Modelling through Differential Equations-Linear Growth and Decay Models-Non - Linear Growth and Decay Models.	10
Unit II	Compartment models.- Mathematical Modelling in Dynamics through Ordinary Differential Equations of First order. (Chapter - 2 : Sections 2.1 to 2.5)- Mathematical Modelling through systems of Ordinary Differential Equations of First order- Mathematical Modelling in Population Dynamics.	11
Unit III	Mathematical Modelling in Epidemics through Systems of Ordinary Differential Equations of First order - Compartment models through Systems of Ordinary Differential Equations - Mathematical Modelling in Economics through Systems of Ordinary Differential Equations of First order – Mathematical Models in medicine, Arms Race, Battles and International Trade in Terms of Systems of Ordinary Differential Equations.	10
Unit IV	Mathematical Modelling in Dynamics through Ordinary Differential Equations of First order. (Chapter - 3 : Sections 3.1 to 3.6) - Mathematical Modelling through Ordinary Differential Equations of second order- Mathematical Modelling of Planetary Motions.	11
Unit V	Mathematical Modelling of Circular Motion and Motion of Satellites- Mathematical Modelling through Linear Differential Equations of second order- Miscellaneous Mathematical Models through Ordinary Differential Equations of Second order. (Chapter - 4 : Sections 4.1 to 4.4)	10
	Total Contact Hrs.	**52**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

J.N.Kapur, Mathematical Modelling, New Age International Publisher, 1988

Related Online Contents[MOOC, SWAYAM,NPTEL, Websites etc.,]

1. https://www.youtube.com/watch?v=df5EK1P6Ph0
2. https://www.youtube.com/watch?v=-uCwgZUz51o

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS3E3	**Title**	**Batch:**	2021 - 2023
		PROGRAMMING LAB IN LATEX	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	2		**Credits:**	2

Course Objective

This course is designed to provide a practical exposure to the students on LATEX.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	apply cross section, cross reference, citation and bibliography in the book environment.	K3
CO2	insert various types of mathematical symbols and pictures in LaTex document.	K3
CO3	draw various types of pictures by accessingLaTex draw.	K3
CO4	prepare a sample article, dissertation in LaTex environment.	K3
CO5	competent in working with LaTex.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	M	M	L	H
CO2	H	H	H	H	H	M	M	L	H
CO3	H	H	H	H	H	M	M	L	H
CO4	H	H	H	H	H	M	M	L	H
CO5	H	H	H	H	H	H	H	L	H

H - HIGH; M - MEDIUM; L - LOW.

List of Programs

1. To illustrate different font sizes in Latex.
2. To prepare a title page in Latex document.
3. To understand the section hierarchy of book environment in Latex.
4. To prepare a list using itemize environment in Latex.
5. To prepare a table in Latex.
6. To prepare a table in Latex with multiple title row.
7. To split the equations in Latex.
8. To type a equations using both left cases and right cases in Latex.
9. To type a system of equations in Latex.
10. To type a Mathematical equations using different equation format.
11. To type a Binomial equations in Latex.
12. To type a Christoffel symbol in Latex.
13. To use a cross reference in Latex article.
14. To import '.eps' picture in Latex.
15. To import a picture using Latex draw in Latex.

Text Book:

Kopka H and Daly P. W., *A Guide to Latex*, Third Edition, Addison Wesley, London,1999.

Books for Reference:

1. George Gratzer, *More Math into Latex*, Fourth Edition, Springer, 2007.
2. www.tug.org.in/tutorials.html,*A Latex primer*

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS3AL	**Title**	**Batch:**	2021 - 2023
		ADVANCED LEARNER COURSE (OPTIONAL): ALGEBRAIC NUMBER THEORY	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	-		**Credits:**	4*

Course Objectives

This course enables the learners

1. an algebraic point-of-view of number theoretic problems
2. to revisit concepts like principal ideal rings and algebraic extensions; and to know new concepts like Noetherian rings and Dedekind rings
3. to study algebraic proofs of several numbers theoretic problems.

