[1] Solution to the Drill problems of chapter 01
(Engineering Electromagnetics,Hayt ,A.Buck 7th ed)
BEE 4A,4B & 4C

D1.1 (a). $\vec{R}_{MN} = N(3,-3,0) - M(-1,2,1) = (4,-5,-1) = 4\hat{a}_x - 5\hat{a}_y - \hat{a}_z$

(b). $\vec{R}_{MP} = P(-2,-3,-4) - M(-1,2,1) = (-1,-5,-5)$
$\vec{R}_{MN} + \vec{R}_{MP} = (4,-5,-1) + (-1,-5,-5) = (3,-10,-6) = 3\hat{a}_x - 10\hat{a}_y - 6\hat{a}_z$

(c). $\vec{r}_M = M(-1,2,1) - O(0,0,0) = (-1,2,1), \mid \vec{r}_M \mid = \sqrt{(-1)^2 + (2)^2 + (1)^2} = 2.45$

(d). $\hat{a}_{MP} = \vec{R}_{MP} / \mid \vec{R}_{MP} \mid, \vec{R}_{MP} = (-1,-5,-5) = -\hat{a}_x - 5\hat{a}_y - 5\hat{a}_z, \mid \vec{R}_{MP} \mid = \sqrt{(-1)^2 + (-5)^2 + (-5)^2} = 7.1414$
$\Rightarrow \hat{a}_{MP} = (-\hat{a}_x - 5\hat{a}_y - 5\hat{a}_z)/7.1414 = -0.14\hat{a}_x - 0.7\hat{a}_y - 0.7\hat{a}_z$

(e). $\vec{r}_P = P(-2,-3,-4) - O(0,0,0) = (-2-0,-3-0,-4-0) = (-2,-3,-4)$
$\Rightarrow 2\vec{r}_P = 2 \times (-2,-3,-4) = (-4,-6,-8)$
$\vec{r}_N = N(3,-3,0) - O(0,0,0) = (3-0,-3-0,0-0) = (3,-3,0)$
$\Rightarrow 3\vec{r}_N = 3 \times (3,-3,0) = (9,-9,0)$
$\Rightarrow 2\vec{r}_P - 3\vec{r}_N = (-4,-6,-8) - (9,-9,0) = (-4-9,-6+9,-8-0) = -13\hat{a}_x + 3\hat{a}_y - 8\hat{a}_z$
$\Rightarrow \mid 2\vec{r}_P - 3\vec{r}_N \mid = \sqrt{(-13)^2 + (3)^2 + (-8)^2} = \sqrt{242} = 15.56$

D1.2 (a). $S = 125\{(x-1)\hat{a}_x + (y-2)\hat{a}_y + (z+1)\hat{a}_z\} / \{(x-1)^2 + (y-2)^2 + (z+1)^2\}$, $P(2,4,3)$
$\Rightarrow S_{P(2,4,3)} = 125\{(2-1)\hat{a}_x + (4-2)\hat{a}_y + (3+1)\hat{a}_z\} / \{(2-1)^2 + (4-2)^2 + (3+1)^2\}$
$\Rightarrow S_{P(2,4,3)} = 125\{\hat{a}_x + 2\hat{a}_y + 4\hat{a}_z\} / \{(1)^2 + (2)^2 + (4)^2\} = 125\{\hat{a}_x + 2\hat{a}_y + 4\hat{a}_z\}/21$
$\Rightarrow S_{P(2,4,3)} = 5.95\hat{a}_x + 11.90\hat{a}_y + 23.8\hat{a}_z$

(b). $\hat{a}_S = S_{P(2,4,3)} / \mid S_{P(2,4,3)} \mid = (5.95\hat{a}_x + 11.90\hat{a}_y + 23.8\hat{a}_z)/\sqrt{(5.95)^2 + (11.90)^2 + (23.8)^2}$
$\Rightarrow \hat{a}_S = 0.218\hat{a}_x + 0.436\hat{a}_y + 0.873\hat{a}_z$

