UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION

(23/May/Adp./36)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the revised Syllabi and Courses of Study of subject of **Mathematics** for Master Degree Programme of Semesters **Ist** and **IInd** under the **Choice Based Credit System (as given in the annexure)** for the examinations to be held in the years as per the details given below:

Subject	**Semester**	**for the examination to be held in the years**
Mathematics	Semester-I Semester-II	December 2023, 2024 and 2025 May 2024, 2025 and 2026

The Syllabi of the courses is available on the University website: www.jammuuniversity.ac.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/23/ 3397-3407
Dated: 25-5-2023.

Copy for information and necessary action to:

1. Dean, Faculty of Mathematical Science
2. Convener, Board of Studies in **Mathematics**
3. Sr. P.A.to the Controller of Examinations
4. All members of the Board of Studies
5. Confidential Assistant to the Controller of Examinations
6. I/C Director, Computer Centre, University of Jammu
7. Deputy Registrar/Asst. Registrar (Conf. /Exams. UG/Eval Non-Prof)
8. Incharge, University Website for Uploading of the notification.

Sunita Sharma
24/5
Deputy Registrar (Academic)

24/5/23

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

The Master Degree Programme in Mathematics of University of Jammu is a two years CBCS programme consisting of four semesters and carries 88 credits with each Course of 4 Credits and the Dissertation in Semester IV shall carry 8 Credits. All courses in Semesters I and II are compulsory, In Semester III, first three courses are compulsory and students can choose any two courses out of rest of the given courses whereas in Semester IV, students can choose any three courses out of the given list of courses and there shall be a Dissertation of 8 credits. Students are required to earn 4 more credits each in Semester III and IV from a MOOC course from SWAYAM platform in Semester III and from an open course in Semester IV (given by different departments at the Campus as laid down in the CBCS guidelines of the University).

Titles of the Courses in each Semester

Semester I

1. PSMATC101	Abstract Algebra
2. PSMATC102	Real Analysis
3. PSMATC103	First Course in Topology
4. PSMATC104	Differential and Integral Equations
5. PSMATC105	Fundamentals of Computers

Semester II

1. PSMATC201	Rings and Modules
2. PSMATC202	Measure Theory
3. PSMATC203	Second Course in Topology
4. PSMATC204	Complex Analysis

15.05.2023

5. PSMATC205 Differential Geometry

Semester III

1. PSMATC301 Advance Complex Analysis
2. PSMATC302 Functional Analysis
3. PSMATC303 Linear Algebra
4. PSMATC304 Advance Measure Theory
5. PSMATC305 Complex Dynamics
6. PSMATC306 Partial Differential Equations
7. PSMATC307 Number Theory
8. PSMATC308 Multivariable Calculus
9. PSMATC309 Linear Programming and Optimization
10. PSMATC310 Numerical Methods
11. PSMATC311 Graph Theory

Semester IV

1. PSMATC401 Analytic Function Spaces
2. PSMATC402 Advance Functional Analysis
3. PSMATC403 Operator Theory
4. PSMATC404 Normal Families in Complex Analysis
5. PSMATC405 Value Distribution of Meromorphic Functions
6. PSMATC406 Geometric Function Theory
7. PSMATC407 Complex Analysis in Several Variables
8. PSMATC408 Algebraic Topology
9. PSMATC409 Harmonic Analysis
10. PSMATC410 Masters Dissertation
11. PSMATO411 Numerical Methods and Graph Theory
    (This is an open course for students of other departments)

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

SEMESTER I

(Examination to be held in December 2023, 2024, 2025)

Course Code: PSMATC101 **Course Title: Abstract Algebra**
Credits: 04 **Total Number of Lectures: 60**

Maximum Marks: 100, **Minor I:** 20 **Marks**, **Minor II:** 20 **Marks**, **Major:** 60 **Marks**

Objectives: The aim of this course is to continue an UG Course on Algebra to nex level.

Prerequisite of this course: UMJMAT402

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Conjugacy classes, class equation, centre of a group, Cauchy's theorem, p-groups, Sylow's Theorem I, II and III. Internal direct sums and direct products of finite groups. Finite Abelian groups as direct sums of Sylow subgroups.

Unit-II

Normal and subnormal series, Solvable groups, Solvability of subgroups, factor groups and of finite p-groups, Commutator subgroups and solvability. Simple groups. Composition series. Jordon-Holders theorem for finite groups. Simplicity and non-solvability of A_n, $n \geq 5$.

