NOTIFICATION
(22/Sept./Adp/34)

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 **Ist and IInd** 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-I	December 2022, 2023 and 2024
	Semester-II	May 2023, 2024 and 2025

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

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/22/6209-6268.
Dated: 21-09-2022

Copy for information and necessary action to:

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

Deputy Registrar (Academic)

Semester – I

SEMESTER I (MATHEMATICS)

4 Credits Courses

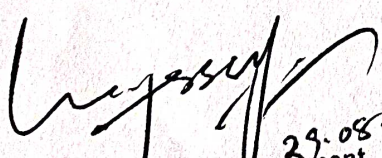| S.No.	Course Type	Course No.	Course Title	Credits	Marks				Total Marks
				4=3Th+1T	Theory		Tutorial		100
1.	Major	UMJMAT101	Differential Caculus	4	Mid Semester: 15 marks	End Semester: 60 marks	Assessment: 10 marks	Exam: 15 Marks	
2.	Minor	UMIMAT102	Calculus-I	4					

3 Credits Courses

S.No.	Course Type	Course No.	Course Title	Credits	Total Marks		Total marks
					Theory		75
1.	MD	UMDMAT103	Foundations of Mathematics	3	Mid Semester: 15 marks	End Semester: 60 marks	
2.	AE	UAEMAT104	A Bridge to Mathematics	3			

2 Credits Courses

S.No.	Course Type	Course No.	Course Title	Credits	Total Marks		Total marks
					Theory		50
1.	SE	USEMAT105	Probability	2	Mid Semester: 10 marks	End Semester: 40 marks	

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SEMESTER I
(Examination to be held in December 2022, 2023, 2024)
Major Course

Course Code: UMJMAT101   **Course Title: Differential Calculus**
Credits: 04   Total Number of Lectures: Theory: 45, Tutorials: 15
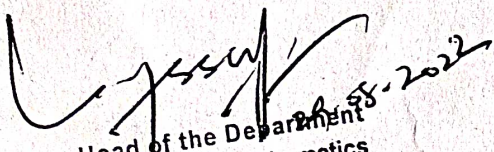**Maximum Marks: 100,   Theory: 75,   Tutorial: 25**

Objectives: Calculus is a study of motion and change. It is an indispensable tool in use in almost every branch of pure and applied science and some of the social sciences besides in other branches of Mathematics. So to make the students acquainted with notions and ideas of Calculus with applications to other disciplines is the main objective of this course.

Prerequisite of this course: 12th standard course on elementary 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

$\epsilon - \delta$ definitions of limit, continuity and differentiability of real-valued functions of real variable with illustrations, Rolle's theorem, mean value theorem(Lagrange) with geometrical interpretations. indeterminate limits, L'Hôpital's rule, idea of optimization with examples, idea of linearization with examples, Newton's method. Examples and exercises on these topics.

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Unit-II

Asymptotes and dominant terms, Concavity and critical points (called singular points) of real-valued functions of a real variable in the explicit form $y = f(x)$ (functions in implicit form $f(x, y) = 0$, are taken up in Unit IV) graphing with first and second derivatives-curve tracing in cartesian coordinate system, Examples and exercises on these topics.

Unit-III

Polar coordinates, relation between cartesian and polar coordinates, angle between radius vector and tangent to the curve, graphing techniques in polar coordinates of functions such as $r = a \pm b \cos\theta, r = a \pm b \sin\theta, r = a \sin n\theta, r = a \cos n\theta, n = 2, 3$. Examples and exercises on these topics.

Unit-IV

Functions of several variables, limits and continuity, partial derivatives and Euler's theorem, differentiability, linearization and differentials, the chain rule, definition of directional derivatives with examples. Concepts to be developed starting from two variables, singular points of order 2(called double points) of functions in the implicit form $f(x, y) = 0$.

