Classical Theory Of Electric And Magnetic Fields

Introduction -- Electrostatics. No dielectrics present -- Electrostatics. Dielectrics present -- Electrostatics: energy, forces, instruments -- Magnetostatics -- Current electricity -- Conduction -- Electromagnetic induction -- Circuit theory -- Electromagnetic waves -- Electrical measurement -- Applied electricity.

Compact and precise coverage of the electrostatic field in vacuum; general methods for solution of potential problems; radiation reaction and covariant formulation of conservation laws of electrodynamics; much more. 1962 edition.

Comprehensive graduate-level text by a distinguished theoretical physicist reveals the classical underpinnings of modern quantum field theory. Topics include space-time, Lorentz transformations, conservation laws, equations of motion, Green's functions, and more. 1964 edition.

There is an uncanny resemblance between Christianity in the middle ages and Physics in the twenty-first century. Formerly, the common man could neither read nor understand the scriptures, as they were written in Latin; the clergy had to interpret the scriptures for the laity with predictable results. Physics in the twenty-first century is similar. Only mathematicians with doctoral degree can understand the universe and how it works, to the rest of mankind the universe is an area of darkness. This is not by any means a desirable development. As human beings, we are all sentient individuals and as such are expected to enquire about our environment, the world around us, and the universe we live in. On a fundamental philosophical basis, it is wrong to believe that such knowledge, whether by circumstance or by design, is limited to a privileged few. This book explains the universe for the first time in a way that is comprehensible to everyone. Neo-classical physics undertakes the study of the behaviour of the universe as an entity, and the physics of sub-atomic particles is easy to understand in everyday terms. Neo-classical physics is the language that sets you free – free to see, free to comprehend and free to wonder anew.

The topics treated in this book are essentially those that a graduate student of physics or electrical engineering should be familiar with in classical electromagnetism. Each topic is analyzed in detail, and each new concept is explained with examples. The text is self-contained and oriented toward the student. It is concise and yet very detailed in mathematical calculations; the equations are explicitly derived, which is of great help to students and allows them to concentrate more on the physics concepts, rather than spending too much time on mathematical derivations. The introduction of the theory of special relativity is always a challenge in teaching electromagnetism, and this topic is considered with particular care. The value of the book is increased by the inclusion of a large number of exercises.

In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual. Galileo Galilei, physicist and astronomer (1564-1642) This book is a second edition of "Classical Electromagnetic Theory" which derived from a set of lecture notes compiled over a number of years of teaching elect- magnetic theory to fourth year physics and electrical engineering students. These students had a previous exposure to electricity and magnetism, and the material from the ?rst four and a half chapters was presented as a review. I believe that the book makes a reasonable transition between the many excellent elementary books such as Gri?th's Introduction to Electrodynamics and the obviously graduate level books such as Jackson's Classical Electrodynamics or Landau and Lifshitz' Elect- dynamics of Continuous Media. If the students have had a previous exposure to Electromagnetictheory, allthematerialcanbereasonablycoveredintwosemesters. Neophytes should probable spend a semester on the ?rst four or ?ve chapters as well as, depending on their mathematical background, the Appendices B to F. For a shorter or more elementary course, the material on spherical waves, waveguides, and waves in anisotropic media may be omitted without loss of continuity.

The evaluation of electromagnetic field coupling to transmission lines is an important problem in electromagnetic compatibility. Traditionally, use is made of the TL approximation which applies to uniform transmission lines with electrically small cross-sectional dimensions, where the dominant mode of propagation is TEM. Antenna-mode currents and higher-order modes appearing at higher frequencies are neglected in TL theory. The use of the TL approximation has permitted to solve a large range of problems (e.g. lightning and EMP interaction with power lines). However, the continual increase in operating frequency of products and higher frequency sources of disturbances (such as UWB systems) makes that the TL basic assumptions are no longer acceptable for a certain number of applications. In the last decade or so, the generalization of classical TL theory to take into account high frequency effects has emerged as an important topic of study in electromagnetic compatibility. This effort resulted in the elaboration of the so-called 'generlized' or 'full-wave' TL theory, which incorporates high frequency radiation effects, while keeping the relative simplicity of TL equations. This book is organized in two main parts. Part I presents consolidated knowledge of classical transmission line theory and different field-to-transmission line coupling models. Part II presents different approaches developed to generalize TL Theory.

Volume 2.

The first comprehensive treatment of relativistic electrodynamics, this volume remains essential reading. This graduate-level text was written by a distinguished theoretical physicist. It deftly reveals the classical underpinnings of modern quantum field theory with explorations of space-time, Lorentz transformations, conservation laws, equations of motion, Green's functions, and action-at-a-distance electrodynamics. 1964 edition.

New Edition: Classical Theory of Electromagnetism (3rd Edition)The topics treated in this book are essentially those that a graduate student of physics or electrical engineering should be familiar with in classical electromagnetism. Each topic is analyzed in detail, and each new concept is explained with examples.The text is self-contained and oriented toward the student. It is concise and yet very detailed in mathematical calculations; the equations are explicitly derived, which is of great help to students and allows them to concentrate more on the physics concepts, rather than spending too much time on mathematical derivations. The introduction of the theory of special relativity is always a challenge in teaching electromagnetism, and this topic is considered with particular care. The value of the book is increased by the inclusion of a large number of exercises.

