Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS101 Title : ALGEBRA		
Hrs/ Week	6	Credits : 4
Objectives	To enable the students to learn several advanced concepts in algebra which have wider applications in higher analysis, topology, theory of numbers, geometry, physics and chemistry etc. This paper is designed in such a way that a student can realize the importance of the topics like Sylow's theorems, polynomial rings, extension fields and Galois theory.	
Units	Contents	Hrs
Unit-I	Sylow's theorem - Inner product spaces - *Modules (Definitions and examples only, Self study)*. Sections : 2.1, 4.4 and *4.5 (Self study)*.	16 hours
Unit-II	*Definitions and examples of rings and some special classes of rings (Self study)* - Polynomial rings - Polynomials over the rational field - Polynomial rings over commutative rings. Sections : *3.1 (Self study), 3.2 (Self study)* and 3.9 to 3.11.	16 hours
Unit-III	Extension Fields - Finite Fields. Sections : 5.1 and 7.1.	15 hours
Unit-IV	Roots of Polynomials - More about roots. Sections : 5.3 and 5.5.	16 hours
Unit-V	The Elements of Galois theory. Section : 5.8.	15 hours
Text Book	Herstein I. N, *Topics in Algebra*, 2nd Edition, Wiley India Pvt. Ltd, New Delhi, 2010.	
Reference Books	1. John B. Fraleigh, *A First Course in Abstract Algebra*, Narosa Publishing House, New Delhi, 2003. 2. Surjeet Singh, Qazi Zameeruddin, *Modern Algebra*, Vikas Publishing House Pvt. Ltd, New Delhi, 2006. *3.* Bhattaracharya P. B, Jain K, and Nagpaul S.R, *Basic Abstract Algebra*, Cambridge University Press, New York, 2009.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS102 Title : REAL ANALYSIS		
Hrs/ Week	6	Credits : 4
Objectives	The aim of this syllabus is to aid learners in attaining a broad understanding of analysis techniques that are the basic stepping-stones to contemporary research. It is assumed that learners are familiar with the subject matter of the undergraduate analysis courses. This syllabus enables the learners to learn and understand in depth sequence and series of functions, functions of several variables and differential forms. Also study Lebesgue integral and Lebesgue measure.	
Units	Contents	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 hours
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 hours
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 on Integrals).	16 hours
Unit-IV	Lebesgue Measure: Lebesgue Outer Measure - The σ-Algebra of Lebesgue Measurable sets - Lebesgue Measurable Functions. Text Book 2, Sections : 2.1, 2.2, 2.3, 3.1, 3.2.	15 hours
Unit-V	Lebesgue 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, 4.2, 4.3, 4.4.	16 hours
Text Book	1. Walter Rudin, *Principles of Mathematical Analysis*, McGraw Hill, New York, 2013. 2. Royden H. L and Fitzpatrick P. M, *Real Analysis*, Fourth Edition, Pearson Education Inc, Prentice Hall Publishing House, 2010.	
Reference Books	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.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS103 Title : COMPLEX ANALYSIS		
Hrs/ Week	6	Credits : 4
Objectives	This paper provides a transition from undergraduate elementary results to postgraduate advanced topics and enables the learners (i) to understand and to evaluate the definite integrals in an easy and effective way using calculus of residues. (ii) to get a deeper understanding in the advanced topics such as harmonic functions, Infinite products and Normal families. Also it motivates the learners to take up research in the field of Complex Analysis.	
Units	Contents	Hrs
Unit-I	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	16 hours
Unit-II	The Calculus of Residues and Harmonic Functions: The Residue Theorem - The Argument Principle - Evaluation of Definite integrals - Definition and Basic Properties of Harmonic Functions - The Mean Value Property. Chapter 4 Sections : 5.1, 5.2, 5.3, 6.1and 6.2.	15 hours
Unit-III	Series and Product Developments: Poisson's Formula - Schwarz's Theorem - The Reflection Principle - Weierstrass's Theorem - The Taylor Series - The Laurent Series. Chapter 4 Sections : 6.3, 6.4, 6.5, Chapter 5 Sections : 1.1, 1.2, 1.3.	15 hours