Course Outcomes (CO)

On completion of the course the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recall the fundamental concepts of Rings and Ideals	K1
CO2	Understand the structure of Noetherian rings and Dedekind rings through analysing examples	K2
CO3	Write minor proofs of Number theoretic results independently	K3
CO4	Analyze the logical arguments and to work in abstract concepts to increase the clarity and efficiency in algebraic number theory concepts	K4
CO5	Pursue further studies in number theory and related areas	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	M	H	H	M	H	M
CO2	H	H	H	H	H	H	H	H	M
CO3	H	H	H	H	H	H	M	H	M
CO4	M	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content
Unit I	Principal ideal rings
Unit II	Elements integral over a ring; elements algebraic over a field
Unit III	Noetherian rings and Dedekind rings
Unit IV	Ideal classes and the unit theorem
Unit V	The splitting of prime ideals in an extension field.

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Algebraic theory of Numbers, Pierre Samuel, (Translated from the French by Allen J.Silberger), Herman, Paris,1970.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://www.youtube.com/watch?v=f3SJON86hcU
2. https://www.youtube.com/watch?v=SCvtxjpVQms

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CERFICATE COURSES

Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS3CC	**Title**	**Batch:**	2021 - 2023
		DATA ANALYTICS USING PYTHON	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	2		**Credits:**	-

Course Objectives

Students will learn how to prepare data for analysis, perform simple statistical analysis, create meaningful data visualizations, predict future trends from data, and more.

Course outcomes (CO)

At the end of this course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	apply data cleansing, transformation techniques and obtain descriptive statistics on data.	K3
CO2	analyze datasets and Create simple visualization plots of data.	K4
CO3	compare the machine learning techniques.	K5
CO4	develop machine learning models for chosen problems of classification and prediction.	K5
CO5	create machine learning models for generating recommendations and clustering data.	K5

Units	Content	Hrs.
Unit I	Handling Raw Data using Numpy and Pandas: Arrays and operations on Arrays using NumPy – Data structure of Pandas - Inserting and Exporting data from CSV, XLS, JSON, database files – Datacleansing – Data Operations – Aggregation and Join operations.	6
Unit II	Data Visualization: Data mining – Presenting an analysis – Studying the Titanic dataset - Data Visualization - Charts – Multiple plots – Playing with text – Styling plots – Box plots – Heatmaps – Scatter plots with histograms – Area Plots – Bubble charts.	6
Unit III	Machine Learning: Types of machine learning – Decision trees – Linear regression – Logistic regression – Naïve Bayes Classifier – K means Clustering – Hierarchical clustering.	6
Unit IV	Case Studies: Performing predictions with a linear regression – Estimating the likelihood of events with Logistic regression.	6
Unit V	Case Studies: Generating recommendations with Collaborative Filtering – Applying Segmentation with k-means Clustering.	6
	Total Contact Hrs.	**30**

Text Books:

1. Samir Madhavan, Mastering Python for Data Science, PACKT Publishing, 2015. (ISBN 978-1-78439-015-0)
2. Wes McKinney, Python for Data Analysis, O'Reilly, 2013.(ISBN: 978-1-449- 31979-3)

Books for Reference:

1. Alberto Boschetti, Luca Massaron, Python Data Science Essentials, PACKT Publishing, Third Edition, 2018.
2. Gopi Subramanian, Python Data Science Cookbook, PACKT Publishing, 2015.
3. Jake VanderPlas, Python Data Science Handbook, O'Reilly, 2017. (ISBN: 978-1-491-91205-8).
4. Joel Grus, Data Science from Scratch, O'Reilly, 2015.

