



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./37)

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 Syllabi and Courses of Study in the subject of **Mathematics** of Semesters **IIIrd** and **IVth** for **Four Year Under Graduate Programme** under the **Choice Based Credit System** as per **NEP-2020 (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-III	December 2023, 2024 and 2025
	Semester-IV	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/23/3408-3418
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.

Sumitashamo
Deputy Registrar (Academic)

SS AOU 24/5/23

Semester – III

SEMESTER III (MATHEMATICS)

4 Credits Courses

S.No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory:75		Tutorial:25		
					Mid Sem Exam	End Sem Exam	Assessment	Exam	
1.	Major	UMJMAT301	Real Analysis-I	4	15 marks	60 marks	10 marks	15 Marks	100
2.	Major	UMJMAT302	Partial Differential Equations	4					
3.	Minor	UMIMAT303	Real Analysis	4					

3 Credits Courses

S.No.	Course Type	Course No.	Course Title	Credits	Total Marks		Total marks
					Theory		
1.	MD	UMDMAT304	Foundations of Mathematics	3	Mid Semester: 15 marks	End Semester: 60 marks	75
2.	AE	UAEMAT306	Linear Programming	3			

2 Credits Courses

S.No.	Course Type	Course No.	Course Title	Credits	Total Marks		Total marks
					Theory	Practical	
1.	SE	USEMAT305	LATEX	2	Mid Semester: 10 marks End Semester: 20 marks	20 marks	50

[Signature]
15.05.2023

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS
as per NEP-2020.

SEMESTER III
(Examination to be held in December 2023, 2024, 2025)
Major Course

Course Code: UMJMAT301
Course Title: Real Analysis-I
Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, Theory: 75, Tutorial: 25

Objectives: The main objective of this course is the study of sequences and series of real numbers.

Prerequisite of this course: UMJMAT101 and UMJMAT201

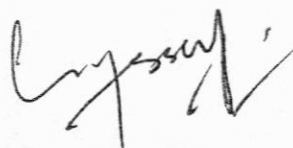
Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

Finite and infinite sets. Intervals. Countable and uncountable sets, Absolute value and the Real line. Triangular Inequality, Bounded and unbounded sets, Supremum and infimum of sets, Least upper bound and greatest lower bound, \mathbb{R} as a complete ordered field, Existence of rationals and irrationals between reals. Examples and Exercises based on these topics-to be done as tutorials.

Unit-II

Definition of real sequences, Limit of a sequence, Convergence, boundedness and divergence of sequences, Oscillatory and monotone sequences, Uniqueness of a limit. Operations on convergent and divergent sequences. Monotone Convergence Theorem and its applications to the calculation of square root of positive numbers. Squeezing Principle. Examples and Exercises based on these topics-to be done as tutorials.



Unit-III

Subsequences and Bolzano-Weierstrass Theorem, Cauchy Sequences, Cauchy's General Principle of Convergence, Nested Interval Theorem, Contractive Sequences. Examples and Exercises based on these topics-to be done as tutorials.

Unit-IV

Infinite series and their convergence and divergence, Cauchy's Criterion for series, Conditional and absolute convergence, Geometric series test, p-series test, comparison tests, D'Alembert's ratio test, Cauchy's root test, Raabe's test, Gauss test (without proof). Examples and Exercises based on these topics-to be done as tutorials.

Text Books:

1. Robert G. Bartle and Donald R. Sherbert. *Introduction to Real Analysis*, Wiley India Edition, 2011.
2. Richard R. Goldberg. *Methods of Real Analysis*. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

Reference Books:

1. S.C. Malik and Savita Arora, *Mathematical Analysis*, New Age International Publisher, 1982 (2020 reprint).
2. Sudhir R. Ghorpade, Balmohan V. Limaye, *A Course in Calculus and Real Analysis*, Springer, 2018.
3. Walter Rudin, *Principles of Mathematical Analysis*, 3rd Edition, McGraw-Hill International Editions, 1976.
4. Tom M. Apostol. *Mathematical Analysis*, Narosa Publishing House, 1985.
5. Charles G. Denlinger, *Elements of Real Analysis*, Jones and Bartlett India Pvt. Ltd, 2011.
6. Houshang H. Sohrab, *Basic Real Analysis*, Birkhauser, 2003.
7. H. Protter, *Basic Elements of Real Analysis*, Springer, 1998.
8. Stevan G. Krantz, *Real Analysis and Foundations*, CRC Press, 2000.
9. William R. Parzynski and Philip W. Zipse, *Introduction to Mathematical Analysis*, McGraw-Hill International Editions, 1987.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.