Text Book: George B. Thomas, Jr. and Ross L. Finney, *Calculus and Analytic Geometry*, 9th Edition, Addison-Wesley Publishing Company, 1998/Pearson, India.
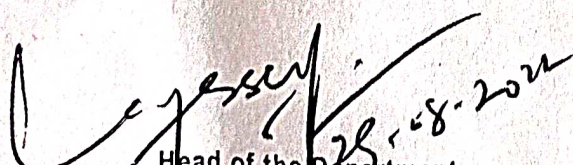
Reference Books:

1. Tom M. Apostol, *Calculus*, Vol. 1, Jhon-Wiley and sons Inc, 2007.

2. Shanti Narayan and P. K. Mittal, *Differential Calculus*, S Chand and Co, 2020.

3. S. Lang, *A first Course in Calculus*, by S. Lang, Springer-Verlag, 1998.

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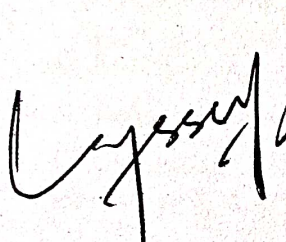
(ii) The External End Semester Examination of 3 hours duration carrying 60 marks, shall consist of two sections:

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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).

25.08.2022

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

SEMESTER I
(Examination to be held in December 2022, 2023, 2024)
Minor Course

Course Code: UMIMAT102   **Course Title: Calculus-I**

Credits: 04   **Total Number of Lectures: Theory: 45, Tutorials: 30**

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

Objectives: Calculus is a study of motion and change. It is an indispensable tool in use in almost every branch of pure and applied science and some of the social sciences besides in other branches of Mathematics. So to make the students acquainted with notions and ideas of Calculus with applications to other disciplines is the main objective of this course.

Prerequisite of this course: 12th standard course on elementary calculus.
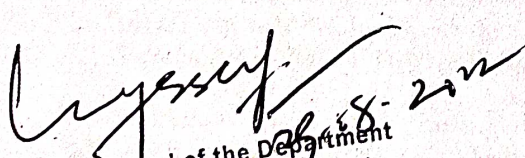
Structure of the Course: This course is divided into four units of 15 class lectures each, wherein one lecture is of one hour duration.

Unit-I

$\epsilon - \delta$ definitions of limit, continuity and differentiability of real-valued functions of real variable with illustrations, Rolle's theorem, mean value theorem(Lagrange) with geometrical interpretations. indeterminate limits, L'Hôpital's rule, idea of optimization with examples, idea of linearization with examples, Newton's method. Examples and exercises on these topics.

Unit-II

Asymptotes and dominant terms, Concavity and critical points (called singular points) of real-valued functions of a real variable in the explicit form $y = f(x)$ (functions in implicit form $f(x,y) = 0$, are taken up in Unit IV) graphing with first and second derivatives-curve tracing in cartesian coordinate system, Examples and exercises on these topics.

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Unit-III

Polar coordinates, relation between cartesian and polar coordinates, angle between radius vector and tangent to the curve, graphing techniques in polar coordinates of functions such as $r = a \pm b\cos\theta, r = a \pm b\sin\theta, r = a\sin n\theta, r = a\cos n\theta, n = 2, 3$. Examples and exercises on these topics.

Unit-IV

Functions of several variables, limits and continuity, partial derivatives and Euler's theorem, differentiability, linearization and differentials, the chain rule, definition of directional derivatives with examples. Concepts to be developed starting from two variables, singular points of order 2(called double points) of functions in the implicit form $f(x, y) = 0$.

Text Book: George B. Thomas, Jr. and Ross L. Finney, *Calculus and Analytic Geometry*, 9th Edition, Addison-Wesley Publishing Company, 1998/Pearson, India.