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS415	**Title**	**Batch:**	2021 - 2023
		FLUID DYNAMICS	**Semester:**	IV
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objectives

The main objectives of this course are:

1. To introduce and explain fundamentals of Fluid Mechanics, which are used in the applications of Aerodynamics, Hydraulics, Marine Engineering, Gas dynamics etc.
2. To study the concepts such as kinematics of fluid, incompressible flows and boundary layer theory in one, two and three dimensions.
3. to determine volumetric flow rates, superpositions, shear and pressure , drag and lift forces for different geometric configurations.

Course Outcomes (CO)

On completion of the course the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	recall the fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.	K1
CO2	understand the fundamental equations of viscous compressible fluid and get an idea about Bernoulli equation, Momentum theorems and their various applications.	K2
CO3	analyze simple fluid flow problems like flow between parallel plates, flow through pipe etc., with Navier-Stoke's equation of motion.	K4
CO4	understand and evaluate problems in two or three dimensional invisid incompressible flows which are used in determining the mass flow rate of petroleum through pipelines,wind turbines, oil pipelines and air conditioning systems etc.,	K5
CO5	understand the phenomenon of flow separation and boundary layer theory and extend their knowledge to pursue research in this field.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	M	H	H	M	H	M
CO2	H	H	H	H	H	H	H	H	M
CO3	H	H	H	H	H	H	M	H	M
CO4	M	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Kinematics of Fluids:**Methods of Describing Fluid Motion: Lagrangian Method, Eulerian Method-Translation, Rotation and Rate of deformation-Streamlines, Path lines and Streak lines- The Material Derivative and Acceleration- Vorticity, Vorticity in Polar Coordinates- Vorticity in Orthogonal Curvilinear Coordinates. **Fundamental Equations of the Flow of Viscous Compressible Fluids**: The Equation of Continuity - Conservation of Mass- Equations of Motion (Navier-Stokes Equations) - Conservation of Momentum. **Chapter 3: Sections: 3.1 - 3.5.** **Chapter 5: Sections:5.1 - 5.3.**	16
Unit II	**One Dimensional Invisid Incompressible Flow:**Equation of continuity- Stream Tube Flow- Equation of Motion- Euler's Equation-The Bernoulli's Equation-Applications of the Bernoulli Equation(a) -Flow from a Tank Through a Small Orifice, (b)-Trajectory of a Free Jet - The Momentum Theorem- Applications of the Momentum Theorem(a)-Pressure Exerted on a Plate by a Free Jet, (b)-Jet Discharge Propulsion. **Two and Three Dimensional InvisidIncompressible Flow**: Equation of Continuity - Eulerian Equation of Motion- Circulation Theorems-Velocity Potential - Irrotational Flow- Integration of the Equations of Motion - Bernoulli's Equation- the Momentum Theorem- theMoment of Momentum Theorem. **Chapter 6: Sections: 6.1 - 6.4, 6.6 - 6.7** **Chapter 7: Sections: 7.1 - 7.7.**	16
Unit III	**Two and Three Dimensional Invisid Incompressible Flow**:Laplace's Equation,Laplace'sEquation in Cartesian Coordinates-Laplace'sEquation in Cylindrical Coordinates - Laplace'sEquation in Spherical Coordinates(derivations omitted) -Stream function in 2 Dimensional Motion-The Flow Net - Two Dimensional Flow Examples- Stream Function in Three Dimensional Motion - Three Dimensional Axially Symmetric Flow Examples. **Chapter 7: Sections: 7.8 - 7.13.**	15