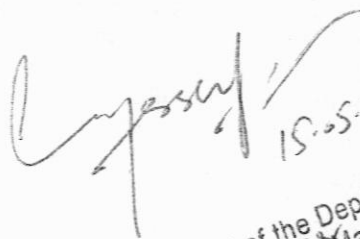
Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).


15.05.2023
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SEMESTER III
(Examination to be held in December 2023, 2024, 2025)
Major Course

Course Code: UMJMAT302
Course Title: Partial Differential Equations Credits: 04
Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, Theory: 75, Tutorial: 25

Objectives: This course aims at gaining a clear intuitive understanding of the concept of partial differential equation and its relevance in describing physical phenomena such as diffusion and wave propagation, and to learn the separation of variables method to solve linear parabolic, elliptic and hyperbolic partial differential equations.

Prerequisite of this course: UMJMAT101 and UMJMAT201

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

Introduction to Partial Differential Equations, order and degree of a partial differential equation, Formation of partial differential equations by eliminating arbitrary constants and functions, types of partial differential equations, Lagrange's method of solving partial differential equations of order one. Examples and Exercises based on these topics-to be done as tutorials.

Unit-II

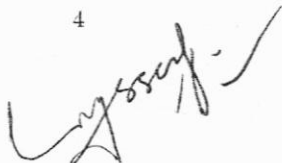
Nonlinear partial differential equations of degree one. Complete integral, singular integral, general solution, Charpit's method and solution of equations of the type $f(p, q) = 0$, $z = px + qy + f(p, q)$, and $f(x, p) = g(y, q)$. Examples and Exercises based on these topics-to be done as tutorials.

Unit-III

Homogenous and Non-Homogenous linear partial differential equations of 2nd and 3rd order with constant coefficients of the type $F(D, D') = g(x, y)$, where $g(x, y) = 0, e^{ax+by}, \sin(ax + by), \cos(ax + by), f(ax + by)x^m y^n, V e^{ax+by}$. Homogenous partial differential equation of the type

$$[(D + m_1 D')(D + m_2 D')(D + m_3 D')]z = f(x, y).$$

Examples and Exercises based on these topics-to be done as tutorials.



Unit-IV

Classification of second order partial differential equation, Canonical form, Canonical form of hyperbolic, parabolic and elliptic equations. Solution of heat and wave equations by separation of variables, Dirichlet problem for a rectangle, Neumann problem for a rectangle. Examples and Exercises based on these topics-to be done as tutorials.

Text Book:

K. Sankara Rao, *Introduction to Partial Differential Equations*, Prentice Hall of India Pvt. Ltd. 2007.

Reference Books:

1. I. N. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill International Editions.
2. T. Hillen, I. E. Leonard and H. Van Roessel, *Partial Differential Equations*, Wiley- A John Wiley and Sons Inc. Publications, 2012.
3. M.D. Raisinghania, *Ordinary and Partial Differential Equations*, S. Chand and Co., 2020.
4. E. G. Petrovsky, *Lectures on Partial Differential Equations*, Dover Publication Inc. 1991.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

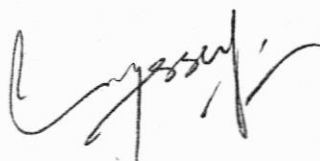
Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).



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SEMESTER III

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

Minor Course

Course Code: UMIMAT303

Course Title: Real Analysis

Credits: 04

Total Number of Lectures: Theory: 45, Tutorials: 15

Maximum Marks: 100, Theory: 75, Tutorial: 25

Objectives: The main objective of this course is the study of sequences and series of real numbers.

Prerequisite of this course: UMJMAT101 and UMJMAT201

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

Finite and infinite sets, Intervals, Countable and uncountable sets, Absolute value and the Real line. Triangular Inequality, Bounded and unbounded sets, Supremum and infimum of sets, Least upper bound and greatest lower bound. \mathbb{R} as a complete ordered field, Existence of rationals and irrationals between reals. Examples and Exercises based on these topics.

Unit-II

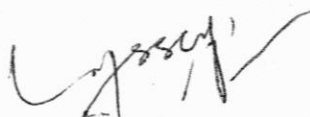
Definition of real sequences, Limit of a sequence, Convergence, boundedness and divergence of sequences, Oscillatory and Monotone sequences. Uniqueness of a limit, Operations on convergent and divergent sequences. Monotone Convergence Theorem and its applications to the calculation of square root of positive numbers, Squeezing Principle. Examples and Exercises based on these topics to be done as tutorials.

Unit-III

Subsequences and Bolzano- Weierstrass Theorem, Cauchy Sequences, Cauchy's General Principle of Convergence, Nested Interval Theorem, Contractive sequences. Examples and Exercises based on these topics to be done as tutorials.

