[1]Solution to the Drill problems of chapter 04
(Engineering Electromagnetics,Hayt,A.Buck 7th ed)
BEE 4A,4B & 4C

D4.1 (a). $\vec{E} = (1/z^2)(8xyz\hat{a}_x + 4x^2z\hat{a}_y - 4x^2y\hat{a}_z)V/m, Q = 6nC, \mid d\vec{L} \mid = 2\mu m, P(2,-2,3)$
$\hat{a}_L = (-6/7)\hat{a}_x + (3/7)\hat{a}_y + (2/7)\hat{a}_z$, Find dW
$d\vec{L} = \hat{a}_L \mid d\vec{L} \mid = 2 \times 10^{-6}((-6/7)\hat{a}_x + (3/7)\hat{a}_y + (2/7)\hat{a}_z) = ((-12/7)\hat{a}_x + (6/7)\hat{a}_y + (4/7)\hat{a}_z) \times 10^{-6}$
$dW = -Q\vec{E} \cdot d\vec{L} \Rightarrow dW = -6 \times 10^{-9}((1/z^2)(8xyz\hat{a}_x + 4x^2z\hat{a}_y - 4x^2y\hat{a}_z)) \cdot (((-12/7)\hat{a}_x + (6/7)\hat{a}_y + (4/7)\hat{a}_z) \times 10^{-6})$
$= -6 \times 10^{-15}((1/z^2)((-96/7)xyz + (24/7)x^2z - (16/7)x^2y)$
$\Rightarrow dW_{P(2,-2,3)} = -6 \times 10^{-15}((1/3^2)((-96/7)(2)(-2)(3) + (24/7)(2)^2(3) - (16/7)(2)^2(-2))$
$= -6 \times 10^{-15}((1/3^2)((1152/7) + (288/7) + (128/7)) = -149.3nJ$

(b). Similar to part(a)

(c). Similar to part(a)

D4.2 (a). Find the work done W, $Q = 4C$, from $B(1,0,0)$ to $A(0,2,0)$ along the path $y = 2 - 2x, z = 1$,
$\vec{E} = 5\hat{a}_x V/m$
we have $W = -Q \int \vec{E} \cdot d\vec{L}$, since the path of integration is a straight line so we have $d\vec{L} = dx\hat{a}_x + dy\hat{a}_y + dz\hat{a}_z$
$\Rightarrow W = -4 \int (5\hat{a}_x + 0\hat{a}_y + 0\hat{a}_z) \cdot (dx\hat{a}_x + dy\hat{a}_y + dz\hat{a}_z) = -4 \int_1^0 5dx = 20J$

(b). Follow the same procedure as in part(a) and we get $W = -4 \int (5x\hat{a}_x + 0\hat{a}_y + 0\hat{a}_z) \cdot (dx\hat{a}_x + dy\hat{a}_y + dz\hat{a}_z)$
$\Rightarrow W = -4 \int_1^0 5xdx = -20 \times \mid x^2/2 \mid_1^0 = 10J$

(C). Follow the same procedure as in part(a) and we get $W = -4 \int (5x\hat{a}_x + 5y\hat{a}_y + 0\hat{a}_z) \cdot (dx\hat{a}_x + dy\hat{a}_y + dz\hat{a}_z)$
$\Rightarrow W = -4(\int_1^0 5xdx + \int_0^2 5ydy) = -20 \times (\mid x^2/2 \mid_1^0 + \mid y^2/2 \mid_0^2) = -20 \times (-(1/2) + 2) = -30J$

