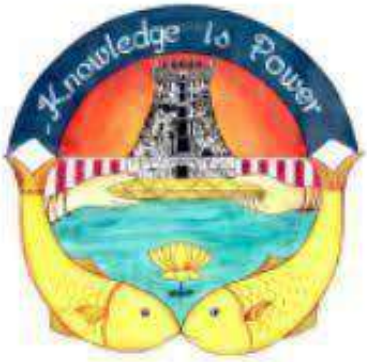
SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN (AUTONOMOUS) MADURAI -2



DEPARTMENT OF MATHEMATICS

CBCS course structure for M.Sc. Mathematics as directed by

Tamil Nadu State Council for Higher Education
(2024 onwards)

SRI MEENAKSHI GOVERNMENT ARTS COLLEGE FOR WOMEN(A)
MADURAI- 625 002

DEPARTMENT OF MATHEMATICS

The Department of Mathematics is offering B.Sc. Mathematics since 1966 and M.Sc. Mathematics since 1980.

The Department of Mathematics has got 11 teaching staff in total that are permanent. In this department there 8 Ph.D., holders, 3 M.Phil., holders and 5 teaching staff are Guest Lecturers, four of them are Ph.D., holders and one of them is M.Phil., holder

Five of the staff members have degree in pedagogy. Three faculty members have PGDCA qualification.

Vision

To Empower Women Students to Attain Academic Excellence

Mission

To Provide a strong foundation in Mathematics which will enable our students to excel in pedagogy and research

Goal

To groom our young students capable of discharging professional, social and economic responsibilities ethically.

Program Outcomes

The successful completion of M.Sc. Program will enable the students to:

PO1 Getting enriched by the existing knowledge in their respective disciplines and applying appropriate methodology for research and implementation.

PO2 Develop technology compatible to new perceptions and evolve innovative pedagogy in their discipline.

PO3 Design creative projects and translate it to the present-day scenario.

PO4 Evaluate the issues and challenges pertaining to their disciplines and synergize them with the growing needs in their area.

PO5 Explore the diverse value systems of our nation and contribute towards building an egalitarian society

Program Specific Outcomes

On successful completion of M.Sc. Mathematics Program students will be able to:

PSO1 Acquire mastery in the core subjects and gain in-depth knowledge in applications of mathematics.

PSO2 Master a wide range of mathematical skills.

PSO3 Develop the ability to model real life problems using the mathematical concepts.

PSO4 Identify the appropriate problem solving technique which can be applied to any given mathematical model.

PSO5 Tackle competitive examinations like CSIR, JRF/NET, TRB recruitment etc with confidence.

M.Sc. Mathematics (2024 Onwards)

Semester	Course Type	Title of the Paper	Hours/ Week	Credits	Exam Hours	Marks		
						Int.	Ext.	Total
Semester I								
	P23CM1	Algebraic Structures	6	6	3	25	75	100
	P23CM2	Real Analysis – I	6	6	3	25	75	100
	P23CM3	Ordinary Differential Equations	6	4	3	25	75	100
	P23DM01/ P23DM02	Number Theory and Cryptography / Graph Theory and Applications	6	3	3	25	75	100
	P23DM03/ P23DM04	Fuzzy Sets and Their Applications / Discrete Mathematics	6	3	3	25	75	100
		Total	**30**	**22**				**500**
Semester II								
	P23CM4	Advanced Algebra	6	5	3	25	75	100
	P23CM5	Real Analysis II	6	5	3	25	75	100
	P23CM6	Partial Differential Equations	6	4	3	25	75	100
	P23DM05/ P23DM06	Mathematical Statistics / Algebraic Topology	5	3	3	25	75	100
	P23DM07/ P23DM08	Wavelets / Machine Learning and Artificial Intelligence	5	3	3 3	25 25	75 75	100 100
	P23SEM1	Mathematical Documentation Using LATEX/other packages (Lab)	2	2	3	25	75	100
		Total	**30**	**22**				**600**

Semester III								
	P23CM7	Complex Analysis	6	5	3	25	75	100
	P23CM8	Probability Theory	6	5	3	25	75	100
	P23CM9	Topology	6	4	3	25	75	100
	P23CM10	Core Industrial Module: Resource Management Techniques	5	3	3	25	75	100
	P23DM09/ P23DM10	Fluid Dynamics / Algebraic Number Theory	5	3	3	25	75	100
	P23SEM2	Mathematical Logic and Reasoning	2	2	3	25	75	100
	P23S1M1	Internship/Industrial Activity (Summer)	-	2	-	-	-	100
		Total	**30**	**24**				**700**
Semester IV								
	P23CM11	Functional Analysis	6	5	3	25	75	100
	P23CM12	Mechanics	6	5	3	25	75	100
	P23MPW	Project with viva voce	10	7	-	60	40	100
	P23DM11/ P23DM12	Differential Geometry / Mathematical Python	5	3	3	25	75	100
	P23SEM3	Professional Competency Skill: Mathematics for NET/UGC – CSIR/ SET/TRB Competitive Examinations	3	2	3	25	75	100
	P23EAM	Extension Activity	-	1	-	-	-	100
		Total	**30**	**23**				**700**

M.Sc. Mathematics (2024 onwards)

Core, Generic Elective, Discipline Specific Elective

EVALUATION PATTERN

Internal	:	25
External	:	75
Total	:	100

Passing Minimum	No Internal Minimum	:	50 Marks
External Minimum		:	45% (34 Marks)
Internal and External together		:	50%

Question Paper Pattern

Time: 3 hours Max Marks : 75

Section A

5 Questions . 5 x 5 marks = 25 marks

(Two Questions in 'Either– or' type from Each Unit)

Section B

5 Questions . 5×10 marks = 50 marks

(Two Questions in 'Either–or' type from Each Unit)

SEMESTER I

COURSE CODE: P23CM1 **Hours: 6/W 90hrs/Sem**

Title of the Paper: ALGEBRAIC STRUCTURES (CORE) **Credits: 6**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

Course Outcomes On completing this course, Students will be able to		**Unit**	**Hours/Sem**
CO1	Recall basic counting principle, define class equations to solve problems, explain Sylow's theorems and apply the theorem to find number of Sylow subgroups	I	18
CO2	Define Solvable groups, define direct products, examine the properties of finite abelian groups, define modules	II	18
CO3	Define similar Transformations, define invariant subspace, explore the properties of triangular matrix, to find the index of nilpotence to decompose a space into invariant subspaces, to find invariants of linear transformation, to explore the properties of nilpotent transformation relating nilpotence with invariants.	III	18
CO4	Define Jordan, canonical form, Jordan blocks, define rational canonical form, define companion matrix of polynomial, find the elementary devices of transformation, apply the concepts to find characteristic polynomial of linear transformation.	IV	18
CO5	Define trace, define transpose of a matrix, explain the properties of trace and transpose, to find trace, to find transpose of matrix, to prove Jacobson lemma using the triangular form, define symmetric matrix, skew symmetric matrix, adjoint, to define Hermitian, unitary, normal transformations and to verify whether the transformation in Hermitian, unitary and normal	V	18

	Program Outcomes						**Program Specific Out comes**		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER I
P23CM1 – ALGEBRAIC STRUCTURES

Lecture Hours : 6 **Credits : 6**

UNIT I

Counting Principle - Class equation for finite groups and its applications – Sylow's theorems (For theorem 2.12.1, First proof only).

UNIT II

Solvable groups - Direct products - Finite abelian groups- Modules

UNIT III

Linear Transformations: Canonical forms –Triangular form - Nilpotent transformations.

UNIT IV

Jordan form - rational canonical form.

UNIT V

Trace and transpose - Hermitian, unitary, normal transformations, real quadratic form.

TEXT BOOK: I.N. Herstein. Topics in Algebra (II Edition) Wiley Eastern Limited, New Delhi, 1975.

Unit I : Chapter 2: Sections 2.11 and 2.12 (Omit Lemma 2.12.5)

Unit II : Chapter 5 : Section 5.7 (Lemma 5.7.1, Lemma 5.7.2, Theorem 5.7.1)
Chapter 2: Section 2.13 and 2.14 (Theorem 2.14.1 only)
Chapter 4: Section 4.5

Unit III: Chapter 6: Sections6.4,6.5

Unit IV : Chapter 6 : Sections 6.6 and 6.7

Unit V: Chapter 6 : Sections 6.8, 6.10 and 6.11 (Omit 6.9)

REFERRENCE BOOKS

1. M.Artin, Algebra, Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition) Cambridge University Press, 1997. (Indian Edition)
3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. Rings, Narosa Publishing House , New Delhi, 1999
4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of Abstract Algebra, McGraw Hill (International Edition), New York. 1997.
5. N.Jacobson, Basic Algebra, Vol. I & II W.H.Freeman 1980); also published by Hindustan Publishing Company, New Delhi.

Website and e-Learning Source

http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org, www.algebra.com.

Semester I

COURSE CODE :P23CM2 **Hours: 6/W 90hrs/Sem**

Title of the Paper: REAL ANALYSIS - I (CORE) **Credits: 6**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	1	-

	Course Outcomes On completing this course ,students will be able to	Unit	Hours
CO1	Analyze and evaluate functions of bounded variation and Rectifiable Curves.	**I**	**18**
CO2	Describe the concept of Riemann-Stieltjes integral and its properties	**II**	**18**
CO3	Demonstrate the concept of step function, upper function, Lebesgue function and their integrals	**III**	**18**
CO4	Construct various mathematical proofs using the properties of Lebesgue integrals and establish the Levi monotone convergence theorem.	**IV**	**18**
CO5	Formulate the concept and properties of inner products, norms and measurable functions.	**V**	**18**

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

SEMESTER I
P23CM2 REAL ANALYSIS – I

Lecture Hours : 6 **Credits : 6**

UNIT-I

Functions of bounded variation - Introduction - Properties of monotonic functions - Functions of bounded variation - Total variation - Additive property of total variation - Total variation on [a, x] as a function of x - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation.

Infinite Series : Absolute and conditional convergence - Dirichlet's test and Abel's test - Rearrangement of series - Riemann's theorem on conditionally convergent series.

UNIT-II

The Riemann - Stieltjes Integral - Introduction - Notation - The definition of the Riemann - Stieltjes integral - Linear Properties - Integration by parts- Change of variable in a Riemann - Stieltjes integral - Reduction to a Riemann Integral – Euler's summation formula - Monotonically increasing integrators, Upper and lower integrals - Additive and linearity properties of upper, lower integrals - Riemann's condition -Comparison theorems.