Unit-IV

Infinite series and their convergence and divergence, Cauchy's Criterion for series, Conditional and absolute convergence, Geometric series test, p-series test, comparison tests, D' Alembert's ratio test, Cauchy's root test, Raabe's test,



Gauss test (without proof). Examples and Exercises based on these topics-to be done as tutorials.

Text Books:

1. Robert G. Bartle and Donald R. Sherbert, *Introduction to Real Analysis*, Wiley India Edition, 2011.
2. Richard R. Goldberg, *Methods of Real Analysis*, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

Reference Books:

1. S.C. Malik and Savita Arora, *Mathematical Analysis*, New Age International Publisher, 1982 (2020 reprint).
2. Walter Rudin, *Principles of Mathematical Analysis*, 3rd Edition. McGraw-Hill International Editions. 1976.
3. Tom M. Apostol. *Mathematical Analysis*, Narosa Publishing House, 1985.
4. Charles G. Denlinger, *Elements of Real Analysis*, Jones and Bartlett India Pvt. Ltd, 2011.
5. Houshang H. Sohrab, *Basic Real Analysis*, Birkhauser, 2003.
6. H. Protter, *Basic Elements of Real Analysis*, Springer, 1998.
7. Stevan G. Krantz, *Real Analysis and Foundations*, CRC Press, 2000.
8. William R. Parzynski and Philip W. Zipse, *Introduction to Mathematical Analysis*, McGraw-Hill International Editions, 1987.


Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to


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Jammu

be answered selecting at least one question from each unit. Each question shall carry 12 marks.
(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

Prof. S. S. S. S.
15.05.2023

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Syllabus Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER III

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

Multidisciplinary Course

Course Code: UMDMAT304

Course Title: Foundations of Mathematics

Credits: 03

Total Number of Lectures: Theory: 45

Maximum Marks: 75,

Objectives: The objectives of the course is to introduce the students to the language of mathematics-the language to know the nature, As Mathematics has vast range of applications to almost all disciplines of learning and evolves the critical thinking develops a logical and rational approach towards the solutions of problems. learning of the basic mathematics is indispensable for for the creation of critical and logical thinkers, that's why this course is designed.

Structure of the Course: This course is divided into four units of 45 lectures in total: tentative number of lectures required for each unit is indicated against each unit, wherein one lecture is of one hour duration.

Unit-I (12 Lectures)

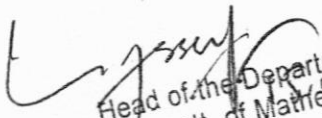
Propositions, truth values and truth tables, negation, conjunction and disjunction, implications, bi-conditional propositions, converse, contrapositive and inverse propositions, propositional equivalence: logical equivalences, predicates and quantifiers, tautology and contradiction. Analysis of arguments. Examples and exercises on these topics.

Unit-II (12 Lectures)

Sets, subsets, set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets, finite sets and counting principle, power set, classes of sets. Difference and symmetric difference of two sets, set identities, generalized union and intersections with laws. Examples and exercises on these topics.

Unit-III (12 Lectures)

Cartesian product of sets, relation between sets, types of relation, partition of a set, fundamental theorem of equivalence relation(statement only). Functions: Basic definitions, injective function, surjective function, bijective function, composition of functions, inverse of a function. Examples and exercises on these topics.


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Unit-IV (09 Lectures)

Prime numbers. GCD, LCM, division algorithm, relation between GCD and LCM, principle of mathematical induction. Examples and exercises on these topics.

Text Book: Steve Warner, *Pure Mathematics for Beginners*, Get 800 LLC, 2018.

Reference Books:

1. Shobha Bagai, Amber Habib and Geetha Venkataraman, *A Bridge to Mathematics*, Sage Publications India Pvt Ltd., 2017.
2. David M. Burton, *Elementary Number Theory*, McGraw Hill Education, 2017.
3. Paul R. Halmos, *Na \bar{A} -ve Set Theory*, Springer, 1998.
4. K. Devlin, *The Joy of Sets: Fundamentals of Contemporary Set Theory*, Undergraduate Texts in Mathematics, 2nd Edition, New York, Springer, 1993.
5. *NCERT Textbook of Mathematics for Class XI*, Jammu and Kashmir State Board of School Education, 2022.

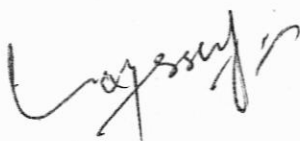
Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus, there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.