D4.3 (a). $\vec{E} = y\hat{a}_x, Q = 3C$, along the straight line segments joining (1,3,5) to (2,3,5) to (2,0,5) to (2,0,3)
we have $W = -Q \int \vec{E} \cdot d\vec{L}$
for (1,3,5) to (2,3,5)
$W_1 = -3 \int (y\hat{a}_x + 0\hat{a}_y + 0\hat{a}_z) \cdot (dx\hat{a}_x)$ (dy and dz are zero for this line segment)
$\Rightarrow W_1 = -3 \int_1^2 ydx = -3y \mid x \mid_1^2 = (-3y)_{y=3} = -9J$
for (2,3,5) to (2,0,5)
$W_2 = -3 \int (y\hat{a}_x + 0\hat{a}_y + 0\hat{a}_z) \cdot (dy\hat{a}_y)$ (dx and dz are zero for this line segment)
$\Rightarrow W_2 = 0$
for (2,0,5) to (2,0,3)
$W_3 = -3 \int (y\hat{a}_x + 0\hat{a}_y + 0\hat{a}_z) \cdot (dz\hat{a}_z)$ (dx and dy are zero for this line segment)
$\Rightarrow W_3 = 0$
$\Rightarrow W = W_1 + W_2 + W_3 = -9 + 0 + 0 = -9J$

(b). Similar to part(a)

D4.4 (a). $\vec{E} = 6x^2\hat{a}_x + 6y\hat{a}_y + 4\hat{a}_z V/m, d\vec{L} = dx\hat{a}_x + dy\hat{a}_y + dz\hat{a}_z$ find $V_{MN}, M(2,6,-1), N(-3,-3,2)$
we have $V_{AB} = -\int_B^A \vec{E} \cdot d\vec{L} \Rightarrow V_{MN} = -\int_N^M \vec{E} \cdot d\vec{L} = -\int_N^M (6x^2\hat{a}_x + 6y\hat{a}_y + 4\hat{a}_z) \cdot (dx\hat{a}_x + dy\hat{a}_y + dz\hat{a}_z)$
$= -(6\int_{-3}^2 x^2dx + 6\int_{-3}^6 ydy + 4\int_2^{-1} dz) = -(6 \times \mid x^3/3 \mid_{-3}^2 + 6 \times \mid y^2/2 \mid_{-3}^6 + 4 \times \mid z \mid_2^{-1}) = -(70 + 81 - 12) = -139V$

(b). we have $V_{AB} = V_A - V_B \Rightarrow V_{MQ} = V_M - V_Q = (-\int_0^M \vec{E} \cdot d\vec{L}) - V_Q$
(V_M and V_Q are the potential differences with respect to the origin (0,0,0))
$\Rightarrow V_{MQ} = -\int_0^M (6x^2\hat{a}_x + 6y\hat{a}_y + 4\hat{a}_z) \cdot (dx\hat{a}_x + dy\hat{a}_y + dz\hat{a}_z) - V_Q$
$\Rightarrow V_{MQ} = -(6\int_0^2 x^2dx + 6\int_0^6 ydy + 4\int_0^{-1} dz) - V_Q = -(6 \times \mid x^3/3 \mid_0^2 + 6 \times \mid y^2/2 \mid_0^6 + 4 \times \mid z \mid_0^{-1}) - V_Q = -120 - 0$
$= -120$ V (since $V_Q = 0$)$\Rightarrow V_M = -120V$

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[1]This document is pregared in LaTeX. (Email: ahmadsajjad019@iit.nust.pk)