UNIT-III

The Riemann-Stieltjes Integral - Integrators of bounded variation-Sufficient conditions for the existence of Riemann-Stieltjes integrals-Necessary conditions for the existence of RS integrals- Mean value theorems -integrals as a function of the interval – Second fundamental theorem of integral calculus-Change of variable -Second Mean Value Theorem for Riemann integral- Riemann-Stieltjes integrals depending on a parameter-Differentiation under integral sign-Lebesgue criteriaon for existence of Riemann integrals.

UNIT-IV

Infinite Series and infinite Products - Double sequences - Double series Rearrangement theorem for double series - A sufficient condition for equality of iterated series - Multiplication of series – Cesaro summability - Infinite products.

Power series - Multiplication of power series - The Taylor's series generated by a function - Bernstein's theorem - Abel's limit theorem - Tauber's theorem.

UNIT-V

Sequences of Functions – Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions - Uniform convergence and continuity - Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions - Riemann - Stieltjes integration – Non-uniform Convergence and Term-by-term Integration - Uniform convergence and differentiation - Sufficient condition for uniform convergence of a series - Mean convergence.

TEXT BOOK

Tom M. Apostol, *Mathematical Analysis*, Second edition, Addison Wesley Publishing Company Inc. Newyork, 1974 .

Unit I : Chapter 6 - Sections 6.1 to 6.8, Chapter 8 - Sections 8.8, 8.15, 8.17, 8.18
Unit II : Chapter 7 - Sections 7.1 to 7.14
Unit III : Chapter 7 - Sections 7.15 to 7.26
Unit IV : Chapter 8 - Sections 8.20 to 8.26,
Chapter 9 - Sections 9.14, 9.15, 9.19, 9.20, 9.22, 9.23
Unit V : Chapter 9 - Sections 9.1 to 9.6, 9.8 to 9.11, 9.13

Reference Books:

1. Bartle, R.G., *Real Analysis*, John Wiley and Sons Inc., 1976.
2. Rudin,W. *Principles of Mathematical Analysis*, 3rd Edition. McGraw Hill Company, New York, 1976.
3. Malik,S.C. and Savita Arora, *Mathematical Anslysis*, Wiley Eastern Limited.

New Delhi, 1991.

4. Sanjay Arora and Bansi Lal, *Introduction to Real Analysis*, Satya Prakashan, New Delhi, 1991.
5. Gelbaum, B.R. and J. Olmsted, *Counter Examples in Analysis*, Holden day, San Francisco, 1964.
6. A.L.Gupta and N.R.Gupta, *Principles of Real Analysis*, Pearson Education, (Indian print)

2003.

Website and e-Learning Source:

http://mathforum.org,

http://ocw.mit.edu/ocwweb/Mathematics,http://ww

w.opensource.org,www.mathpages.com.

Semester I

COURSE CODE : P23CM3

Title of the Paper: ORDINARY DIFFERENTIAL EQUATIONS (CORE)

Hours: 6/W 90hrs/Sem **Credits:4**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

Course Outcomes

	On completing this course, Students will be able to	Unit	Hours
CO1	Establish the qualitative behaviour of solutions of systems of differential equations	**I**	**18**
CO2	Recognize the physical phenomena model by differential equations and dynamical systems.	**II**	**18**
CO3	Analyze solutions using appropriate methods and give examples.	**III**	**18**
CO4	Formulate Green's function for boundary value problems.	**IV**	**18**
CO5	Understand and use various theoretical ideas and results that underlie the mathematics in this course	**V**	**18**

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER I

P23CM3- ORDINARY DIFFERENTIAL EQUATIONS

Lecture Hours : 6 **Credits :4**

Unit I

Linear equations with constant coefficients: Second order homogeneous equations – Initial value problems – Linear dependence and independence – Wronskian and a formula for Wronskian – Non-homogeneous equation of order two.

Unit II

Linear equations with constant coefficients: Homogeneous and non-homogeneous equation of order n -Initial value problems - Annihilator method to solve nonhomogeneous equation -Algebra of constant coefficient operators.

Unit III

Linear equations with variable coefficients: Initial value problems – Existence and uniqueness theorems - Solutions to solve a non-homogeneous equation – Wronskian and linear dependence – Reduction of the order of a homogenous equation – Homogenous equations with analytic Coefficients - The Legendre equation.

Unit IV

Linear equations with regular singular points: The Euler equation - Second order equations with regular singular points – The exceptional cases – Bessel function.

Unit V

Existence and uniqueness of solutions to first order equations: Equations with variables separated – Exact equation – Method of successive approximations –The Lipschitz condition – Convergence of the successive approximations and the existence theorem.

TEXT BOOK

E. A. Coddington, An introduction to ordinary differential equations (3rd printing) Prentice Hall of India Ltd., New Delhi, 1987

Unit I: Chapter 2: Sections 1 to 6.
Unit II: Chapter 2: Sections 7 to 12.
Unit III: Chapter 3: Sections 1 to 8.
Unit IV: Chapter 4: Sections 1 to 4 and 6 to 8
Unit V: Chapter 5: Sections 1 to 6

REFERENCE BOOKS

1. Williams E. Boyce and Richard C. DI Prima, *Elementary differential equations and boundary value problems*, John Wiley and sons, New York, 1967.
2. George F Simmons, *Differential equations with applications and historical notes,* Tata McGraw Hill, New Delhi, 1974.
3. N.N. Lebedev, *Special functions and their applications*, Prentice Hall of India, New Delhi, 1965.
4. W.T. Reid, *Ordinary Differential Equations*, John Wiley and Sons, New York, 1971 5.M.D.Raisinghania, *Advanced Differential Equations*, S. Chand& Company Ltd. New Delhi
   2001.
5. B.Rai, D.P. Choudary and H.I. Freedman, *A Course in Ordinary Differential Equations,* Narosa Publishing House, New Delhi, 2002.

Website and e-Learning

Sourcehttp://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org,www.mathpages.com

Semester I

COURSE CODE :P23DM01 Hours: 6/W 90hrs/Sem

Title of the Paper: NUMBER THEORY AND CRYPTOGRAPHY Credits:3

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

	Course Outcomes On completing this course the students will be able to	Unit	Hours/Sem.
CO1	understand problems in elementary number theory	I	18
CO2	apply elementary number theory to Cryptography	II	18
CO3	develop a deep understanding of theoretical basis of number theory and Cryptography	III	18
CO4	identify how number theory is related and applied in Cryptography	IV	18
CO5	develops knowledge of encryption and decryption and their application in managing the security of data.	V	18

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER I

NUMBER THEORY AND CRYPTOGRAPHY-(P23DM01)

Lecture hours : 6 **Credits : 3**

UNIT I

Introduction – Conjectures, Theorems, and Proofs-Well Ordering and Induction-Sigma Notation and Product Notation Binomial Coefficients- Greatest Integer Functions-Divisibility, Greatest Common Divisor, Euclid's algorithm; GCD via Euclid's algorithm- Least Common Multiple- Representation of integers

UNIT II

Introduction –Primes, Prime Counting Function. Prime Number Theorem; Test of Primality by Trial Division –Sieve of Eratosthenes, Canonical Factorization, Fundamental Theorem of Arithmetic.

UNIT III

Congruences and Equivalence Relations-Linear Congruences -Linear Diophantine Equations and the Chinese Remainder Theorem- Polynomial Congruences – Modular Arithmetic: Fermat's Theorem –Wilson's Theorem and Fermat Numbers.

UNIT IV

Introduction- Sigma Function. Tau Functions. Dirichlet Product –Dirichlet Inverse, Moebius Function, Euler's Function, Euler's Theorem.

UNIT V

Cryptography: Introduction – Some simple crypto systems –Enciphering Matrices–The idea of Public key Cryptography– RSA.

TEXT BOOKS

1.Neville Robbins; Beginning Number Theory, Second Edition, Narosa, 2006.
2.Neal Koblitz: A Course in Number Theory and Cryptography, Second edition, Springer-Verlag Newyork-1994.

Unit I : Text Book 1 – Chapter1 – Sections 1.1 to 1.6
Chapter2 – Sections 2.1 to 2.4

Unit II : Text Book 1 – Chapter3 – Sections 3.1 to 3.3

Unit III : Text Book 1 – Chapter 4 – Sections 4.2 to 4.4

Unit IV : Text Book 1 - Chapter5 –Sections 5.1 to 5.3

Unit V : Text Book 2 - Chapter III – Section1.2 and
Chapter IV – Section 1.2.

REFERENCE BOOKS

1. Cryptograpy and Network Security Principles and Practice by William Stallings, Prentice Hall, Fifth Edition, New Delhi, 2011.
2. Tom Apostol, Introduction to Analytic Number theory, Narosa Publications, New Delhi , 1998.
3. David M.Burton, Elementary Number Theory, Wm.C.Brown Publishers, Dubuque, Iowa, 1989.
4. Ivan Nivan, H. S. Zuckerman and H. L. Montgomery; An Introduction to the theory of Number, 5th Ed paperback-International Edition, 1991,

Semester I

COURSE CODE : P23DM02

Title of the Paper : Graph Theory and Applications

Hours: 6/W 90hrs/Sem **Credits:3**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

Course Outcomes:

	On completing this course, students will be able to	Unit	Hours
CO1	Understand and write precise mathematical definitions of objects in graph theory.	**I**	**18**
CO2	Understand the properties of trees and distance concept in graphs.	**II**	**18**
CO3	Identify Eulerian/Hamiltonian graphs, apply algorithms to construct Eulerian trails in graphs.	**III**	**18**
CO4	Enumerate properties of edge connectivity and understand the matching concept	**IIV**	**18**
CO5	Validate and critically assess the vertex coloring and planarity.	**V**	**18**

	Pos						**PSOs**		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

SEMESTER I

GRAPH THEORY AND APPLICATIONS (P23DM02)

Lecture Hours : 6 **Credits : 3**

UNIT I

Graphs and simple graphs, graphs isomorphism, the incidence and adjacency matrix, subgraphs, vertex degrees, paths and connection, cycles, applications.

UNIT II

Trees, cut edges and bonds, cut vertices, Cayle's formula, applications.

UNIT III

Connectivity, blocks, Euler tours, Hamiltonian cycles, application: the chinese postman problem.