Unit-III

Modules. submodules. sum of submodules, finitely generated modules, cyclic modules, finite direct sum and direct product. Quotient Modules, homomorphisms, Isomorphism theorems. Submodules of Quotient Modules, Ring as a modules over itself and its submodules. Algebra of ideals of a ring, maximal and prime ideals, ideals of quotient Ring.

Unit-IV

Unit, prime and irreducible elements of a ring. Factorization domain and the ascending chain condition on principal ideals. $R[x]$ the polynomial rings as a factorization domain when R is a factorization domain. The ring $\mathbb{Z}[x]$ as a factorization domain. Euclidean domain and principal ideal domain as factorization domains. Unique factorization domain and the irreducible and prime elements of U.F.D., Polynomial rings over a U.F.D. Eisenstein's irreducibility criterion and Gauss theorem.

15.05.2023

Text Books:

1. I. N. Herstein. Topics in Algebra, Wiley, 2nd edition, 1975. (Unit-I & II)
2. D. S. Dummit and R. M. Foote, Abstract Algebra, Wiley, 3rd edition, 2011.

Reference Books:

1. J. A. Gallian, Contemporary Abstract Algebra, 9th Edition, Brooks/Cole Cengage Learning, 2017.
2. N. Jacobson, Basic Algebra I, Dover Publications Inc, 2nd edition, 2009.
3. T. A. Hungerford, Algebra, Graduate Texts in Mathematics, Springer-Verlag, 1980.
4. C. Musili, Introduction to Rings and Modules, Narosa Publishing House, 1984.
5. N.S.Gopalakrishnan, University Algebra, second Edition, Wiley Eastern Ltd., New Delhi 1994.

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60

Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

   a) Section A shall have one question equally distributed over Unit-I and Unit-II.

   b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

SEMESTER I

(Examination to be held in December 2023 2024, 2025)

Course Code: PSMATC102 Course Title: Real Analysis Credits: 04
Total Number of Lectures: 60

Maximum Marks: 100, **Minor I:** 20 **Marks**, **Minor II:** 20 **Marks**, **Major:** 60 **Marks**

Objectives: The conventional portion of limits, continuity and differentiability on $\mathbb{R}$ have been done at undergraduate level. The purpose of this Course is to introduce some of the remaining portion of Real Analysis Viz. Topology of $\mathbb{R}^n$, the uniform continuity, uniform convergence of sequences and series of functions, Riemann-Stieltjes integrals and functions of several variables.

Prerequisite of this course: Undergraduate Calculus Courses.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Elements of Point Set Topology: Euclidean Space $\mathbb{R}^n$, Open ball and Open sets in $\mathbb{R}^n$, Closed sets, adherent sets, Bolzano-weistrass theorem, Cantor intersection theorem, Lindeloff covering theorem, Hein-Borel theorem, compactness in , Metric spaces, open sets and closed sets in metric spaces, compact subsets of metric spaces, Boundary of a set in metric spaces.

Unit-II

Riemann-Steiltjes Integral: Definition of Riemann-Stieltjes integral, linear properties of R-S integrals, integtration by parts, change of variable, reduction to Riemann-Stieltjes integral to finite sum, Euler's summation formula, upper and lower R-S integrals, Riemann's condition, comparison theorems. First and second mean value theorems for R-S integrals. Function of bounded variation, total variation, additive property of total variation. Total variation on $[a, x]$ expressed as the difference of increasing functions. Rectifiable path and arc length. First and second fundamental theorems of integral calculus.

Unit-III

Pointwise and uniform convergence, uniform convergence and continuity, Cauchy condition for uniform convergence, uniform convergence of infinite series. Weistrass M-test, uniform convergence and R-S integration, uniform convergence and differentiation. Power series, multiplication of power series, the substitution theorem. Reciprocal of a power series, Taylor's series generated by a function. Bernstein's theorem. Abel's limit theorem, Tauber's theorem.

Unit-IV

Functions of Several Variables: The Directional derivative, total derivative, matrix of a linear function, Jacobian matrix and the 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 formula for function from $\mathbb{R}^n$ to $\mathbb{R}^n$. Functions with non-zero Jacobian determinant, the inverse function theorem. the implicit function theorem (only statements).