Unit-IV	Partial Fractions and Factorization and Entire Functions: Partial Fractions - Infinite Products - Canonical Products - The Gamma Function - Zensen's Formula. Chapter 5 Sections : 2.1, 2.2, 2.3, 2.4, Chapter 5 Sections : 3.1.	16 hours
Unit-V	Normal Families and Elliptic Functions: Equi-continuity - Normality and Compactness - Arzela's Theorem - Families of Analytic Functions - Simply Periodic Functions - Representation by Exponentials - The Fourier Development - *Doubly Periodic Functions - The Period Module - Unimodular Transformations (Self study).* Chapter 5 Sections : 5.1, 5.2, 5.3, 5.4. Chapter 7 Sections : 1.1, 1.2, Chapter 7 Sections : 2.1, 2.2.	16 hours
Text Book	Lars V. Ahlfors, *Complex Analysis*, McGraw Hill International Edition, Third Edition (Indian Edition), 2013.	
Reference Books	1. Serge Lang, *Complex Analysis*, Springer International Edition, 2005 2. Shanti Narayan and Mittal P. K, Theory *of Functions of a Complex Variable*, S. Chand & Company Pvt. Ltd, 2014. 3. Herb Silvermann, *Complex Analysis*, Houghton Mifflin Company, 1975.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS104 Title : ORDINARY DIFFERENTIAL EQUATIONS		
Hrs/ Week	6	Credits : 4
Objectives	Differential equations play an important role in science, engineering and social sciences. Many phenomena in these branches of knowledge are interpreted in terms of differential equations and their applications. This paper helps the students to (i) learn linear equations and systems, (ii) study the existence and uniqueness of solutions of initial value problems, (iii) find solution by various methods, (iv) understand the results of oscillation and boundary value problems.	
Units	Contents	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 hours
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 (Except 3.1)	15 hours
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 (Except 4.1)	15 hours
Unit-IV	Existence and uniqueness of solutions and Oscillations of second order equations: Introduction - Preliminaries - Successive approximations - Picard's theorem - Fundamental matrix - Strum's comparison theorem - Elementary linear oscillations - Comparison theorem of Hille-Winter - Oscillations of $\ddot{x}+a(t)x=0$. Chapter 5 and 6 Sections : 5.1 - 5.4 and 6.1 - 6.5 (Except 5.5 to 5.8 and 6.6)	16 hours
Unit-V	Boundary Value problems: Introduction - Strum-Liouville problem - Green's functions - Picard's theorem. Chapter 7 Sections : 7.1, 7.2, 7.3, 7.5 (Except 7.4).	16 hours
Text Book	Deo S. G and Raghavendra V, *Ordinary Differential Equations and stability Theory*, Tata McGraw Hill Publishing company Limited, 1990.	
Reference Books	1. Martin H, *Ordinary Differential Equations*, Tata McGraw Hill Publishing Company Limited, 1985. 2. Coddington E. A and Levinson N, *Theory of Ordinary Differential Equations*, McGraw Hill, New York, 1955.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year :2017
Subject code : 17PMS1E1 Title : MAT LAB		
Hrs/ Week	4	Credits : 3
Objectives	To make students to learn the software in a friendly and non-intimidating fashion and helps them to solve the numerous sample problems in Mathematical sciences as a new users of MATLAB.	
Units	Contents	Hrs
Unit-I	Starting with MATLAB - Creating arrays - Mathematical operations with arrays. Chapter 1, 2 and 3.	11 hours
Unit-II	Scripts files - Functions and function files - *Global variables (Self study)* Chapter 4 and 6.	11 hours
Unit-III	Two-dimensional plots - Three dimensional plots - *Polar plots (Self study).* Chapter 5 and 9.	10 hours
Unit-IV	Programming in MATLAB. Chapter 7	10 hours
Unit-V	Polynomial - Curve fitting and Interpolation. Chapter 8.	10 hours
Text Book	Amos Gilat, *MATLAB - An Introduction with Application,* John Wiley & Sons, Singapore, 2004.	
Reference Books	1. Prata R. P, *Getting Started with MATLAB - A Quick Introduction for Scientist and Engineers*, Oxford University Press, New Delhi, 2006. 2. Palm W. J, *Introduction to MATLAB 7 for Engineers*, McGraw Hill Education, New York, 2005. 3. Etter D. M, Kuncicky D. C and Moore H, *Introduction to MATLAB 7*, Prentice Hall, New Jersy, 2004.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS1E2 Title : PROGRAMMING LAB IN MATLAB		
Hrs/ Week	2	Credits : 2

