

# Introduction To General Topology Kd Joshi

Eventually, you will totally discover a additional experience and completion by spending more cash. still when? accomplish you acknowledge that you require to acquire those every needs behind having significantly cash? Why dont you attempt to acquire something basic in the beginning? Thats something that will lead you to comprehend even even more more or less the globe, experience, some places, subsequently history, amusement, and a lot more?

It is your very own times to play reviewing habit. in the middle of guides you could enjoy now is **Introduction To General Topology Kd Joshi** below.

**Measure and Integration** - M Thamban Nair  
2019-11-06

This concise text is intended as an introductory course in measure and integration. It covers essentials of the subject, providing ample motivation for new concepts and theorems in the form of discussion and remarks, and with many worked-out examples. The novelty of Measure

and Integration: A First Course is in its style of exposition of the standard material in a student-friendly manner. New concepts are introduced progressively from less abstract to more abstract so that the subject is felt on solid footing. The book starts with a review of Riemann integration as a motivation for the necessity of introducing the concepts of measure and integration in a

general setting. Then the text slowly evolves from the concept of an outer measure of subsets of the set of real line to the concept of Lebesgue measurable sets and Lebesgue measure, and then to the concept of a measure, measurable function, and integration in a more general setting. Again, integration is first introduced with non-negative functions, and then progressively with real and complex-valued functions. A chapter on Fourier transform is introduced only to make the reader realize the importance of the subject to another area of analysis that is essential for the study of advanced courses on partial differential equations. Key Features Numerous examples are worked out in detail. Lebesgue measurability is introduced only after convincing the reader of its necessity. Integrals of a non-negative measurable function is defined after motivating its existence as limits of integrals of simple measurable functions. Several inquisitive questions and important conclusions are

displayed prominently. A good number of problems with liberal hints is provided at the end of each chapter. The book is so designed that it can be used as a text for a one-semester course during the first year of a master's program in mathematics or at the senior undergraduate level. About the Author M. Thamban Nair is a professor of mathematics at the Indian Institute of Technology Madras, Chennai, India. He was a post-doctoral fellow at the University of Grenoble, France through a French government scholarship, and also held visiting positions at Australian National University, Canberra, University of Kaiserslautern, Germany, University of St-Etienne, France, and Sun Yat-sen University, Guangzhou, China. The broad area of Prof. Nair's research is in functional analysis and operator equations, more specifically, in the operator theoretic aspects of inverse and ill-posed problems. Prof. Nair has published more than 70 research papers in nationally and

internationally reputed journals in the areas of spectral approximations, operator equations, and inverse and ill-posed problems. He is also the author of three books: Functional Analysis: A First Course (PHI-Learning, New Delhi), Linear Operator Equations: Approximation and Regularization (World Scientific, Singapore), and Calculus of One Variable (Ane Books Pvt. Ltd, New Delhi), and he is also co-author of Linear Algebra (Springer, New York).

**Numerical Methods** - Rajesh Kumar Gupta  
2019-05-09

Written in an easy-to-understand manner, this comprehensive textbook brings together both basic and advanced concepts of numerical methods in a single volume. Important topics including error analysis, nonlinear equations, systems of linear equations, interpolation and interpolation for Equal intervals and bivariate interpolation are discussed comprehensively. The textbook is written to cater to the needs of undergraduate students of mathematics,

computer science, mechanical engineering, civil engineering and information technology for a course on numerical methods/numerical analysis. The text simplifies the understanding of the concepts through exercises and practical examples. Pedagogical features including solved examples and unsolved exercises are interspersed throughout the book for better understanding.

**A Course in Abstract Algebra, 5th Edition** -  
Khanna V.K. & Bhamri S.K 2016

Designed for undergraduate and postgraduate students of mathematics, the book can also be used by those preparing for various competitive examinations. The text starts with a brief introduction to results from Set theory and Number theory. It then goes on to cover Groups, Rings, Fields and Linear Algebra. The topics under groups include subgroups, finitely generated abelian groups, group actions, solvable and nilpotent groups. The course in ring theory covers ideals, embedding of rings,