Reference Books:

1. Tom M. Apostol, *Calculus*, Vol. 1, Jhon-Wiley and sons Inc, 2007.

2. Shanti Narayan and P. K. Mittal, *Differential Calculus*, S Chand and Co, 2020.

3. S. Lang, *A first Course in Calculus*, by S. Lang, Springer-Verlag, 1998.

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.
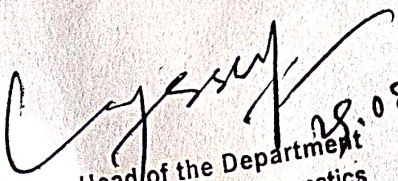
Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall 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 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 I
(Examination to be held in December 2022, 2023, 2024)
Multidisciplinary Course

Course Code: UMDMAT103 **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.
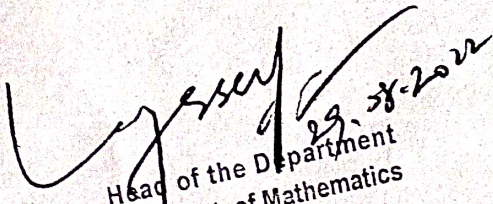
Unit-I (12 Lectures)

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, *Naïve 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.

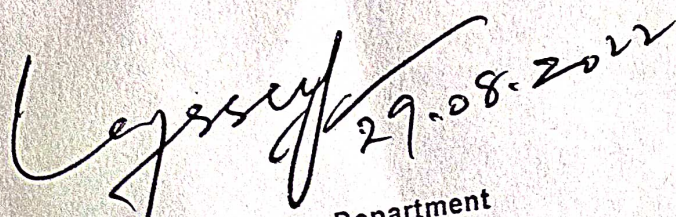5. *NCERT Textbook of Mathematics for Class XI*, Jammu and Kashmir State Board of School Education, 2022.

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 I
(Examination to be held in December 2022, 2023, 2024)
Ability Enhancement Course

Course Code: UAEDMAT104 **Course Title: A Bridge to Mathematics**

Credits: 03 **Total Number of Lectures: Theory: 45**

Maximum Marks: 75

Objectives: The objective of the course is to construct a bridge to Mathematics by introducing 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 with logic and reasoning, learning of the basic mathematics is indispensable across all disciplines. Precisely this course aims at

- increasing the appreciation of mathematics as an art and a human endeavour;

- motivating students towards the study and use of mathematics by providing them basic tools to understand critical issues-evolving mathematical ability to handle real life problems

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.
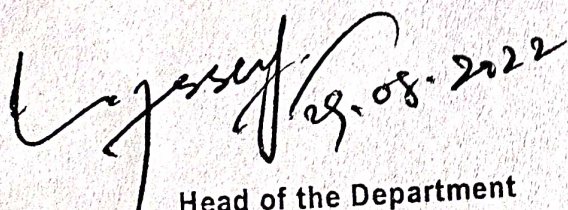
Unit-I (13 Lectures)

Motivation: To illustrate how mathematics has grown out of human needs, use of examples to highlight different aspects and applications of mathematics starting from the dawn of human civilization to the present day.
Logic and Reasoning: Statements, analysing statements-simple statements with quantifiers, negating a simple statement, compound statements, conjunctions and disjunctions, truth tables,tautologies and contradictions, establishing logical equivalence using truth tables,, De'Morgan's laws. Analysis of arguments: disjunctive syllogism, contrapositive reasoning, direct reasoning, transitive reasoning, invalid patters of reasoning. Examples and exercises on these topics.

Unit-II (13 Lectures)

Sets: Describing a set, roster form, set-builder form, equality of sets, sets of different sizes, subsets, power set, Union of sets,intersection of sets, complement of a set, Euler diagrams, configuration of two sets, configuration of three sets, Venn diagrams, counting with Venn diagrams. Examples and exercises on these topics.

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Unit-III (10 Lectures)

Data Analysis and Modelling: Interacting with data, ratio and percentage, raw and grouped data, introduction to spreadsheet programs, spreadsheet functions, grouping data with spreadsheets, copying from one cell to another.

Unit-IV (10 Lectures)

Bar charts with spreadsheets, histograms and pie charts with spreadsheets, line plots, line plots and graphs in spreadsheets, identifying trends from graphs, linear interpolation and line of the best fit, scatter plots in spreadsheets, locating the center, mode, median and mean and their calculations with spreadsheets, percentiles, percentiles in spreadsheets, percent rank, variance and standard deviation.

