M.Sc. Mathematics Programme

Scheme of Examinations

(For candidates admitted from 2012-13 onwards)

Semester	Course Code	Course Title	Hours per week	Duration of Exam Hrs (ESE)	Max. Marks CA	ESE	Total	Credit Points
I	11PMS01	Algebra	6	3	25	75	100	4
	11PMS02	Real Analysis	6	3	25	75	100	4
	11PMS03	Complex Analysis	6	3	25	75	100	4
	11PMS04	Ordinary Differential Equations	6	3	25	75	100	4
	11PMS05	RDBMS & Oracle	4	3	25	75	100	3
	11PMS06	Programming Lab. in RDBMS & ORACLE	2	3	40	60	100	2
	11PMS07	Subject Viva-Voce I	-	-	-	-	100 #	2
II	11PMS08	Linear Algebra	6	3	25	75	100	4
	11PMS09	Measure and Integration	6	3	25	75	100	4
	11PMS10	Partial Differential Equations	6	3	25	75	100	4
	11PMS11	Mechanics	6	3	25	75	100	4
	11PMS12	Visual Basic	4	3	25	75	100	3
	11PMS13	Programming Lab. in Visual Basic	2	3	40	60	100	2
	11PMS14	Subject Viva –Voce II	-	-	-	-	100 #	2
III	11PMS15	Topology	6	3	25	75	100	4
	11PMS16	Functional Analysis	6	3	25	75	100	4
	11PME17	Elective I- Combinatorics	6	3	25	75	100	4
	11PME18	Elective II- Graph theory	6	3	25	75	100	4
	11PMS19	JAVA Programming	4	3	25	75	100	3
	11PMS20	Programming Lab in JAVA	2	3	40	60	100	2
	11PMS21	Subject Viva –Voce III	-	-	-	-	100 #	2
IV	11PMS22	Fluid Dynamics	6	3	25	75	100	4
	11PMS23	Operator Theory	6	3	25	75	100	4
	11PME24	Elective III- Control Theory	6	3	25	75	100	4
	11PME25	Elective IV- Stochastic Differential Equations	6	3	25	75	100	4
	12PMS26	Latex	4	3	25	75	100	2
	12PMS27	Programming Lab in Latex	2	3	40	60	100	1
	12PMS28	Subject Viva –Voce IV	-	-	-	-	100 #	2
					Total:	2400		90

- 50 Marks (Internal) + 50 Marks (External) = 100 Marks
T – Theory P- Practical

* In the IV Semester Students are given two choices viz.,

(i) 5 Papers and a Subject Viva-Voce Examination.

(ii) 2 Papers, a Subject Viva -Voce Examination and a Major Project (Instead of any of three elective papers).

Students admitted from 2011 onwards may opt any one of the two choices given above.

General Question Pattern

Papers

Max Marks: 100	Internal : 25	External 75	
Section	Pattern	Mark	Total
Part A	One word question (10 Questions)	10 ∗ 1	10
Part B	Either (or) choice (5 Questions)	5 ∗ 5	25
Part C	Either (or) choice (5 Questions)	5∗ 8	40
		Total :	75

List of Electives

1. Combinatorics
2. Stochastic Differential Equations
3. Magneto Hydro Dynamics
4. Control Theory
5. Differential Geometry
6. Algebraic Number Theory
7. Algebraic Topology
8. Fuzzy Logic and Fuzzy Sets
9. Graph Theory
10. Cryptography

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 01 **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 of fields and Galois theory.	
Unit	**Contents**	**Hrs**
Unit-I	Sylow's Theorem and Inner Product Spaces**.**	15 hours
Unit-II	Polynomial Rings, Polynomials over the Rational field and Polynomial Rings over Commutative Rings.	16 hours
Unit-III	Extension Fields and Finite Fields**.**	14 hours
Unit-IV	Roots of Polynomials and More about roots.	16 hours
Unit-V	The Elements of Galois theory.	14 hours
Text Book	Herstein, I.N. *Topics in Algebra*. 2nd Edition. New Delhi. Vikas Publishing Company Private Limited.	
Reference Books	1. John B. Fraleigh. *A First Course in Abstract Algebra*. New Delhi: Narosa Publishing House. 2. Surjeet Singh, Qazi Zameeruddin. *Modern Algebra*. Delhi: Vikas Publishing House Pvt. Ltd. 3. Bhattaracharya, P.B., Jain, K. and Nagpaul, S.R. *Basic Abstract Algebra*. New York: Cambridge University Press.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 02 **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, special function, functions of several variables and differential forms.	