Text Books:

Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.

Reference Books:

1. 1. W. Rudin : Principles of Mathematical Analysis, McGraw Hill International Edition (Third edition), 1976.
2. Steven G. Krantz, Real Analysis and Foundations, CRC Press Inc., 1991.
3. Robert T. Seeley. Calculus of Several Variables. Scott. Foresman and Company, 1970.
4. S.C. Malik and Savita Arora, Mathematical Analysis, Wiley Easter. New Delhi 1984.

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60

Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

   a) Section A shall have one question equally distributed over Unit-I and Unit-II.

   b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

15.05.2023

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

SEMESTER I

(Examination to be held in December 2023, 2024, 2025)

Course Code: PSMATC103 Course Title: First Course in Topology
Credits: 04 Total Number of Lectures: 60

Maximum Marks: 100, Minor I: 20 Marks, Minor II: 20 Marks, Major: 60 Marks

Objectives: The syllabus aims to familiarize students with the essential concepts and techniques of set theory and topology. The first part of the syllabus includes topics such as Axioms of Choice, cardinality, and the continuum hypothesis. The second part focuses on topological spaces, continuous functions, and their properties like connectedness, compactness, and limit points. The goal is to provide students with a solid understanding of mathematical reasoning and problem-solving, allowing them to apply these concepts in various mathematical contexts. The problems and exercises based on these concepts are intended to develop their analytical and critical thinking skills.

Prerequisite of this course: Undergraduate course on set theory and real analysis.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Cartesian product of a family of sets, Axioms of Choice and some of its equivalent forms: Hausdorff Maximality Principle, Zorn's Lemma, the well-ordering principle. Applications of Zorn's Lemma, the principle of transfinite induction. The concept of the cardinal numbers, ordering of cardinal numbers, the Schröder-Bernstein Theorem, cardinal number of power set, Cantor's Theorem, the continuum hypothesis and its generalization. Problems and exercises based on these concepts.

Unit-II

Topological Spaces, basis and subbasis for a topology, order topology, product topology, Subspace topology, closed sets and limit points, closure and interior sets, Hausdorff space. Problems and exercises based on these concepts.

Unit-III

Continuous functions, homeomorphisms, the pasting lemma, product topology, box topology and uniform topology and their relationships. Metric topology, the sequence lemma, Uniform limit theorem, quotient topology. Problems and exercises based on these concepts.

15.05.2023

Unit-IV

Connectedness, path connectedness, components and local connectedness, compact spaces, compact subspaces of the real line, uniform continuity theorem, finite intersection property, limit point compactness, sequential compactness. Concept of Nets. Problems and exercises based on these concepts.

Text Books:

1. T Lin and You-Feng Lin, Set Theory, Houghton Mifflin Company Boston, 1974 (for Unit-I).
2. J. R. Munkres, Topology, Pearson Education India, 2013 (for Unit-II, III & IV).

Reference Books:

1. H. B. Ederton, Elements of Set Theory, Academic Press, 1977.
2. P. R. Halmos, Naive Set Theory, East-West Press, 1960.
3. M. H. A. Newman, Elements of the Topology of Plane Sets of Points, 2nd edn. Cambridge University Press, 1951.
4. S. Willard, General Topology, Addison Wesley, 1970.
5. G. F, Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Education, 1963.
6. J. Dugundji, Topology, Allyn and Bacon, 1966.
7. J. L. Kelley, General Topology, Springer Science & Business Media, 1975.

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60

Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

15.05.2023

a) Section A shall have one question equally distributed over Unit-I and Unit-II.

b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

15.05.2023

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

SEMESTER I

(Examination to be held in December 2023, 2024, 2025)

Course Code: PSMATC104 **Course Title: Differential and Integral Equations** **Credits: 04** **Total Number of Lectures: 60**

Maximum Marks: 100, **Minor I: 20 Marks,** **Minor II: 20 Marks,** **Major: 60 Marks**

Objectives: The subject of Differential Equations is the natural application of elementary calculus and most important part of Mathematics for understanding the physical sciences, engineering and technology, economics etc. Also, in the deeper questions it generates, it is the source of most of the ideas and theories which constitute higher analysis. It is indispensable for understanding the nature mathematically. So the objective of this course is to make the students understand the physical world mathematically besides preparing to do analysis at higher levels.