Classical Theory of Electric and Magnetic Fields is a textbook on the principles of electricity and magnetism. This book discusses mathematical techniques, calculations, with examples of physical reasoning, that are generally applied in theoretical physics. This text reviews the classical theory of electric and magnetic fields, Maxwell's Equations, Lorentz Force, and Faraday's Law of Induction. The book also focuses on electrostatics and the general methods for solving electrostatic problems concerning images, inversion, complex variable, or

separation of variables. The text also explains ma ...

The fourth edition contains seven new sections with chapters on General Relativity, Gravitational Waves and Relativistic Cosmology. The text has been thoroughly revised and additional problems inserted. The Complete course of Theoretical Physics by Landau and Lifshitz, recognized as two of the world's outstanding physicists, is published in full by Butterworth-Heinemann. It comprises nine volumes, covering all branches of the subject; translations from the Russian are by leading scientists.

This book contains 157 problems in classical electromagnetism, most of them new and original compared to those found in other textbooks. Each problem is presented with a title in order to highlight its inspiration in different areas of physics or technology, so that the book is also a survey of historical discoveries and applications of classical electromagnetism. The solutions are complete and include detailed discussions, which take into account typical questions and mistakes by the students. Without unnecessary mathematical complexity, the problems and related discussions introduce the student to advanced concepts such as unipolar and homopolar motors, magnetic monopoles, radiation pressure, angular momentum of light, bulk and surface plasmons, radiation friction, as well as to tricky concepts and ostensible ambiguities or paradoxes related to the classical theory of the electromagnetic field. With this approach the book is both a teaching tool for undergraduates in physics, mathematics and electric engineering, and a reference for students wishing to work in optics, material science, electronics, plasma physics.

The study of classical electromagnetic fields is an adventure. The theory is complete mathematically and we are able to present it as an example of classical Newtonian experimental and mathematical philosophy. There is a set of foundational experiments, on which most of the theory is constructed. And then there is the bold theoretical proposal of a field-field interaction from James Clerk Maxwell. This textbook presents the theory of classical fields as a mathematical structure based solidly on laboratory experiments. Here the student is introduced to the beauty of classical field theory as a gem of theoretical physics. To keep the discussion fluid, the history is placed in a beginning chapter and some of the mathematical proofs in the appendices. Chapters on Green's Functions and Laplace's Equation and a discussion of Faraday's Experiment further deepen the understanding. The chapter on Einstein's relativity is an integral necessity to the text. Finally, chapters on particle motion and waves in a dispersive medium complete the picture. High quality diagrams and detailed end-of-chapter questions enhance the learning experience.

A detailed introduction to modern network theory. Includes computer models of semiconductor devices and circuits, and several computer modeling techniques. Brings together many useful techniques and basic concepts that have previously been scattered throughout other texts and professional journals. Establishes a strong analytical foundation for the analysis, design, and optimization of active and passive linear electrical networks, unifying classical theory and electronic circuit design. Features rigorous theoretical developments and design-oriented examples and exercises.

Based on a highly regarded lecture course at Moscow State University, this is a clear and systematic introduction to gauge field theory. It is unique in providing the means to master gauge field theory prior to the advanced study of quantum mechanics. Though gauge field theory is typically included in courses on quantum field theory, many of its ideas and results can be understood at the classical or semi-classical level. Accordingly, this book is organized so that its early chapters require no special knowledge of quantum mechanics. Aspects of gauge field theory relying on quantum mechanics are introduced only later and in a graduated fashion--making the text ideal for students studying gauge field theory and quantum mechanics simultaneously. The book begins with the basic concepts on which gauge field theory is built. It introduces gauge-invariant Lagrangians and describes the spectra of linear perturbations, including perturbations above nontrivial ground states. The second part focuses on the construction and interpretation of classical solutions that exist entirely due to the nonlinearity of field equations: solitons, bounces, instantons, and sphalerons. The third section considers some of the interesting effects that appear due to interactions of fermions with topological scalar and gauge fields. Mathematical digressions and numerous problems are included throughout. An appendix sketches the role of instantons as saddle points of Euclidean functional integral and related topics. Perfectly suited as an advanced undergraduate or beginning graduate text, this book is an excellent starting point for anyone seeking to understand gauge fields.

In this monograph, the authors present their recently developed theory of electromagnetic interactions. This neoclassical approach extends the classical electromagnetic theory down to atomic scales and allows the explanation of various non-classical phenomena in the same framework. While the classical Maxwell–Lorentz electromagnetism theory succeeds in describing the physical reality at macroscopic scales, it struggles at atomic scales. Here, quantum mechanics traditionally takes over to describe non-classical phenomena such as the hydrogen spectrum and de Broglie waves. By means of modifying the classical theory, the approach presented here is able to consistently explain quantum-mechanical effects, and while similar to quantum mechanics in some respects, this neoclassical theory also differs markedly from it. In particular, the newly developed framework omits probabilistic interpretations of the wave function and features a new fundamental spatial scale which, at the size of the free electron, is much larger than the classical electron radius and is relevant to plasmonics and emission physics. This book will appeal to researchers interested in advanced aspects of electromagnetic theory. Treating the classical approach in detail, including non-relativistic aspects and the Lagrangian framework, and comparing the neoclassical theory with quantum mechanics and the de Broglie–Bohm theory, this work is completely self-contained.