UNIT IV

Matchings, matchings and coverings in bipartite graphs, perfect matchings, edge chromatic number, Vizing's theorem, applications

UNIT V

Independent sets, chromatic number, Brook's Theorem, vertex colorings and upper bounds, Brooks' theorem, chromatic polynomials, planar and planar graphs, dual graphs, Euler's Formula

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TEXT BOOK

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

Unit I: Chapter 1- Sections 1.1 to 1.8

Unit II: Chapter 2- Sections 2.1 to 2.5, 3.1&3.2

Unit III: Chapter3 – Sections3.1, 3.2, 4.1 to 4.3

Unit IV: Chapter 5 - Sections 5.1 to 5.3, 6.1 to 6.3

Unit V: Chapter 8 - Sections 8.1, 8.2, 8.4, Chapter 9 – Sections 9.1 to 9.3

REFERENCE BOOKS

1. F. Harary – Graph Theory, Addison Wesley publishing house, 1972
2. R. Balakrishnan and K.Ranganathan – A text book of Graph Theory, Springer Verlag, 2000
3. G. Chartrand – Introductory Graph Theory, Dover publications, 1985

4. G. Chartrand and O. R. Oellerman – Applied and Algorithmic Graph Theory, Mcgraw Hill, 1993
5. M. Murugan – Topics in Graph Theory and Algorithms, Mudali publishing house, 2003,
6. NarasinghDeo – Graph Theory with Applications to Engineering and Computer science, Prentice Hall of India, 1984
7. K. R. Parthasarathy – Basic Graph Theory, Tata Mcgraw Hill, 1994
8. D. B. West – Introduction to Graph Theory, Prentice Hall of India, 2001

Websites/ e-Learning Resources: http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,http://www.opensource.org,

SEMESTER I

COURSE CODE : P23DM03 **Hours: 6/W 90hrs/Sem**
Title of the Paper : Fuzzy Sets and Their Applications **Credits:3**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

Course Outcomes

	On completing this course, students will be able to	Unit	Hours
CO1	Recall the basic concept of crisp sets and develope an alogous patterns in fuzzy sets using alpha cuts and decomposition theorems	**I**	**18**
CO2	Characterize fuzzy complement,t-norm,t-co norm.	**II**	
CO3	Identify and characterize fuzzy numbers and realize real number as a special case of fuzzy number, illustrate arithmetic operation on fuzzy numbers and solve fuzzy equations.	**III**	**18**
CO4	Compare and contrast fuzzy relations with crisp relations	**IV**	**18**
CO5	Discuss methods for solving fuzzy relation equations and illustrate with examples	**V**	**18**

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	Pos						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

SEMESTER I

FUZZY SETS AND THEIR APPLICATIONS (P23DM03)

Lecture Hours : 6 **Credits:3**

UNIT I

Introduction – Crisp sets – Fuzzy sets – Basic concepts – Properties of cuts – Representations of fuzzy sets – Decomposition theorems — Extension Principle for fuzzy sets.

UNIT II

Fuzzy complements – First Characterization Theorem of Fuzzy complements – Second Characterization Theorem of Fuzzy complements – Fuzzy intersections (t–Norms) – Fuzzy Union (t-conorms) – Characterization theorem of t-norms,t-co norms– Combinations of operations–Aggregation operations.

UNIT III

Fuzzy Numbers–Linguistic variables–Arithmetic Operationson intervals – Arithmetic Operations on Fuzzy numbers – Lattice of fuzzy numbers –Fuzzy Equations.

UNIT IV

Crisp and fuzzy relations–Projections and Cylindrical extensions–Binary fuzzy relations Binary relations on a single set–Fuzzy equivalence relations – sup-i compositions of fuzzy relations – inf $_I$ compositions of fuzzy relations.

UNIT V

Fuzzy relation equations –Partitioning–Solution method.

TEXT BOOK

GeorgeJ.KlirandBoYuan,Fuzzysetsandfuzzylogic,theoryandapplications,Prentice Hallof India, 2005.

Unit I : Chapter1 – Sections 1.1 to 1.5& Chapter 2 – Sections 2.1 to 2.3
Unit II : Chapter 3 – Sections 3.1 to 3.6
Unit III: Chapter 4 – Sections 4.1 to 4.6
Unit IV : Chapter5Sections 5.1 to 5.5&5.9 to 5.10
Unit V : Chapter6Sections 6.1 to 6.3, Chapter 7

REFERENCE BOOKS

1. G.J.KlirandT.A.Folger,Fuzzysets,uncertaintyandinformation,PrenticeHallofIndia, 2001.
2. H.T.NguyenandE.T.Walker,Afirstcourseinfuzzylogic,ChapmanandHall,1999.
3. H.J.Zimmermann,Fuzzysettheoryanditsapplications,Alliedpublishers, 1996.

SEMESTER I

COURSE CODE : P23DM04 **Hours: 6/W 90hrs/Sem**

Title of the Paper : Discrete Mathematics **Credits:3**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

Course Outcomes

	On completing this course, Students will be able to	Unit	Hours
CO1	Understand the foundations of LOGIC and PROOFS	I	18
CO2	Analyse counting Techniques	II	18
CO3	Demonstrate Turing Machine	III	18
CO4	Apply coding theory	IV	18
CO5	Deal with Formal languages	V	18

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

SEMESTER I

DISCRETE MATHEMATICS (P23DM04)

Lecture Hours : 6 **Credits : 3**

UNIT I

The Foundations: LOGIC & PROOFS: Propositional Logic - Applications of Propositional Logic - Propositional Equivalences- Predicates and Quantifiers – Nested Quantifiers. Algorithms: The Growth of Functions

UNIT II

Counting & Advanced Counting Techniques: The Basics of Counting - The Pigeonhole Principle - Permutations and Combinations - Generalized Permutations and Combinations - Generating Permutations and Combinations - Applications of Recurrence Relations - Solving Linear Recurrence Relations - Generating Functions

UNIT III

Boolean Algebra & Modeling Computations: Boolean Functions - Representing Boolean Functions - Logic Gates - Minimization of Circuits - Finite- State machines with Output - Finite - State machines with No Output - Turing Machines.

UNIT IV

Coding Theory: Introduction to Coding - Linear Codes- Cyclic codes

Special Cyclic codes.

UNIT V

Further Applications of Algebra: Semi group - Semigroup and Automata - Semigroup and formal Languages- Linear Recurring sequences.

TEXT BOOK

1. Kenneth H. Rosen, Discrete Mathematics and it's Applications, 7th Edition/ McGraw Hill Education, New York, 2012. (Units I, II, III).

2. Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra 2nd Edition Springer, 1997. (Units IV & V).

Unit I : TB1 : Chapter 1 - Sections 1.1 to 1.5 & Chapter 3 Sections 3.1, 3.2

UnitII : TB1 : Chapter 6 and Chapter 8 - Sections 8.1, 8.2, 8.4

UnitIII : TB1 : Chapter 12 and Chapter 13- Sections 13.2, 13.3, 13.5

UnitIV : TB2 : Chapter 4 - Sections 4. 16 to 4.19

Unit V : TB2 : Chapter 7- Sections 7. 28 to 7.30 and 7. 33

REFERENCE BOOKS

1. J.P. Tremblay & R. Manohar, A First Course in Discrete Structures with Applications to Computer Science, McGraw Hill, 1987.
2. T. Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw HillsPublishing Company Limited, 7th Reprint, 2008
3 .Liu C.L, Elements of Discrete Mathematics, McGraw Hill, New York, 1978
4. Grimaldi R.P and Ramana B.V, Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, 2004

SEMESTER II

COURSE CODE : P23CM4 **Hours: 6/W 90hrs/Sem**

Title of the Paper: ADVANCED ALGEBRA **Credits: 5**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	1	-

Course Outcomes

	On completing this course ,students will be able to	Unit	Hours
CO1	prove theorems applying algebraic ways of thinking.	I	18
CO2	connect groups with graphs and understand about Hamiltonian graphs.	II	18
CO3	compose clear and accurate proofs using the concepts of Galois theory.	III	18
CO4	bring out insight into Abstract Algebra with focus on axiomatic theories	IV	18
CO5	Understand Solvability by radicals and apply Four – Square theorem.	V	18

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

SEMESTER II

P23CM4- ADVANCED ALGEBRA

Lecture Hours : 6 **Credits: 5**

UNIT I

Extension fields – Transcendence of e.

UNIT II

Roots or Polynomials.- More about roots.

UNIT III

Elements of Galois theory.

UNIT IV

Finite fields - Wedderburn's theorem on finite division rings.

UNIT V

Solvability by radicals - A theorem of Frobenius - Integral Quaternions and the Four - Square theorem.

TEXT BOOK

I.N. Herstein. *Topics in Algebra* (II Edition) Wiley Eastern Limited, New Delhi, 1975.

Unit I: Chapter 5 - Sections 5.1 and 5.2

Unit II: Chapter 5 - Sections 5.3 and 5.5

Unit III: Chapter 5 - Section 5.6

Unit IV: Chapter 7 - Sections 7.1 and 7.2 (Theorem 7.2.1 only)

Unit V: Chapter 5 - Section 5.7 (omit Lemma 5.7.1, Lemma 5.7.2 and Theorem 5.7.1)

Chapter 7 - Sections 7.3 and 7.4

REFERENCE BOOKS

1. M.Artin, *Algebra,* Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, *Basic Abstract Algebra* (II Edition) Cambridge University Press, 1997. (Indian Edition)
3. I.S.Luther and I.B.S.Passi, *Algebra,* Vol. I –Groups (1996); Vol. II Rings, Narosa Publishing House , New Delhi, 1999
4. D.S.Malik, J.N. Mordeson and M.K.Sen, *Fundamental of Abstract Algebra*, McGraw Hill (International Edition), New York. 1997.
5. N.Jacobson, *Basic Algebra,* Vol. I & II, Hindustan Publishing Company, New Delhi.

Websites/ e-Learning Resources :

http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics,

http://www.opensource.org,www.algebra.com

SEMESTER II

COURSE CODE :P23CM5 Title of the Paper: REAL ANALYSIS II

Hours: 6/W 90hrs/Sem Credits:5

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	1	-

Course Outcomes

	On completing this course ,students will be able to	Unit	Hours
CO1	Understand the concepts of Lebesgue measure, measurable sets and functions.	I	18
CO2	Analyse Riemann and Lebesgue integrals.	II	18
CO3	Evaluate Fourier series and Fourier integrals.	III	18
CO4	Analyze various forms of partial derivative and mixed partial derivativesandapply Taylor's theorem for functions ofR^n to R^1.	IV	18
CO5	Understand implicit functions and solve extremum problems with side conditions.	V	18

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	3	3	3	2	1
CLO2	2	1	3	1	3	3	3	2	1
CLO3	3	2	3	1	3	3	3	2	1
CLO4	1	2	3	2	3	3	3	2	1
CLO5	3	1	2	3	3	3	3	2	1

SEMESTER II

P23CM5 - REAL ANALYSIS II

Lecture Hours : 6 **Credits :5**

UNIT I

Measure on the Real line: Lebesgue Outer Measure - Measurable sets - Regularity - Measurable Functions - Borel and Lebesgue Measurability.