(c). We are given that $\mid S \mid = 1$
$\Rightarrow 125\left\{\sqrt{(x-1)^2 + (y-2)^2 + (z+1)^2}\right\} / \{(x-1)^2 + (y-2)^2 + (z+1)^2\} = 1$
$\Rightarrow 125\left\{\sqrt{(x-1)^2 + (y-2)^2 + (z+1)^2}\right\} = (x-1)^2 + (y-2)^2 + (z+1)^2$
$\Rightarrow 125\left\{\sqrt{(x-1)^2 + (y-2)^2 + (z+1)^2}\right\} = \sqrt{(x-1)^2 + (y-2)^2 + (z+1)^2} \times \sqrt{(x-1)^2 + (y-2)^2 + (z+1)^2}$
$\Rightarrow \sqrt{(x-1)^2 + (y-2)^2 + (z+1)^2} = 125$

D1.3 (a). $\vec{R}_{AB} = B(-2,3,-4) - A(6,-1,2) = (-2-6,3+1,-4-2) = (-8,4,-6) = -8\hat{a}_x + 4\hat{a}_y - 6\hat{a}_z$

(b). $\vec{R}_{AC} = C(-3,1,5) - A(6,-1,2) = (-3-6,1+1,5-2) = (-9,2,3) = -9\hat{a}_x + 2\hat{a}_y + 3\hat{a}_z$

(c). $\vec{R}_{AB} \cdot \vec{R}_{AC} = \mid \vec{R}_{AB} \mid \mid \vec{R}_{AC} \mid \cos\theta_{BAC} \Rightarrow \cos\theta_{BAC} = (\vec{R}_{AB} \cdot \vec{R}_{AC})/(\mid \vec{R}_{AB} \mid \mid \vec{R}_{AC} \mid)$
$\Rightarrow \cos\theta_{BAC} = \{(-8)(-9) + (4)(2) + (-6)(3)\} / \left\{\sqrt{(-8)^2 + (4)^2 + (-6)^2} \times \sqrt{(-9)^2 + (2)^2 + (3)^2}\right\}$
$\Rightarrow \cos\theta_{BAC} = 62/\sqrt{(116)(94)} \Rightarrow \cos\theta_{BAC} = 62/104.422 = 0.5937 \Rightarrow \theta_{BAC} = \arccos(0.5937) = 53.6^{\circ}$

(d). First we need to find the scalar composent of $\vec{R}_{AB}$ in the direction of $\vec{R}_{AC}$, and that scalar component is $\mid \vec{R}_{AB} \mid \cos\theta_{BAC} = \vec{R}_{AB} \cdot \vec{R}_{AC} / \mid \vec{R}_{AC} \mid$ (from part(c)), then we need to find a unit vector in the direction of $\vec{R}_{AC}$ which is given by $\hat{a}_{R_{AC}} = \vec{R}_{AC} / \mid \vec{R}_{AC} \mid$, now multiply these two components to find the vector projection of $\vec{R}_{AB}$ on $\vec{R}_{AC}$
$\Rightarrow \left(\vec{R}_{AB} \cdot \vec{R}_{AC} / \mid \vec{R}_{AC} \mid\right)\left(\vec{R}_{AC} / \mid \vec{R}_{AC} \mid\right)$, we have already calculated all the values present in the last formula in part (c),so using those values we get $\left(62/\sqrt{94}\right)\left(\left(-9\hat{a}_x + 2\hat{a}_y + 3\hat{a}_z\right)/\sqrt{94}\right) = -5.94\hat{a}_x + 1.319\hat{a}_y + 1.979\hat{a}_z$

[1] This document is pregared in LaTeX. (Email: ahmadsajjad01@ciit.net.pk)

Drill Problems Solution Of Engineering Electromagnetics Chapter 1

Ulaby

Drill Problems Solution Of Engineering Electromagnetics Chapter 1:

Electromagnetic Concepts and Applications Stanley V. Marshall,Gabriel G. Skitek,1990 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 **Midwest Engineer** ,1958

Applied Electromagnetics Stuart M. Wentworth,2025-08-05 A timely and authoritative update to a leading text on the applied electromagnetics of transmission lines In the newly revised second edition of Applied Electromagnetics Early Transmission Lines Approach experienced engineer and professor Stuart Wentworth delivers an up to date and authoritative discussion of the electromagnetic foundations of signal transmission The book explains practical applications for wireless systems transmission lines waveguides including optical fiber and antennas Wentworth provides a detailed theoretical grounding of the subject and combines it with hands on MATLAB simulations available on the web that help students understand critical concepts Brand new end of chapter problems at a broad range of difficulty levels Many more drill and example problems Worked solutions provided on the companion website Extensively updated material as well as entirely new material on metamaterials and patch antennas Perfect for undergraduate students of electrical engineering Applied Electromagnetics Early Transmission Lines Approach will also benefit researchers and educators in electrical engineering

Choice Richard K. Gardner,Phyllis Grumm,1976 **Fundamentals of Electromagnetics with Engineering Applications** Stuart M. Wentworth,2005 *Electronic & Radio Engineer* ,1958 Electronic Technology ,1958 The Log Analyst ,1993 Proceedings of the IRE. ,1950 **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 *Electromagnetics Problem Solver ,* Each Problem Solver is an insightful and essential study and solution guide chock full of clear concise problem solving gems All your questions can be found in one convenient source from one of the most trusted names in reference solution guides More useful more practical and more informative these study aids are the best review books and textbook companions available Nothing remotely as comprehensive or as helpful exists in their subject anywhere Perfect for undergraduate and graduate studies Here in this highly useful reference is the finest overview of electromagnetics currently available with hundreds of electromagnetics problems that cover everything from dielectrics and magnetic fields to plane waves and transmission lines Each problem is clearly solved with step by step detailed solutions DETAILS The PROBLEM SOLVERS are unique the ultimate in study guides They are ideal for helping students cope with the toughest subjects They greatly simplify study and learning tasks They enable students to come to grips with difficult problems by showing them the way step by step toward solving problems As a result they save hours of frustration and time spent on groping for answers and understanding They cover material ranging from the elementary to the advanced in each subject They work exceptionally well with any text in its field PROBLEM SOLVERS are available in 41 subjects Each PROBLEM SOLVER is prepared by supremely knowledgeable experts Most are over 1000 pages PROBLEM SOLVERS are not meant to be read cover to cover They offer whatever may be needed at a given time An excellent index helps to locate specific problems rapidly TABLE OF CONTENTS Introduction SECTION I Chapter 1 Vector Analysis Scalars and Vectors Gradient Divergence and Curl Line Surface and Volume Integrals Stoke s Theorem Chapter 2 Electric Charges Charge Densities and Distributions Coulomb s Law Electric Field Chapter 3 Electric Field Intensity Electric Flux Gauss s Law Charges Chapter 4 Potential Work Potential Potential and Gradient Motion in Electric Field Energy Chapter 5 Dielectrics Current Density Resistance Polarization Boundary Conditions Dielectrics Chapter 6 Capacitance Capacitance Parallel Plate Capacitors Coaxial and Concentric Capacitors Multiple Dielectric Capacitors Series and Parallel Combinations Potential Stored Energy and Force in Capacitors Chapter 7 Poisson s and Laplace Equations Laplace s Equation Poisson s Equation Iteration Method Images Chapter 8 Steady Magnetic Fields Biot Savart s Law Ampere s Law Magnetic Flux and Flux Density Vector Magnetic Potential H Field Chapter 9 Forces in Steady Magnetic Fields Forces on Moving Charges Forces on Differential Current Elements Forces on Conductors Carrying Currents Magnetization Magnetic Boundary Conditions Potential Energy of Magnetic Fields Chapter 10 Magnetic Circuits Reluctance and Permeance Determination of Ampere Turns Flux Produced by a Given mmf Self and Mutual Inductance Force and Torque in Magnetic Circuits Chapter 11 Time Varying Fields and Maxwell s Equations Faraday s Law Maxwell s Equations Displacement Current Generators Chapter 12 Plane Waves Energy and the Poynting Vector Normal Incidence Boundary Conditions Plane Waves in Conducting Dielectric Media Plane Waves in Free Space Plane Waves and Current Density Chapter 13 Transmission Lines Equations of