Unit IV	**Two and Three Dimensional Invisid Incompressible Flow**: Motion of Solid Bodies in a Fluid,Rankine's Method of Constructing Streamlines- Superposition of Source and Rectilinear Flow- Superposition of Source and Sink with Rectilinear flow - The Rankine Body- Superposition of Rectilinear flow and Doublet- Superposition of Vortex, Rectilinear Flow and Doublet in a Two Dimensional Case. **Chapter 7: Sections: 7.14 - 7.16, 7.18- 7.19.**	15
Unit V	**Laminar Flow of Viscous Incompressible Fluids:** Flow Between Parallel Flat Plates- Steady Flow in Pipes, Flow Between Two Coaxial Cylinders- Flow Between TwoConcentric Rotating Cylinders. **The Laminar Boundary Layer:**TheBoundaryLayer Equations in Two-Dimensional Flows- The Boundary Layer Along a Flat Plate- The Blasius Solution, Shearing Stress and Boundary Layer Thickness. **Chapter 8:Sections: 8.3 - 8.5.** **Chapter 9:Sections:9.2 - 9.3.**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Yuan, S.W. ,*Foundations of fluid mechanics.*Prentice Hall of India Pvt. Ltd.,1988.

Books for Reference:

1. Frank Chorlton ,*Text book on Fluid Dynamics*, CBS Publishers and Distributors, Delhi., 2010.
2. M.D.Raisinghania, Fluid Dynamics, S.Chand and company Ltd, 2010.
3. ShanthiSwarup, *Fluid dynamics*, Krishna Prakasan media Pvt. Ltd., Meerut, 2000.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/115/106/115106124/
2. https://youtu.be/lfXDJKKPGfy

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS416	**Title**	**Batch:**	2021 - 2023
		OPERATOR THEORY	**Semester:**	IV
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

This course will enable the students to obtain duals of certain sequence spaces and study some of the properties of such spaces namely reflexivity and weak convergence using duality consideration. Further the course enables to study about compact operators, spectral results for Banach space operators, and some operators on Hilbert spaces and various other properties of these operators.

Course Outcomes (CO)

On successful completion of this core paper, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand the notions of Reflexivity, weak convergence and compact operators and to illustrate them with examples.	K2
CO2	have a deep understanding of Spectrum, Resolvent set of an operator and Spectral mapping theorem.	K2
CO3	apply the concept of linear isometry and dual spaces to acquire representations of duals of some sequence spaces.	K3
CO4	have well founded knowledge about adjoint of an operator, self adjoint, normal, unitary operators and their properties.	K3
CO5	pursue research purely or by applying the concepts and results covered in the course to operator equations, integral & differential equations and mathematical physics.	K4

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	H	M	H	M
CO2	M	H	H	H	H	H	M	H	M
CO3	H	H	H	H	H	H	M	H	M
CO4	H	H	H	H	H	H	M	H	M
CO5	M	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Dual Space Considerations:**Representation of Dual Spaces - Dual of $l^p(n)$ - Duals of Some Sequence Spaces - Duals of C[a,b] and $L^p[a,b]$ - Separability Revisited. **Chapter 8: Sections: 8.1, 8.1.1 - 8.1.4.**	16
Unit II	**Dual Space Considerations:**Reflexivity and Weak Convergence - Reflexivity - Weak Convergence - Best Approximation in Reflexive Spaces. **Chapter 8: Sections: 8.2, 8.2.1 - 8.2.3.**	16
Unit III	**Compact Operators:** Some Characterizations - Space of Compact Operators - Further Properties. **Chapter 9: Sections: 9.1 - 9.3**.	15
Unit IV	**Spectral Results for Banach Space Operators:** Eigenspectrum and Approximate Eigenspectrum - Spectrum and Resolvent Set - Spectral Radius - Spectral Mapping Theorem - Gelfand-Mazur Theorem and Spectral Radius Formula (In 10.2.3, Theorem 10.17 only). **Chapter 10: Sections: 10.1, 10.2, 10.2.1 - 10.2.3. (In 10.2.3, Theorem 10.17 only)**	16
Unit V	**Operators on Hilbert Spaces:**Adjoint of an Operator - Compactness of the Adjoint Operator - *SesquilinearFunctionals(Self study)* -Self-Adjoint, Normal and Unitary Operators - Numerical Range and Numerical Radius - *Some Characterizations (Self study)*. **Chapter 11: Sections: 11.1, 11.1.1, 11.1.2, 11.2, 11.2.1, 11.2.2.**	15
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Book:

Thamban Nair M, *Functional Analysis - A First Course*, Prentice Hall of India Pvt. Ltd, New Delhi, 2010.