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.

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS205 Title : LINEAR ALGEBRA		
Hrs/ Week	6	Credits : 4
Objectives	The aim of the syllabus is to (i) provide the students with a good understanding of the concepts and methods described in the syllabus (ii) help students to develop the ability to solve the problems using Linear Algebra (iii) connect Linear Algebra to other fields both within and without Mathematics (iv) develop abstract and critical reasoning by studying logical proofs and the axiomatic methods as applied in the Linear Algebra.	
Units	Contents	Hrs
Unit-I	Elementary Canonical Forms: Characteristic Values - Annihilating Polynomials - Invariant Subspaces. Chapter 6 Sections : 6.2 to 6.4.	16 hours
Unit-II	Direct Sum Decompositions - Invariant Direct Sums - The Primary Decomposition Theorem. Chapter 6 Sections : 6.6 to 6.8.	16 hours
Unit-III	The Rational and Jordan Forms: Cyclic Subspaces and Annihilators - Cyclic Decompositions and the Rational Form. Chapter 7 Sections : 7.1, 7.2.	15 hours
Unit-IV	The Jordan Form - Computations of Invariant Factors. Chapter 7 Sections : 7.3, 7.4.	15 hours
Unit-V	Bilinear Forms: Bilinear Forms - Symmetric Bilinear Forms. Chapter 10 Sections : 10.1, 10.2.	16 hours
Text Book	Kenneth Hoffman and Ray Kunze, *Linear Algebra*, Second Edition, PHI learning Pvt. Ltd, New Delhi, 2013.	
Reference Books	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.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS206 Title : MATHEMATICAL STATISTICS		
Hrs/ Week	6	Credits : 4
Objectives	The objective of this syllabus is to give a systematic introduction to modern probability theory and Mathematical Statistics. Students mastering the material in this syllabus will be able to read research reports and to do research in this field. It will help the students to face SLET, NET, and CSIR examinations.	
Units	Contents	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, 1.2, 1.3, 1.5, 1.6, 1.7. Chapter 2 Sections : 2.1 to 2.8 and Chapter 3 Sections : 3.1 to 3.4.	15 hours
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: *One point and Two point distributions (Self study)* - The Bernoulli scheme - The Binomial distribution -The Poisson distribution. Chapter 4 Sections : 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7. Chapter 5 Sections : 5.1, 5.2, 5.5.	16 hours
Unit-III	Some probability distributions: The uniform distribution - 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 : 5.6 to 5.10. Chapter 6 Sections : 6.1, 6.2, 6.3, 6.6, 6.7.	15 hours

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(X, S) - Student's t-distribution - Fisher's Z-distribution. Significance tests: The concept of statistical test - Parametric tests for small samples - Parametric tests for large samples. Chapter 9 Sections : 9.1to 9.7. Chapter 12 Sections : 12.1to 12.3.	16 hours
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 to 13.8.	16 hours
Text Book	Marek Fisz, *Probability theory and Mathematical Statistics*, Third Edition, John Wiley & sons, Inc, 1980.	
Reference Books	1. Gupta S. C and Kapoor V. K, *Fundamentals of Mathematical Statistics a Modern Approach*, 10th Edition, Sultan Chand & Sons, 2000. 2. Irwin Miller and Marylees Miller, *Mathematical Statistics*, 7th Edition, Pearson Prentice Hall Pvt. Ltd, 2011.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS207 Title : PARTIAL DIFFERENTIAL EQUATIONS		
Hrs/ Week	5	Credits : 4
Objectives	On completion of the course the students are expected to have i. Obtain solid introduction to nonlinear and linear partial differential equations. ii. Understood Charpit's method, Jacobi method, method of seperation of variables, method of integral transforms. iii. a good understanding of Laplace equation, wave equation, diffusion equations and a good knowledge of their various applications in mathematics and other fields.	
Units	Contents	Hrs
Unit-I	*Partial differential equations (Self study)* - *Origins of first order partial differential equations (Self study)* - Non-linear partial differential equations of the first order - Compatible systems of first order equations - Charpit's Method - Special types of first order equations and Jacobi's Method. Chapter 2 Sections : *1 (Self study), 2 (Self study),* 7, 9,10, 11 and 13.	15 hours
Unit-II	*The origin of second order partial differential equations (Self study)* - Linear partial differential equations with constant co-efficients and Equations with variable coefficients. Chapter 3 Sections : *1 (Self study),* 4 and 5.	16 hours
Unit-III	Method of separation of variables and the method of integral transforms. Chapter 3 Sections : 9, 10.	15 hours
Unit-IV	Elementary solutions of Laplace's equations - Families of equi potential surfaces - Boundary value problems - Separation of variables and Problems with axial symmetry. Chapter 4 Sections : 2 - 6.	16 hours
Unit-V	Elementary solutions of one dimensional wave equation - Vibrating membranes: Application of calculus of variations - Elementary solutions of diffusion equation and Separation of variables. Chapter 5 Sections : 2 and 4, Chapter 6 Sections : 3 and 4.	16 hours
Text Book	Ian N. Sneddon, *Elements of Partial Differential Equations. Dover Publication,* New York, 2006.	
Reference Books	1. Sankara Rao K, *Introduction to Partial Differential Equations, Second Edition,* PHI Learning Pvt.Ltd, New Delhi, 2009. 2. 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.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS208 Title : MECHANICS		
Hrs/ Week	6	Credits : 4
Objectives	On completion of the course the students are expected to have (i) studied and understood Lagrange's equation, Hamilton's equation and various simple but important results related to them. (ii) obtained a sound knowledge in Hamilton-Jacobi theory.	