Prerequisite of this course: Undergraduate course on Calculus.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Existence and uniqueness theorem for first order differential equations, Picard's method of successive approximations. Linear differential equation of order n, definition and basic existence theorem, basic theorem on linear homogeneous differential equation, idea of linear independence and linear dependence, Wronskian. method of reduction of order, method of variation of parameters. the Cauchy Euler equation. Examples and exercises on these topics with applications in electric circuits.

15.05.2023

Unit-II

Power series solutions about ordinary points, definitions and existence theorem, solutions of Legender equation, Legender polynomials, generating function, Rodrigues formula, and orthogonality property of Legender's polynomials. Power series solutions about singular points- the method of Frobenius, definition, existence theorem, thge method of Frobenius, solutiuons of Bessel's equations, Bessel's functions and their properties. Gauss hypergeometric differential equations and functions defined by them with some important properties- Chebyshev polnomials and minimax property. Riemann's equations- the generalized Gauss hypergeometric equations. Examples and exercises based on these topics.

Unit-III

Laplace transform: Definition, Existence and Basic properties of Laplace transform, the Inverse Laplace transform and the convolution, applications of Laplace transform to linear differential equations with constant coefficients, Sturm-Liouville boundary value problems: Definitions and examples, characteristic values and characteristic functions, and orthogonality of characteristic functions.Green's function: Concept of Green's function, properties of Green's function. Construction of Green's function for various differential operators, and idea of Dirac- delta function. Examples and exercises based on these topics.

Unit-IV

Linear Integral Equations: Introduction, classifications- Fredholom and Volterra equations, conversion of differential equations into integral equations-IVP and BVP, Fredholom equations with degenerate Kernels- equations of first and second kinds, Fredholom equations- method of resolvent Kernels, Volterra equations-Resolvent Kernels. Examples and exercises based on these topics.

Text Books:

1. S.L. Ross: Differential Equations, 3rd Edition, John Wiley and Sons (Asia) Pvt. Ltd. 2004(for unit I, II, and III).
2. B.P. Prasher: Differential and Integral Equations, CBS Publishers and Distributors, Delhi- 1989 (for Units III and IV).

Reference Books:

1. G.F. Simmons, Differential Equations with Applications and Historical Notes, Tata McGraw- Hill 2003.
2. W. E. Boyce, and R.C.DiPrima, Elementary Differential Equations and Boundary value Problems, John Wiley and Sons, 1977.
3. E. A. Coddignton, An Introduction to Ordinary Differential Equation, Prentice Hall of India Pvt. Ltd., New Delhi 2005.

15.05.2023

4. R. P. Kanwal, Linear Integral Equations- Theory and Techniques, Academic Press, New York, 1971.

5. F.G. Roach, Green's Function. Von Nostrand, 1970.

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60

Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

   a) Section A shall have one question equally distributed over Unit-I and Unit-II.

   b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

15.05.2023

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

SEMESTER I

(Examination to be held in December 2023, 2024, 2025)

Course Code: PSMATC105
Course Title: Computer Applications in Mathematics
Credits: 04
Total Number of Lectures: 60
Maximum Marks: 100, Minor I(Laboratory Work): 20 Marks
Minor II(Laboratory Work): 20 Marks
Major: 60 Marks.

Objectives: The course aims to develop:

1. basic understanding of the problem solving using Computer and developing skills to prepare technical mathematical write-ups.
2. familiarity with the concepts and terminologies that is essential to mathematical problem solving.
3. the minimal and invasive knowledge and skills developed through this course will enable to understand the Computer Science subjects in a better way and explore further developments in the area.

Prerequisite of this course: Basics of mathematics and computers.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Mathematical writing using LaTeX Introduction to LaTeX, Basic Syntax, Latex Compilation, DVI file, Formatting Text- Fonts, Shapes and Styles, Line spacing, Two-column landscape document, Table of Contents, Page Breaks. Customizing header and footer, Footnotes, Bulleted and Numbered Lists, Tables, Combining rows and columns, Merging cells with multirow package, Label and reference of picture, Generating an index page, Creating bibliography-citing text and listing the references.

Unit-II

C-Language Fundamentals, Programming Language and its Types, Language Compiler and Interpreter, Characteristics of C, C Program Structure, C Preprocessor Directives, Statements and Functions. Executing C-program. Data Types, Input Output functions, Operators and Expressions, Control statements, Repetitive statements, Programming Exercises.