Engineering Electromagnetics Drill Solution Ch 7

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Engineering Electromagnetics William Hart Hayt,John A. Buck,2006 Now in its Seventh Edition Bill Hayt and John Buck s Engineering Electromagnetics is a classic book that has been updated for electromagnetics today This widely respected book stresses fundamentals and problem solving and discusses the material in an understandable readable way Numerous illustrations and analogies are provided to aid the reader in grasping difficult concepts In addition independent learning is facilitated by the presence of many examples and problems Jacket *Fundamentals of electromagnetics with engineering applications* Stuart M. Wentworth,2005 **Engineering Electromagnetics** William H. Hayt, Jr, **Elements of Engineering Electromagnetics** Nannapaneni Narayana Rao,2000 Successful text with a versatile approach including thorough coverage of statics with an emphasis on the dynamics of engineering electromagnetics It integrates practical applications numerical details and the thorough coverage of principles NEW Two part coverage Fundamental Elements and Applied Elements Associates the chapters on Applied Elements with major technologies based on Maxwells equations Serves the needs of twenty first century electromagnetics education with Chapters 1 6 comprehensive for a one semester introductory course and Chapters 7 12 accessible for follow up on elective courses for electrical engineering majors NEW Material on Crosstalk on Transmission Lines Pulse Broadening in Dispersive Medium and Finite Difference Time Domain Method Topics previously covered in higher level courses now becoming increasingly important to be taught in beginning courses because of advances in technology NEW Review problems Follow homework problems in each chapter Serve as review of material covered in a chapter by integrating concepts introduced in more than one section of the chapter Uniform plane waves Presents topic immediately following Maxwell **Elements of Engineering Electromagnetics** Nannapaneni Narayana Rao,2004 This book with its versatile approach includes thorough coverage of statics with an emphasis on the dynamics of engineering electromagnetics It integrates practical applications numerical details and completely covers all relevant principles Topics include vectors and fields Maxwell s Equations fields and waves electromagnetic potentials devices circuits and systems and transmission line essentials for digital electronics The second part of the book covers communications guided wave principles electronics and photonics and radiation and antennae A valuable resource for computer engineering and electrical engineering professionals *Electromagnetic Methods in Applied Geophysics* Misac N. Nabighian,1988 As a slag heap the result of strip mining creeps closer to his house in the Ohio hills fifteen year old M C is torn between trying to get his family away and fighting for the home they love *Microwave Circuit Modeling Using Electromagnetic Field Simulation* Daniel G. Swanson,Wolfgang J. R. Hoefer,2003 Annotation This practical how to book is an ideal introduction to electromagnetic field solvers Where most books in this area are strictly theoretical this unique resource provides engineers with helpful advice on selecting the right tools for their RF radio frequency and high speed digital circuit

design work Teaching Engineering, Second Edition Phillip C. Wankat,Frank S. Oreovicz,2015-01-15 The majority of professors have never had a formal course in education and the most common method for learning how to teach is on the job training This represents a challenge for disciplines with ever more complex subject matter and a lost opportunity when new active learning approaches to education are yielding dramatic improvements in student learning and retention This book aims to cover all aspects of teaching engineering and other technical subjects It presents both practical matters and educational theories in a format useful for both new and experienced teachers It is organized to start with specific practical teaching applications and then leads to psychological and educational theories The practical orientation section explains how to develop objectives and then use them to enhance student learning and the theoretical orientation section discusses the theoretical basis for learning teaching and its impact on students Written mainly for PhD students and professors in all areas of engineering the book may be used as a text for graduate level classes and professional workshops or by professionals who wish to read it on their own Although the focus is engineering education most of this book will be useful to teachers in other disciplines Teaching is a complex human activity so it is impossible to develop a formula that guarantees it will be excellent However the methods in this book will help all professors become good teachers while spending less time preparing for the classroom This is a new edition of the well received volume published by McGraw Hill in 1993 It includes an entirely revised section on the Accreditation Board for Engineering and Technology ABET and new sections on the characteristics of great teachers different active learning methods the application of technology in the classroom from clickers to intelligent tutorial systems and how people learn **Elements of Engineering Electromagnetics** Nannapaneni Narayana Rao,1994 This text examines applications and covers statics with an emphasis on the dynamics of engineering electromagnetics This edition features a new chapter on electromagnetic principles for photonics and sections on cylindrical metallic waveguides and losses in waveguides and resonators *Applied Electromagnetics* Stuart M. Wentworth,2007-01-09 STUDENT COMPANION SITE Every new copy of Stuart Wentworth s Applied Electromagnetics comes with a registration code which allows access to the Student s Book Companion Site On the BCS the student will find Detailed Solutions to Odd Numbered Problems in the text Detailed Solutions to all Drill Problems from the text MATLAB code for all the MATLAB examples in the text Additional MATLAB demonstrations with code This includes a Transmission Lines simulator created by the author Weblinks to a vast array of resources for the engineering student Go to www wiley com college wentworth to link to Applied Electromagnetics and the Student Companion Site ABOUT THE PHOTO Passive RFID systems consisting of readers and tags are expected to replace bar codes as the primary means of identification inventory and billing of everyday items The tags typically consist of an RFID chip placed on a flexible film containing a planar antenna The antenna captures radiation from the reader s signal to power the tag electronics which then responds to the reader s query The PENI Tag Product Emitting Numbering Identification Tag shown developed by the University of Pittsburgh in a team led by Professor Marlin H Mickle integrates the