Units	Contents	Hrs
Unit-I	Introductory concepts: *Mechanical system (Self study) - Generalized Coordinates (Self study)* - Constraints - Virtual Work - Energy and Momentum. Chapter 1 Sections : 1.1 - 1.5.	16 hours
Unit-II	Lagrange's equations: Derivations of Lagrange's Equations - Examples - Integrals of Motion. Chapter 2 Sections : 2.1 - 2.3.	15 hours
Unit-III	Hamilton's equations: Hamilton's Principle - Hamilton's Equations. Chapter 4 Sections : 4.1, 4.2.	16 hours
Unit-IV	Hamilton - Jacobi theory: Hamilton's Principle function - Hamilton-Jacobi Equation. Chapter 5 Sections : 5.1, 5.2.	15 hours
Unit-V	Canonical transformations: Differential forms and Generating Functions - Lagrange and Poisson Brackets. Chapter 6 Sections : 6.1, 6.3.	16 hours
Text Book	Donald T. Greenwood, C*lassical Dynamics, Dover Publication,* New York, 2014.	
Reference Books	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.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS209 Title : NUMERICAL ANALYSIS		
Hrs/ Week	4	Credits : 3
Objectives		
Units	Contents	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. Chapter 1 Sections : 1.3, 1.4, 1.5, 1.7, 1.8, 1.11.	11 hours
Unit-II	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 1/3 rule - *Simpson's 3/8 rule (Self study)*. Chapter 5 Sections : 5.2, 5.3, 5.6 and 5.7.	11 hours
Unit-III	Solving Set Of Equations : The elimination method - Gauss Elimination and Gauss Jordan methods - LU decomposition method - Matrix inversion by Gauss-Jordan method - Methods of iteration - Jacobi and Gauss Seidal iteration - Relaxation method - Systems of nonlinear equations. Chapter 2 Sections : 2.3 - 2.5, 2.7, 2.10 - 2.12.	10 hours
Unit-IV	Solution Of Ordinary Differential Equations : Taylor series method - Euler and modified Euler methods - Runge-Kutta methods - Multistep methods - Milne's method - Adams-Moulton method - *Relaxation method (Self study)*. Chapter 6 Sections : 6.2 - 6.7.	10 hours
Unit-V	Boundary Value Problems And Characteristic Value Problems: The shooting method - Solution through a set of equations - Derivative boundary conditions - Characteristic value problems - Eigen values of a matrix by iteration - The power method. Chapter 7 Sections : 7.2 - 7.5.	10 hours
Text Book	Gerald C. F and Wheatley P. O, *Applied Numerical Analysis*, Sixth Edition, Addison Wesley, 1998.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS210 Title : PROGRAMMING LAB IN NUMERICAL ANALYSIS USING MATLAB		
Hrs/ Week	2	Credits : 2