Text Book: Shobha Bagai, Amber Habib and Geetha Venkataraman, *A Bridge to Mathematics*, Sage Publications India Pvt Ltd., 2017.

Reference Books:

1. Ajit Kumar, S. Kumaresen and Bhaba Kumar Sarma, *A Foundation Course in Mathematics*, Narosa Publications, 2018.

2. Steve Warner, *Pure Mathematics for Beginners*, Get 800 LLC, 2018.

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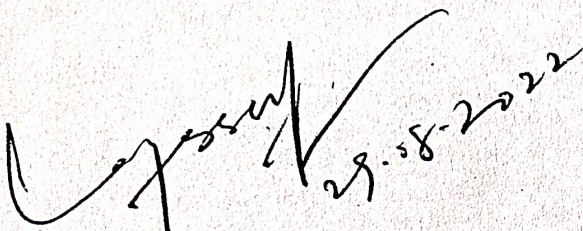
Note to the College: Teaching and understanding of concepts of Mathematics being different from other disciplines requires problem solving sessions beyond regular class work. Therefore, extra three lectures per week be devoted to problem solving sessions as tutorials.

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 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.

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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 I
(Examination to be held in December 2022, 2023, 2024)
Skill Enhancement Course

Course Code: USEMAT105 **Course Title: Probability**

Credits: 02 **Total Number of Lectures: Theory: 30**

Maximum Marks: 50,

Objectives: The objective of this course is to equip students with a skill in Mathematics in addition to Major course in Mathematics. A course on Probability having wide range of applications to other disciplines shall serve the purpose of skill enhancement in mathematics.

Structure of the Course: This course is divided into three units of 30 lectures in total; tentative number of lectures required for each unit is indicated against the unit, wherein one lecture is of one hour duration.

Unit-I (10 Lectures)

Sample Space, Probability set function and its properties including Inclusion Exclusion formula, Boole's inequality, continuous theorem of probability and Bayes' theorem along with their applications. Random variables, cumulative distribution function and its properties, like lower(upper) limits, continuity and monotoncity. Examples and exercise based on the above concepts using sample space obtained from tossing of coin(s), casting of dice(die) and selection of card(s) from a deck of playing cards.
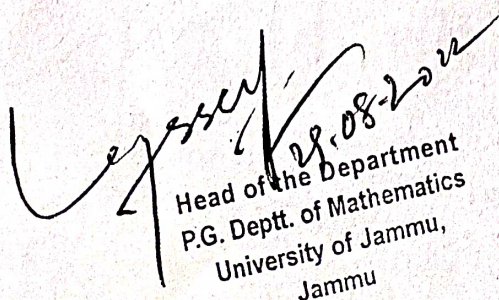
Unit-II (10 Lectures)

Discrete Random Variable: Probabilty mass function, transformation of discrete random variable. Continuous Random Variable: Probabilty density function, transformation of continuous random variable. Examples and exercises on these topics.

Unit-III (10 Lectures)

Expection of Random Variable : Properties and use of distibutions of a random variable to get the expectation of a transformed random variable, Markov's Inequality, Chebyshev Inequality. Momment generating function of a random variable and its transformtion. Examples and exercises based on these concepts.

Textbook:

Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to Mathematical Statistics*, Pearson Education, Asia, 2007.

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Reference Books

1. Irvin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Applications,* Pearson Education, Asia, 2006.

2. Sheldon Ross, *Introduction to Probability Models,* Academic Press, Indian Reprint, 2007.

3. Alexender M. Mood, Franklin A. Graybil and Duane C. Boes, em Introduction to the Theory of Statistics, Tata Mc Graw-Hill, 2007.