antenna with the rest of the tag electronics RFID systems involve many electomagnetics concepts including antennas radiation transmission lines and microwave circuit components Photo courtesy of Marlin H Mickle **Dynamic Electromagnetics** Paul Diament,2000 Drawn from the author s decades of experience teaching the subject Dynamic Electromagnetics offers a uniquely accessible approach to a discipline often viewed as complicated and mysterious The text addresses the key principles with extensive problems and examples and provides comprehensive coverage without overwhelming the student with advanced math Gauss s Law Surface Integrals and Electric Fields Amp re s Law Line Integrals and Magnetic Fields Emf Field Dynamics and Maxwell s Equations Maxwell s Equations and Quasistatic Analysis Transmission Lines Time Delay and Wave Propagation Steady State Wave Transmission and Plane Waves Impedance Matching Techniques and Oblique Waves Poynting Theorems and Lossy Transmission Lines Waveguiding and Radiating Structures For individuals interested in an accessible approach to Electromagnetics **Signals and Systems** Shaila Dinkar Apte,2016-05-09 This book provides a rigorous treatment of deterministic and random signals It offers detailed information on topics including random signals system modelling and system analysis System analysis in frequency domain using Fourier transform and Laplace transform is explained with theory and numerical problems The advanced techniques used for signal processing especially for speech and image processing are discussed The properties of continuous time and discrete time signals are explained with a number of numerical problems The physical significance of different properties is explained using real life examples To aid understanding concept check questions review questions a summary of important concepts and frequently asked questions are included MATLAB programs with output plots and simulation examples are provided for each concept Students can execute these simulations and verify the outputs **Advanced Engineering Mathematics** Michael D. Greenberg,1998-09 *Fiber Optics Engineering* Mohammad Azadeh,2009-08-05 Within the past few decades information technologies have been evolving at a tremendous rate causing profound changes to our world and our ways of life In particular fiber optics has been playing an increasingly crucial role within the telecommunication revolution Not only most long distance links are fiber based but optical fibers are increasingly approaching the individual end users providing wide bandwidth links to support all kinds of data intensive applications such as video voice and data services As an engineering discipline fiber optics is both fascinating and challenging Fiber optics is an area that incorporates elements from a wide range of techno gies including optics microelectronics quantum electronics semiconductors and networking As a result of rapid changes in almost all of these areas fiber optics is a fast evolving field Therefore the need for up to date texts that address this growing field from an interdisciplinary perspective persists This book presents an overview of fiber optics from a practical engineering perspective Therefore in addition to topics such as lasers detectors and optical fibers several topics related to electronic circuits that generate detect and process the optical signals are covered In other words this book attempts to present fiber optics not so much in terms of a field of optics but more from the perspective of an engineering