List of Programs

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

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS2N1 Title : NME - MATHEMATICAL STATISTICS AND TECNIQUES		
Hrs / Week : 1		Credits: 2
Units	Contents	Hrs
Unit-I	Mean - Median - Standard deviation - Coefficient of variation	3 hours
Unit-II	Correlation Analysis: Simple and Rank Correlation	2 hours
Unit-III	Regression Analysis: Simple Linear Regression	2 hours
Unit-IV	Testing Of Hypothesis: Z Test - t Test	3 hours
Unit-V	Testing Of Hypothesis: Chi square Test - F Test	3 hours
Text Books	Gupta S. P, *Statistical Methods,* Sultan chand & sons, New Delhi, 2006.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS2N2 Title : MATHEMATICS IN FINANCE		
Hrs/ Week	1	Credits : 2
Units	Contents	Hrs
Unit I	Financial statement analysis: Introduction - Ratio analysis - Meaning and Rationale - Basis of comparison. Chapter 4 Sections : 4.1, 4.2.	3 hours
Unit II	Types of ratios - Liquidity ratio - Net working capital - Current ratios - Acid test/Quick ratios -Turnover ratio - Defensive - Interval ratio - Leverage/Capital structure ratio. Chapter 4 Sections 4.3, 4.4, 4.5.	3 hours
Unit III	Debt-Equity Ratios - Debt to total capital ratio - Coverage ratios - Profitability ratios - Profitability ratios related to sales - Profit margin - Expenses ratio. Chapter 4 Section 4.6.	3 hours
Unit IV	Profitability ratios related to investments: Return on investment - Importance of ratio analysis - Limitations of Ratio Analysis. Chapter 4 Sections 4.9, 4.10.	2 hours
Unit V	Capital budgeting : Principle and techniques: Nature of capital budgeting - Data requirement : Identifying relevant cash flows. Chapter 5 Sections 5.1 - 5.3.	2 hours
Text Book	Khan M.Y and Jain P. K, *Financial Management,* Tata McGraw Hill Publishing Company Ltd, New Delhi, 1990.	
Reference Books	1. Aswath Damodaran, *Corporate Finance*, Theory and Practice, John Wiley and Sons, Inc, 2007. 2. Prasanna Chandra, *Managing Investment*, Tata McGraw Hill Publishing Company Ltd, New Delhi, 1998.	

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Department	Mathematics	
Course	M.Sc.	Effective From the Year : 2017
Subject code : 17PMS311 Title : TOPOLOGY		
Hrs/ Week	6	Credits : 4
Objectives	Topology is one of the basic disciplines of pure mathematics and concerns more on logical precision. Its ideas and methods have transformed large parts of geometry and analysis almost beyond recognition. It has also greatly stimulated the growth of abstract algebra. The course content of this paper serves to lay foundation for further study in analysis, geometric and algebraic topology.	
Units	Contents	Hrs
Unit-I	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 to 17.	16 hours
Unit-II	Continuous functions - The metric topology - The metric topology (Continued) . Chapter 2 Sections : 18, 20, 21.	15 hours
Unit-III	Connected spaces - Connected subspaces of the real line - Components and Local Connectedness - Compact spaces. Chapter 3 Sections : 23 to 26.	15 hours
Unit-IV	The Separation axioms - Normal spaces - The Urysohn lemma - The Urysohn Metrization Theorem - The Tietz Extension theorem. Chapter 4 Sections : 31 to 35.	16 hours
Unit-V	The Tychonoff theorem - The Stone-Cech Compactification - The Nagata-Smirnov Metrization theorem - The Smirnov Metrization Theorem. Chapter 5 Sections :37, 38, Chapter 6 Sections :40, 42.	16 hours
Text Book	Munkres J. R, *Topology*, Second Edition, Pearson Education, Inc, 2000.	
Reference Books	1. Simmons G. F, *Introduction to topology and modern analysis*, Tata McGraw Hill book company, Inc, 1963. 2. Dugundji J, *Topology*, Prentice Hall of India, 1975. 3. John Kelly L, *General Topology*, Van Nostrand Reinhold Company,1968. 4. Stephen Willard, *General Topology*, Addision Wesley, 1970. 5. Benjamin Sims T, *Fundamentals of Topology*, Macmillan Publishing Company, 1976.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS312 Title : FUNCTIONAL ANALYSIS		
Hrs/ Week	6	Credits : 4
Objectives	On Completion of the course the students are expected (i) to have a clear understanding of Normed linear spaces, Banach spaces, Hilbert spaces and ß(X,Y). (ii) to understand some important, but simple to follow, theorems such as best approximation theorems, Projection theorem and Riesz Representation theorem. (iii) to have full grasp of the three important theorems of Functional Analysis namely Hahn-Banach Theorem, The Uniform Boundedness Principle and Closed Graph Theorem. (iv) to apply the concepts and results covered in the course to Numerical Analysis and Operator equations.	
Units	Contents	Hrs
Unit-I	Norm on a Linear Space - Examples of Normed Linear Spaces - Semi Norms 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 hours
Unit-II	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, 2.4, 2.5, 2.6.	16 hours
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 - *Completeness of ß(X, Y) (Self Study)* - Bessel's Inequality - Fourier Expansion and Parseval's Formula - Riesz-Fischer Theorem. Chapter 3 Sections : 3.1, 3.1.1, 3.2, 3.3, 3.4.1. Chapter 4 Sections : 4.2, 4.3, 4.4.	16 hours
Unit-IV	Hahn-Banach Theorem and Its Consequences -The Extension Theorem - Consequences - On Uniqueness of Extension - Separation Theorem. Chapter 5 Sections : 5.1, 5.2, 5.3, 5.4.	15 hours
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, 7.2, 7.3, 7.3.1.	16 hours