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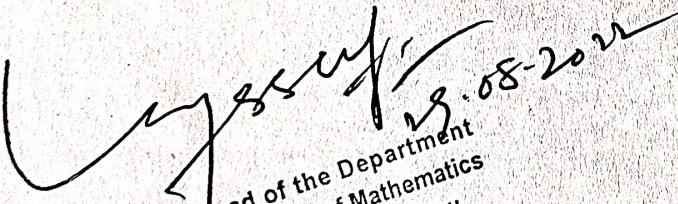
Scheme of Examination: Internal Examination to be conducted by the Course Coordinator.

(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 40 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry $2\frac{1}{2}$ 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 three(3) questions are to be answered selecting at least one question from each unit. Each question shall carry 10 marks.

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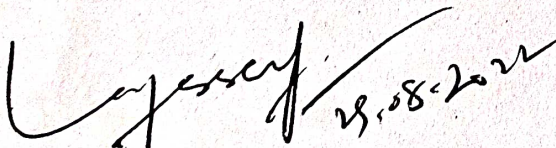Jammu

Semester – II(MATHEMATICS)

4 Credits Courses

S.No.	Course Type	Course No.	Course Title	Credits	Marks					Total Marks
				4=3Th+1T	Theory		Tutorial			100
1.	Major	UMJMAT201	Integral Calculus and Differential Equations	4	Mid Semester: 15 marks	End Semester: 60 marks	Assessment: 10 marks	Exam: 15 Marks		
2.	Minor	UMIMAT202	Calculus-II	4						

3 Credits Courses

S.No.	Course Type	Course No.	Course Title	Credits	Total Marks		Total marks
					Theory		75
1.	MD	UMDMAT203	Foundations of Mathematics	3	Mid Semester: 15 marks	End Semester: 60 marks	
2.	AE	UAEMAT203	Matrices and Linear Equations	3	Mid Semester: 15 marks	End Semester: 60 marks	

2 Credits Courses

S.No.	Course Type	Course No.	Course Title	Credits	Total Marks		Total marks
				2	Theory		50
1.	SE	USEMAT205	Numerical Methods	2	Mid Semester: 10 marks	End Semester: 40 marks	

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SEMESTER II
(Examination to be held in May 2023, 2024, 2025)
Major Course

Course Code: UMJMAT201   **Course Title: Integral Calculus and Differential Equations**

Credits: 04   **Total Number of Lectures: Theory: 45, Tutorials: 30**

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

Objectives: The objective of this course is to acquaint the students with applications of Differential Calculus and Integral Calculus to study the physical phenomena-the differential equations.

Prerequisite of this course: A course on Differential Calculus studied in Semester-I.

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

Integration of irrational functions, reduction formulae:

$$\int \sin^n x\,dx, \int \cos^n x\,dx, \int \tan^n x\,dx, \int \sec^n x\,dx,$$

$$\int \csc^n x\,dx, \int \sin^n \cos^m x\,dx, \int (\log x)^n\,dx.$$

Areas between curves, volumes of solids of revolution along x-axis and y-axis, length of plane curves, areas of surfaces of revolution.

Unit-II

Review of differential equations: Linear differential equations and Bernoulli equation, first order higher degree differential equations solvable for x, y, p. Clairaut's equation, exact and non-exact differential equations, integrating factors and rule for finding the integrating factor of a non-exact differential equations. Examples and exercises based on these topics.

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Unit-III

Basic theory of linear differential equations: Linearly dependent and linearly independent functions, Wronskian and its properties, linear homogeneous differential equations with constant coefficients, solving a linear homogeneous differential equation with variable coefficients by reducing its order. Examples and exercises based on these topics.

Unit-IV

Non-homogeneous linear differential equations with constant coefficients-the method of undetermined coefficients. Non-homogeneous linear differential equations with variable coefficients-the method of variation of parameters and the Cauchy-Euler equation. Examples and exercises based on these topics.
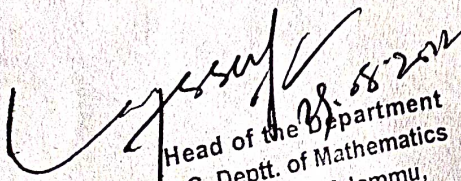
Text Books:

1. George B. Thomas, Jr. and Ross L. Finney, *Calculus and Analytic Geometry*, 9th Edition, Addison-Wesley Publishing Company, 1998/Pearson, India (for Unit I).