Transmission Lines Input Impedances Smith Chart Matching Reflection Coefficient Chapter 14 Wave Guides and Antennas Cutoff Frequencies for TE and TM Modes Propagation and Attenuation Constants Field Components in Wave Guides Absorbed and Transmitted Power Characteristics of Antennas Radiated and Absorbed Power of Antennas SECTION II Summary of Electromagnetic Propagation in Conducting Media II 1 Basic Equations and Theorems Maxwell s Equation Auxiliary Potentials Harmonic Time Variation Particular Solutions for an Unbounded Homogenous Region with Sources Poynting Vector Reciprocity Theorem Boundary Conditions Uniqueness Theorems TM and TE Field Analysis II 2 Plane Waves Uniform Plane Waves Nonuniform Plane Waves Reflection and Refraction at a Plane Surface Refraction in a Conducting Medium Surface Waves Plane Waves in Layered Media Impedance Boundary Conditions Propogation into a conductor with a Rough Surface II 3 Electromagnetic Field of Dipole Sources Infinite Homogenous Conducting Medium Semi Infinite Homogenous Conducting Medium Static Electric Dipole Harmonic Dipole Sources Far Field Near Field Quasi Static Field Layered Conducting Half Space II 4 Electromagnetic Field of Long Line Sources and Finite Length Electric Antennas Infinite Homogenous Conducting Medium Long Line Source Finite Length Electric Antenna Semi Infinite Homogenous Conducting Medium Long Line Source Finite Length Electric Antenna Layered Conducting Half Space Long Line Source Finite Length Electric Antenna Appendix Parameters of Conducting Media Dipole Approximation Scattering Antenna Impedance ELF and VLF Atmospheric Noise Index WHAT THIS BOOK IS FOR Students have generally found electromagnetics a difficult subject to understand and learn Despite the publication of hundreds of textbooks in this field each one intended to provide an improvement over previous textbooks students of electromagnetics continue to remain perplexed as a result of numerous subject areas that must be remembered and correlated when solving problems Various interpretations of electromagnetics terms also contribute to the difficulties of mastering the subject In a study of electromagnetics REA found the following basic reasons underlying the inherent difficulties of electromagnetics No systematic rules of analysis were ever developed to follow in a step by step manner to solve typically encountered problems This results from numerous different conditions and principles involved in a problem which leads to many possible different solution methods To prescribe a set of rules for each of the possible variations would involve an enormous number of additional steps making this task more burdensome than solving the problem directly due to the expectation of much trial and error Current textbooks normally explain a given principle in a few pages written by an electromagnetics professional who has insight into the subject matter not shared by others These explanations are often written in an abstract manner that causes confusion as to the principle s use and application Explanations then are often not sufficiently detailed or extensive enough to make the reader aware of the wide range of applications and different aspects of the principle being studied The numerous possible variations of principles and their applications are usually not discussed and it is left to the reader to discover this while doing exercises Accordingly the average student is expected to rediscover that which has long been established and practiced but not always published or