Unit	**Contents**	**Hrs**
Unit-I	**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.	15 hours
Unit-II	**Some special functions** Power series, The Exponential and Logarithmic functions, The Trigonometric functions, Fourier series.	14 hours
Unit-III	**Functions of several variables** Linear transformations, Differentiation, The contraction principle, The inverse function theorem, Determinants, Derivatives of higher order.	16 hours
Unit-IV	**Integration of differential forms** Integration, Primitive mappings, Partitions of unity, Differential forms	15 hours
Unit-V	**Integration of differential forms (contd.,)** Simplexes and Chains, Stoke's theorem, closed forms and exact forms, Vector analysis	15 hours
Text Book	Walter Rudin. (1976). *Principles of Mathematical Analysis*. Third Edition. McGraw – Hill.Inc.	
Reference Book	Tom. M. Apostol. (Reprint 1990). *Mathematical Analysis.* Narosa Publishing House.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 03 **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 1) to understand and to evaluate the definite integrals in an easy and effective way using calculus of residues 2) 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.	

Unit	Contents	Hrs
Unit-I	**Laurent Series and the Residue Theorem:** Classification of Singularities - Laurent Series - Evaluation of Real Integrals**.**	15 hours
Unit-II	**Harmonic Functions:** Comparison with Analytic Functions - Poisson Integral Formula.	14 hours
Unit-III	**Positive Harmonic functions and Conformal mapping:** Positive Harmonic functions - Conformal mapping**.**	14 hours
Unit-IV	**Normal Families and Riemann Mapping Theorem:** Normal Families - Riemann Mapping Theorem	16 hours
Unit-V	**Entire and Meromorphic Functions:** Infinite Products - Weierstrass's Product Theorem - Mittag Leffler's Theorem.	16 hours

Text Book	Herb Silverman, Houghton Mifflin Company, Boston. (1975). *Complex Variables*.
Reference Books	1. Lars V.Ahlfors. (1979). *Complex Analysis.* Third Edition. Mc Graw-Hill book company. 2. Ponnusamy, S. (2005). *Foundations of Complex Analysis.* Second Edition. Narosa Publishing house.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 04 **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.	

Unit	**Contents**	**Hrs**
Unit-I	Linear differential equations of higher order	15 hours
Unit-II	Solutions in power series (Except 3.1)	14 hours
Unit-III	Systems of Linear Differential Equations (Except 4.1)	15 hours
Unit-IV	Existence and uniqueness of solutions; and Oscillations of second order equations (Except 5.5 to 5.8 & 6.6)	16 hours
Unit-V	Boundary Value problems (Except 7.4)	15 hours
Text Book	Deo, S.G. and Ragavendran, V. (1980). *Ordinary Differential Equations and Stability Theory.* TATA Mc GRAW-HILL Publishing Company Ltd.	
Reference Book	1. Martin H.(1985), *Ordinary Differential Equations*, Tata McGraw Hill Publishing company Limited. 2. Coddington E. A and Levinson N.,(1955), *Theory of Ordinary Differential Equations*, McGraw Hill, New York.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 05 **Title : RDBMS AND ORACLE**		
Hrs/ Week	4	**Credits :** 3
Objectives	The aim of this paper is (i) to understand the basic concepts of DBMS and RDBMS (ii) to acquire knowledge in SQL and PL/SQL (iii) to gain knowledge and develop skills to apply the above in the IT field.	

Unit	**Contents**	**Hrs**
Unit-I	Introduction - Purpose of Database Systems -View of Data - Data Models -Database Languages - Transaction Management - Storage Management - Database Administrator -Database users -Overall System Structure.	9 hours
Unit-II	Entity - Relational Model (E - R Model)-Basic concepts - Mapping Constraints – Keys- Entity Relationship Diagram- Design Phases - Reduction of E - R Diagram to tables. Relational Model - Structure of Relational Databases - Relational Algebra - Extended Relational Algebra Operations - Modification of the Database.	11 hours
Unit-III	Introduction to Oracle - Tools of Oracle - Oracle Internal Datatypes - Division of SQL - Data Definition Language - Data Manipulation Language - Transaction Control and Data Control Language. Operators in SQL * Plus - Arithmetic Operators, Comparison Operators and Logical Operators -SQL * Plus Functions- Single Row Functions -Group Functions.	10 hours
Unit-IV	Set Operators -Join Concept - Usage of Sub-queries - Constraints - Locks - Types of Locks. Database Objects- Tables - Synonym - Sequences - View - Index.	