Euclidean domains, PIDs, UFDs, polynomial rings, Noetherian (Artinian) rings. Topics of field include algebraic extensions, splitting fields, normal extensions, separable extensions, algebraically closed fields, Galois extensions, and construction by ruler and compass. The portion on linear algebra deals with vector spaces, linear transformations, Eigen spaces, diagonalizable operators, inner product spaces, dual spaces, operators on inner product spaces etc. The theory has been strongly supported by numerous examples and worked-out problems. There is also plenty of scope for the readers to try and solve problems on their own. New in this Edition • A full section on operators in inner product spaces. • Complete survey of finite groups of order up to 15 and Wedderburn theorem on finite division rings. • Addition of around one hundred new worked-out problems and examples. • Alternate and simpler proofs of some results. • A new section on quick recall of various useful results at the end of the book to

facilitate the reader to get instant answers to tricky questions.

*Fundamentals of Real Analysis* - Sterling K. Berberian 2013-03-15

"This book is very well organized and clearly written and contains an adequate supply of exercises. If one is comfortable with the choice of topics in the book, it would be a good candidate for a text in a graduate real analysis course." -- MATHEMATICAL REVIEWS

**Introduction to General Topology** - 2014

*Introduction to Topology and Modern Analysis* - George Finlay Simmons 1963

This material is intended to contribute to a wider appreciation of the mathematical words "continuity and linearity". The book's purpose is to illuminate the meanings of these words and their relation to each other --- Product Description.

Topology of Metric Spaces - S. Kumaresan 2005  
"Topology of Metric Spaces gives a very

streamlined development of a course in metric space topology emphasizing only the most useful concepts, concrete spaces and geometric ideas to encourage geometric thinking, to treat this as a preparatory ground for a general topology course, to use this course as a surrogate for real analysis and to help the students gain some perspective of modern analysis." "Eminently suitable for self-study, this book may also be used as a supplementary text for courses in general (or point-set) topology so that students will acquire a lot of concrete examples of spaces and maps."--BOOK JACKET.

*Painlevé Transcendents* - A. S. Fokas 2006

This is the first book to present in detail the important subject of asymptotic behavior of Painleve transcendents. Authors summarize recent developments in the theory of the six Painleve equations using the Riemann-Hilbert method. Emphasis on explicit formulae content gives this book appeal to users of Painleve functions in mathematics and theoretical

physics.

Basic Topology - Armstrong 2004-01-01

**Basic Algebraic Topology** - Anant R. Shastri 2016-02-03

Building on rudimentary knowledge of real analysis, point-set topology, and basic algebra, Basic Algebraic Topology provides plenty of material for a two-semester course in algebraic topology. The book first introduces the necessary fundamental concepts, such as relative homotopy, fibrations and cofibrations, category theory, cell complexes, and si

*Applied Discrete Structures* - K. D. Joshi 1997

Although This Book Is Intended As A Sequel To Foundations Of Discrete Mathematics By The Same Author, It Can Be Read Independently Of The Latter, As The Relevant Background Needed Has Been Reviewed In Chapter 1. The Subsequent Chapters Deal With Graph Theory (With Applications), Analysis Of Algorithms (With A Detailed Study Of A Few Sorting

Algorithms And A Discussion Of Tractability), Linear Programming (With Applications, Variations, Karmarkars Polynomial Time Algorithm, Integer And Quadratic Programming), Applications Of Algebra (To Polyas Theory Of Counting, Galois Theory, Coding Theory Of Designs). A Chapter On Matroids Familiarises The Reader With This Relatively New Branch Of Discrete Mathematics. Even Though Some Of The Topics Are Relatively Advanced, An Attempt Has Been Made To Keep The Style Elementary, So That A Sincere Student Can Read The Book On His Own. A Large Number Of Comments, Exercises, And References Is Included To Broaden The Readers Scope Of Vision. A Detailed Index Is Provided For Easy Reference.