15.05.2023

Unit-III

Data Representation and Processing Fundamentals Arrays, Strings, Two Dimensional Arrays, Representing matrices and performing matrix operations, Structures, User-defined Functions, Concepts of File Management, Working with text and Binary Files, Programming Exercises base on Arrays: like, searching an item, finding minimum/maximum item finding average and standard deviation etc.

Unit-IV

Programming in Mathematica Expressions, Special Input Forms, Lists and Strings, Generating Lists, Manipulating Lists, Character Strings, Procedural Programming, Functions, Conditional Execution, Iteration, Parameter-Passing Semantics, Matrices and operations, Scalars and Vectors, Solving linear system of equations, Eigen Values and Eigen Vectors, Tensors.

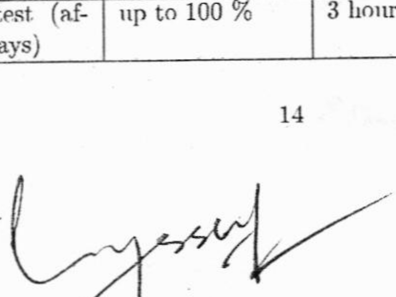
Reference Books:

1. Stefan Kottwitz, Latex: Beginner's guide (1st edition), Packt publishing, Indian edition, 2011.
2. Lamport Leslie, LaTeX: A Document Preparation System, User's Guide and Reference Manual (2nd ed.). Pearson Educatio, Indian Reprint, 1994.
3. SwapnaKumar, Latex -A beginner guide to professional documentation (1st edition), Trinity Press, 2019.
4. E. Balagurusamy, Programming with ANSI-C, Sixth Edition, Tata McGraw Hill, 2012.
5. H. M. Deitel and P. J. Deitel, How to program, 7th edition, Pearson Education, 2010.
6. Stephen Wolfram, The Mathematica (5th Edition), Wolfram Media, 2003.
7. Sal Mangano, Mathematica Cookbook (1st edition), O'relley Publications, 2010.

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60



Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

   a) Section A shall have one question equally distributed over Unit-I and Unit-II.

   b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

SEMESTER II

(Examination to be held in May 2024, 2025, 2026)

Course Code: PSMATC201 **Course Title: Rings and Modules**
Credits: 04 **Total Number of Lectures:** 60

Maximum Marks: 100, **Minor I:** 20 Marks, **Minor II:** 20 Marks,
Major: 60 Marks

Objectives: The aim of this course is to extend the study of algebraic structures beyond group structures. In this course the algebraic structures like rings and modules are considered.

Prerequisite of this course: PSMATC101

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Annihilators of Modules, change of Rings, faithful Modules , simple Modules. Primitive ideal. Homomorphic images of prime, primitive and maximal ideals, prime, primitive and simple Rings. Existence of maximal ideal and minimal prime ideals of a ring. Prime radical and semi- prime ideals. Jacobson radical and quasi- regular elements. Case of commutative rings. Matrix rings and their ideals.

Unit-II

Chain condition on Modules. Noetherian and Artinian Modules. Noetherian and Artinian rings. Maximum and minimum conditions. Case of direct products and matrix rings. Hilbert basis theorem.

Unit-III

Prime radical in the Noetherian case. Nakayama lemma and Jacobson radical in the Artinian case. Opposite ring and Schur's lemma. Chevalley Jocobson density theorem. Structure of simple Artinian rings, Prime ideals of an Artinian ring. Neotherianness of Artinian rings.

Unit-IV

Free modules. modules over a P.I.D., submodules of a free module over a P.I.D., Torsion and Torsion free modules, Structure theorem for finitely generated modules over a P.I.D., The elementary divisior theorem, Applications to finite abelian groups.