	SQL*Plus formatting commands - Compute Commands -Title Commands - Setting Page Dimensions - Storing and Printing Query Results.	11 hours
Unit-V	Introduction to PL/SQL - Advantages of PL/SQL - Architecture of PL/SQL - PL/SQL block - Datatypes - Control Structures -Concept of Error Handling and Exceptions -Cursor Management -Sub-programs and Packages - Database Triggers and Built in Packages.	9 hours
Text Books	1. Henry F. Korth and Sundharasan, S. *Database system concept.* **2.** Ivan Bayross. (1997). *Oracle.* BPB Publications.	
Reference Books	1. Nilesh Shah. (2011), *Database Systems using ORACLE.* PHI learning Pvt. Ltd. 2. Ivan Bayross. (2005). *SQL, PL/SQL The programming language of oracle.* BPB Publications.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year : 2011**
Subject code : 11 PMS 06 **Title : PROGRAMMING LAB IN RDBMS AND ORACLE**		
Hrs/ Week	2	**Credits : 2**

List of Programs

1. Create a table and working with DDL commands
2. Working with DML commands
3. Working with DCL commands
4. Working with TCL commands
5. SQL * Plus Functions
6. SQL * Plus operators
7. Set Operators
8. Join Concept
9. Usage of Sub-queries
10. Constraints
11. sequences
12. Views
13. Indexs
14. SQL*Plus Formatting Commands

PL/SQL Commands

15. Control Structure – Conditional Control if … then…else
16. Control Structure – Conditional Control if … then…elsif
17. Control Structure – Iterative Control Simple loop
18. Control Structure – Iterative Control While loop
19. Control Structure – Iterative Control For loop
20. Display origin and destination of a route
21. Checking price value or not using exception
22. Passenger details using cursor management

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 08 **Title : LINEAR ALGEBRA**		
Hrs/ Week	6	**Credits : 4**
Objectives	The aim of the syllabus is • To provide the students with a good understanding the concepts and methods described in the syllabus. • To help students develop the ability to solve problems using linear Algebra. • To connect Linear Algebra to other fields both within and without Mathematics. • To develop abstract and critical reasoning by studying logical proofs and the axiomatic method as applied in the Linear Algebra.	
Unit	**Contents**	**Hrs**
Unit-I	**Elementary Canonical Forms** ❖ Characteristic Values ❖ Annihilating Polynomials ❖ Invariant Subspaces	15 hours
Unit-II	❖ Simultaneous Triangulation; Simultaneous Diagonalization ❖ Direct Sum Decompositions ❖ Invariant Direct Sums	16 hours
Unit-III	**The Rational and Jordan Forms** ❖ Cyclic Subspaces and Annihilators ❖ Cyclic Decompositions and the Rational Form	14 hours
Unit-IV	❖ The Jordan Form ❖ Computations of Invariant Factors	15 hours
Unit-V	**Bilinear Forms**	

	❖ Bilinear Forms ❖ Symmetric Bilinear Forms	15 hours
Text Book	Kenneth Hoffman and Ray Kunge. (2010). *Linear Algebra*. Second Edition. New Delhi: PHI learning Private Ltd.	
Reference Books	1. I. N. Herstein. (1981). *Topics in Algebra.* Vikas publishing house pvt. Ltd.,. 2. S. Kumaresan . (2001). *Linear Algebra.* Prentice-Hall of India. 3. Serge Lang. (2005). *Introduction to linear algebra*. Springer.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 09 **Title : MEASURE AND INTEGRATION**		
Hrs/ Week	6	**Credits :** 4
Objectives	This course is designed to provide the learners i. an introduction to outermeasure, measurable sets, measurable functions ii. a solid foundation in the Labegue integration theory iii. an opportunity to study and analysis general convergence theorems, Hahn Decomposition theorem, Jordan Decomposition theorem, Radon-Nikodym theorem and L^P spaces.	
Unit	**Contents**	**Hrs**
Unit-I	**Lebesgue Measure:** Introduction, Outer measure, Measurable sets and Lebesgue measure, Measurable functions, and Littlewood's three principles.	14 hours
Unit-II	**The Lebesgue Integral:** The Lebesgue integral of a bounded function over a set of finite measure, The integral of a non negative function, The general Lebesgue integral and Convergence in measure.	16 hours
Unit-III	**Differentiation and Integration:** Differentiation of monotone functions, Functions of bounded variation, Differentiation of an integral and absolute continuity.	15 hours
Unit-IV	**Measure and Integration:** Measure spaces, Measurable functions and Integration and General Convergence theorems.	14 hours
Unit-V	**Radon-Nikodym Theorem:**	