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SEMESTER III

(Examination to be held in December 2022, 2023, 2024)

Skill Enhancement Course

Course Code: USEMAT305

Course Title: $LATEX$

Credits: 02

Total Number of Lectures: 30, Theory: 15, Practicals: 15

Maximum Marks: 50,

Objectives: This course aims at learning at Mathematical Typesetting with $LATEX$ so as to acquaint the students with tips and techniques for document processing.

Structure of the Course: This course is divided into three units of 15 lectures in total; tentatively 5 lectures are required for each unit wherein one lecture is of one hour duration.

Unit-I(5 Lecture)

Introduction to Latex: Benefits of LaTeX, open-source software, installing LaTeX, introduction to LaTeX packages, creating a document (Preamble-commands to create LaTeX file), adding basic information to a document, formatting words, lines, paragraphs, line spacing and changing styles, creating a two-column landscape document.

Unit-II(5 Lecture)

Mathematical typesetting with Latex: Accents and symbols, mathematical typesetting (elementary and advanced): use of braces, backslash, power, subscript, superscript, fractions, roots, ellipsis etc.

Unit-III(5 Lecture)

Mathematical Equations: Writing mathematical equations, mathematical symbols, multiline equations, inserting sections, subsections, pictures, enumerating the text, writing matrices. Introduction to Beamer presentations. Introduction to Overleaf (for creating LaTeX document online).

Practical: 01 Credit

Duration: 15 hours

Computer Laboratory Work:

At least 10 practicals from the entire syllabus: creating 05 LaTeX documents with different packages and styles. 03 practicals for preparing beamer presentation and 02 practicals on creating LaTeX document in Overleaf.

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15.05.2023

Book Recommended

1. Stefan Kottwitz, *LateX: Beginner's Guide*, Packt Publishing, Brmingham, Mumbai, 2011.
2. Antoni Diller, *LATEX: Line by Line*, John Wiley and Sons, 1999.
3. Donald Bindner and Martin Erickson, *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*, CRC Press, Taylor and Francis Group, LLC, 2011.
4. Leslie Lamport, *LaTeX: A Document Preparation System, User's Guide and Reference Manual*, Second Edition, Pearson Education. Indian Reprint, 1994.
5. M. Goossen, S. Rahtz and F. Mittelbach, *The LATEX: Graphics Companion*, Adison Wesley, 1997.

Scheme of Examination: Internal Examination: To be conducted by the Course Coordinator.

(i) After covering half of the syllabus, there shall be a Mid Term Assessment Test of 90 minutes duration carrying 10 marks. The question paper must spread uniformly over half of the syllabus covered and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The Internal End Semester Examination of $2\frac{1}{2}$ hours duration carrying 15 marks, shall consist of two sections:

Section A. Four(3) short answer questions one question from each unit and each question shall carry 2 marks. All questions shall be compulsory.

Section B. Six(6) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which thre(3) questions are to be answered selecting at least one question from each unit. Each question shall carry 3 marks.

Practical Examination

(i) Daily Evaluation of practicals/tutorials/viva-voce/records: 10 marks

(ii) Final Practical Examination: 15 marks.

M. Goossen
15/05/2023

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SEMESTER III
(Examination to be held in December 2023, 2024, 2025)
Ability Enhancement Course

Course Code: UAEMAT306
Course Title: Linear Programming
Credits: 03 Total Number of Lectures: Theory: 45
Maximum Marks: 75

Objectives: Besides finding the optimal solution, the main objective of this course is using LPP to provide an information base for the most efficient allocation of scarce so as to optimize the allocation of some resources.

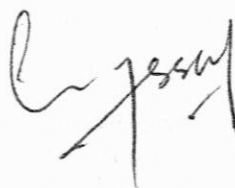
Structure of the Course: This course is divided into four units of 45 lectures in total; tentative number of lectures required for each unit is indicated against each unit, wherein one lecture is of one hour duration.

Unit-I (12 Lectures)

The Linear Programming Problems: Standard, Canonical and Matrix Forms, Decision Variables, Objective Function and Constraints, Solution of LP Problems by Graphical Method; Hyperplanes, Extreme Points, Convex and Polyhedral Sets. Examples and Exercises based on these concepts-to be done as tutorials.

Unit-II(11 Lectures)

Idea of Slack and Surplus Variables, Basic solutions: Basic Feasible Solutions; Reduction of any feasible solution to a basic feasible solution; Infeasible solution, unbounded solution, Non-degenerate basic feasible solution, Maximum Feasible Solution; Correspondence between basic feasible solutions and Extreme Points, Fundamental Theorem of Linear Programming. Examples and Exercises based on these concepts-to be done as tutorials.

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Unit-III (11 Lectures)

Simplex method: Optimal solution, Termination criteria for optimal solution of the Linear Programming Problem, Unique and Alternate Optimal Solutions, Unboundedness; Simplex Algorithm and its Tableau Format. Examples and Exercises based on these concepts-to be done as tutorials.