Books for Reference:

1. Simmons, G. F, *Introduction to Topology and Modern Analysis*, McGraw Hill Kogakusha, Tokyo, 1963.
2. Sunder V. S, *Functional Analysis: Spectral Theory*, Hindustan Book Agency, New Delhi, 1997.
3. Taylor A. E. and Lay D. C, *Introduction to Functional Analysis*, Second Edition, Wiley, New York, 1980.
4. G. Bachman and L. Narici, *Functional Analysis*, Dover Publications,2000.
5. Kreyszig E., *IntroductoryFunctional Analysis with Applications*, Johan-Wiley & Sons, NewYork, 2007.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. **https://nptel.ac.in/courses/111/106/111106147/#**
2. **https://www.youtube.com/watch?v=D_B44KX_Lgc&list=PL5022A32B9BCFE3E4&index=37**
3. **https://www.youtube.com/watch?v=s5bCfENHg8&list=PL5022A32B9BCFE3E4&index=26**
4. **https://www.youtube.com/watch?v=IOHr1lc6CO8&list=PL5022A32B9BCFE3E4&index=18**

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name with Signature	CDC	COE
Name: Dr. J. JAYASUDHA Signature	Name: Dr. V. INTHUMATHI Signature	Name: Signature	Name: Signature

Dr. V. Inthumathi, Ph.D.,
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS417	**Title**	**Batch:**	2021 - 2023
		ALGEBRAIC TOPOLOGY	**Semester:**	IV
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	4

Course Objective

To introduce the ideas of algebraic topology to other branches of Mathematics and to find algebraic invariants that classify topological spaces up to homeomorphism, though usually most classify up to homotopy equivalence.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	understand the basic algebraic and geometric ideas that underpin homology theory.	K2
CO2	apply knowledge of algebraic topology to formulate and solve problems of a geometrical and topological nature in mathematics.	K2
CO3	apply methods from algebraic topology to problems in a broader mathematical context.	K3
CO4	analyze the concept of homotopy with proof or counterexample as appropriate	K4
CO5	evaluate simplicial homology groups for applying in further research	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	H	M	H	H
CO2	H	H	H	H	H	H	M	H	H
CO3	H	H	H	H	H	H	M	H	H
CO4	H	H	H	H	H	H	M	H	H
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**The Fundamental Group:** Homotopy of paths-The fundamental group **Text Book 1:** Chapter 9: Sections: 51, 52	16
Unit II	**The Fundamental Group:** Covering spaces-The Fundamental group of the circle **Text Book 1:** Chapter 9: Sections: 53, 54	15
Unit III	**The Fundamental Group:** Retractions and Fixed Point- The Fundamental Theorem of Algebra- Deformation Retracts and Homotopy Type **Text Book 1:** Chapter 9: Sections: 55, 56 and 58	16
Unit IV	**Cell Complexes and Simplicial Complexes:** Abstract Simplicial Complexes – Geometric Realization of Simplicial Complexes – Barycentric Subdivision – Simplicial Approximation. **Text Book 2:** Chapter 2: Sections: 2.6-2.9	16
Unit V	**Homology:** Simplicial and Singular Homology-Complexes-Simplicial Homology-Homotopy Invariance. **Text Book 3:** Chapter 2: Section: 2.1	15
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Books:

1. J. R. Munkres, Topology, Second Edition, Pearson Education, New Delhi, 2006.
2. Anant R. Shastri, Basic Algebraic Topology, CRC Press, 2003.
3. Allen Hatcher, Algebraic Topology, Cambridge University Press, 2002.