2. Shepley L. Ross, *Differential Equations*, 3rd Edition, John Willy and Sons, 1984(for Units II, III and IV)

Reference Books:

1. Shanti Narayan and P. K. Mittal, *Integral Calculus*, S. Chand and Co, 2020.

2. Frank Ayres Jr, *Schaum's Outline of Theory and Problems of Differential Equations*, McGraw-Hill Book Company, Singapore, 1972.

3. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill International Edition, 1967.

4. Earl A. Coddington, *An Introduction to Ordinary Differential Equations*, PHI Learning Private Limited, New Delhi, 2009.

5. George F. Simmons, *Differential Equations with Applications and Historical Notes*, McGraw Hill Education; 2nd edition, 2017.

6. M. D. Raisinghania, *Ordinary and Partial Differential Equations*, S. Chand and Co., New Delhi, 2005.

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

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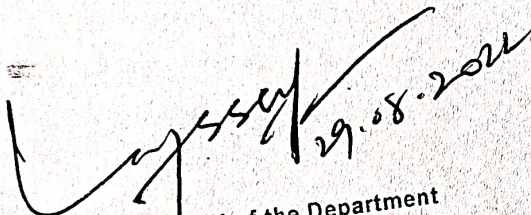P.G. Deptt. of Mathematics
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marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall be conducted by the course coordinator.

(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 II
(Examination to be held in May 2023, 2024, 2025)
Minor Course

Course Code: UMIMAT202　　　　**Course Title: Calculus-II**

Credits: 04　　**Total Number of Lectures: Theory;45, Tutorials: 30**

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

Objectives: The objective of this course is to acquaint the students with applications of Differential Calculus and Integral Calculus to study the physical phenomena-the differential equations.

Prerequisite of this course: 12th standard calculus and a course on Differential Calculus studied in Semester-I.

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

Integration of irrational functions, reduction formulae:

$$\int \sin^n x\, dx, \quad \int \cos^n x\, dx, \quad \int \tan^n x\, dx, \quad \int \sec^n x\, dx,$$

$$\int cosec^n x\, dx, \quad \int \sin^n \cos^m x\, dx, \quad \int (\log x)^n dx.$$

Areas between curves, volumes of solids of revolution along $x-$axis and $y-$axis, length of plane curves, areas of surfaces of revolution.
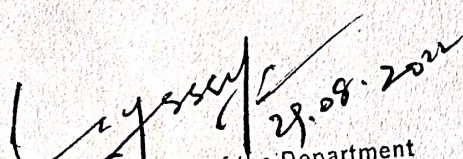
Unit-II

Review of differential equations: Linear differential equations and Bernoulli equation, first order higher degree differential equations solvable for x, y, p. Clairaut's equation, exact and non-exact differential equations, integrating factors and rule for finding the integrating factor of a non-exact differential equations. Examples and exercises based on these topics.

Unit-III

Basic theory of linear differential equations: Linearly dependent and linearly independent functions, Wronskian and its properties, linear homogeneous differential equations with constant coefficients, solving a linear homogeneous differential equation with variable coefficients by reducing its order. Examples and exercises based on these topics.

Unit-IV

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Non-homogeneous linear differential equations with constant coefficients-the method of undetermined coefficients. Non-homogeneous linear differential equations with variable coefficients-the method of variation of parameters and the Cauchy-Euler equation. Examples and exercises based on these topics.

Text Books:

1. George B. Thomas, Jr. and Ross L. Finney, *Calculus and Analytic Geometry*, 9th Edition, Addison-Wesley Publishing Company, 1998/Pearson, India (for Unit I).