UNIT II

Integration of Functions of a Real variable: Integration of Non- negative functions - The General Integral - Riemann and Lebesgue Integrals.

UNIT III

Fourier Series and Fourier Integrals: Introduction - Orthogonal system of functions - The theorem on best approximation - The Fourier series of a function relative to an orthonormal system - Properties of Fourier Coefficients - The Riesz-Fischer Theorem - The convergence and representation problems for trignometric series - The Riemann - Lebesgue Lemma - The Dirichlet Integrals - An integral representation for the partial sums of Fourier series - Riemann's localization theorem - Sufficient conditions for convergence of a Fourier series at a particular point –Cesaro summability of Fourier series- Consequences of Fejes's theorem - The Weierstrass approximation theorem.

UNIT IV

Multivariable Differential Calculus - Introduction - The Directional derivative - Directional derivative and continuity - The total derivative - The total derivative expressed in terms of partial derivatives - The matrix of linear function - The Jacobian matrix - The chain rule - Matrix form of chain rule - The mean value theorem for differentiable functions - A sufficient condition for differentiability - A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of R^n to R^1.

UNIT V

Implicit Functions and Extremum Problems: Functions with non-zero Jacobian determinants – The inverse function theorem - The Implicit function theorem-Extrema of real valued functions of severable variables - Extremum problems with side conditions.

TEXT BOOKS

1.G. de Barra, *Measure Theory and Integration*, Wiley Eastern Ltd., New Delhi, 1981.

2.M. Apostol, *Mathematical Analysis*, Addison Wesley Publishing house, 2010.

Unit I: **TB1** - Chapter 2 - Sections 2.1 to 2.5

Unit II: **TB1** –Chapter3- Sections 3.1, 3.2 and 3.4

Unit III: **TB2** - Chapter 11 - Sections 11.1 to 11.15

Unit IV: **TB2** - Chapter 12 - Sections 12.1 to 12.14 (except 12.6)

Unit V: **TB2** - Chapter 13 - Sections 13.1 to 13.7 (except 13.5)

REFERENCE BOOKS

1. Burkill,J.C.*The Lebesgue Integral*, Cambridge University Press, 1951.
2. Munroe,M.E.*Measure and Integration*. Addison-Wesley, Mass.1971.
3. Roydon,H.L.*Real Analysis*, Macmillan Pub. Company, New York, 1988.
4. Rudin, W.,*Principles of Mathematical Analysis*, McGraw Hill Company, New York,1979.
5. Malik,S.C. and Savita Arora,*Mathematical Analysis,* Wiley Eastern Limited, New Delhi, 1991.
6. Sanjay Arora and Bansi Lal, *Introduction to Real Analysis*, Satya Prakashan, New Delhi, 1991.

Website and e-Learning Source:

http://mathforum.org,

http://ocw.mit.edu/ocwweb/Mathematics,http://www.opensource.org,www.mathpages.com

Semester II

COURSE CODE : P23CM6

Title of the Paper : PARTIAL DIFFERENTIAL EQUATIONS(CORE)

Hours: 6/W 90hrs/Sem **Credits:4**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

Course Outcomes

	On completing this course, students will be able to	Unit	Hours
CO1	Understand and classify second order equations and find general solutions	**I**	**18**
CO2	Analyse and solve wave equations in different polar coordinates	**II**	**18**
CO3	Solve Vibrating string problem, Heat conduction problem, to identify and solve Laplace and beam equations	**III**	**18**
CO4	Apply maximum and minimum principle's and solve Dirichlet, Neumann problems for various boundary conditions.	**IV**	**18**
CO5	Apply Green's function and solve Dirichlet, Laplace problems, to apply Helmholtz operation and to solve higher dimensional problem.	**V**	**18**

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER II

PARTIAL DIFFERENTIAL EQUATIONS – (P23CM6)

Lecture Hours : 6 **Credits : 4**

UNIT I

Mathematical Models and Classification of second order equation: Classical equations-Vibrating string – Vibrating membrane – waves in elastic medium – Conduction of heat in solids – Gravitational potential – Second order equations in two independent variables – canonical forms – equations with constant coefficients – general solution

UNIT II

Cauchy Problem: The Cauchy problem – Cauchy-Kowalewsky theorem – Homogeneous wave equation – Initial Boundary value problem- Non-homogeneous boundary conditions – Finite string with fixed ends – Non-homogeneous wave equation – Riemann method – Goursat problem – Spherical wave equation – Cylindrical wave equation.

UNIT III

Method of separation of variables: Separation of variable- Vibrating string problem– Existence and uniqueness of solution of vibrating string problem - Heat conduction problem – Existence and uniqueness of solution of heat conduction problem – Laplace and beam equations.

UNIT IV

Boundary Value Problems: Boundary value problems – Maximum and minimum principles – Uniqueness and continuity theorem – Dirichlet Problem for a circle , a circular annulus, a rectangle – Dirichlet problem involving Poisson equation – Neumann problem for a circle and a rectangle.

UNIT V

Green's Function: The Delta function – Green's function – Method of Green's function – Dirichlet Problem for the Laplace and Helmholtz operators – Method of images and eigen functions – Higher dimensional problem – Neumann Problem.

TEXT BOOK

TynMyint-U and Lokenath Debnath, *Partial Differential Equations for Scientists and Engineers* (Fourth Edition), North Hollan, New York, 1987.

Unit I: Chapter 3- Sections 3.1 to 3.6
Chapter 4 - Sections 4.1 to 4.4

Unit II: Chapter 5- Sections 5.1 to 5.11

Unit III: Chapter 7 - Sections 7.1 to 7.7

Unit IV: Chapter 9 - Sections 9.1 to 9.9

Unit V: Chapter 11 - Sections 11.1 to 11.10

REFERENCE BOOKS

1. M.M.Smirnov, Second Order partial Differential Equations, Leningrad, 1964.
2. I.N.Sneddon, Elements of Partial Differential Equations, McGraw Hill, New Delhi, 1983.
3. R. Dennemeyer, Introduction to Partial Differential Equations and Boundary Value Problems, McGraw Hill, New York, 1968.
4. M.D.Raisinghania, Advanced Differential Equations, S.Chand& Company Ltd., New Delhi, 2001.
5. S, Sankar Rao, Partial Differential Equations, 2nd Edition, Prentice Hall of India, New Delhi. 2004

Semester II

COURSE CODE : P23DM05 **Hours: 5/W 75hrs/Sem**

Title of the Paper : Mathematical Statistics **Credits:3**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

	Course Outcomes On completing this course the students will be able to	Unit	Hours
CO1	Recall discrete and continuous types of random variables.	I	15
CO2	Describe two dimensional random variables.	II	15
CO3	Interpret Binomial, Poisson, Normal, Gamma and Chi-square distributions.	III	15
CO4	Construct probability density function of given functions of the random variables.	IV	15
CO5	State and demonstrate Central Limit Theorem.	V	15

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER II

MATHEMATICAL STATISTICS (P23DM05)

Lecture hours : 5 **Credits : 3**

UNIT I

Random Variables: Random variables of the discrete type – Random variables of the continuous type – Properties of the distribution function – Expectation of a random variable – Some special expectations – Chebyshev's Inequality.

UNIT II

Multivariate distributions: Distribution of two random variables – Conditional Distributions and expectations – The correlation coefficient – Independent random variables – Extension to several Random Variables.

UNIT III

Some special distributions: The Binomial and related distributions – The Poisson distribution – The Gamma and Chi-Square distributions – The normal distribution – The Bivariate normal distribution.

UNIT IV

Distributions of Functions of Random variables: Sampling theory – Transformations of variables of the discrete type – Transformations of variables of the continuous type - The Beta, t and F distributions – Extensions of the change of the variable technique – Distributions of order statistics – The Moment Generating function Technique – The distributions of $\bar{X}$ and ns^2/σ^2–Expectations of functions of random variables.

UNIT V

Limiting Distributions: Convergence in distribution – Convergence in probability – Limiting Moment Generating functions – The Central Limit theorem – Some theorems on limiting distributions.

TEXT BOOK

Introduction to Mathematical Statistics by Robert V.Hogg and Allen T.Craig (V Edition) Pearson Education (Singapore) Pvt.Ltd, Third Reprint 2004.

Unit I : Chapter 1 - Sections 1.5 to 1.10

Unit II : Chapter 2 - Sections 2.1 to 2.5

Unit III : Chapter 3 - Sections 3.1 to 3.5

Unit IV : Chapter 4 - Sections 4.1 to 4.9

Unit V : Chapter 5 - Sections 5.1 to 5.5

REFERENCE BOOKS

1. M. Fisz, Probability theory and Mathematical statistics, John Wiley & sons, New York, 1963. 2. E. J. Dudewiczn and S. N. Mishra, Modern Mathematical Statistics, John Wiley & sons, New York, 1988.
2. V. N. Rohatgi, An introduction to Probability theory and Mathematical statistics, Wiley Eastern Limited, New Delhi, 1988.
3. Fundamentals of Mathematical Statistics by S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons Educational Publishers, New Delhi, 1997.
4. Mathematical Statistics with Applications by I. Miller and M.Miller; Seventh Edition, Pearson Education, 2004.
5. Mathematical Statistics by Jun Shao, Second Edition, Springer, 2003.
6. An introduction to probability and Statistics by Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh, Second edition, Wiley, 2008.

   Second edition, Wiley, 2008.

COURSE CODE : P23DM06

Title of the Paper : ALGEBRAIC TOPOLOGY **Credits: 3**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	5	4	1	-	

	Course Outcomes On completing this course the students will be able to	Unit	Hours
CO1	Geometric Complexes and Polyhedra	I	15
CO2	Simplicial Homology Groups	II	15
CO3	Simplicial Approximation	III	15
CO4	The Fundamental Group	IV	15
CO5	Covering spaces	V	15

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER II
ALGEBRAIC TOPOLOGY –(P23DM06)

Lecture Hours : 5 **Credits : 3**

UNIT I

Geometric Complexes and Polyhedra: Introduction. Examples, Geometric Complexes and Poly- hedra, Orientation of geometric complexes.