Books for Reference:

1. SatyaDeo, Algebraic Topology, Hindustan Book Agency (trim series), 2006.
2. Singer and Thrope, Lecture Notes in Elementary Topology and Geometry, Springer, 1967.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. **https://nptel.ac.in/courses/111/101/111101002/**
2. **https://nptel.ac.in/courses/111/101/111101144/**

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name with Signature	CDC	COE
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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS4E1	**Title**	**Batch:**	2021 - 2023
		MATHEMATICAL METHODS	**Semester:**	IV
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	5

Course Objective

This course concerns the analysis and applications of calculus of variationsand integral equations. Applications include areas such as classical mechanics and differential equations.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	recall the fundamental concepts of integral equations.	K1
CO2	understand the concepts of classical Fredholm theory, variational problems and field of extremals.	K2
CO3	analyze initial and boundary value problems and convert into Volterra and Fredholm integral equations.	K3
CO4	evaluate the extremals of various functional through different types of direct methods.	K5
CO5	acquire the mathematical skills required to solve real world problems and pursue research.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	M	H	M	M	H	M
CO2	H	H	H	H	H	M	M	H	M
CO3	H	H	H	H	H	H	M	H	M
CO4	H	H	H	H	H	M	M	H	M
CO5	H	H	H	H	H	H	H	H	H

H - HIGH; M - MEDIUM; L - LOW.

Units	Content	Hrs.
Unit I	**Introduction**: Definition - Regularity Conditions - Special Kinds of Kernels – Eigenvalues and Eigenfunctions - Convolution Integral - The Inner or Scalar Product of Two Functions. **Integral Equations with Separable Kernels:**Reduction to a System of Algebraic Equations - Examples - Fredholm Alternative - Examples - An Approximate Method. **Method of Successive Approximations:**Iterative scheme - Examples- Volterra Integral equation - Examples - S*ome results about the Resolvent Kernel(Self study).* **Classical Fredholm theory:**The Method of Solution of Fredholm- Fredholm'sfirst Theorem - Examples - Fredholm's second Theorem, Freholm's Third Theorem. **Text Book 1: Chapter 1: Sections: 1.1-1.6,** **Chapter 2: Sections: 2.1-2.5,** **Chapter 3: Sections: 3.1-3.5,** **Chapter4: Sections: 4.1-4.5.**	16
Unit II	**Applications to Ordinary Differential Equations**: Initial value problems - Boundary value problems - Examples. **Singular integral equations**: The Abel integral equation - Examples. **Text Book 1: Chapter 5: Sections: 5.1, 5.2, 5.3.** **Chapter 8: Sections: 8.1, 8.2.**	15
Unit III	**The Method of Variations in Problems with Fixed Boundaries:** Variation and its properties - Euler's Equation - Functionals of the Form $\int F(x,y1,y2,\ldots yn,y1',y2',\ldots yn')dx$ - Functionals Dependent on Higher Order Derivatives - Functional Dependent on the Functions of Several Independent Variables - Variational Problems in Parametric Form - Some Applications. **Text Book 2: Chapter 6: Sections: 6.1-6.7.**	16
Unit IV	**Sufficient Conditions for an Extremum:** Field of Extremals - The Function E(x,y,p,y') - Transforming the Euler Equations to the Canonical Form. **Text Book 2: Chapter 8: Sections: 8.1-8.3.**	15
Unit V	**Direct Methods in Variational Problems:** Direct Methods - Euler's Finite-Difference Method - The Ritz Method - Kantorovich's Method. **Text Book 2: Chapter 10: Sections: 10.1-10.4.**	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Books:

1. Kanwal R. P., *Linear Integral Equations - Theory and Technique* , Academic Press, NewYork and London, 1971.
2. Elsgolts L.,*Differential Equations and the Calculus of Variations,* MIR Publishers, Moscow, 1970.