*Modern Algebra - Eighth Edition - Qazi Zameeruddin* 2009-11

For More Than Thirty Years Modern Algebra Has Served The Student Community As A Textbook For Introductory Courses On The

Subject. The Book Starts From Set Theory And Covers An Advanced Course In Group Theory And Ring Theory. A Detailed Study Of Field Theo  
**Topology for Physicists** - Albert S. Schwarz  
2013-03-09

In recent years topology has firmly established itself as an important part of the physicist's mathematical arsenal. Topology has profound relevance to quantum field theory-for example, topological nontrivial solutions of the classical equations of motion (solitons and instantons) allow the physicist to leave the frame work of perturbation theory. The significance of topology has increased even further with the development of string theory, which uses very sharp topological methods-both in the study of strings, and in the pursuit of the transition to four-dimensional field theories by means of spontaneous compactification. Important applications of topology also occur in other areas of physics: the study of defects in condensed media, of singularities in the excitation spectrum of

crystals, of the quantum Hall effect, and so on. Nowadays, a working knowledge of the basic concepts of topology is essential to quantum field theorists; there is no doubt that tomorrow this will also be true for specialists in many other areas of theoretical physics. The amount of topological information used in the physics literature is very large. Most common is homotopy theory. But other subjects also play an important role: homology theory, fibration theory (and characteristic classes in particular), and also branches of mathematics that are not directly a part of topology, but which use topological methods in an essential way: for example, the theory of indices of elliptic operators and the theory of complex manifolds.

**Educative JEE Mathematics** - K.D. Joshi  
2004-03

**General Topology** - John L. Kelley 2017-03-07  
Comprehensive text for beginning graduate-level students and professionals. "The clarity of the

author's thought and the carefulness of his exposition make reading this book a pleasure."  
— Bulletin of the American Mathematical Society. 1955 edition.

**Introduction to General Topology** - Helen F. Cullen 1967

Physiology: Prep Manual for Undergraduates - Vijaya D Joshi 2014-11-26

The Fifth Edition of this book is a must-have for all undergraduate medical students as it prepares them for both theory and viva-voce examinations. It is also useful for paramedical, dental, homeopathy and ayurveda students, besides those preparing for PG entrance examinations. It covers entire syllabus of physiology laid down by the Medical Council of India and health universities across the country. Salient Features Systemize presentation of text in Question-Answer format helps in revision and self-assessment before examination Extensively revised, updated, and strengthened to keep up

with the latest changes in the standard books of physiology Thoroughly revised topics like blood; nerve and muscle; cardiovascular system; and central nervous system Large number of diagrams, tables and flowcharts to facilitate quick learning and greater retention of knowledge

**TEXTBOOK OF TENSOR CALCULUS AND DIFFERENTIAL GEOMETRY - PRASUN**

KUMAR NAYAK 2011-12-23

Primarily intended for the undergraduate and postgraduate students of mathematics, this textbook covers both geometry and tensor in a single volume. This book aims to provide a conceptual exposition of the fundamental results in the theory of tensors. It also illustrates the applications of tensors to differential geometry, mechanics and relativity. Organized in ten chapters, it provides the origin and nature of the tensor along with the scope of the tensor calculus. Besides this, it also discusses N-dimensional Riemannian space, characteristic

peculiarity of Riemannian space, intrinsic property of surfaces, and properties and transformation of Christoffel's symbols. Besides the students of mathematics, this book will be equally useful for the postgraduate students of physics. KEY FEATURES : Contains 250 worked out examples Includes more than 350 unsolved problems Gives thorough foundation in Tensors *Fuzzy Sets, Fuzzy Logic and Their Applications* - Michael Gr. Voskoglou 2020-03-25

The present book contains 20 articles collected from amongst the 53 total submitted manuscripts for the Special Issue "Fuzzy Sets, Fuzzy Logic and Their Applications" of the MDPI journal Mathematics. The articles, which appear in the book in the series in which they were accepted, published in Volumes 7 (2019) and 8 (2020) of the journal, cover a wide range of topics connected to the theory and applications of fuzzy systems and their extensions and generalizations. This range includes, among others, management of the

uncertainty in a fuzzy environment; fuzzy assessment methods of human-machine performance; fuzzy graphs; fuzzy topological and convergence spaces; bipolar fuzzy relations; type-2 fuzzy; and intuitionistic, interval-valued, complex, picture, and Pythagorean fuzzy sets, soft sets and algebras, etc. The applications presented are oriented to finance, fuzzy analytic hierarchy, green supply chain industries, smart health practice, and hotel selection. This wide range of topics makes the book interesting for all those working in the wider area of Fuzzy sets and systems and of fuzzy logic and for those who have the proper mathematical background who wish to become familiar with recent advances in fuzzy mathematics, which has entered to almost all sectors of human life and activity.