field within optoelectronics **Foundations for Microstrip Circuit Design** Terry C. Edwards,Michael B. Steer,2016-02-01 Building on the success of the previous three editions Foundations for Microstrip Circuit Design offers extensive new updated and revised material based upon the latest research Strongly design oriented this fourth edition provides the reader with a fundamental understanding of this fast expanding field making it a definitive source for professional engineers and researchers and an indispensable reference for senior students in electronic engineering Topics new to this edition microwave substrates multilayer transmission line structures modern EM tools and techniques microstrip and planar transmision line design transmission line theory substrates for planar transmission lines Vias wirebonds 3D integrated interposer structures computer aided design microstrip and power dependent effects circuit models microwave network analysis microstrip passive elements and slotline design fundamentals **Electromagnetic and Photonic Simulation for the Beginner: Finite-Difference Frequency-Domain in MATLAB®** Raymond C. Rumpf,2022-01-31 This book teaches the finite difference frequency domain FDFD method from the simplest concepts to advanced three dimensional simulations It uses plain language and high quality graphics to help the complete beginner grasp all the concepts quickly and visually This single resource includes everything needed to simulate a wide variety of different electromagnetic and photonic devices The book is filled with helpful guidance and computational wisdom that will help the reader easily simulate their own devices and more easily learn and implement other methods in computational electromagnetics Special techniques in MATLAB are presented that will allow the reader to write their own FDFD programs Key concepts in electromagnetics are reviewed so the reader can fully understand the calculations happening in FDFD A powerful method for implementing the finite difference method is taught that will enable the reader to solve entirely new differential equations and sets of differential equations in mere minutes Separate chapters are included that describe how Maxwell s equations are approximated using finite differences and how outgoing waves can be absorbed using a perfectly matched layer absorbing boundary With this background a chapter describes how to calculate guided modes in waveguides and transmission lines The effective index method is taught as way to model many three dimensional devices in just two dimensions Another chapter describes how to calculate photonic band diagrams and isofrequency contours to quickly estimate the properties of periodic structures like photonic crystals Next a chapter presents how to analyze diffraction gratings and calculate the power coupled into each diffraction order This book shows that many devices can be simulated in the context of a diffraction grating including guided mode resonance filters photonic crystals polarizers metamaterials frequency selective surfaces and metasurfaces Plane wave sources Gaussian beam sources and guided mode sources are all described in detail allowing devices to be simulated in multiple ways An optical integrated circuit is simulated using the effective index method to build a two dimensional model of the 3D device and then launch a guided mode source into the circuit A chapter is included to describe how the code can be modified to easily perform parameter sweeps such as plotting reflection and transmission as a function of frequency

wavelength angle of incidence or a dimension of the device The last chapter is advanced and teaches FDFD for three dimensional devices composed of anisotropic materials It includes simulations of a crossed grating a doubly periodic guided mode resonance filter a frequency selective surface and an invisibility cloak The chapter also includes a parameter retrieval from a left handed metamaterial The book includes all the MATLAB codes and detailed explanations of all programs This will allow the reader to easily modify the codes to simulate their own ideas and devices The author has created a website where the MATLAB codes can be downloaded errata can be seen and other learning resources can be accessed This is an ideal book for both an undergraduate elective course as well as a graduate course in computational electromagnetics because it covers the background material so well and includes examples of many different types of devices that will be of interest to a very wide audience Fundamentals of Electric Circuits Charles K. Alexander,Matthew N. O. Sadiku,2007 For use in an introductory circuit analysis or circuit theory course this text presents circuit analysis in a clear manner with many practical applications It demonstrates the principles carefully explaining each step Medical Device Design ,2012-12-17 This book provides the bridge between engineering design and medical device development There is no single text that addresses the plethora of design issues a medical devices designer meets when developing new products or improving older ones It addresses medical devices regulatory FDA and EU requirements some of the most stringent engineering requirements globally Engineers failing to meet these requirements can cause serious harm to users as well as their products commercial prospects This Handbook shows the essential methodologies medical designers must understand to ensure their products meet requirements It brings together proven design protocols and puts them in an explicit medical context based on the author s years of academia R D phase and industrial commercialization phase experience This design methodology enables engineers and medical device manufacturers to bring new products to the marketplace rapidly The medical device market is a multi billion dollar industry Every engineered product for this sector from scalpelsstents to complex medical equipment must be designed and developed to approved procedures and standards This book shows how Covers US and EU and ISO standards enabling a truly international approach providing a guide to the international standards that practicing engineers require to understand Written by an experienced medical device engineers and entrepreneurs with products in the from the US and UK and with real world experience of developing and commercializing medical products *Microwave Devices, Circuits and Subsystems for Communications Engineering* Ian A. Glover,Steve Pennock,Peter Shepherd,2006-05-01 Microwave Devices Circuits and Subsystems for Communications Engineering provides a detailed treatment of the common microwave elements found in modern microwave communications systems The treatment is thorough without being unnecessarily mathematical The emphasis is on acquiring a conceptual understanding of the techniques and technologies discussed and the practical design criteria required to apply these in real engineering situations Key topics addressed include Microwave diode and transistor equivalent circuits Microwave transmission line technologies and microstrip design