UNIT II

` Simplicial Homology Groups: Chains, cycles, Boundaries and homology groups, Examples of homology groups, The structure of homology groups- Simplicial Homology Groups(Contd.):The Euler Poincare's Theorem, Pseudomanifolds and the homology groups of S

UNIT III

Simplicial Approximation: Introduction, Simplicial approximation, Induced homomorphisms on the Homology groups, The Brouwer fixed point theorem and related results

UNIT IV

The Fundamental Group: Introduction, Homotopic Paths and the Fundamental Group, The Covering Homotopy Property for S1, Examples of Fundamental Groups.

UNIT V

Covering spaces- The definitions and some examples- Properties of covering spaces – Classification of covering space- universal covering space.

TEXT BOOK

Fred h. Croom, Basic Concepts of Algebraic Topology, utm, springer - verlag, ny, 1978

Unit I : Chapter 1- Sections 1.1 to 1.4

Unit II : Chapter 2 - Sections 2.1 to 2.5

Unit III : Chapter 3 - Sections 3.1 to 3.4

Unit IV : Chapter 4 - Sections 4.1 to 4.4

Unit V : Chapter 5 - Sections 5.1 to5.4

REFERENCE BOOKS

1. Eilenberg S, Steenrod N.: Foundations of Algebraic Topology; Princeton Univ. Press; 1952

2. S.T. Hu: Homology Theory; Holden-Day; 1965

3. Massey W.S.: AlgebraicTopology: An Introduction; Springer Verlag NY; 1977

4. C.T.C. Wall: A Geometric Introduction to Topology; Addison- Wesley Pub. Co. Reading Mass;1972 .

SEMESTER II

COURSE CODE :P23DM07

Title of the Paper : WAVELETS

Hours: 5/W 75hrs/Sem **Credits: 3**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	5	4	1	-	-

Course Outcomes

	On completing this course, students will be able to	Unit	Hours
CO1	Understand the concept of various signals and its representation.	**I**	**15**
CO2	Analyse the idea of continuous wavelet transform and its properties.	**II**	**15**
CO3	Get knowledge about the concept of various twochannel filter banks along with discrete wavelet transform.	**III**	**15**
CO4	Analyse the idea of discrete time systems with extension to higher dimensions and wave packets.	**IV**	**15**
CO5	Emphasis on the various applications of wavelet transformations.	**V**	**15**

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER II

WAVELETS – (P23DM07)

Lecture Hours : 5 **Credits : 3**

UNIT I

` Stationary and non-stationary signals, Signal representation using basis and frames, Brief introduction to Fourier transform and Short time Fourier transform, Timefrequency analysis, Bases of time frequency: orthogonal, Filter banks, Multi resolution formulation: Wavelets from filters, Classes of wavelets: Haar, Daubechies, bi-orthogonal

UNIT II

Continuous wavelet transform (CWT), Time and frequency resolution of the continuous wavelet transform, Construction of continuous wavelets:Spline, orthonormal, bi-orthonormal, Inverse continuous wavelet transform, Redundancy ofCWT, Zoom property of the continuous wavelet transform, Filtering in continuous wavelettransform domain.

UNIT III

Orthogonal and bi-orthogonal two-channel filter banks, Design of two-channel filter banks, Tree-structured filter banks, Discrete wavelet transform, Non-linear approximation in the Wavelet domain, multi resolution analysis, Construction and Computation of the discrete wavelet transform, the redundant discrete wavelet transform.

UNIT IV

Multi rate discrete time systems, Parameterization of discrete wavelets, Biorthogonal wavelet bases, Two dimensional, wavelet transforms and Extensions to higher dimensions, wave packets

UNIT V

Signal and Image compression, Detection of signal changes, analysis andclassification of audio signals using CWT, Wavelet based signal de-noising and energycompaction, Wavelets in adaptive filtering, Adaptive wavelet techniques in signalacquisition, coding and lossy transmission, Digital Communication and MulticarrierModulation, Trans multiplexers , Image fusion, Edge Detection and object isolation.

TEXT BOOKS

1. A Wavelet Tour of Signal Processing, 2nd edition, S. Mallat, Academic Press, 1999.
2. Wavelets and Sub band Coding, M. Vetterli and J. Kovacevic, Prentice Hall, 1995.
3. Wavelet transforms: Introduction, Theory and applications, Raghuveer rao and Ajit S.Bopardikar, Pearson Education Asia, 2000.

REFERENCE BOOKS

1. Fundamentals of Wavelets: Theory, Algorithms, and Applications, J.C. Goswami and A.K.Chan, 2nd ed., Wiley, 2011.
2. Wavelets and their Applications, Michel Misiti, Yves Misiti, Georges Oppenheim, Jean-Michel Poggi, John Wiley & Sons, 2010 .
3. A premier on Wavelets and their scientific applications, J S Walker, CRC press, 2002. 4.Wavelets and signal processing: An application based introduction, Stark, Springer, 2005.
5. A friendly guide to Wavelets, Gerald keiser, Springer, 2011.
6. Multirate Systems and Filter Banks, P. P. Vaidyanathan, Pearson Education, 2004.
7. Wavelets : from math too practice, Desanka.P.Radunovik, springer, 2009.
8. Insight into wavelets from theory to practice, K P Soman and KL Ramachandran, PHI,2008.

SEMESTER II

COURSE CODE : P23DM08 **Hours: 5/W 75 hrs/Sem**

Title of the Paper : MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

Credits: 3

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	5	4	1	-	-

Course Outcomes

	On completing this course, students will be able to	Unit	Hours
CO1	Understand the AI Foundations	I	15
CO2	Deal with Data.	II	15
CO3	Work with Data in an AI project.	III	15
CO4	Construct Machine Learning Algorithms .	IV	15
CO5	Construct Machine Learning Algorithms.	V	15

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER II

MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE(P23DM08)

Lecture Hours : 5 **Credits : 3**

UNIT I

AI Foundations, Alan Turing and the Turing Test, Strong AI, Weak AI, Golden Age of AI, Technological Drivers of Modern AI, Structure of AI.

UNIT II

Data - The Fuel for AI, Data Basics, Types of Data, Big Data, Volume, Variety and Velocity of Data, Databases and Other Tools, Data Process, Business Understanding, Data Understanding, Data Preparation, Ethics and Governance, How Much Data Do You Need for AI?, More Data Terms and Concepts.

UNIT III

Machine Learning - Mining Insights from Data, What Can You Do with Machine Learning?, The Machine Learning Process - Data Order, Choose a Model, Train the Model, Evaluate the Model, Fine-Tune the Model, Applying Algorithms, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Semi-supervised Learning.

UNIT IV

Common Types of Machine Learning Algorithms, General Framework for Machine Learning Algorithms, Naïve Bayes Classifier, K-Nearest Neighbour, Linear Regression, Decision Tree, Ensemble Modelling, K-Means Clustering.

UNIT V

Deep Learning - Difference Between Deep Learning and Machine Learning, What is Deep Learning, The Brain and Deep Learning, Artificial Neural Networks, Back Propagation, The Various Neural Networks - RNN, CNN, GANs, Deep Learning

TEXT BOOK

1.Tom Taulli, Artificial Intelligence Basics: A Non-Technical Introduction, Apress .

Unit I : Chapter 1

Unit II : Chapter 2

Unit III : Chapter 3

Unit IV : Chapter 3

Unit V : Chapter 4

REFERENCE BOOKS

1. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Pearson Education, 2007.
2. Kevin Night, Elaine Rich, and Nair B., Artificial Intelligence, McGraw Hill, 2008.
3. Tom Mitchell, Machine Learning, McGraw Hill, 3rd Edition,1997.
4. Charu C. Aggarwal, Data Classification Algorithms and Applications, CRC Press, 2014.

COURSE CODE :P23SEM1

Title of the Paper : MATHEMATICAL DOCUMENTATION USING LATEX

Lecture Hours : 2 **Credits : 2**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	2 (Lab)	-	-	-	-

Course Outcomes

	On completing this course, students will be able to	Unit	Hours
CO1	know how to create basic types of LaTex documents (article)	I	6
CO2	typeset latex commands	II	6
CO3	create a paragraph, symbols, comments and font style	III	6
CO4	change font characteristics	IV	6
CO5	know about various environments	V	6

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER II

MATHEMATICAL DOCUMENTATION USING LATEX (P23SEM1)

Lecture Hours : 2 **Credits : 2**

UNITI

Typing a very short ―article‖ – Typing Math- Formula gallery – Typing equations and aligned formulas- The anatomy of an article – Article templates

UNITII

Your first article – LATEX error Messages – Logical & Visual design- A brief over view Using LATEX- What's next?

UNITIII

Typing Text : The Keyboard- Words, sentences & paragraphs- Instructing LATEX – Symbols not on the keyboard – Commenting Out- Changing font characteristics

UNITIV

Lines, paragraphs and pages, Spaces, Boxes, Foot notes, Splitting up the file

UNITV

Text environments: List environments – Tabbing environment – Miscellaneous displayed text environments- Proclamations – Proof environment- Some general rules for displayed text environment – Tabular environments – Style & Size environments

TEXT BOOK

Math into Latex : An Introduction to Latex and AMS Latex George Grazer ISBN 0-8176-3805-9. © Birkhauser Boston 1996.

Unit I : Chapter 1- Sections 1.1 to 1.6

Unit II : Chapter 1 - Sections 1.7 to 1.12

Unit III : Chapter 2 - Sections 2.1 to 2.6

Unit IV : Chapter 2 - Sections 2.7 and 2.11

Unit V : Chapter 3 - Sections 3.1 to 3.8

REFERENCE BOOK

1. A document preparation system LATEX, Second Edition, Leslie Lamport
2. LATEX- A Beginner Guide to Professional documentation, S. Swapna Kumar.

Website and e-Learning Source

https://services.math.duke.edu/computing/tex/online.html,
https://www.overleaf.com/learn

SEMESTER III

COURSE CODE : P23CM7

Title of the Paper : COMPLEX ANALYSIS

Hours: 6/W 90hrs/Sem **Credits:5**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

Course Outcomes

	On completing this course, students will be able to	Unit	Hours
CO1	Analyze and evaluate local properties of analytical functions and definite integrals.	**I**	**18**
CO2	Describe the concept of definite integral and harmonic functions.	**II**	**18**
CO3	Demonstrate the concept of the general form of Cauchy's theorem	**III**	**18**
CO4	Develop Taylor and Laurent series	**IV**	**18**
CO5	Explain the infinite products, canonical products and Jensen's formula .	**V**	**18**

	Program Outcomes						Program Specific outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CLO1	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CLO2	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CLO3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CLO4	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CLO5	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**1**

SEMESTER III

COMPLEX ANALYSIS-(P23CM7)

Lecture Hours : 6 **Credits : 5**

UNIT 1

Cauchy's Integral Formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives. Local Properties of analytical Functions: Removable Singularities-Taylors's Theorem – Zeros and poles – The local Mapping – The Maximum Principle.