Unit-IV (11 Lectures)

Motivation and Formulation of Dual Problem. Dual Simplex Method, Applications of LP models to: Product-Mix Problems. Transportation Problem, Assignment Problem, Diet Problem. Examples and Exercises based on these concepts-to be done as tutorials.

Text Books:

1. G. Hadley, *Linear Programming*, Narosa Publishing House. 1997.
2. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali. *Linear Programming and Network Flows*, (4th Ed.), John Wiley and Sons, 2010.

Reference Books:

1. G. V. Shenoy, *Linear Programming, Methods and Applications*, Wiley Easter Ltd. 1992.
2. Steve Vajda, *Mathematical Programming*, Dover Publications Inc. 2009.

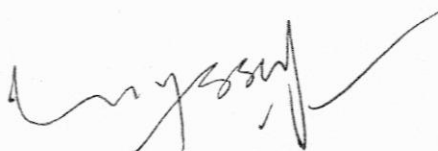
Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus, there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over uniformly on the first two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

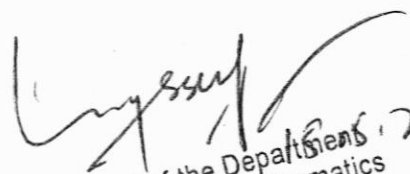
Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.



Semester – IV(MATHEMATICS)

4 Credits Courses

S.No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
					Theory: 75		Tutorial:25		
1.	Major	UMJMAT401	Real Analysis-II	4	Mid Semester: 15 marks	End Semester 60 marks	Assessment 10 marks	Exam 15 marks	100
2.	Major	UMJMAT402	Abstract Algebra-I	4					
3.	Major	UMJMAT403	Theory of Numbers	4					
4.	Major	UMJMAT405	Three Dimensional Solid Geometry	4					
5.	Minor	UMIMAT406	Abstract Algebra	4					


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 (Convener - BOS(Maths))
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Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER IV
(Examination to be held in May 2024, 2025, 2026)
Major Course

Course Code: UMJMAT401
Course Title: Real Analysis-II
Credits: 04 Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, Theory: 75, Tutorial: 25

Objectives: This course aims at advancing the course on Real Analysis-I (UMJMAT301) that includes uniform continuity, Riemann integral, uniform convergence of sequences and series of functions.

Prerequisite of this course: UMJMAT301

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

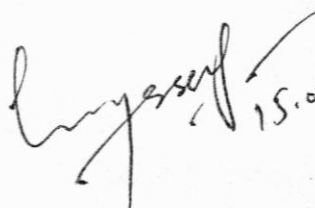
Cauchy's condensation test and convergence of alternating series, Absolute and conditional convergence, Leibnitz's test. Some theorems on continuity and uniform continuity viz. every continuous function attains its bounds on a closed and bounded interval, location of roots, Intermediate value theorem. continuity implies uniform continuity on closed and bounded intervals, relation between continuity and uniform continuity. Examples and exercises based on these concepts-to be done as tutorials.

Unit-II

The Riemann Integral: Definitions and existence of the integral, Refinement of a partition, Darboux's property, Conditions of integrability, the integral as a limit of sum, Integration and differentiation, The Fundamental Theorem of Calculus, Mean Value Theorems of Integral Calculus, Integration by parts. Change of variable in an integral, Second Mean Value Theorem. Examples and exercises based on these concepts-to be done as tutorials.

Unit-III

Point-wise and uniform convergence of a sequence and series of functions, Cauchy's criterion for uniform convergence. M_n -test for uniform convergence of a sequence, Weierstrass M -test for uniform convergence of a series, Abel's test. Examples and exercises based on these concepts-to be done as tutorials.

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Unit-IV

Properties of uniformly convergent sequences and series: Uniform convergence and continuity. Uniform convergence and Integration, Uniform convergence and differentiation. Examples and exercises based on these concepts-to be done as tutorials.

Text Books:

1. Robert G. Bartle and Donald R. Sherbert, *Introduction to Real Analysis*, Wiley India Edition, 2011.
2. Richard R. Goldberg, *Methods of Real Analysis*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

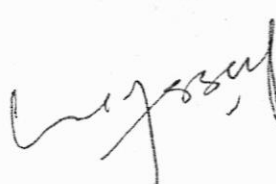
Reference Books:

1. S.C. Malik and Savita Arora, *Mathematical Analysis*, New Age International Publisher, 1982 (2020 reprint).
2. Walter Rudin, *Principles of Mathematical Analysis*, 3rd Edition. McGraw-Hill International Editions, 1976.
3. Tom M. Apostol. *Mathematical Analysis*, Narosa Publishing House, 1985.
4. Charles G. Denlinger. *Elements of Real Analysis*, Jones and Bartlett India Pvt. Ltd, 2011.
5. Houshang H. Sohrab, *Basic Real Analysis*, Birkhauser, 2003.
6. H. Protter, *Basic Elements of Real Analysis*, Springer, 1998.
7. Stevan G. Krantz, *Real Analysis and Foundations*, CRC Press, 2000.
8. William R. Parzynski and Philip W. Zipse, *Introduction to Mathematical Analysis*, McGraw-Hill International Editions, 1987.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

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Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

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University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER IV
(Examination to be held in May 2024, 2025, 2026)
Major Course

Course Code: UMJMAT402
Course Title: Abstract Algebra-I
Credits: 04 Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, Theory: 75, Tutorial: 25

Objectives: The aim of this course is to introduce an algebraic structure called group and study its properties. Three fundamental theorems of group isomorphism is the ultimate goal of this course.

Prerequisite of this course: Knowledge of Higher Secondary level mathematics courses is enough to follow this course.

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

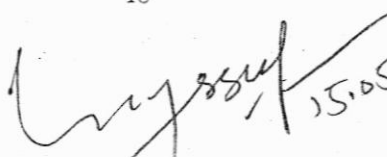
Review of Logic, Equivalence relation and Fundamental Theorem on equivalence relation. Binary operations, semi-group and group with plenty of examples from number systems, matrices, functions, polynomials, group of symmetries of triangle, square (Dihedral groups) etc. Abelian group, non-abelian group, finite group, order of an element of a group. Examples and exercises on these topics-to be done as tutorials.

Unit-II

Sub-groups and their characterisation, intersection, union and product of sub-groups, subgroups generated by a subset, center of group, commutator subgroup of a group, characterisation of abelian group in terms of commutator subgroup. Examples and exercises on these topics-to be done as tutorials.

Unit-III

Permutations and their properties, Even and Odd permutations, Cyclic groups and their generators, properties of cyclic groups. Cosets: Left Cosets and Right Cosets and their properties, Lagrange's Theorem, Index of a subgroup, Euler's Theorem, Fermat Theorem. Examples and exercises on these topics-to be done as tutorials.


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Unit-IV

Normal subgroups and their properties, Group homomorphisms and their properties, Group isomorphisms and their properties. Quotient groups, Kernel of a group homomorphism. First, Second and Third Isomorphism Theorems for groups. Examples and exercises on these topics-to be done as tutorials.

Text Books:

1. Steve Warner, *Pure Mathematics for Beginners*, Get 800 LLC, 2018.
2. N.S Gopalakrishnan, *University Algebra*, New Age International Publishers, 2009.

Reference Books:

1. John B. Fraleigh, *A first Course in Algebra*, Narosa Publishing House, 2003.
2. I. N. Herstein. *Topics in Algebra*, John Wiley and Sons Inc., 2006.
3. Michael Artin, *Algebra*, Pearson New International Edition, 2013.
4. Thomas W. Hungerford, *Algebra*, Springer, 1974 (Seventh Indian Print, 2014).
5. D. A. R. Wallace, *Groups, Rings and Fields*, Springer, Second Indian Print, 2015.
6. Surjeet Singh and Qazi Zameeruddin. *Modern algebra*, Vikas Publishing House Pvt. Ltd., 1972.

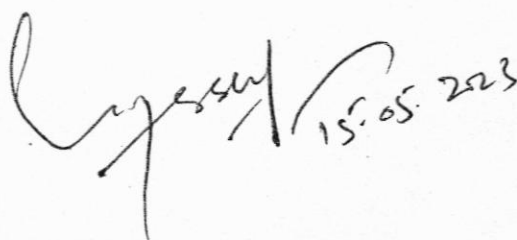
Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to

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be answered selecting at least one question from each unit. Each question shall carry 12 marks.
(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

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University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER IV

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

Major Course

Course Code: UMJMAT403

Course Title: Theory of Numbers

Credits: 04 Total Number of Lectures: Theory: 45, Tutorials: 15
Maximum Marks: 100, Theory: 75, Tutorial: 25

Objectives: The main objective of this course is to introduce an elementary theory of numbers.

Prerequisite of this course: Knowledge of Higher Secondary level mathematics 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

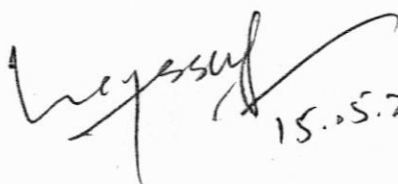
Divisibility: the division algorithms and its uniqueness, greatest common divisor, prime number, Euclid's first theorem, Fundamental Theorem of Arithmetic, standard form of an integer, divisor of n . Linear Diophantine Equation $ax + by = c$, necessary and sufficient condition for solvability of linear Diophantine equation, Radix representation, Euclid's second theorem, Infinitude of primes of the form $4n + 3$ and of the form $6n + 5$. Examples and exercises on these topics-to be done as tutorials.