Accessible treatment offers highly detailed accounts concerning development of ideas and theories about the nature of electricity and space (aether), focusing on period from Descartes to Lorentz, Einstein, and Minkowski. 1960 edition.

College physics course for students majoring in science and engineering.

Translated from the 6th Russian edition, this latest edition contains seven new sections with chapters on General Relativity, Gravitational Waves and Relativistic Cosmology, where Professor Lifshitz's interests lay. The text of the 3rd English edition has been thoroughly revised and additional problems inserted

In this book we display the fundamental structure underlying classical electro dynamics, i. e. , the phenomenological theory of electric and magnetic effects. The book can be used as a textbook for an advanced course in theoretical electrodynamics for physics and mathematics students and, perhaps, for some highly motivated electrical engineering students. We expect from our readers that they know elementary electrodynamics in the conventional (1 + 3)-dimensional form including Maxwell's equations. More over, they should be familiar with linear algebra and elementary analysis, in cluding vector analysis. Some knowledge of differential geometry would help. Our approach rests on the metric-free integral formulation of the conservation laws of electrodynamics in the tradition of F. Kottler (1922), E. Cartan (1923), and D. van Dantzig (1934), and we stress, in particular, the axiomatic point of view. In this manner we are led to an understanding of why the Maxwell equa tions have their specific form. We hope that our book can be seen in the classical tradition of the book by E. J. Post (1962) on the Formal Structure of Electro magnetics and of the chapter "Charge and Magnetic Flux" of the encyclopedia article on classical field theories by C. Truesdell and R. A. Toupin (1960), in cluding R. A. Toupin's Bressanone lectures (1965); for the exact references see the end of the introduction on page 11. .

This book presents a generalization of electromagnetism into the bitemporal microcosm, where by hypothesis regular causal relationships do not apply, and time is allowed to flow in both directions. Labeled the Neo-classical Electromagnetic Theory, the proposition is put on a sound formal footing by noting that Maxwell's field equations are valid for positive as well as negative time. The book explores the ramifications of the extra degree of freedom arising from incorporation of negative time elements, which introduce additional boundary conditions modifying orthodox quantum interpretations in a nontrivial way. The theory provides a merger of electromagnetism and quantum theory of photons, applicable to macroscopic as well as microscopic phenomena. Avoiding the hand-waving arguments so often encountered in quantum texts, the book presents detailed analyses of a number of well-known and famous quantum experiments riddled with interpretational dilemmas, such as the double-slit experiments for photons and electrons, the Einstein-Podolsky-Rosen (EPR) paradox, and many more. The investigations turned out to be a fascinating journey into largely unexplored territory, with rewards in the way of resolutions of bizarre puzzles and paradoxes in the quantum family, together with consistent agreements with existing experimental facts. In examples from the macroscopic domain, the book proposes a photonic origin of the enigmatic 1/f noise occurring in all active electronic components and devices, a proposition supported by detailed analysis consistent with existing empirical data. Incorporation of negative time elements into the field equations gives rise to the concept of photon doublets, a composite entity consisting of a bitemporal photon pair of zero net energy, which in the neo-classical theory fills all vacuum space. In this theory the doublet entities replace the so-called Zero Point Fluctuations of conventional quantum theory, which predicts infinite energy density of the vacuum state, an embarrassing concept remaining a puzzle to contemporary physicists, as well as to cosmologists. From its electromagnetic platform the Neo-classical Theory takes the consistent view that quantum phenomena are objective entities, describing these in an overall theoretical framework that can be characterized as an observer-independent quantum theory. From this viewpoint alone the book is an important contribution to the ongoing debate of the true interpretation of the quantum world.

This volume is intended as a systematic introduction to gauge field theory for advanced undergraduate and graduate students in high energy physics. The discussion is restricted to the classical (non-quantum) theory in Minkowski spacetime. Particular attention has been given to conceptual aspects of field theory, accurate definitions of basic physical notions, and thorough analysis of exact solutions to the equations of motion for interacting systems.

"Quantum Theory of Near-field Electrodynamics" gives a self-contained account of the fundamental theory of field-matter interaction on a subwavelength scale. The quantum physical behavior of matter (atoms and mesoscopic media) in both classical and quantum fields is treated. The role of local-field effects and nonlocal electrodynamics, and the tight links to the theory of spatial photon localization are emphasized. The book may serve as a reference work in the field, and is of general interest for physicists working in quantum optics, mesoscopic electrodynamics and physical optics. The macroscopic and microscopic classical theories form a good starting point for the quantum approach, and these theories are presented in a manner appropriate for graduate students entering near-field optics.

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