UNIT II

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 - Residue theorem - The argument principle.

UNIT III

Evaluation of Definite Integrals and Harmonic Functions Evaluation of definite integrals - Definition of Harmonic function and basic properties - Mean value property - Poisson formula.

UNIT IV

Harmonic Functions and Power Series Expansions: Schwarz theorem - The reflection principle - Weierstrass theorem– Taylor's Series – Laurent series .

UNIT V

Partial Fractions and Factorization: Partial fractions - Infinite products – Canonical products – Gamma Function- Jensen's formula – Hadamard's Theorem.

TEXT BOOK

Lars V. Ahlfors, *Complex Analysis*, (3rd edition) McGraw Hill Co., New York, 1979,

Unit I **:** Chapter 4 - Sections 2.1 to 2.3 &3.1 to 3.4

Unit II : Chapter 4 - Sections 4.1 to 4.7 ,5.1 &5.2

Unit III : Chapter 4 - Section 5 : 5.3 &6.1 to 6.3

Unit IV : Chapter 4 - Sections 6.4 and 6.5 &
Chapter 5 - Sections 1.1 to 1.3

Unit V : Chapter 5 - Sections 2.1 to 2.4 , 3.1 &3.2

REFERENCE BOOKS

1. H.A. Presfly, *Introduction to complex Analysis*, Clarendon Press, oxford, 1990.
2. J.B. Conway, *Functions of one complex variables* Springer - Verlag, International student Edition, Naroser Publishing Co.1978
3. E. Hille, *Analytic function Thorey*(2 vols.), Gonm& Co, 1959.
   M.Heins, *Complex function Theory*, Academic Press, New York,1968.

Website and e-Learning Source

http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org, http://en.wikipedia.org

SEMESTER III

COURSE CODE : P23CM8
Title of the Paper : PROBABILITY THEORY
Hours: 6/W 90hrs/Sem **Credits:5**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	1	-

Course Outcomes

	On completing this course ,students will be able to	Unit	Hours
CO1	Tackle problems regarding point and interval estimation	**I**	**18**
CO2	Analyse the properties of estimators	**II**	**18**
CO3	Understand Bayesian estimation and Rao crammer inequality	**III**	**18**
CO4	Devise powerful tests and determine best critical region	**IV**	**18**
CO5	Develop suitable tests for normal models	**V**	**18**

	Program Outcomes						Program Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO4	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO5	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**1**

SEMESTER III
P23CM8 - PROBABILITY THEORY

Lecture Hours : 6 **Credits : 5**

UNIT I

Introduction to Statistical inference:Point estimation – Confidence Intervals for Means – Confidence intervals for differences of means – Tests of Statistical Hypotheses – Additional comments about statistical tests – Chi-square tests.

UNIT II

Sufficient Statistics:Measures of quality of estimators – A sufficient statistic for a parameter – Properties of a sufficient statistic – Completeness and uniqueness – The Exponential class of probability density functions – Functions of a parameter.

UNIT III

More about Estimation:Bayesian Estimation – Fisher Information and the Rao - Cramer inequality – Limiting distributions of maximum likelihood estimators – Robust M-estimation.

UNIT IV

Theory of statistical tests:Certain best tests – Uniformly most powerful tests – Likelihood ratio tests – The sequential Probability ratio test.

UNIT V

Inferences about normal models:The distributions of certain quadratic forms – A test of the equality of several means – noncentral χ^2(Chi-Square) and noncentral F – Multiple comparisons – The analysis of variance – A regression problem

TEXT BOOK

Introduction to Mathematical Statistics by Robert V.Hogg and Allen T.Craig (V Edition) Pearson Education (Singapore) Pvt.Ltd, Third Reprint 2004.

Unit I : Chapter 6

Unit II : Chapter 7 - Sections 7.1 to 7.6

Unit III : Chapter 8

Unit IV : Chapter 9 - Sections 9.1 to 9.4

Unit V : Chapter 10 - Sections 10.1 and 10.6

REFERENCE BOOKS

1. Fundamentals of Mathematical Statistics by S.C.Gupta and V.K.Kapoor, Sultan Chand & Sons Educational Publishers, New Delhi, 1997.
2. Mathematical Statistics with Applications by I. Miller and M.Miller; Seventh Edition, Pearson Education, 2004.
3. Mathematical Statistics by Jun Shao, Second Edition, Springer, 2003.
4. An introduction to probability and Statistics by Vijay K. Rohatgi, A.K. Md. EhsanesSaleh, Second edition, Wiley, 2008.
5. *5.R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972*
6. *6.K.L.Chung, A course in Probability, Academic Press, New York, 1974.*

7. *7.R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York, 1996.*
8. *8.V.K.RohatgiAn Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1988(3rd Print).*
9. *9.S.I.Resnick, A Probability Path, Birhauser, Berlin,1999.*
10. *10.B.R.Bhat , Modern Probability Theory (3rd Edition), New Age International (P)Ltd, New* Delhi, 1999.

Website and e- Learning Source :

http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org,http://www.probability.net

SEMESTER III

COURSE CODE : P23CM9 Hours: 6/W 90hrs/Sem

Title of the Paper : TOPOLOGY(CORE) Credits:4

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	5	4	1	-	1

Course Outcomes

	On completing this course ,students will be able to	Unit	Hours
CO1	Define and illustrate the concept of topological spaces and the basic definitions of open sets, neighbourhood, interior, exterior, closure and their axioms for defining topological space.	**I**	**18**
CO2	Understand continuity, compactness, connectedness, homeomorphism and topological properties	**II**	**18**
CO3	Analyze and apply the topological concepts in Functional Analysis.	**III**	**18**
CO4	Ability to determine that a given point in a topological space is either a limit point or not for a given subset of a topological space	**IV**	**18**
CO5	Develop qualitative tools to characterize connectedness, compactness, second countable, Hausdorff and develop tools to identify when two are equivalent(homeomorphic)	**V**	**18**

	Program Outcomes						Program Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CLO1	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CLO2	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CLO3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CLO4	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CLO5	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**1**

SEMESTER III

TOPOLOGY-P23CM9

Lecture Hours : 6 **Credits :4**

UNIT I

Topological spaces: Topological spaces – Basis for a topology – The order topology – The product topology on X Y – The subspace topology – Closed sets and limit points.

UNIT II

Continuous functions: Continuous functions – the product topology – The metric topology.

UNIT III

Connectedness: Connected spaces- connected subspaces of the Real line – Components and local connectedness.

UNIT IV

Compactness : Compact spaces – compact subspaces of the Real line – Limit Point Compactness – Local Compactness.

UNIT V

Countability and Separation axioms: The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohnmetrization Theorem – The Tietz extension theorem.

TEXT BOOK

James R. Munkres, *Topology* (2nd Edition) Pearson Education Pvt. Ltd., Delhi- 2002(Third Indian Reprint)

Unit I : Chapter 2 - Sections 12 to 17.

Unit I1: Chapter 2 - Sections 18 to 21 .

Unit I1I: Chapter 3 - Sections 23 to 25.

Unit IV: Chapter 3 - Sections 26 to 29.

Unit V: Chapter 4 - Sections 30 to 35.

REFERENCE BOOKS

1. J. Dugundji ,*Topology* , Prentice Hall of India, New Delhi, 1975. George F.Sinmons, *Introduction to Topology and Modern Analysis*, McGraw Hill Book Co., 1963
2. J.L. Kelly, *General Topology*, Van Nostrand, Reinhold Co., New York
3. L.Steen and J.Subhash, Counter Examples in Topology, Holt, Rinehart and Winston, New York, 1970.
4. S.Willard, *General Topology*, Addison - Wesley, Mass., 1970

Website and e-Learning Source

http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics,http://www.opensource.org, http://en.wikipedia.org

SEMESTER III

COURSE CODE : P23CM10
Title of the Paper : RESOURCE MANAGEMENT TECHNIQUES
Hours: 5/W 75hrs/Sem **Credits:3**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	5	3	1	-	1

Course Outcomes

	On completing this course ,students will be able to	Unit	Hours
CO1	Explain the fundamental knowledge of Linear Programming	I	15
CO2	Use classical optimization techniques and numerical methods of optimization. Enumerate fundamentals of Integer programming technique and apply different techniques to solve various optimization problem	II	15
CO3	Describe the basics of different Heuristic algorithms and solve Dynamic Programming problems.	III	15
CO4	Enumerate fundamentals of Integer programming technique and apply different techniques to solve various optimization problem	IV	15
CO5	Understand Queuing systems and understand constrained and unconstrained problems	V	15

	Program outcome						Programe Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER III

RESOURCE MANAGEMENT TECHNIQUES-P23CM10

Lecture Hours :5 **Credits: 3**

UNIT I

Linear Programming Model: Two variable LP model – Graphical LP solution – Applications-Simplex method- Artificial starting solution - Special cases in simplex method.

UNIT II

Duality and Advanced Linear Programming**:** Definition of Dual problem - Primal -Dual Relationships-Additional Simplex algorithms- Post optimal analysis-Simplex method fundamentals-Revised Simplex Method, Bounded-Variable Algorithm, Duality.

UNIT III

Goal and Integer Programming: Goal programming formulation - Goal Programming algorithms-Formulation and Applications-Cutting Plane Algorithm.

UNIT IV

Heuristic and Deterministic Dynamic Programming :Greedy Heuristics- Meta heuristic - Tabu Search algorithm - Constraint programming-Recursive nature of Dynamic programming computations - Forward and backward recursion- Selected DP applications - Knapsack/Fly-away kit/cargo-loading model- Investment models.

UNIT V

Queuing Systems and Classical optimization theory: Pure birth and Pure death models- Generalized Poisson queuing model, single server models.

TEXT BOOK

Hamdy A.Taha, Operations Research- An Introduction, 10th Edition, Pearson Education – 2017

Unit I : Chapter 2- Sections 2.1, 2.2, 2.4.

Chapter 3 - Sections 3.3 to 3.5

Unit II : Chapter 4 - Sections 4.1,4.2,4.4,4.5,

Chapter 7 – Sections 7.1 to 7.4

Unit III : Chapter 8 - Sections 8.1, 8.2,
Chapter 9 – Sections 9.1, 9.2.2

Unit IV : Chapter 10 - Sections 10.1 to 10.3,10.5
Chapter 12- Sections 12.1,12.2,12.3.1,12.3.4

Unit V : Chapter 18 - Sections 18.1 to 18.5,18.6.2

REFERENCE BOOKS

1. 1.L.R.Foulds, Optimization Techniques , Springer ,Utm , 1981
2. 2.Garrido José M. Introduction to Computational Models with Python. CRC Press,2016.