Books for Reference:

1. Corduneanu C.,*Integral Equations and Applications*, Cambridge University Press, Cambridge, 1991.
2. Weinstock R., *Calculus of Variations with Applications to Physics and Engineering*, McGraw Hill Book Co. Inc. New York, 1952.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://nptel.ac.in/courses/111/107/111107103/
2. https://nptel.ac.in/courses/111/104/111104025/
3. https://nptel.ac.in/courses/111/102/111102129/

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name with Signature	CDC	COE
Name:Mrs. A.GNANASOUNDARI Signature	Name: Dr. V. INTHUMATHI Signature	Name: Signature	Name: Signature

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Programme Code:	M.Sc.	**Programme Title:**	M.Sc. Mathematics	
Course Code:	21PMS4E2	**Title**	**Batch:**	2021 - 2023
		FUZZY LOGIC AND FUZZY SETS	**Semester:**	IV
Lecture Hrs./Week or Practical Hrs./Week	6		**Credits:**	5

Course Objective

On completion of the course the learners are expected to have

1. understood fuzzy sets, fuzzy relations and fuzzy measures
2. developed knowledge on uncertainty and information
3. studied several applications in science, arts and management.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	recall the concepts of set theory, crisp sets and Measure theory.	K1
CO2	understand the concepts of Fuzziness in various systems and fuzzy set theory.	K2
CO3	analyze the difference between crisp sets and fuzzy set theory.	K4
CO4	develop the knowledge to deal different types of uncertainties.	K4
CO5	apply the concepts of fuzzy logic to solve real life problems in the field of medicine, social sciences and decision making problems.	K3

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	H	H	M	H	H	H
CO2	H	H	H	M	H	H	H	H	H
CO3	H	H	H	M	H	H	H	H	H
CO4	H	H	H	M	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H

H – HIGH; M – MEDIUM; L – LOW.

Units	Content	Hrs.
Unit I	**Crisp Sets and Fuzzy Sets** Introduction, Crisp Sets :An over view, The Notion of Fuzzy Sets, Basic concepts of Fuzy Sets, Classical Logic: Complement, Fuzzy union, Fuzzy intersection and Combination of operations.	15
Unit II	**Fuzzy Relations** Crisp and Fuzzy relations, Binary relations, Binary relations on a single set, Equivalence and similarity relations, Compatibility on Tolerance Relations, Orderings, Morhhism and Fuzzy relations Equations.	16
Unit III	**Fuzzy Measures** General discussion, Belief and plausibility measure, Probability measures, Possibility and Necessity measures and Relationship among Classes of Fuzzy measures.	15
Unit IV	**Uncertainty and Information** Types of Uncertainty, Measures of Fuzziness, Classical Measures of Uncertainty, Measures of Dissonance, Measures of Confusion, Measures of Non-Specificity, Uncertainty and Information, Information and Complexity and Principles of Uncertainty and Information.	16
Unit V	**Applications** Natural,life and Social Sciences, Medican-Management and decision making, Computer Sciences, System Science and Other Applications.	16
	Total Contact Hrs.	**78**

Pedagogy:

Direct Instruction, Flipped Class, Power Point Presentation.

Assessment Methods:

Seminar, Chalk and talk, Quiz, Assignments, Group Task.

Text Books:

1. George J.Klir and Tina A.Folger,Fuzzy Sets , Uncertainty and Information, Prentice-Hall of India Private Limited-Fourth Printing-June1995.
2. Georg J.Klir and Boyuan, Fuzzy Sets And Fuzzy Logic-Theory and ApplicationsPrentice-Hall of India Private Limited

Books for Reference:

1. Corduneanu C.,*Integral Equations and Applications*, Cambridge University Press, Cambridge, 1991.
2. Weinstock R., *Calculus of Variations with Applications to Physics and Engineering*, McGraw Hill Book Co. Inc. New York, 1952.

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2. https://nptel.ac.in/courses/111/104/111104025/
3. https://nptel.ac.in/courses/111/102/111102129/

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