2. Shepley L. Ross, *Differential Equations*, 3rd Edition, John Willy and Sons, 1984(for Units II, III and IV)

Reference Books:

1. Shanti Narayan and P. K. Mittal, *Integral Calculus*, S. Chand and Co, 2020.

2. Frank Ayres Jr, *Schaum's Outline of Theory and Problems of Differential Equations*, McGraw-Hill Book Company, Singapore, 1972.

3. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill International Edition, 1967.

4. Earl A. Coddington, *An Introduction to Ordinary Differential Equations*, PHI Learning Private Limited, New Delhi, 2009.

5. George F. Simmons, *Differential Equations with Applications and Historical Notes*, McGraw-Hill Education, 2nd edition, 2017.

6. M. D. Raisinghania, *Ordinary and Partial Differential Equations*, S. Chand and Co., New Delhi, 2005.

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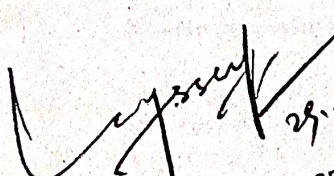
Scheme of Examination: (i) After covering half of the syllabus (two units) there shall be a Mid Term Assessment Test of 90 minutes duration carrying 15 marks. The question paper must spread over entire two units and questions asked should be of short answer as well as long answer type. This test shall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

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

Course Code: UMDMAT203   **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.
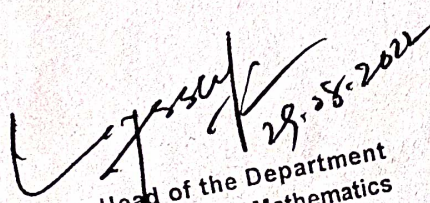
Unit-I (12 Lectures)

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, *Naïve 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.

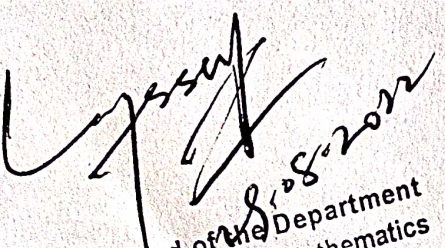5. *NCERT Textbook of Mathematics for Class XI*, Jammu and Kashmir State Board of School Education, 2022.

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 II
(Examination to be held in May 2023, 2024, 2025)
Ability Enhancement Course

Course Code: UAE/MAT204 **Course Title: Matrices and Linear Equations**

Credits: 03   **Total Number of Lectures: Theory: 45**

Maximum Marks: 75

Objectives: The objective of the course is to construct a bridge to Mathematics by introducing 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 with logic and reasoning, learning of the basic mathematics is indispensable across all disciplines. Precisely this course aims at

- increasing the appreciation of mathematics as an art and a human endeavour;
- motivating students towards the study and use of mathematics by providing them basic tools to understand critical issues-evolving mathematical ability to handle real life problems
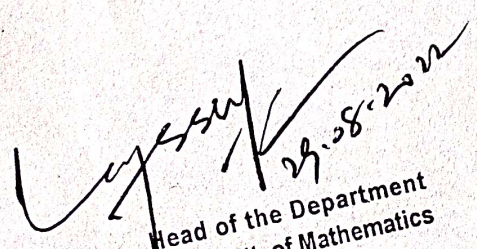
Structure of the Course: This course is divided into four units of 45 lectures in total; tentative number of lectures required for each unit is indicated against each unit, wherein one lecture is of one hour duration.

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 (11 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.

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Unit-III (12 Lectures)

Matrices: Importance of matrices, definitions and concepts, equal matrices, sums of matrices, product of matrices, types of matrices, adjoint of a square matrix(of orders 2 and 3), inverse of a matrix. Determinant of matrices of orders 2 and 3 and properties of determinants. Examples and exercises on these topics.

Unit-IV (10 Lectures)

Determinant of matrices of orders 2 and 3 and properties of determinants. Linear equations: Systems of non-homogeneous equations, solution using matrices, Cramer's rule, system of homogeneous equations. Examples and exercises on these topics.