Network methods and s parameter measurements Smith chart and related design techniques Broadband and low noise amplifier design Mixer theory and design Microwave filter design Oscillators synthesisers and phase locked loops Each chapter is written by specialists in their field and the whole is edited by experience authors whose expertise spans the fields of communications systems engineering and microwave circuit design Microwave Devices Circuits and Subsystems for Communications Engineering is suitable for senior electrical electronic or telecommunications engineering undergraduate students first year postgraduate students and experienced engineers seeking a conversion or refresher text Includes a companion website featuring Solutions to selected problems Electronic versions of the figures Sample chapter **Wireless Communications** Andreas F. Molisch,2012-02-06 Professor Andreas F Molisch renowned researcher and educator has put together the comprehensive book Wireless Communications The second edition which includes a wealth of new material on important topics ensures the role of the text as the key resource for every student researcher and practitioner in the field Professor Moe Win MIT USA Wireless communications has grown rapidly over the past decade from a niche market into one of the most important fast moving industries Fully updated to incorporate the latest research and developments Wireless Communications Second Edition provides an authoritative overview of the principles and applications of mobile communication technology The author provides an in depth analysis of current treatment of the area addressing both the traditional elements such as Rayleigh fading BER in flat fading channels and equalisation and more recently emerging topics such as multi user detection in CDMA systems MIMO systems and cognitive radio The dominant wireless standards including cellular cordless and wireless LANs are discussed Topics featured include wireless propagation channels transceivers and signal processing multiple access and advanced transceiver schemes and standardised wireless systems Combines mathematical descriptions with intuitive explanations of the physical facts enabling readers to acquire a deep understanding of the subject Includes new chapters on cognitive radio cooperative communications and relaying video coding 3GPP Long Term Evolution and WiMax plus significant new sections on multi user MIMO 802 11n and information theory Companion website featuring supplementary material on DECT solutions manual and presentation slides for instructors appendices list of abbreviations and other useful resources

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This branch of physiology is an essential part of the ... Praktische Arbeitsphysiologie Praktische. Arbeitsphysiologie. Begründet von Günther Lehmann. 3. neubearbeitete ... 2.1 Begriff Arbeit in der Arbeitsphysiologie. 5. 2.2 Mensch-Arbeits-System. 7. Georg Thieme, 1953. (U.S. distrib.: Grune and Stratton ... by J Brožek · 1953 — Praktische Arbeitsphysiologie (Applied Physiology of Human Work). Gunther Lehmann. Stuttgart: Georg Thieme, 1953. (U.S. distrib.: Grune and Stratton, New York.) ... Praktische Arbeitsphysiologie : Lehmann, Gunther Praktische Arbeitsphysiologie ... Gr.-8°, OLwd. mit Goldpräg. Stuttgart: Thieme Verlag, 1962. Vlll, 409 S., mit 205 Abb., 2., Überarb. u. erw. Aufl., gebraucht: o ... Praktische Arbeitsphysiologie. Gunther Lehmann Praktische Arbeitsphysiologie. Gunther Lehmann. A. Kurt Weiss. A. Kurt Weiss. Search for more articles by this author · PDF · PDF PLUS · Add to favorites ... Praktische Arbeitsphysiologie Aug 16, 2023 — Praktische Arbeitsphysiologie · Angaben zum Objekt · Klassifikation und Themen · Beteiligte, Orts- und Zeitangaben · Weitere Informationen.

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