Text Books:

15.05.2023

1. N.H. McCoy, The Theory of Rings, New York, Macmillan 1964. (Unit-I)
2. C. Musili, Introduction to Rings and Modules, Narosa Pub. House, New Delhi, 1994. (Unit-II,III & IV)

Reference Books:

1. D. S. Dummit and R. M. Foote, Abstract Algebra, Wiley, 3rd edition, 2011.
2. N. Jacobson, Basic Algebra I & II, Dover Publications Inc, 2nd edition. 2009.
3. T. A. Hungerford, Algebra, Graduate Texts in Mathematics, Springer-Verlag, 1980.
4. Atiyah M.F. and MacDonald I. G., Introduction to commutative algebra, CRC Press, 2018

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60

Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

   a) Section A shall have one question equally distributed over Unit-I and Unit-II.

   b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

15.5.2023

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

SEMESTER II
(Examination to be held in May 2024, 2025, 2026)

Course Code: PSMATC202 **Course Title: Measure Theory**
Credits: 04 **Total Number of Lectures: 60**
Maximum Marks: 100, **Minor I: 20 Marks,** **Minor II: 20 Marks,**
Major: 60 Marks

Objectives: The main purpose of this course is to study general theory of measure integration. The theory of measures has its origin in the idea of length, area and volume in Euclidean spaces. It has a lot of application in functional theory and several branches of Physics.

Prerequisite of this course:PSMATC102

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

$\sigma-$algebra of sets, limits of sequences of sets. Generation of algebras, Borel $\sigma-$algebra, G_δ and F_σ sets. Measure on $\sigma-$algebra, Measures of sequences of sets, Measurable spaces and measure space. Outer measures, regular outer measure, metric outer measure, construction of outer measure. Examples and exercises on these topics.

Unit-II

Lebesgue outer measure on R, properties of Lebesgue measure spaces, translation invariances of Lebesgue measure. Existence of non-Lebesgue measurable sets. Regularity of Lebesgue outer measure. Cantor ternary set and cantor function. Relation between Lebesgue and Borel measurability, completion of measure space. Completion of Borel measure space to the Lebesgue measure space. Examples and exercises on these topics.

Unit-III

Measurable functions, Operation with measurable function, equality a.e., Sequence of measurable functions, continuity and Borel Lebesgue measurability of functions on $\mathbb{R}$, integration of simple functions, Lebesgue integral of non-negative and measurable functions. Properties of Lebesgue integrals. Examples and exercises on these topics.

15.05.2023

Unit-IV

Convergence a.e., Almost uniform convergence, Egroff's theorem, convergence in measure, convergence in mean. Cauchy sequence in measure, relation among various convergence types. Fatou's lemma, Lebesgue monotone convergence theorem. Lebesgue dominated theorem. Examples and exercises based on these concepts.

Text Books: J. Yeh : Lectures on Real Analysis, World Scientific, 2000.

Reference Books:

1. M.E. Munroe : An Integration 2nd ed. Addison Wesley, 1971.
2. G.D. Barra : Measure Theory and Integration, Willey Eastern 1987.
3. H.L. Royden : Real Analysis, 3rd edition, Macmilon, New York 1988.

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60

Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

   a) Section A shall have one question equally distributed over Unit-I and Unit-II.

   b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

15.05.2023

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

SEMESTER II

(Examination to be held in May 2024, 2025, 2026)

Course Code: PSMATC203
Course Title: Second Course in Topology Credits: 04
Total Number of Lectures: 60
Maximum Marks: 100, **Minor I:** 20 Marks, **Minor II:** 20 Marks, **Major:** 60 Marks

Objectives: The objective of this course is to introduce and explore advanced topics in topology such as the countability axioms, separation axioms, Urysohn Lemma, the Urysohn Metrization Theorem, the Tietze Extension Theorem, local compactness, one-point compactification, Tychonoff's theorem, Stone-Ĉech compactification, metrization theorems, completeness, equicontinuity. Ascoli's theorem, Baire spaces, and topological dimension.

Prerequisite of this course: First Course in Topology- PSMATC103.

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

The countability axioms, the separation axioms. Normal spaces, the Urysohn Lemma, the Urysohn Metrization Theorem, the Tietze Extension Theorem, m-manifolds, Imbeddings of Manifolds, Theorem on existence of finite partitions of unity. Problems and exercises based on these concepts.

Unit-II

Local compactness, one-point compactification, the Tychonoff theorem for finite products. Tychonoff's theorem for arbitrary products, Stone-Čech compactification, applications of the Tychonoff theorem. Local finiteness, paracompactness, metrizable space, metrization theorems: the Nagata-Smirnov metrization theorem and the Smirnov metrization theorem. Problems and exercises based on these concepts.