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

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS313 Title : COMBINATORICS		
Hrs/ Week	6	Credits : 4
Objectives	On completion of the course the learners are expected to (i) have gained a working knowledge of the basic ideas and techniques of the subject (ii) handle various aspects of assignment problems, beginning with the famous result of Philip Hall, and on to various applications. (iii) deal with configurations and have a sound knowledge of block designs and its applications to error correcting codes (iv) understand the Steiner system S(5, 8, 24) and the construction of Leech Lattice in 24 dimensions.	
Units	Contents	Hrs
Unit-I	Introduction to basic ideas - Selections and Binomial coefficients - Permutations - Ordered selections - Unordered selections - Further remarks on the binomial theorem - Miscellaneous. Chapter 1 and 2.	16 hours
Unit-II	Pairings problems: Pairings within a set - Pairings between sets - An optimal assignment problem and Gale's optimal assignment problem. Chapter 3.	15 hours
Unit-III	Concurrence: Some miscellaneous problems - Fibonacci type relations - Using Generating Functions - Miscellaneous methods and Counting simple electrical networks. Chapter 4.	16 hours
Unit-IV	The Inclusion-Exclusion Principle: The Principle - *The Rook Polynomials (Self study)* - Steiner Systems and Sphere Packings - Introductory remarks - Steiner Systems S(5,8,24) - Leech's Lattice. Chapter 5 and 7.	16 hours
Unit-V	Block Designs and Error correcting codes: *Block designs (Self study)* - Square block designs - Hadamard configurations - Error correcting codes. Chapter 6.	15 hours
Text Book	Ian Anderson, *A first course in Combinatorial Mathematics*, Oxford University press, 1974.	
Reference Books	1. Krishnamurthy V, *Combinatorics*, Affiliated East West Press Pvt Ltd, New Delhi, 1986. 2. Balakrishnan V. K and Balakrishnan V, *Schaum's outline of Combinatorics*, McGraw Hill Publishers, 1984.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS314 Title : GRAPH THEORY		
Hrs/ Week	6	Credits : 4
Objectives	Graph theory is a major area of Combinatorics. In this Course we introduce the learners to some basic topics in graph theory.	
Units	Contents	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 hours
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 hours
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 hours
Unit-IV	Edge Colorings: Edge chromatic number and Vizing's theorem. Vertex Colorings: Chromatic number, Brooks' theorem, Hajo's Conjecture - Dirac's Theorem, Chromatic polynomials, Girth and chromatic number. Chapter 6 Sections : 6.1,6.2, Chapter 8 Sections : 8.1 - 8.5.	15 hours
Unit-V	Planar Graphs: Plane and planar graphs, Dual graphs - Euler's formula and Kuratowski's theorem. Directed Graphs: Directed graphs - Directed paths and Directed cycles. Chapter 9 Sections : 9.1 - 9.3, 9.5, Chapter 10 Sections : 10.1 - 10.3.	15 hours
Text Book	Bondy J. A and Murty U. S. R, *Graph Theory with Applications*, Macmillan Company, 1976.	
Reference Books	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 Ringel G, *Pearls in Graph Theory*, Academic Press, 1990.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year :2017
Subject code : 17PMS3E3 Title : LATEX		
Hrs/ Week	4	Credits : 3
Objectives	On completion of the course the students are expected to (i) learn the basic features of LATEX system. (ii) learn to prepare their own document in different environments. (iii) built their confidence to work in LATEX.	
Units	Contents	Hrs
Unit-I	Text formatting - TEX and its offspring - What's different in LATEX 2ε - Distinguishing LATEX 2ε - Basics of LATEX file. Chapter 1 Sections : 1.1 - 1.5.	11 hours
Unit-II	Commands and environments - Command names and arguments - Environments - Declarations - *Lengths(Self study)* - Special Characters - Fragile Commands - Exercises. Chapter 2 Sections : 2.1 - 2.6.	11 hours
Unit-III	Document layout and Organization - Document class, Page style - Parts of the document - Table of contents - Fine-tuning text - Word division - Displayed text - Changing font - Centering and indenting - Lists - Generalized lists - Theorem like declarations - Tabulator stops - Boxes. Chapter 3 Sections : 3.1 - 3.6.	10 hours
Unit-IV	Displayed text - Changing font - *Centering and indenting (Self study)* - Lists - Generalized lists - Theorem like declarations - Tabulator stops - Boxes - Tables - Printing literal text - Footnotes and marginal notes - Drawing pictures with Latex. Chapter 4 Sections : 4.1 - 4.11.	10 hours
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 hours
Text Book	Kopka H and Daly P. W, *A Guide to Latex*, Third Edition, Addison Wesley, London, 1999.	
Reference Books	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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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS3E4 Title : PROGRAMMING LAB IN LATEX		
Hrs/ Week	2	Credits : 2