	Signed measures, The Radon-Nikodym Theorem and The L^p spaces.	16 hours
Text Book	Real Analysis, H.L.Royden, 3rd Edition, Macmillan Publishing Company, New York.	
Reference Books	1. Walter Rudin. (1976). *Principles of Mathematical Analysis.* Third Edition. New York: McGraw – Hill.Inc. 2. De Barra, G. (1981). *Measure Theory and Integration*, New Delhi: Wiley Eastern.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year : 2011**
Subject code : 11 PMS 10 **Title : PARTIAL DIFFERENTIAL EQUATIONS**		
Hrs/ Week	6	**Credits : 4**
Objectives	On completion of the course the students are expected to have i. Obtained 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.	

Unit	**Contents**	**Hrs**
Unit-I	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.	15 hours
Unit-II	Linear partial differential equations with **c**onstant co-efficients and Equations with variable coefficients.	14 hours
Unit-III	Method of separation of variables and the method of integral transforms.	14 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.	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.	16 hours
Text Book	Ian Sneddon. *Elementary Partial Differential Equations.*	
Reference Books	1. Michael Renardy and Robert C. Rogers. (2004). *An Introduction to Partial Differential Equations.* Second Edition. Springer. 2. Robert C. Mc Owen. (2004). *Partial Differential Equations, Methods and Applications.* Second Edition. Pearson Education, Inc.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 11 **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, Hamilton's equations and various simple but important results related to them. ii. obtained a sound knowledge in Hamilton-Jacobi theory iii. grasped the basics of relativity	
Unit	**Contents**	**Hrs**
Unit-I	**LAGRANGE'S EQUATIONS** Derivation of Lagrange's equations, Examples and Integrals of the Motion.	15 hours
Unit-II	**HAMILTON'S EQUATIONS** Hamilton's Principle, Hamilton's Equations and Other Variational Principles.	15 hours
Unit-III	**HAMILTON-JACOBI THEORY** Hamilton's Principal Function, The Hamilton-Jacobi Equation and Separability.	15 hours
Unit-IV	**INTRODUCTION TO RELATIVITY** Introduction and Relativistic Kinematics.	15 hours
Unit-V	**INTRODUCTION TO RELATIVITY** Relativistic Dynamics and Accelerated Systems.	15 hours
Text Book	Donald T. Greenwood. (1990). *Classical Dynamics.* New Delhi: Prentice-Hall of India.	
Reference Books	1. Goldstein, H. (1950). *Classical Mechanics*. Addison Wesley Press, Inc. 2. Synge, J.L. and Griffith, B.A. (1959). *Principles of Mechanics*. Third Edition. McGraw-Hill company. 3. Robert Resnick. *Introduction to special Relativity*. Wiley Eastern Limited.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 12 **Title : VISUAL BASIC**		
Hrs/ Week	4	**Credits :** 3
Objectives	Visual Basic is one of the most powerful Languages in the field of computer science. This paper enables the students i. to understand basic concepts, notions and visual basic environment ii. to enhance their skills in developing graphics iii. to write simple visual basic programs.	
Unit	**Contents**	**Hrs**
Unit-I	**Getting started with Visual Basic:** Introduction to Visual Basic, Visual Basic programming environment, properties, methods and events, Getting started with an application, Adding code for the program, Creating an executable file, Visual Basic programming fundamentals, Modules, Data types, Variables Public VS Local variables Static variables, Procedures, Sub procedures, Function procedures, Property procedures, Control structures If---Then, Select ----case statement, Do while----- loop, Do ---- loop while structure, the for ----next loop, Exit ----for and Exit Do statement.	10 hours
Unit-II	**Working with controls, menus:** Creating and using controls, Control categories, Tab index property of controls, Using option button control, Using List box and combo box controls, using scroll bar control, Working with control arrays, creating control arrays at design time, adding a control arrays at runtime, control array application, events in the control array application, Menu interface, using the menu editor, writing a program, writing code for menu controls, adding a separator bar and shortcut keys, Menus, Pop-up, making menu controls	