SEMESTER III
FLUID DYNAMICS
Sub. Code: P23DM09

Title of the paper : Fluid Dynamics

Lecture Hours: 5/W 75hrs/Sem **Credits :3**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

Course Outcomes

	On completing this course ,students will be able to	Unit	Hours
CO1	Understand the basic properties and principles of viscous and non-viscous fluids	**I**	**15**
CO2	Derive and deduce the consequences of the governing equations of fluid	**II**	**15**
CO3	Solve kinematics problems such as finding particle paths and streamlines	**III**	**15**
CO4	Understand the basic theorems of fluid mechanics and its applications	**IV**	**15**
CO5	Derive the boundary layer equations of some basic flows and its solutions	**V**	**15**

	Program Outcomes						Program Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO4	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO5	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**1**

SEMESTER III

FLUID DYNAMICS-P23DM09

Lecture Hours: 5 **Credits : 3**

UNIT I

Kinematics of Fluids in motion : Real fluids and Ideal fluids - Velocity of a fluid at a point, Stream lines, path lines, steady and unsteady flows - Velocity potential – The velocity vector- Local and particle rates of changes - Equations of continuity - Worked examples - Acceleration of a fluid - Conditions at a rigid boundary.

UNIT II

Pressure at a point in a fluid at rest Pressure at a point in a moving fluid - Conditions at a boundary of two inviscid immiscible fluids- Euler‘s equation of Motion- Bernaull’s Equation- Worked Examples- Discussion of the case of steady motion under conservative body forces.

UNIT III

Some three dimensional flows – Introduction - Sources, sinks and doublets - Images in a rigid infinite plane - Axis symmetric flows - Stokes stream function.

UNIT IV

Meaning of two dimensional flow - Use of Cylindrical polar coordinate - The stream function - The complex potential for two dimensional, irrotational incompressible flow - Complex velocity potentials for standard two dimensional flows - Some worked examples - Two dimensional Image systems - The Milne Thompson circle Theorem.

UNIT V

Stress components in a real fluid - Relations between Cartesian components of stress - Translational motion of fluid elements - The rate of strain quadric and principal stresses - Some further properties of the rate of strain quadric - Stress analysis in fluid motion - Relation between stress and rate of strain - The coefficient of viscosity and Laminar flow - The Navier - Stokes equations of motion of a Viscous fluid.

TEXT BOOK

F. Chorlton, Text Book of Fluid Dynamics, CBS Publications, Delhi, 1985.

Unit I : Chapter 2 - Sections 2.1 to 2.10

Unit II : Chapter 3 - Sections 3.1 to 3.7

Unit III : Chapter 4- Sections 4.1 to 4.5 (except 4.4)

Unit IV : Chapter 5 - Sections 5.1 to 5.8

Unit V : Chapter 8 - Sections 8.1 to 8.9

Website and e-Learning Source

http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org

SEMESTER III

Course code: P23DM10

Title of the Paper: ALGEBRAIC NUMBER THEORY

Lecture Hours : 5 /W 75hrs/ Sem **Credits:3**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

	On completing this course ,students will be able to	Unit	Hours
CO1	understand the concept of Modules	I	15
CO2	deal with algebraic integers and its applications	II	15
CO3	understand the concept of Quadratic fields and cyclotomic fields	III	15
CO4	learn Ramanujan-Nagell Theorem	IV	15
CO5	understand Prime Factorization of Ideals	V	15

	Program Outcomes						Program Specific Outcomes		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

SEMESTER III

ALGEBRAIC NUMBER THEORY -P23DM10

Lecture Hours : 5 **Credits : 3**

UNIT I

Rings and Fields- Factorization of Polynomials - Field Extensions – Symmetric Polynomials - Modules - Free Abelian Groups .

UNIT II

Algebraic numbers - Conjugates and Discriminants - Algebraic Integers – Integral Bases - Norms and Traces - Rings of Integers.

UNIT III

Quadratic fields and cyclotomic fields - Factorization into Irreducibles - Trivial factorization - Factorization into irreducibles - Examples of non-unique factorization into irreducibles.

UNIT IV

Prime Factorization - Euclidean Domains - Euclidean Quadratic fields – Consequences of unique factorization - The Ramanujan- Nagell Theorem.

UNIT V

Prime Factorization of Ideals - The norms of an Ideal – Nonunique Factorization in Cyclotomic Fields.

TEXT BOOK

I. Steward and D.Tall, Algebraic Number Theory and Fermat's Last Theorem (3rd Edition)

A.K.Peters Ltd., Natrick, Mass. 2002.

Unit I : Chapter 1 - Sections 1.1 to 1.6

Unit II : Chapter 2 - Sections 2.1 to 2.6

Unit III : Chapter 3 – Sections 3.1, 3.2 &

Chapter 4- Sections 4.2 to 4.4

Unit IV : Chapter 4 - Sections 4.5 to 4.9

Unit V : Chapter 5 - Sections 5.2 to 5.4

Reference Books

1. Z.I.Bosevic and I.R.Safarevic, Number Theory, Academic Press, New York, 1966
2. J.W.S.Cassels and A.Frohlich, Alge braic Number Theory, Academic Press, New York, 1967
3. P.Ribenboim, Algebraic Numbers, Wiley, New York, 1972
4. P. Samuel, Algebraic Theory of Numbers, Houghton Mifflin Company, Boston, 1970 5. A.Weil. Basic Number Theory, Springer, New York, 1967.

Website and e-Learning Source : http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org, www.algebra.com

Semester III

CourseCode : P23SEM2
Title of the Paper: MATHEMATICAL LOGIC AND REASONING
Lecture Hours : 2 /W 30hrs/ Sem **Credits : 2**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	2	2	-	-	-

	On completing this course the students will be able to	Unit	Hrs/S
CO1	Gain the Knowledge of Mathematical Operators & Mathematical Problems	1	6
CO2	Develop increase their cognitive capabilities	2	6
CO3	Acquire knowledge to complete a series	3	6
CO4	Understand the Direction Sense Test – Numbers Test and Time Sequence Test	4	6
CO5	Learn about Blood relation	5	6

	Program Outcomes						**Program Specific Outcomes**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO4	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO5	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**1**

Semester III

P23SEM2-MATHEMATICAL LOGIC AND REASONING

Lecture Hours : 2 **Credits :2**

UNIT – I

Mathematical Operators – Mathematical Problem

UNIT – II

Puzzle Test - Analogy Test

UNIT – III

Arranging in Order – Series Completion Test

UNIT – IV

Direction Sense Test – Numbers Test and Time Sequence Test

UNIT – V

Deductive Logic – Blood Relation Test

TEXT BOOK

1. Alok Kumar – CSIR-UGC NET/JRF/SET Mathematical Sciences, Latest Revised Edition, Upkar Prakashan, AGRA – 2.

UNIT I : Page Number 3-15

UNIT II : Page Number 16 – 33 & 39 - 43

UNIT III : Page Number 44 - 54

UNIT IV : Page Number 55 - 64

UNIT V : Page Number 65 – 83

SEMESTER IV

Course Code: P23CM11

Title of the Paper: FUNCTIONAL ANALYSIS

Lecture Hours: 6/W 90hrs/ Sem **Credits:5**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	1	-

Course Outcomes

	On completing this course ,students will be able to	Unit	Hours
CO1	Understand Continuos linear Transformations and conjugate of an Operator	**I**	**18**
CO2	Describe Adjoint of an operator, Self adjoint operator, Normal and unitary operators.	**II**	**18**
CO3	Apply Spectral Theorem.	**III**	**18**
CO4	Analyse general preliminaries of Banach Algebra.	**IV**	**18**
CO5	Prove Gelfand-Neumark theorem.	**V**	**18**

	Program Outcomes						Program Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO4	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO5	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**1**

SEMESTER IV
FUNCTIONAL ANALYSIS (P23CM11)

Lecture Hours :6 **Credits : 5**

UNIT I

Banach Spaces: The definition and some examples – Continuous linear transformations – The Hahn-Banach theorem – The natural imbedding of N in N^{**}- The open mapping theorem – The conjugate of an Operator.

UNIT II

Hilbert Spaces:The definition and some simple properties–Orthogonal complements–Ortho normal sets–The conjugate space H^*-The adjoint of an operator–self adjoint operators-Normal and unitary operators – Projections.

UNIT III

Finite-Dimensional Spectral Theory: Matrices – Determinants and the spectrum of an operator –The spectral theorem.

UNIT IV

General Preliminaries on Banach Algebra: The definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius– The radical and semi-simplicity.

UNIT V

The Structure of Commutative Banach Algebra: The Gelfand mapping – Application of the formula $r(x) = \lim \|x^n\|^{1/n}$– Involutions in Banach algebras-The Gelfand- Neumark theorem.

TEXT BOOK

G.F.Simmons, IntroductiontoTopology and Modern Analysis, McGraw Hill Education (India) Private Limited, New Delhi, 1963.

Unit I **:** Chapter 9 - Sections 46 to 51
Unit II **:** Chapter10 - Sections52 to 59
Unit III **:** Chapter 11- Sections 60 to 62
Unit IV **:** Chapter 12 - Sections 64 to 69
Unit V **:** Chapter 13 - Sections 70 to 73

REFERENCE BOOKS

1. W.Rudin, Functional Analysis, McGraw Hill Education (India)Private Limited, NewDelhi, 1973.
2. B.V. Limaye, Functional Analysis, New Age International,1996.
3. C. Goffman and G. Pedrick, First course in Functional Analysis, Prentice Hall of India, NewDelhi,1987.
4. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, NewYork, 1978.
5. M. Thamban Nair, Functional Analysis, A First course, Prentice Hall of India, NewDelhi, 2002.

Website and e-Learning Source

http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org,http://en.wikiepedia.org

SEMESTER IV

COURSE CODE : P23CM12

Title of the Paper : MECHANICS (CORE)

Hours: 6/W 90hrs/Sem **Credits:5**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	6	4	1	-	1

Course Outcomes

	On completing this course, students will be able to	Unit	Hours
CO1	Demonstrate the knowledge of core principles in mechanics	**I**	**18**
CO2	Interpret and consider complex problems of classical dynamics in a systematic way.	**II**	**18**
CO3	Apply the variation principle for real physical situations	**III**	**18**
CO4	Explore different applications of these concepts in the mechanical and electromagnetic fields	**IV**	**18**
CO5	Describe and apply the concept of Angular momentum, Kinetic energy and Moment of inertia of a particle .	**V**	**18**

	POs						PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO4	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO5	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**1**

SEMESTER IV

P23CM12 - MECHANICS

Lecture Hours :6 **Credits : 5**

UNIT I

Mechanical Systems: The Mechanical system- Generalised coordinates – Constraints - Virtual work - Energy and Momentum.