Unit-II

Congruences and their properties, Complete residue system, reduced residue system. Multiplicative function, Euler's ϕ -function, Fermat's little theorem, Euler theorem. Generalization of Fermat's Theorem, Polynomial congruences, degree of polynomial congruence. Linear Congruence, solution of linear congruence. Chinese Remainder theorem. Wilson's theorem and its application to the solution of $x \equiv -1 \pmod{p}$. Examples and exercises based on these concepts-to be done as tutorials.

Unit-III

Integers belonging to a given exponent \pmod{m} , Primitive roots, power residues, congruence of degree two. power modulus. Quadratic residue and quadratic non residue. Quadratic residue of m cannot be a primitive root of m . Quadratic residues of a odd prime are congruent to even powers of a primitive root of p and conversely, quadratic non residue of an odd prime are congruent to odd powers of a primitive root of p and conversely, Euler criterion, Legendre symbols and their properties, lemma of Gauss. Quadratic Reciprocity law, Jacobi symbols. Examples and exercises based on these concepts-to be done as tutorials.


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Unit-IV

Greatest integer function, Number theoretic functions or Arithmetic functions, simple properties of $\phi(n)$, $\tau(n)$, $\sigma(n)$. Perfect number, divisors of n Mobius function, F. Martein's lemma, Mobius Inversion formulae. Theorem of Gauss. Examples and exercises based on these concepts-to be done as tutorials.

Text Books David M. Burton, *Elementary Number Theory*, Mc Graw-Hill Edition(India) Pvt. Ltd., 2013.

Reference Books:

1. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, *An Introduction to Theory of Numbers*, Wiley India Pvt. Lrd., 2008.
2. Tom M. Apostol, *Introduction to Analytic Number Theory*, Narosa Publishing House, 1991.
3. Ian Stewart and David Hall, *Algebraic Number Theory*. Chapman and Hall 1979.
4. Gareth A. Jones and J. Mary Jones, *Elementary Theory of Numbers*, Springer, 1998.
5. M. G. Nadkarni, *Number Theory*, Tata Mac. Graw Hill, 1988.

Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week need to be devoted to problem solving sessions as tutorials.

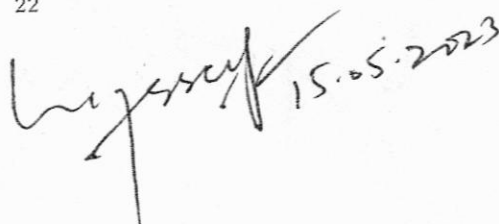
Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

(iii) 25 marks are allotted to Tutorials out of which 10 marks are allotted to continuous assessment and 15 marks are for the final examination (on Tutorials).

 15.05.2023

University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER IV

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

Major Course

Course Code: UMJMAT404

Course Title: Three Dimensional Solid Geometry

Credits: 04 Total Number of Lectures: Theory: 45, Tutorials: 15

Maximum Marks: 100, Theory: 75, Tutorial: 25

Objectives: The aim of this course is to study the geometry of three dimensional solid figures like sphere, cone and cylinder.

Prerequisite of this course: Euclidean Geometry and elementary Vector 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

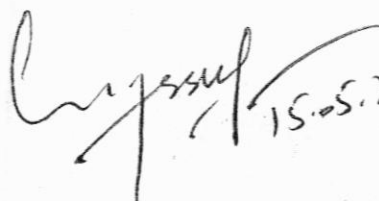
Equation of straight line, plane, and circle, Tangent Plane, Direction Cosines and ratios, relation between Direction ratios and direction cosines. Angle between lines, planes and lines and plane, Intersection of planes and lines. Examples and exercises based upon these concepts. Examples and exercises based on these concepts-to be done as tutorials.

Unit-II

Definition of sphere and its formation, tangent plane to the sphere, General, Standard and Central form of equation of sphere, Equation of a sphere through four points, Intersection of a sphere and a line, Angle between two spheres, Orthogonal spheres. Examples and exercises based upon these concepts. Examples and exercises based on these concepts-to be done as tutorials.

Unit-III

Definition of Cone and its formation, tangent plane to the cone, Equation of Cone with a given vertex and guiding Curve, Equation of a cone with vertex at origin, General condition for a 2nd degree eqn. to represent a Cone, Intersection of two Cones with a Common vertex, Right Circular Cone. Examples and exercises based upon these concepts. Examples and exercises based on these concepts-to be done as tutorials.