	invisible, using check marks and menu control arrays.	10 hours
Unit-III	**Mouse events and dialog boxes, and Graphics:** Mouse events, positioning a control, graphical mouse application, mouse mouse application, dragging and dropping, Dialog boxes, model and modeless dialog boxes, predefined dialog boxes using input box function custom dialog control, using the command dialog control, Graphics for application, fundamentals of graphics, using graphical controls, line control, shape control, image control, adding pictures, removing pictures, moving and sizing pictures, using graphics methods.	10 hours
Unit-IV	**Objects and classes:** Introduction to objects, encapsulation, polymorphism, object variables, the new keyword, Working with objects, controlling objects with their properties, setting property values, getting property values, performing actions with methods, using methods in code, specific and generic object types, forms as objects, constructors and destructors, classes and class modules, creating a new class modules steps to create a class module, coding included in the code window of the class module, using the thing object and running the project.	10 hours
Unit-V	**MDI and GRID, Files system controls:** Multiple document interface, Creating an MDI application, Adjusting the textbox, Creating a toolbox, Creating a Status bar, Using the grid control, Changing the cell width and cell height, Entering the values in the columns, Using Graphics in grid control, Scroll bars of the grid control, File system controls, Accessing files, Random access files, Opening the random access file, Sequential access files, Binary access files and Interfacing with Windows working with the active control property.	10 hours
Text & Reference Books	1. Gary Cornell. *Visual Basic 5.0* from the ground up. 2. Martin L. Rinehart. *Visual Basic 5.0 Power OOP*.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 13 **Title : PROGRAMMING LAB IN VISUAL BASIC**		
Hrs/ Week	2	**Credits : 2**

List of programs:

1. Write a program to prepare a statement of marks.
2. Write a program to draw the curves.
3. Write a program to calculate the sales bill.
4. Write a program to create file options using common dialog box.
5. Write a program to calculate the pay slip.
6. Write a program to design a calculator using control array.
7. Write a program to calculate the conversion of units using menu editor.
8. Write a program for the admission to professional courses using scrollbar and options buttons.
9. Write a program to calculate arithmetic functions using menu editor.
10. Write a program to design the admission system using input screen.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 15 **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.	
Unit	**Contents**	**Hrs**
Unit-I	Topological spaces, Basis for a topology, The order topology, The product topology on X ×Y, The subspace topology, Closed sets and Limit points	15 hours
Unit-II	Continuous functions, The metric topology, The metric topology (Continued)	14 hours
Unit-III	Connected spaces, Connected subspaces of the real line, Components and Local Connectedness, Compact spaces	15 hours
Unit-IV	The Separation axioms, Normal spaces, The Urysohn lemma, The Urysohn Metrization Theorem, The Tietz Extension theorem	16 hours
Unit-V	The Tychonoff theorem, The Stone-Cech Compactification, Metrization theorems and Para Compactness, The Nagata-Smirnov Metrization theorem, The Smirnov Metrization Theorem, Complete metric spaces	15 hours
Text Book	Munkres, J.R. (2000). *Topology*. Second Edition. Pearson Education, Inc.	
Reference Books	1. Simmons, G.F. (1963). *Introduction to topology and modern analysis*. Tata Mc Graw Hill book company, INC. 2. Dugundji, J. (1975). *Topology*. Prentice Hall of India. 3. John L. Kelly. (1968). *General Topology*. Van Nostrand Reinhold Company. 4. Stephen Willard. (1970). *General Topology*. Addision Wesley. 5. Benjamin T.sims. (1976). *Fundamentals of Topology*. Macmillan Publishing Company.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 16 **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.	

Unit	**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 (Omit Example 2.7 (VI) P.No .83, 84).	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.	16 hours