Measure theory and Integration - G De Barra  
2003-07-01

This text approaches integration via measure theory as opposed to measure theory via integration, an approach which makes it easier

to grasp the subject. Apart from its central importance to pure mathematics, the material is also relevant to applied mathematics and probability, with proof of the mathematics set out clearly and in considerable detail. Numerous worked examples necessary for teaching and learning at undergraduate level constitute a strong feature of the book, and after studying statements of results of the theorems, students should be able to attempt the 300 problem exercises which test comprehension and for which detailed solutions are provided.

Approaches integration via measure theory, as opposed to measure theory via integration, making it easier to understand the subject  
Includes numerous worked examples necessary for teaching and learning at undergraduate level  
Detailed solutions are provided for the 300 problem exercises which test comprehension of the theorems provided

**Introduction to General Topology** - K. D. Joshi 1983

*An Illustrated Introduction to Topology and Homotopy* - Sasho Kalajdzievski 2015-03-24  
An Illustrated Introduction to Topology and Homotopy explores the beauty of topology and homotopy theory in a direct and engaging manner while illustrating the power of the theory through many, often surprising, applications. This self-contained book takes a visual and rigorous approach that incorporates both extensive illustrations and full proofs  
*A Course in Calculus and Real Analysis* - Sudhir R. Ghorpade 2006-10-14

This book provides a self-contained and rigorous introduction to calculus of functions of one variable, in a presentation which emphasizes the structural development of calculus. Throughout, the authors highlight the fact that calculus provides a firm foundation to concepts and results that are generally encountered in high school and accepted on faith; for example, the classical result that the ratio of circumference to diameter is the same for all circles. A number of

topics are treated here in considerable detail that may be inadequately covered in calculus courses and glossed over in real analysis courses.

**Krishna's Topology: (For Honours and Post Graduate Students of All Indian Universities)** - J. N. Sharma 2014

This book provides exposition of the subject both in its general and algebraic aspects. It deals with the notions of topological spaces, compactness, connectedness, completeness including metrizable and compactification, algebraic aspects of topological spaces through homotopy groups and homology groups. It begins with the basic notions of topological spaces but soon going beyond them reaches the domain of algebra through the notions of homotopy, homology and cohomology. How these approaches work in harmony is the subject matter of this book.

*Functional Analysis* - Balmohan Vishnu Limaye 1996

This Book Is An Introductory Text Written With Minimal Prerequisites. The Plan Is To Impose A Distance Structure On A Linear Space, Exploit It Fully And Then Introduce Additional Features Only When One Cannot Get Any Further Without Them. The Book Naturally Falls Into Two Parts And Each Of Them Is Developed Independently Of The Other The First Part Deals With Normed Spaces, Their Completeness And Continuous Linear Maps On Them, Including The Theory Of Compact Operators. The Much Shorter Second Part Treats Hilbert Spaces And Leads Up To The Spectral Theorem For Compact Self-Adjoint Operators. Four Appendices Point Out Areas Of Further Development. Emphasis Is On Giving A Number Of Examples To Illustrate Abstract Concepts And On Citing Various Applications Of Results Proved In The Text. In Addition To Proving Existence And Uniqueness Of A Solution, Its Approximate Construction Is Indicated. Problems Of Varying Degrees Of Difficulty Are Given At The End Of Each Section.

Their Statements Contain The Answers As Well.  
**Introduction to Topology** - Colin Conrad Adams 2008

Learn the basics of point-set topology with the understanding of its real-world application to a variety of other subjects including science, economics, engineering, and other areas of mathematics. Introduces topology as an important and fascinating mathematics discipline to retain the readers interest in the subject. Is written in an accessible way for readers to understand the usefulness and importance of the application of topology to other fields. Introduces topology concepts combined with their real-world application to subjects such DNA, heart stimulation, population modeling, cosmology, and computer graphics. Covers topics including knot theory, degree theory, dynamical systems and chaos, graph theory, metric spaces, connectedness, and compactness. A useful reference for readers wanting an intuitive introduction to topology.