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students want to look up a particular type of problem and solution they can readily locate it in the book by referring to the index that has been extensively prepared It is also possible to locate a particular type of problem by glancing at just the material within the boxed portions Each problem is numbered and surrounded by a heavy black border for speedy identification **Engineering Electromagnetics** Balanis,Constantine A. Balanis,1989-10-24 *Electromagnetics* Editors of Rea,Research and Education Association Editors,1984-01-17 Each Problem Solver is an insightful and essential study and solution guide chock full of clear concise problem solving gems All your questions can be found in one convenient source from one of the most trusted names in reference solution guides More useful more practical and more informative these study aids are the best review books and textbook companions available Nothing remotely as comprehensive or as helpful exists in their subject anywhere Perfect for undergraduate and graduate studies Here in this highly useful reference is the finest overview of electromagnetics currently available with hundreds of electromagnetics problems that cover everything from dielectrics and magnetic fields to plane waves and transmission lines Each problem is clearly solved with step by step detailed solutions DETAILS The PROBLEM SOLVERS are unique the ultimate in study guides They are ideal for helping students cope with the toughest subjects They greatly simplify study and learning tasks They enable students to come to grips with difficult problems by showing them the way step by step toward solving problems As a result they save hours of frustration and time spent on groping for answers and understanding They cover material ranging from the elementary to the advanced in each subject They work exceptionally well with any text in its field PROBLEM SOLVERS are available in 41 subjects Each PROBLEM SOLVER is prepared by supremely knowledgeable experts Most are over 1000 pages PROBLEM SOLVERS are not meant to be read cover to cover They offer whatever may be needed at a given time An excellent index helps to locate specific problems rapidly TABLE OF CONTENTS Introduction SECTION I Chapter 1 Vector Analysis Scalars and Vectors Gradient Divergence and Curl Line Surface and Volume Integrals Stoke s Theorem Chapter 2 Electric Charges Charge Densities and Distributions Coulomb s Law Electric Field Chapter 3 Electric Field Intensity Electric Flux Gauss s Law Charges Chapter 4 Potential Work Potential Potential and Gradient Motion in Electric Field Energy Chapter 5 Dielectrics Current Density Resistance Polarization Boundary Conditions Dielectrics Chapter 6 Capacitance Capacitance Parallel Plate Capacitors Coaxial and Concentric Capacitors Multiple Dielectric Capacitors Series and Parallel Combinations Potential Stored Energy and Force in Capacitors Chapter 7 Poisson s and Laplace Equations Laplace s Equation Poisson s Equation Iteration Method Images Chapter 8 Steady Magnetic Fields Biot Savart s Law Ampere s Law Magnetic Flux and Flux Density Vector Magnetic Potential H Field Chapter 9 Forces in Steady Magnetic Fields Forces on Moving Charges Forces on Differential Current Elements Forces on Conductors Carrying Currents Magnetization Magnetic Boundary Conditions Potential Energy of Magnetic Fields Chapter 10 Magnetic Circuits Reluctance and Permeance Determination of Ampere Turns Flux Produced by a Given mmf Self and Mutual Inductance Force and Torque in Magnetic Circuits Chapter 11 Time