Unit-III	Operators on Normed Linear Spaces Bounded Operators (Omit Example 3.1(viii) - P.No. 130) Some Basic Results and Examples The Space ß (X, Y) Norm on ß (X,Y) (Omit Example 3.3 (x) - P.No.142-143 and omit some estimates for norms of certain operators P.No.144-148) Riesz Representation Theorem Completeness of ß (X, Y) Bessel's Inequality Fourier Expansion and Parseval's Formula Riesz-Fischer Theorem	16 hours
Unit-IV	Hahn-Banach Theorem and Its Consequences The Extension Theorem Consequences On Uniqueness of Extension Separation Theorem	14 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	14 hours
Text Book	Thamban Nair, M. (2002). *Functional Analysis - A First Course.* New Delhi: Prentice Hall of India Pvt. Ltd.	
Reference Books	1. Limaye, B.V. (1981). *Functional Analysis.* New Delhi: Wiley Eastern. 2. Simmons, G.F. (1963). *Introduction to Topology and Modern Analysis.* Tokyo: McGraw-Hill Kogakusha.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PME 17 **Title : COMBINATORICS**		
Hrs/ Week	6	**Credits :** 4
Objectives	On completion of the course the learners are expected i. to have gained a working knowledge of the basic ideas and techniques of the subject ii. to handle various aspects of assignment problems, beginning with the famous result of Philip Hall, and on to various applications. iii. to deal with configurations iv. to have a sound knowledge of block designs and its applications to error correcting codes v. to understand the Steiner system S(5, 8, 24) and the construction of Leech Lattice in 24 dimensions.	
Unit	**Contents**	**Hrs**
Unit-I	Introduction to basic ideas, Selections and binomial coefficients, Permutations, Ordered selections, Unordered selections, Further remarks on the binomial theorem and Miscellaneous	15 hours
Unit-II	**Pairings problems:** Pairings within a set, Pairings between sets, an optimal assignment problem and Gale's optimal assignment problem.	14 hours
Unit-III	**Recurrence:** Some miscellaneous problems, Fibonacci type relations, Using generating Functions, Miscellaneous methods and Counting simple electrical networks.	16 hours
Unit-IV	**The Inclusion, Exclusion principle:** The principle, The Rook Polynomials, Steiner systems and sphere packings: Introductory remarks, Steiner systems S (5, 8, 24) and Leech's lattice.	16 hours
Unit-V	**Block Designs and Error correcting codes:** Block designs, Square block designs, Hadamard configurations and Error correcting codes.	14 hours
Text Book	Ian Anderson. (1974). *A first course in combinatorial Mathematics.* Oxford University press.	

Reference Books	1. Krishnamurthy, V. (1986). *Combinatorics.* New Delhi: Affiliated east west press pvt ltd. 2. Balakrishnan, V.K. and Balakrishnan, V. (1984). *Schaum's outline of Combinatorics.* Mcgraw hill publishers.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PME 18 **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.	

Unit	**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.	15 hours
Unit-II	**Connectivity:** Connectivity and Blocks. Euler Tours and Hamilton cycles: Euler tours and Hamilton cycles.	14 hours
Unit-III	Matchings: Matchings, Matchings and coverings in bipartite graphs and perfect matchings. Independent sets and Cliques: Independent sets.	15 hours
Unit-IV	**Edge Colourings:** Edge chromatic number and Vizing's theorem. Vertex Colourings: Chromatic number, Brooks' theorem, Hajo's Conjecture - Dirac's Theorem, Chromatic polynomials, Girth and chromatic number.	16 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.	15 hours

Text Book	Bondy, J.A. and Murty, U.S.R. (1976). *Graph Theory with Applications*, Macmillan Company.
Reference Books	1. Balakrishnan, R. and Ranganathan, K. (2000). *A Text Book on Graph Theory*. New York: Springer Verlog. 2. Gould, R. (1988). *Graph Theory*. California: The Benjamin/ Cummings Publishing Company, Inc. 3. Hartsfield, N. and Ringel, G. (1990). *Pearls in Graph Theory*. Academic Press.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 19 **Title : JAVA PROGAMMING**		
Hrs/ Week	4	**Credits :** 3
Objectives	JAVA has now emerged as the language of choice of the world computing community due to its simplicity, portability and security. Java, the only pure object oriented language available to say, is now used in almost all applications, from simple home appliances control systems to complex space control systems. The ultimate goal of this course content is to develop Java programs, both applications and applets.	
Unit	**Contents**	**Hrs**
Unit-I	Fundamentals of Object-Oriented Programming, Java Evolution, Overview of Java Language, Constants, Variables and Data Types.	10 hours
Unit-II	Operators and Expressions, Decision making and Branching, Decision making and looping, Arrays, Strings and Vectors.	10 hours
Unit-III	Classes, Objects and Methods, Interfaces: Multiple Inheritances.	9 hours
Unit-IV	Packages: Putting Classes Together, Multithreaded programming, Managing errors and exceptions.	10 hours
Unit-V	Applet programming, How applet differ from applications, Preparing to write applets, Building applet code, Applet life cycle, Creating an executable applet, Designing a web page, Applet Tag, Adding Applet to HTML File, Running the Applet.	11 hours
Text Book	Balaguruswamy, E. (1998). *Programming with JAVA*. Second Edition. Tata Mc GRAW hill.	
Reference Book	Patric Naughton. (1996). *Java hand book*. Tata McGRAW Hill.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 20 **Title : PROGRAMMING LAB IN JAVA**		
Hrs/ Week	2	**Credits :** 2

List of programs:

1. Program to count the number of digits, alphabets and special characters in a string.
2. Program to read a string and rewrite it in the alphabetic order
3. Program to sort given n names
4. Program for matrix multiplication
5. Program to find the transpose of a square matrix, the sum of elements and largest element
6. Program to sort the array of given names
7. Program to accept a shopping list of a few items from the command line and store them in a vector. Also perform the following:
    a. delete an item in the list
    b. add an item at a specified location in the list
    c. add an item at the end of the list
    d. print the contents of the vector
8. Program to demonstrate the stack class by creating two integers stacks that pushes some values onto each and pops them off.
9. Designing a website having minimum of three web pages
10. Designing a web page of our college offering courses and an applet for selecting the smallest, largest and the sum of three numbers
11. Designing a web page with an applet to display bar chart for a diabetic patient for the data given: Period: Week1 Week2 Week3 Week4 Week5 Week6 Week7

    Level: 170 130 230 160 150 140 180

    Include hospital name, Patients name, Age, Sex in the web page

12. Program to create a class "Account" that stores customer name, account number and type of accounts. From this derive the classes "curr_acct" and "sb_acct" to them more

specific to their requirements. Include necessary methods in order to achieve the following tasks.

a. Accept deposit from a customer and update the balance.

b. Display the balance

c. Permit withdrawal and update the balance.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PMS 22 **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.	

Unit	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.	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.	16 hours

Unit-III	**Laplace's equation** Stream function in 2 dimensional motion- The Flow net-Stream function in three dimensional motion- Two dimensional flow examples- Three dimensional axially symmetric flow examples.	14 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.	14 hours
Unit-V	**Laminar flow of viscous incompressible fluids and Boundary Layer Theory** Flow between parallel flat plates- Steady flow in pipes, Flow through a pipe – The Hagen- Poiseuille flow- Boundary layer concept- The boundary layer equations in two dimensional flow- The boundary layer along a flat plate- The Blasius solution.	15 hours
Text Book	Yuan, S.W. (1988). *Foundations of fluid mechanics.* New Delhi: Prentice Hall of India Pvt. Ltd.	
Reference Books	1. Curle, N and Davies, H.J. (1971). *Modern Fluid Dynamics.* London: Van Nostrand publishers. 2. Shanthi Swarup. (2000). *Fluid dynamics.* Meerut: Krishna Prakasan media Pvt. Ltd. 3. Frank Chorlton. (1985). *Text book on fluid dynamics*. Delhi: CBS Publishers and Distributors.	

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PME 23 **Title : OPERATOR THEORY**		
Hrs/ Week	6	**Credits :** 4
Objectives	On completion of the course the students are expected (i) To understand the concepts of Dual space, Reflexivity, Weak convergence and Compact operators and to illustrate them with examples. (ii) To have a clear understanding of Spectrum, Resolvent set of an operator and Spectral mapping theorem (iii) To have well founded knowledge in adjoint of an operators, self adjoint operators, normal operators, unitary operators and their properties.	
Unit	**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	15 hours
Unit-II	Reflexivity and Weak Convergence – Reflexivity - Weak Convergence - Best Approximation in Reflexive Spaces	14 hours
Unit-III	Compact Operators - Some Characterizations - Space of Compact Operators - Further Properties	14 hours
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)	16 hours
Unit-V	Operators on Hilbert Spaces - Adjoint of an Operator - Compactness of the Adjoint Operator - Sesquilinear Functionals - Self-Adjoint, Normal and Unitary Operators - Numerical Range and Numerical Radius - Some Characterizations	16 hours
Text Book	Thamban Nair, M. (2002). *Functional Analysis - A First Course.* New Delhi: Prentice Hall of India Pvt. Ltd.	
Reference Books	1. Simmons, G.F. (1963). *Introduction to Topology and Modern Analysis.* Tokyo: McGraw-Hill Kogakusha.	

	2. Sunder, V.S. (1997). *Functional Analysis: Spectral Theory*. New Delhi: Hindustan Book Agency. 3. Taylor, A.E. and Lay, D.C. (1980). *Introduction to Functional Analysis.* Second Edition. New York: Wiley.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PME 24 **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.	