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.

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS415 Title : FLUID DYNAMICS		
Hrs/ Week	6	Credits : 4
Objectives	On completion of the course the students are expected (i) to have a good understanding of the fundamental equation of viscous compressible fluid. (ii) to have studied Bernoulli equation, Momentum theorems and their various applications. (iii) to understand the motion of solid bodies in fluid. (iv) to have a sound knowledge of boundary layer theory.	

Units	Contents	Hrs
Unit-I	Kinematics of fluids and Fundamental equations of the flow of viscous compressible fluids: Methods of describing fluid motion: Lagrangian method, Eulerian method-Translation, Rotation and Rate of deformation - Streamlines, Path lines and Streak lines - Material derivative and acceleration - Vorticity, Vorticity in Polar coordinates - Vorticity in orthogonal curvilinear coordinates - The equation of continuity - Conservation of mass - Equation of motion - conservation of momentum- *The energy equation - conservation of energy (Self study).* Chapter 3 Sections : 3.1 - 3.5, 5.1 - 5.3.	16 hours
Unit-II	One dimensional invisid incompressible flow and two and three 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) & (b)) - The Momentum theorem - Applications of the momentum theorem((a) & (b)) - 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 - The moment of momentum theorem. Chapter 6 Sections : 6.1 - 6.4, 6.6 - 6.7, 7.1 - 7.7.	16 hours
Unit-III	Laplace's equation: Laplace equation in Cartesian coordinates - Laplace equation in cylindrical coordinates - Laplace equation 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 hours
Unit-IV	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 hours

Unit-V	Laminar flow of viscous incompressible fluids and Boundary Layer Theory: Flow between parallel flat plates - Steady flow in pipes, Flow between two co-axial cylinders - Flow between two concentric rotating cylinders - Boundary layer concept - The Boundary layer equations in two dimensional flows - The boundary layer along a flat plate - The Blasius solution. Chapter 8 Sections : 8.3 - 8.4,8.5, 9.2 - 9.3.	16 hours

Text Book	Yuan S. W, *Foundations of fluid mechanics,* Prentice Hall of India Pvt. Ltd, 1988.
Reference Books	1. Shanthi Swarup, *Fluid dynamics*, Krishna Prakasan media Pvt. Ltd, Meerut, 2000. 2. Frank Chorlton, *Text book on Fluid Dynamics*, CBS Publishers and Distributors, Delhi, 2004.