Text Books:

1. Shobha Bagai, Amber Habib and Geetha Venkataraman, *A Bridge to Mathematics*, Sage Publications India Pvt Ltd., 2017.

2. Frank Ayres Jr., *Theory and Problems of Matrices, Schaum's Outline Series*, McGraw-Hill International Book Company, Singapore, Asian Student Edition, 1982.

Reference Books:

1. Ajit Kumar, S. Kumaresen and Bhaba Kumar Sarma, *A Foundation Course in Mathematics*, Narosa Publications, 2018.

2. Steve Warner, *Pure Mathematics for Beginners*, Get 800 LLC, 2018.

3. Paul R. Halmos, *Naïve Set Theory*, Springer, 1998.

4. *NCERT Textbook of Mathematics for Class XI*, Jammu and Kashmir State Board of School Education, 2022.

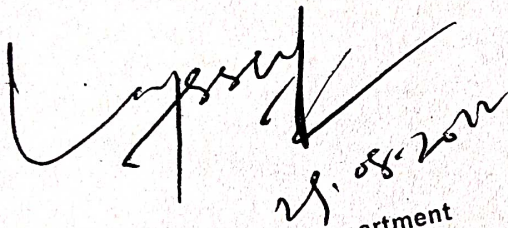5. H. Schneider and G. P. Barker, *Matrices and Linear Algebra*, Dover Publications, 1989.

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.

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(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 II
(Examination to be held in December 2023, 2024, 2025)
Skill Enhancement Course

Course Code: USEMAT205 **Course Title: Numerical Methods**
Credits: 02 **Total Number of Lectures: Theory: 30**
Maximum Marks: 50,

Objectives: The objective of this course is to equip students with a skill in Mathematics in addition to Major course in Mathematics. A course on Numerical Methods having applications in many disciplines shall serve the purpose of developing a skill in Mathematics.

Structure of the Course: This course is divided into three units of 30 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 (15 Lectures)

Accuracy of Numbers; Different types of errors and rules for estimating error; Error in the approximation of a function; Iterative methods for solution of equations: Bisection method and Regula-Falsi method. Examples and exercises on these topics.
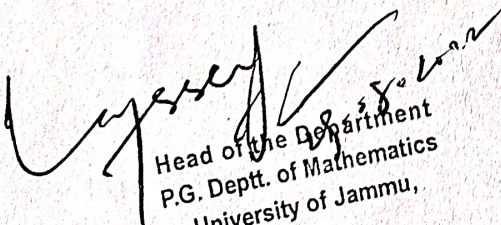
Unit-II (10 Lectures)

Further iterative methods of solutions of equation: Secant method, Iteration method and Newton-Raphson method. Solutions of simultaneous linear equations using Gauss elimination method and Jacobi's iteration method.

Unit-III (10 Lectures)

Finite Differences: Forward differences and Backward differences; Differences of a polynomial; Interpolation: Newton's forward and backward interpolation formulae, and Lagrange's interpolation formula.

Textbook:

B.S. Grewal, *Numerical Methods in Engineering and Science*, 11th edition, Khanna Publishers, 2017.

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Reference Books

1. B. Bradie, *A friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.

2. M.K. Jain, S.R.K Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, New Age Publisher, India, 2007.

3. S.S. Sastry, *Introductory Methods of Numerical Analysis*, Fifth Edition, Prentice Hall India Private Limited, 2012.

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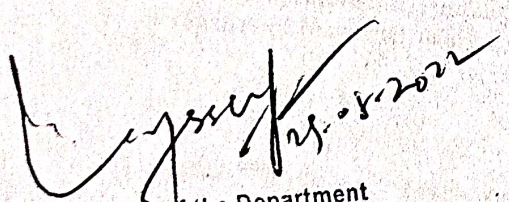
Scheme of Examination: Internal Examination to be conducted by the Course Coordinator.

(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 40 marks, shall consist of two sections:

Section A. Four(4) short answer questions one question from each unit and each question shall carry $2\frac{1}{2}$ 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 three(3) questions are to be answered selecting at least one question from each unit. Each question shall carry 10 marks.

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