UNIT II

Lagrange's Equations: Derivation of Lagrange's equations- Examples- Integrals of motion.

UNIT III

Hamilton's Equations: Hamilton's Principle - Hamilton's Equation - Other variational principle.

UNIT IV

Hamilton-Jacobi Theory: Hamilton Principle function – Hamilton-Jacobi Equation – Separability.

UNIT V

Canonical Transformation: Differential forms and generating functions – Special Transformations– Lagrange and Poisson brackets.

TEXT BOOK

D. Greenwood, *Classical Dynamics*, Prentice Hall of India, New Delhi, 1985

Unit I : Chapter 1 - Sections 1.1 to 1.5

Unit II : Chapter 2 - Sections 2.1 to 2.3

Unit III : Chapter 4 - Sections 4.1 to 4.3

Unit IV : Chapter 5 - Sections 5.1 to 5.3

Unit V : Chapter 6 - Sections 6.1, 6.2 and 6.3

REFERENCE BOOKS

1. H. Goldstein, *Classical Mechanics,* (2nd Edition) Narosa Publishing House, New Delhi. 2. N.C.Rane and P.S.C.Joag, *Classical Mechanics*, Tata McGraw Hill, 1991.
2. J.L.Synge and B.A.Griffth, *Principles of Mechanics* (3rd Edition) McGraw Hill Book Co., New York, 1970.

Website ande-Learning Source

http://mathforum.org,http://ocw.mit.edu/ocwweb/Mathematics, http://www.opensource.org,www.physicsforum.com

SEMESTER IV

Course Code: P23DM11
Title of the Paper: DIFFERENTIAL GEOMETRY
Hours: 5/W 75hrs/ Sem **Credits: 3**

Pedagogy	Hours/W	Lecture	Peer Teaching	GD/Tutorial/Videos	ICT
	6	2	2	1	1

Course Outcomes

	On completing this course the students will be able to	Unit	Hours
CO1	Basic definitions of space curve	**I**	**15**
CO2	Understand intrinsic equation, Fundamental existence theorem for space curve and Helics	**II**	**15**
CO3	Gain the knowledge of metric, local intrinsic properties of a surface and Geodesics	**III**	**15**
CO4	Present the knowledge of Geodesic parallels, Geodesic curvature and Gauss Bonnet theorem	**IV**	**15**
CO5	Get the knowledge of local non-intrinsic properties of a surface.	**V**	**15**

	Program Outcomes						**Program Specific Outcomes**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO4	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO5	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**1**

SEMESTER – IV

P23DM11 –DIFFERENTIAL GEOMETRY

Lecture hours: 5 **Credits: 3**

UNIT I

Space curves - Definition of a space curve – Arc length – Tangent – Normal and binormal – Curvature and torsion – Contact between curves and surfaces – Tangent surface – Involutes and evolutes – Intrinsic equations – Fundamental existence theorem for space curves – Helics.

UNIT II

Intrinsic properties of a surface - Definition of a surface – Curves on a surface – Surface of revolution – Helicoids – Metric – Direction coefficients – Families of curves – Isometric correspondence – Intrinsic properties.

UNIT III

Geodesics – Canonical geodesic equations – Normal property of geodesics – Existence theorems Geodesics – Canonical geodesic equations – Normal property of geodesics – Existence theorems – Geodesic parallels – Geodesics curvature- Gauss Bonnet Theorem – Gaussian curvature – Surface of constant curvature.

UNIT IV

Non intrinsic properties of a surface - The second fundamental form – Principal curvature – Lines of curvature – Developable - Developable associated with space curves and with curves on surface – Minimal surfaces – Ruled surfaces.

UNIT V

The second fundamental form – Principal curvatures – Lines of Curvature – Developables associated with space curves– Developables associated with curves on surfaces - minimal surfaces – ruled surfaces.

TEXT BOOK

1. An Introduction to Differential Geometry by T.J. Willmore published by Oxford University Press,New Delhi 2009.

UNIT I : Chapter 1 - Sections 1 to 9

UNIT II : Chapter 2 - Sections 1 to 9

UNIT III : Chapter 2 - Sections 10 to 18

UNIT IV : Chapter 3 - Sections 1 to 8

UNIT V : Chapter 4 - Sections 1 to 8

REFERENCE BOOKS

1. D.T. Struik, “Lectures on Classical Differential Geometry”, Addition – Wesley, Mass, 1950.
2. S. Kobayashi and K. Nomizu, “Foundations of Differential Geometry”,Interscience Publishers, 1963.
3. W. Klingenberg, “A Course in Differential Geometry”, Graduate Texts in Mathematics, Springer – Verlag 1979.
4. C.E.Weatherburn, “Differential Geometry of Three Dimensions”, University Press, Cambridge, 1930.

SEMESTER IV

Course Code :P23DM12
Title of the paper : MATHEMATICAL PYTHON

Lecture Hours:5/W 75hrs/Sem (Theory Hours :3 Lab:2 Hours) Credits : 3

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	5	**3**	-	-	2

Course Outcomes

	On completing this course the students will be able to	Unit	Hrs/S
CO1	Basic definitions of space curve	I	15
CO2	Understand intrinsic equation, Fundamental existence theorem for space curve and Helics	II	15
CO3	Gain the knowledge of metric, local intrinsic properties of a surface and Geodesics	III	15
CO4	Present the knowledge of Geodesic parallels, Geodesic curvature and Gauss Bonnet theorem	IV	15
CO5	Get the knowledge of local non-intrinsic properties of a surface.	V	15

	POs						**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**
CO1	**3**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO2	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**1**
CO4	**1**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**1**
CO5	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**1**

SEMESTER IV

MATHEMATICAL PYTHON-P23DM12

Lecture Hours : 5 **Credits : 3**

UNIT I

Features of Python - Chronology and Uses - Installation of Anaconda - Basic Data Types Revisited – Strings - Lists and Tuples - Conditional Statements: if, if…else, and if…else if…else constructs – if…else if…else Ladder - Logical Operators - The Ternary Operator – get Construct – Examples

UNIT II

Looping: While - Patterns -Nesting and Applications of Loops in Lists – Functions: Features of a Function - Basic Terminology - Definition and Invocation - Types of Function - Implementing Search – Scope - Recursion

UNIT III

Iterations, Generators, and Comprehensions: Power of ―For‖ - Iterators - Defining an Iterable Object - Generators – Comprehensions - File Handling: Introduction - File Handling ,Mechanism - Open Function and File Access Modes - Python Functions for File Handling - Command Line Arguments - Implementation and Illustrations

UNIT IV

Strings: Introduction - Use of ―For‖ and ―While‖ - String Operators - Functions for String Handling - Introduction to Object Oriented Paradigm: Introduction - Creating New Types -Attributes and Functions - Elements of Object-Oriented Programming

UNIT V

Classes and Objects: Introduction to Classes - Defining a Class -Creating an Object - Scope of Data Members - Nesting - Constructor - Constructor Overloading – Destructors – Inheritance: Introduction to Inheritance and Composition - Importance and Types – Methods - Search in Inheritance Tree - Class Interface and Abstract Classes

TEXT BOOK

H.Bhasin: Python Basics, Mercury Learning and Information Dulles, Virginia Boston, Massachusetts New Delhi

Unit I : Chapter 1 - Sections 1.2, 1.4, 1.5

Chapter 2 - Sections 2.2 to 2.4 & Chapter 3- Sections 3.2 to 3.7

Unit II : Chapter 4 - Sections 4.2 to 4.4 & Chapter 5 - Sections 5.2 to 5.8

Unit III : Chapter 6 - Sections 6.2 to 6 & Chapter 7 - Sections 7.1 to 7.6

Unit IV : Chapter 8 – Sections 8.1 to 8.4

Chapter 9 - Sections 9.1 to 9.4

Unit V : Chapter 10 - Sections 10.1 to 10.8

Chapter 11 - 11.1 to 11.5

REFERENCE BOOKS

1. Beginning-Python, Second Edition by Magnus Lie Hetland
2. The Complete Reference Python by Martin C. Brown
3. Head First Python by Patrick Barry
4. Learning Python, O'Reilly by Mark Lutz
5. Python in a Nutshell, O'Reilly by Alex Martelli

Website and e-Learning Source

https://nptel.ac.in/courses/106/106/106106212/

https://programmingsteps.blogspot.com/2013/10/raptor-flowchart

https://wiki.python.org/moin/BeginnersGuide/Download https://www.edx.org/learn/python

SEMESTER IV
SKILL ENHANCEMENT COURSE

Course Code:P23SEM3 **Lecture Hours:3/W /45hrs /Sem**
Title of the paper : Mathematics for NET/UGC-CSIR/SET/TRB Competitive Examinations **Credits : 2**

Pedagogy	Hours / Week	Lecture	Peer Teaching	GD/Tutorial/ Videos	ICT
	3	2	1	-	-

	Course Outcomes On completing this course the students will be able to	Unit	Hrs/S
CO1	Gain the knowledge of mathematical operators and mathematical problems	1	9
CO2	Develop increase their cognitive capabilities	2	9
CO3	Acuquire knowledge to complete a series	3	9
CO4	Understand the direction sense test-numbers test and time sequence test	4	9
CO5	Learn about blood relation	5	9

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CO1	3	1	3	2	3	3	3	2	1
CO2	2	1	3	1	3	3	3	2	1
CO3	3	2	3	1	3	3	3	2	1
CO4	1	2	3	2	3	3	3	2	1
CO5	3	1	2	3	3	3	3	2	1

Semester IV

P23SEM3- Mathematics for NET/UGC-CSIR/SET/TRB Competitive Examinations

Lecture Hours: 3/W 45hrs/Sem **Credits:2**

UNIT I

Algebra

UNIT II

Linear Algebra

UNIT III

Complex Analysis

UNIT IV

Ordinary Differential Equations and Partial Differential Equations

UNIT V

Numerical Analysis.

TEXT BOOK

Alok Kumar – CSIR-UGC NET/JRF/SET Mathematical Sciences, Latest Revised Edition, Upkar Prakashan, AGRA – 2,

UNIT I : Chapter 4
UNIT II : Chapter 2
UNIT III : Chapter 3
UNIT IV : Chapter 5
UNIT V : Chapter 6