**Introduction to General Topology** - K. D. Joshi 1983

*Computer Vision* - Richard Szeliski 2010-09-30  
Computer Vision: Algorithms and Applications explores the variety of techniques commonly used to analyze and interpret images. It also describes challenging real-world applications where vision is being successfully used, both for specialized applications such as medical imaging, and for fun, consumer-level tasks such as image editing and stitching, which students can apply to their own personal photos and videos. More than just a source of "recipes," this exceptionally authoritative and comprehensive textbook/reference also takes a scientific approach to basic vision problems, formulating physical models of the imaging process before inverting them to produce descriptions of a scene. These problems are also analyzed using statistical models and solved using rigorous engineering techniques. Topics and features:

structured to support active curricula and project-oriented courses, with tips in the Introduction for using the book in a variety of customized courses; presents exercises at the end of each chapter with a heavy emphasis on testing algorithms and containing numerous suggestions for small mid-term projects; provides additional material and more detailed mathematical topics in the Appendices, which cover linear algebra, numerical techniques, and Bayesian estimation theory; suggests additional reading at the end of each chapter, including the latest research in each sub-field, in addition to a full Bibliography at the end of the book; supplies supplementary course material for students at the associated website, <http://szeliski.org/Book/>. Suitable for an upper-level undergraduate or graduate-level course in computer science or engineering, this textbook focuses on basic techniques that work under real-world conditions and encourages students to push their creative boundaries. Its design and

exposition also make it eminently suitable as a unique reference to the fundamental techniques and current research literature in computer vision.

Foundations of Discrete Mathematics - Peter Fletcher 1991

Principles of Topology - Fred H. Croom  
2016-02-17

Originally published: Philadelphia: Saunders College Publishing, 1989; slightly corrected.

*Foundations of Discrete Mathematics* - K. D. Joshi 1989

This Book Is Meant To Be More Than Just A Text In Discrete Mathematics. It Is A Forerunner Of Another Book Applied Discrete Structures By The Same Author. The Ultimate Goal Of The Two Books Are To Make A Strong Case For The Inclusion Of Discrete Mathematics In The Undergraduate Curricula Of Mathematics By Creating A Sequence Of Courses In Discrete Mathematics Parallel To The Traditional

Sequence Of Calculus-Based Courses. The Present Book Covers The Foundations Of Discrete Mathematics In Seven Chapters. It Lays A Heavy Emphasis On Motivation And Attempts Clarity Without Sacrificing Rigour. A List Of Typical Problems Is Given In The First Chapter. These Problems Are Used Throughout The Book To Motivate Various Concepts. A Review Of Logic Is Included To Gear The Reader Into A Proper Frame Of Mind. The Basic Counting Techniques Are Covered In Chapters 2 And 7. Those In Chapter 2 Are Elementary. But They Are Intentionally Covered In A Formal Manner So As To Acquaint The Reader With The Traditional Definition-Theorem-Proof Pattern Of Mathematics. Chapter 3 Introduces Abstraction And Shows How The Focal Point Of Today's Mathematics Is Not Numbers But Sets Carrying Suitable Structures. Chapter 4 Deals With Boolean Algebras And Their Applications. Chapters 5 And 6 Deal With More Traditional Topics In Algebra, Viz., Groups, Rings, Fields,

Vector Spaces And Matrices. The Presentation Is Elementary And Presupposes No Mathematical Maturity On The Part Of The Reader. Instead, Comments Are Inserted Liberally To Increase His Maturity. Each Chapter Has Four Sections. Each Section Is Followed By Exercises (Of Various Degrees Of Difficulty) And By Notes And Guide To Literature. Answers To The Exercises Are Provided At The End Of The Book.

Foundations of General Topology - William J. Pervin 2014-05-12

Foundations of General Topology presents the value of careful presentations of proofs and shows the power of abstraction. This book provides a careful treatment of general topology. Organized into 11 chapters, this book begins with an overview of the important notions about cardinal and ordinal numbers. This text then presents the fundamentals of general topology in logical order processing from the most general case of a topological space to the restrictive case of a complete metric space. Other chapters

consider a general method for completing a metric space that is applicable to the rationals and present the sufficient conditions for metrizable. This book discusses as well the study of spaces of real-valued continuous functions. The final chapter deals with uniform continuity of functions, which involves finding a distance that satisfies certain requirements for all points of the space simultaneously. This book is a valuable resource for students and research workers.