Unit-III

Complete Metric Spaces, uniform metric, sup metric, completion of metric space, a space-filling curve, compactness in metric spaces, equicontinuity, classical version of Ascoli's theorem, pointwise and compact convergence, evaluation map, Ascoli's theorem. Problems and exercises based on these concepts.

Unit-IV

Baire spaces, the Baire category theorem, applications of the Baire category theorem, a nowhere-differenriable function, m-manifolds, topological dimension, imbedding theorem. Problems and exercises based on these concepts.

15.05.2023

Text Books:

1. J. R. Munkres, Topology, Pearson Education India, 2013.

Reference Books:

1. S. Willard, General Topology, Addison Wesley, 1970.
2. J. R. Munkres, Topology of Manifolds, Westview Press, 1991.
3. G. F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Education, 1963.
4. G. E. Bredon, Topology and Geometry, Springer, 1993.
5. R. Brown, Topology and Groupoids, BookSurge Publishing. 2005.
6. J. Dugundji, Topology, Allyn and Bacon, 1966.
7. J. L. Kelley, General Topology, Springer Science & Business Media, 1975.

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60

Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

   a) Section A shall have one question equally distributed over Unit-I and Unit-II.

   b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

15.05.2023

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS) University of Jammu.

SEMESTER II

(Examination to be held in May 2024, 2025, 2026)

Course Code: PSMATC204 **Course Title: Complex Analysis**
Credits: 04 **Total Number of Lectures:** 60

Maximum Marks: 100, **Minor I:** 20 **Marks, Minor II:** 20 **Marks, Major:** 60 **Marks**

Objectives: This course aims at proving the Cauchy Theorem. its consequences, Laurent's Theorem, Cauchy Residue Theorem and its consequences and applications.

Prerequisite of this course: PSMATC102 and PSMATC103

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

A quick review of analytic functions done at UG level (not more than 3 lectures).
Spherical representation of complex numbers and the extended complex plane, real differentiability, the fuctions f_z and $f_{\bar{z}}$.
Complex Integration: Paths in the Complex Plane, Smooth and Piecewise Smooth Paths, Parametrizing of Paths, Change of Parameter, Integral Along Paths, Complex Line Integrals, Properties of Contour Integrals and Primitives. Rectifiable Paths, Integral Along Rectifiable Paths. Examples and Exercises based on these topics.

Unit-II

Cauchy Theorem for a rectangle. Integral and Primitives, Cauchy Theorem for a disk. Winding Numbers, Oriented Paths, Jordon Contours, the Cauchy Integral Formula, the Cauchy Integral Formula for higher derivatives-analyticity of derivatives. Derivative Estimates-(cauchy's Estimate, Liouville's Theorem, Fundamental Theorem of Algebra). Maximum Principle, Schwarz Lemma and Hadamard Three Circle Theorem. Simply Connected Domains: Simple Connectivity, Primitives and Logarithms.

Unit-III

Sequences and Series of Analytic Functions: Uniform convergence and normal convergece, general results, Taylor's series, Laurent's series and Laurent's Theorem. Zeros of analytic functions, classification of isolated singularities of analytic functions-removable singularity, pole and essential singularity, and singularity

15.05.2023

at infinity. Cauchy Residue Theorem and evaluating integrals with Cauchy Residue Theorem, Consequences of Cauchy Residue Theorem-(Arguemnt Principle, Rouch's Theorem, Open Mapping Theorem and Hurwitz's Theorem).

Unit-IV

Conformal Mappings: Curvilinear Angles, Diffeomorphisms, Conformal Mappings, Some Standard Conformal Mappings, Self-mappings of the Plane and the Unit Disk, Conformal Mappings in the Extended Plane.
Mobius Transformations: Elementary Mobius Transmormations, Mobius Transformation and Matrices, Fixed Points, Cross Ratios, Circles in the Extended Plane, Reflection and Symmetry, Classification of Mobius transformations and Invariant Circles.

Text Books:

Bruce P. Palka, An Introduction to Complex Function Theory, Springer Science+Business Media, New York, 1991.