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Unit-IV

Definition of Cylinder and its formation, tangent plane to the cylinder, Equation of cylinder whose generators intersect a given Conic, Enveloping cylinder of a sphere, Equation of right circular cylinder. Examples and exercises based upon these concepts. Examples and exercises based on these concepts-to be done as tutorials.

Text Book:

Shanti Narayan and P. K. Mittal, *Analytical Solid Geometry*, S. Chand and Co., 17th Edition, 2007.

Reference Books:

1. A. R. Vasishtha and D. C. Agarwal. *Analytical Solid Geometry*, Krishna Prakashan, 2019.
2. C. Godfrey and A. W. Siddons, *Solid Geometry*, Cambridge University Press, 2016.
3. William F. Osgood and William C. Graustein, *Plane and Solid Analytic Geometry*, New York Macmillan Company, 1921.

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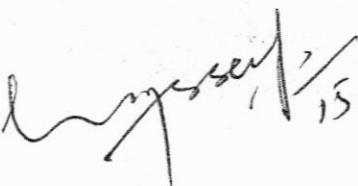
Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry three(3) marks. All questions shall be compulsory.

Section B. Eight(8) long answer questions spread uniformly over the entire syllabus (two questions from each unit) out of which four(4) questions are to be answered selecting at least one question from each unit. Each question shall carry 12 marks.

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University of Jammu
Syllabus of Mathematics at FYUGP under CBCS as per NEP-2020.

SEMESTER IV
(Examination to be held in May 2024, 2025, 2026)
Minor Course

Course Code: UMIMAT405
Course Title: Abstract Algebra
Credits: 04 **Total Number of Lectures:** Theory: 45, Tutorials: 15
Maximum Marks: 100, Theory: 75, Tutorial: 25

Objectives: The aim of this course is to introduce an algebraic structure called group and study its properties. Three fundamental theorems of group isomorphism is the ultimate goal of this course.

Prerequisite of this course: Knowledge of Higher Secondary level mathematics courses is enough to follow this course.

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

Review of Logic, Equivalence relation and Fundamental Theorem on equivalence relation. Binary operations, semi-group and group with plenty of examples from number systems, matrices, functions, polynomials, group of symmetries of triangle, square (Dihedral groups) etc. Abelian group, non-abelian group, finite group, order of an element of a group. Examples and exercises based on these concepts-to be done as tutorials.

Unit-II

Sub-groups and their characterisation, intersection, union and product of subgroups, subgroups generated by a subset, center of group, commutator subgroup of a group, characterisation of abelian group in terms of commutator subgroup. Examples and exercises on these topics-to be done as tutorials.

Unit-III

Permutations and their properties, Even and Odd permutations, Cyclic groups and their generators, properties of cyclic groups. Cosets: Left Cosets and Right Cosets and their properties, Lagrange's Theorem, Index of a subgroup. Euler's Theorem, Fermat Theorem. Examples and exercises on these topics-to be done as tutorials.

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Unit-IV

Normal subgroups and their properties, Group homomorphisms and their properties, Group isomorphisms and their properties. Quotient groups, Kernel of a group homomorphism, First, Second and Third Isomorphism Theorems for groups. Examples and exercises on these topics-to be done as tutorials.

Text Books:

1. Steve Warner, *Pure Mathematics for Beginners*, Get 800 LLC, 2018.
2. N.S Gopalakrishnan, *University Algebra*, New Age International Publishers, 2009.

Reference Books:

1. John B. Fraleigh, *A first Course in Algebra*, Narosa Publishing House, 2003.
2. I. N. Herstein. *Topics in Algebra*, John Wiley and Sons Inc., 2006.
3. Michael Artin, *Algebra*, Pearson New International Edition, 2013.
4. Thomas W. Hungerford, *Algebra*, Springer, 1974 (Seventh Indian Print, 2014).
5. D. A. R. Wallace, *Groups, Rings and Fields*, Springer, Second Indian Print, 2015.
6. Surjeet Singh and Qazi Zameeruddin, *Modern algebra*, Vikas Publishing House Pvt. Ltd., 1972.

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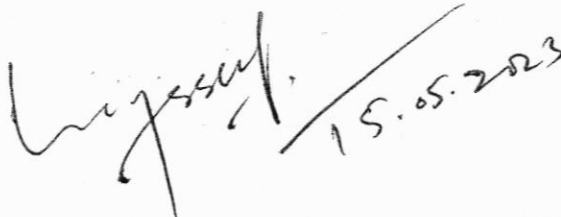
Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

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