Unit	**Contents**	**Hrs**
Unit-I	**Observability:** Linear Systems, Observability Grammian, Constant coefficient systems, Reconstruction kernel and Nonlinear Systems.	16 hours
Unit-II	**Controllability:** Linear Systems, Controllability Grammian, Adjoint Systems, Constant coefficient systems, Steering function and Controllability of Nonlinear System.	15 hours
Unit-III	**Stability:** Stability, Uniform Stability and Asymptotic Stability of Linear Systems. Perturbed linear systems and Nonlinear systems.	14 hours
Unit-IV	**Stabilizability:** Stabilization via linear feedback control, Bass method, The Controllable subspace and Stabilization with restricted feedback.	15 hours
Unit-V	**Optimal Control:** Linear time varying systems with quadratic performance criteria. Linear time invariant systems and nonlinear systems.	15 hours

Text Book	Balachandran, K. and Dauer, J.P. (1999). *Elements of Control Theory*. New Delhi: Narosa.
Reference Books	1. Conti, R. (1976). *Linear Differential Equations and Control*. London: Academic Press. 2. Curtain, R.F. and Pitchard, A.J. (1977). *Functional Analysis and Modern Applied Mathematics*. New York: Academic Press. 3. Klamka, J. (1991). *Controllability of Dynamical Systems*.

	Dordrecht: Klumer Academic Publisher. 4. Russell, D.L. (1979). *Mathematics of Finite Dimensional Control Systems*. New York: Marcel Dekker.

Department	Mathematics	
Course	M.Sc	**Effective From the Year :** 2011
Subject code : 11 PME 25 **Title : STOCHASTIC DIFFERENTIAL EQUATIONS**		
Hrs/ Week	6	**Credits :** 4
Objectives	Stochastic differential equation have a wide range of applications inside as well as outside mathematics and the subject has a rapidly developing life of its own as a fascinating research field with many interesting unanswered questions. The course needs some background in measure theory. In this paper six problems are introduced where stochastic differential equations play an essential role in finding their solutions, which will motivate the students for the further advance studies in this and related branches of mathematics.	

Unit	Contents	Hrs
Unit-I	**Introduction:** Stochastic Analogs of Classical Differential Equations, Filtering Problems, Stochastic Approach to Deterministic Boundary Value Problems, Optimal Stopping, Stochastic Control and Mathematical Finance. **Some Mathematical Preliminaries:** Probability Spaces, Random Variables and Stochastic Processes and an Important Example: Brownian motion.	15 hours
Unit-II	**Ito Integrals:** Construction of the Ito Integral, Some Properties of the Ito Integral and Extensions of the Ito Integral.	14 hours
Unit-III	**The Ito Formula and The Martingale Representation Theorem:** The 1-dimensional Ito Formula, the Multi-dimensional Ito Formula and the Martingale Representation Theorem **Stochastic Differential Equations:** Examples and Some Solution Methods, An Existence and Uniqueness Result and Weak and Strong Solutions.	16 hours
Unit-IV	**The Filtering Problem:** Introduction, the 1-dimensional Linear Filtering Problem and the Multidimensional Linear Filtering Problem.	14 hours

Unit-V	**Diffusions: Basic Properties:** The Markov Property, the Strong Markov Property, the Generator of Ito Diffusion, the Dynkin Formula, and the Characteristic Operator.	16 hours
Text Book	Bernt Oksendal. (2003). *Stochastic Differential Equations – An Introduction with Applications.* Sixth Edition. Heidelberg: Springer-Verlog.	
Reference Book	J. Medhi. (2009). *Stochastic Processes.* Third Edition. New Age International(p) ltd.	

Department	Mathematics	
Course	M. Sc	**Effective From the Year :** 2013
Subject code : 12PMS26 **Title : LATEX**		
Hrs/ Week	4	**Credits : 2**
Objectives		

Unit	**Contents**	**Hrs**
Unit-I	Text formatting, TEX and its offspring, What's different in LATEX 2ε, Distinguishing LATEX 2ε, Basics of a LATEX file.	08
Unit-II	Commands and environments – Command names and arguments, Environments, Declarations, Lengths, Special Characters, Fragile Commands, Exercises.	10
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.	10
Unit-IV	Tables, Printing literal text, Footnotes and marginal notes, Drawing pictures with Latex.	10
Unit-V	Mathematical formulas – Mathematical environments, Main elements of math mode, Mathematical symbols, Additional elements, Fine – tuning mathematics.	10

Text Book	Kopka.H and Daly P.W. (1999) *A Guide to Latex, Third Edition, Addison – Wesley, London*.
Reference Books	1. George Gratzer . (2007). *More Math into latex, Fourth Edition, Springer*. 2. www.tug.org.in/tutorials.html. *A latex primer*

Department	Mathematics	
Course	M. Sc	**Effective From the Year :** 2013
Subject code : 12PMS27 **Title : PROGRAMMING LAB IN LATEX**		
Hrs/ Week	2	**Credits : 1**
Objectives		
	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.	