Reference Books:

1. Lars V. Ahlfors, Complex Analysis, McGraw-Hill International Editions, 1979.
2. John B. Conway, Functions of One Complex Variable, Narosa Publishing House, 1990.
3. James W. Brown and Ruel V. Churchill, Complex Variables and Applications, McGraw-Hill Education, New York, 2014.
4. Theodore W. Gamelin, Complex Analysis, Springer, 2001.
5. S. Ponnusamy and Herb Silverman, Complex Variables with Applications, Birkhauser, 2006.
6. Serge Lvovski, Principles of Complex Analysis, Springer, 2020.
7. Reinhold Remmert, Theory of Complex Functions, Springer, 1991.
8. Steven G. Krantz, Complex Variables. Chapman and Hall/CRC, 2008.
9. Joseph L. Taylor, Complex Variables, American Math. Soc., 2011.
10. Elias M. Stein and Rami Shakarchi, Princeton University Press, 2003.
11. Zeev Nihari. Conformal Mappings, Dover Publications Inc. New York, 1975.

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

15.05.2023

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60

Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

  a) Section A shall have one question equally distributed over Unit-I and Unit-II.

  b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

15.05.2023

Revised Syllabi and Course of Study of Two Years Master Degree Programme in Mathematics (CBCS)
University of Jammu.

SEMESTER II

(Examination to be held in May 2024, 2025, 2026)

Course Code: PSMATC205 **Course Title: Differential Geometry**
Credits: 04 **Total Number of Lectures: 60**

Maximum Marks: 100, Minor I: 20 Marks, Minor II: 20 Marks, Major: 60 Marks

Objectives: Being a fundamental course, this course aims at preparing students to realise and do mathematics geometrically by understanding curves, surfaces and geodesics.

Prerequisite of this course: Undergraduate courses on Calculus, Vector Calculus and Three Dimensional Geometry

Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Curves: Differentiable curves, arc length, parametrization by arc length, plane curves, plane curvature, Directed curvature, Fundamental Theorems for plane curves.
Curves in space: Tangent, normal and binormal unit vectors, curvature and torsion. Oriented Serret frame, Fernet- Serret theorem. Fundamental Theorem for curves in $\mathbb{R}^3$. Properties of curves such as Helix, Bertrand mete, involute, curves on sphere.

Unit-II

Surfaces: A regular surface, examples, coordinate charts, change of coordinate , differentiable functions, diffeomorphism, tangent plane, unit normal vector, oriented surfaces, first fundamental form, element of arc length, invariance of line element under coordinate change, angle between two curves, orthogonal parametrization. Area, curvature for surfaces, Euler's work on surfaces, Principle curvatures, line of curvature. Rodrigue's formula, Gauss map, second fundamental form. Meusnier's theorem, Gaussian curvature, Dupin indicatrix.

Unit-III

Metric Equivalence of Surfaces: Isometry, local isometry, Christoffel symbols, Theorema Egreguem. Gauss equations, Mainardi- Codazzi equations, Statement of Fundamental theorem for regular surfaces, Line of curvature, asymptotic line, special, Geodesic curvature.

15.05.2023

Unit-IV

Geodesics: Local distance, minimizing properties of geodesics, exponential map, Hopf-Rinow Theorem. Statement of Hopf's Umlaufsatz. Gauss-Bonnet Theorem, Some applications of Gauss-Bonnet Theorem.

Text Books:

John McCleary, Geometry From a Differentiable Point of View. Cambridge University Press, 1994.

Reference Books:

1. D.T. Struik. Differential Geometry, Addison Wesley, 1961.
2. Nirmala Parkash, Differential Geometry, Tata MacGraw Hill, Publication Company, New Delhi.
3. W. Klingenberg, A Course in Differential Geometry, Springer-Verlag. New York, 1976.
4. M. Do Carmo: Differential Geometry of Curves and surfaces, Prentice Hall Englewood Cliff's, N.J. 1976.

Scheme of Examination:

There shall be three tests and the students shall be continuously evaluated on the basis of their performance as follows:

Theory	Syllabus to be covered in the examination	Time allotted for the examination	% weight age marks
Minor test-I (after 30 days)	up to 25 %	1 hour 30 min.	20
Minor test-II (after 60 days)	up to 50 %	1 hour 30 min.	20
Major test (after 90 days)	up to 100 %	3 hour	60

Note for paper setting of Major Test:

i) There shall be two sections in the question paper, namely, Section A and Section B.

   a) Section A shall have one question equally distributed over Unit-I and Unit-II.

   b) Section B shall have four questions equally distributed over Unit-III and Unit-IV.

ii) Each question shall be of the same weightage of 12 marks.

iii) There shall be 100 % internal choice.

15.05.2023