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Department	Mathematics	
Course	M. Sc.	Effective From the Year :2017
Subject code : 17PMS416 Title : OPERATOR THEORY		
Hrs/ Week	6	Credits : 4
Objectives	On completion of the course the students are expected to (i) understand the concepts of Dual space, Reflexivity, Weak convergence and Compact operators and to illustrate them with examples. (ii) have a clear understanding of Spectrum, Resolvent set of an operator and Spectral mapping theorem. (iii) have well founded knowledge in adjoint of operators, self adjoint operators, normal operators, unitary operators and their properties.	
Units	Contents	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, 8.1.2, 8.1.3, 8.1.4.	16 hours
Unit-II	Reflexivity and Weak Convergence - Reflexivity - Weak Convergence - Best Approximation in Reflexive Spaces. Chapter 8 Sections : 8.2, 8.2.1, 8.2.2, 8.2.3.	15 hours
Unit-III	Compact Operators - Some Characterizations - Space of Compact Operators - Further Properties. Chapter 9 Sections : 9.1, 9.2, 9.3.	15 hours
Unit-IV	Spectral Results for Banach Space Operators - Eigen spectrum and Approximate Eigen spectrum - 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, 10.2.2, 10.2.3 (In 10.2.3, Theorem 10.17 only).	16 hours
Unit-V	Operators on Hilbert Spaces - Adjoint of an Operator - Compactness of the Adjoint Operator - *Sesquilinear Functionals (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.	16 hours
Text Book	Thamban Nair, M, *Functional Analysis - A First Course.* Prentice Hall of India Pvt. Ltd, New Delhi, 2010.	
Reference Books	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.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS417 Title : CONTROL THEORY		
Hrs/ Week	6	Credits : 4
Objectives	Control theory is relatively a young branch of Applied Mathematics. On completion of the course the students are expected to develop their knowledge in the basic problems, namely, observability, controllability, stability, stabilizability and optimal control.	
Units	Contents	Hrs
Unit-I	Observability: Linear Systems - Observability Grammian - Constant Coefficient systems - Construction kernel and Nonlinear Systems. Chapter 2 Sections : 2.1, 2.2.	16 hours
Unit-II	Controllability: Linear Systems - Controllability Grammian, Adjoint Systems - Constant Coefficient systems - Steering function and Controllability of Nonlinear System. Chapter 3 Sections : 3.1 , 3.2.	15 hours
Unit-III	Stability: Stability - Uniform Stability and Asymptotic Stability of Linear Systems - Perturbed linear systems and Nonlinear systems. Chapter 4 Sections 4.1 - 4.3.	15 hours
Unit-IV	Stabilizability: Stabilization via linear feedback control, Bass method - The Controllable subspace and *Stabilization with restricted feedback (Self study).* Chapter5 : Sections 5.1 - 5.3.	16 hours
Unit-V	Optimal Control: Linear time varying systems with quadratic performance criteria - Linear time invariant systems and *nonlinear systems(Self study).* Chapter6 : Sections 6.1 - 6.3.	16 hours
Text Book	Balachandran K and Dauer J. P, *Elements of Control Theory*, Narosa, New Delhi, 2012.	
Reference Books	1. Conti R, *Linear Differential Equations and Control*, Academic Press, London, 1976. 2. Curtain R. F and Pitchard A. J , *Functional Analysis and Modern Applied Mathematics*, Academic Press, New York, 1977. 3. Klamka J, *Controllability of Dynamical Systems*, Klumer Academic Publisher, Dordrecht, 1991.	

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Department	Mathematics	
Course	M. Sc.	Effective From the Year : 2017
Subject code : 17PMS4E5 Title : MATHEMATICAL METHODS		
Hrs/ Week	6	Credits : 5
Objectives	1. To provide a practical working knowledge of Mathematics. 2. To acquire the mathematical skills required to solve problems arising in daily life. 3. To provide a useful supplement to methods courses for mathematics students.	
Units	Contents	Hrs
Unit-I	Integral Equations: Introduction - Integral equations with separable kernels - Reduction to a system of algebraic equations, Fredholm alternative, an approximate method - Fredholm integral equations of the first kind, method of successive approximations - Iterative scheme - Volterra integral equation, *some results about the resolvent kernel(Self study)* - classical Fredholm theory - Fredholm's method of solution - Fredholm's first, second, third theorems. Chapter 1 to Chapter 4.	16 hours
Unit-II	Applications of Integral Equations: Application to ordinary differential equation - Initial value problems, boundary value problems - Singular integral equations - Abel integral equation. Chapter 5 Sections : 5.1, 5.2, Chapter 8 Sections : 8.1, 8.2.	15 hours
Unit-III	Calculus of Variations : 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 - Functionals dependent on the functions of several independent variables - Variational problems in parametric form - Some applications. Chapter 6.	16 hours
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. Chapter 8.	15 hours
Unit-V	Direct Methods in Variational Problems: Direct methods - Euler's finite difference method - The Ritz method - Kantorovich's method. Chapter 10.	16 hours

Text Book	1. Kanwal R. P, *Linear Integral Equations - Theory and Technique* Second Edition, Birkhauser, Boston, 1997. 2. Elsgolts L, *Differential Equations and the Calculus of Variations*, MIR Publishers, Moscow, 1970.
Reference Book	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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