**Calculus for Scientists and Engineers** - K. D. Joshi 2002

Focusing on the "why's" of mathematics rather than the "how's," the unique approach of this text will appeal to a wide range of readers, from those taking a first course in calculus to those seeking deeper insights or needing a transition from calculus to analysis. The author takes care to supply strong motivations for abstract concepts, thereby helping beginners overcome the intimidation often felt when first confronting

abstraction. While emphasizing the "why's," the book does not entirely neglect the "how's" and provides sufficient exposure to the techniques through numerous exercises, with answers supplied in the back of the book.

**Elements of Differential Topology** - Anant R. Shastri 2011-03-04

Derived from the author's course on the subject, *Elements of Differential Topology* explores the vast and elegant theories in topology developed by Morse, Thom, Smale, Whitney, Milnor, and others. It begins with differential and integral calculus, leads you through the intricacies of manifold theory, and concludes with discussions on algebraic topol

**Scientia Magna, Vol. 6. No. 4, 2010** - Zhang Wenpeng

Papers on kn-digital sequence and Smarandache function, generalized separation axioms, the bounds of the largest eigen value and the Laplacian energy of certain class of graphs, several identities involving the classical Catalan

numbers, more about functional Alexandroff topological spaces, clopen sets in uniform topology on BE-algebras, and similar topics. Contributors: S. Balasubramanian, V. Lokesh, Ranjini P. S, D. Senthilkumar and K. Thirugnanasambandam, N. Murugesan, P. Suguna, M. Mohamadhasani, and others. *University Algebra* - N. S. Gopalakrishnan 1986

The Theory of Near-Rings - Robert Lockhart 2021

This book offers an original account of the theory of near-rings, with a considerable amount of material which has not previously been available in book form, some of it completely new. The book begins with an introduction to the subject and goes on to consider the theory of near-fields, transformation near-rings and near-rings hosted by a group. The bulk of the chapter on near-fields has not previously been available in English. The transformation near-rings chapters considerably augment existing

knowledge and the chapters on product hosting are essentially new. Other chapters contain original material on new classes of near-rings and non-abelian group cohomology. The Theory of Near-Rings will be of interest to researchers in the subject and, more broadly, ring and representation theorists. The presentation is elementary and self-contained, with the necessary background in group and ring theory available in standard references.

*A First Course in Topology* - John McCleary 2006

How many dimensions does our universe require for a comprehensive physical description? In 1905, Poincare argued philosophically about the necessity of the three familiar dimensions, while recent research is based on 11 dimensions or even 23 dimensions. The notion of dimension itself presented a basic problem to the pioneers of topology. Cantor asked if dimension was a topological feature of Euclidean space. To answer this question, some important topological ideas were introduced by Brouwer,

giving shape to a subject whose development dominated the twentieth century. The basic notions in topology are varied and a comprehensive grounding in point-set topology, the definition and use of the fundamental group, and the beginnings of homology theory requires considerable time. The goal of this book is a focused introduction through these classical topics, aiming throughout at the classical result of the Invariance of Dimension. This text is based on the author's course given at Vassar College and is intended for advanced undergraduate students. It is suitable for a semester-long course on topology for students who have studied real analysis and linear algebra. It is also a good choice for a capstone course, senior seminar, or independent study.

**Interactive Theorem Proving** - Sandrine Blazy  
2013-07-22

This book constitutes the refereed proceedings of the 4th International Conference on Interactive Theorem Proving, ITP 2013, held in

Rennes, France, in July 2013. The 26 regular full papers presented together with 7 rough diamond papers, 3 invited talks, and 2 invited tutorials were carefully reviewed and selected from 66 submissions. The papers are organized in topical sections such as program verification, security, formalization of mathematics and theorem prover development.

### **Differential Geometry of Curves and**

**Surfaces** - Manfredo P. do Carmo 2016-12-14

One of the most widely used texts in its field, this volume introduces the differential geometry of curves and surfaces in both local and global aspects. The presentation departs from the traditional approach with its more extensive use

of elementary linear algebra and its emphasis on basic geometrical facts rather than machinery or random details. Many examples and exercises enhance the clear, well-written exposition, along with hints and answers to some of the problems. The treatment begins with a chapter on curves, followed by explorations of regular surfaces, the geometry of the Gauss map, the intrinsic geometry of surfaces, and global differential geometry. Suitable for advanced undergraduates and graduate students of mathematics, this text's prerequisites include an undergraduate course in linear algebra and some familiarity with the calculus of several variables. For this second edition, the author has corrected, revised, and updated the entire volume.