Varying Fields and Maxwell s Equations Faraday s Law Maxwell s Equations Displacement Current Generators Chapter 12 Plane Waves Energy and the Poynting Vector Normal Incidence Boundary Conditions Plane Waves in Conducting Dielectric Media Plane Waves in Free Space Plane Waves and Current Density Chapter 13 Transmission Lines Equations of Transmission Lines Input Impedances Smith Chart Matching Reflection Coefficient Chapter 14 Wave Guides and Antennas Cutoff Frequencies for TE and TM Modes Propagation and Attenuation Constants Field Components in Wave Guides Absorbed and Transmitted Power Characteristics of Antennas Radiated and Absorbed Power of Antennas SECTION II Summary of Electromagnetic Propagation in Conducting Media II 1 Basic Equations and Theorems Maxwell s Equation Auxiliary Potentials Harmonic Time Variation Particular Solutions for an Unbounded Homogenous Region with Sources Poynting Vector Reciprocity Theorem Boundary Conditions Uniqueness Theorems TM and TE Field Analysis II 2 Plane Waves Uniform Plane Waves Nonuniform Plane Waves Reflection and Refraction at a Plane Surface Refraction in a Conducting Medium Surface Waves Plane Waves in Layered Media Impedance Boundary Conditions Propogation into a conductor with a Rough Surface II 3 Electromagnetic Field of Dipole Sources Infinite Homogenous Conducting Medium Semi Infinite Homogenous Conducting Medium Static Electric Dipole Harmonic Dipole Sources Far Field Near Field Quasi Static Field Layered Conducting Half Space II 4 Electromagnetic Field of Long Line Sources and Finite Length Electric Antennas Infinite Homogenous Conducting Medium Long Line Source Finite Length Electric Antenna Semi Infinite Homogenous Conducting Medium Long Line Source Finite Length Electric Antenna Layered Conducting Half Space Long Line Source Finite Length Electric Antenna Appendix Parameters of Conducting Media Dipole Approximation Scattering Antenna Impedance ELF and VLF Atmospheric Noise Index WHAT THIS BOOK IS FOR Students have generally found electromagnetics a difficult subject to understand and learn Despite the publication of hundreds of textbooks in this field each one intended to provide an improvement over previous textbooks students of electromagnetics continue to remain perplexed as a result of numerous subject areas that must be remembered and correlated when solving problems Various interpretations of electromagnetics terms also contribute to the difficulties of mastering the subject In a study of electromagnetics REA found the following basic reasons underlying the inherent difficulties of electromagnetics No systematic rules of analysis were ever developed to follow in a step by step manner to solve typically encountered problems This results from numerous different conditions and principles involved in a problem which leads to many possible different solution methods To prescribe a set of rules for each of the possible variations would involve an enormous number of additional steps making this task more burdensome than solving the problem directly due to the expectation of much trial and error Current textbooks normally explain a given principle in a few pages written by an electromagnetics professional who has insight into the subject matter not shared by others These explanations are often written in an abstract manner that causes confusion as to the principle s use and application Explanations then are often not sufficiently detailed or extensive enough to make the reader aware of the wide

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students to view the methods of analysis and solution techniques This learning approach is similar to that practiced in various scientific laboratories particularly in the medical fields In using this book students may review and study the illustrated problems at their own pace students are not limited to the time such problems receive in the classroom When students want to look up a particular type of problem and solution they can readily locate it in the book by referring to the index that has been extensively prepared It is also possible to locate a particular type of problem by glancing at just the material within the boxed portions Each problem is numbered and surrounded by a heavy black border for speedy identification **Engineering Electromagnetics. Solutions to Problems** William Hart Hayt,1958 **Electromagnetics for Engineers** Ulaby,2005-02-01 **Electromagnetics for Engineers** Fawwaz T Ulaby, Ph.D.,2008-09-01 **Solved Problems in Electromagnetics** Félix Salazar Bloise,Rafael Medina Ferro,Ana Bayón Rojo,Francisco Gascón Latasa,2016-10-27 This book presents the fundamental concepts of electromagnetism through problems with a brief theoretical introduction at the beginning of each chapter The present book has a strong didactic character It explains all the mathematical steps and the theoretical concepts connected with the development of the problem It guides the reader to understand the employed procedures to learn to solve the exercises independently The exercises are structured in a similar way The chapters begin with easy problems increasing progressively in the level of difficulty This book is written for students of physics and engineering in the framework of the new European Plans of Study for Bachelor and Master and also for tutors and lecturers Engineering Electromagnetics William H. Hayt,196? **Electromagnetics for Engineers(CD1□□□)(Paperback)(CD1□□□)(Paperback)** Ulaby,2011-01-01

Unveiling the Magic of Words: A Report on "**Drill Problems Solution Of Engineering Electromagnetics Chapter 1**"

In a global defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their ability to kindle emotions, provoke contemplation, and ignite transformative change is truly awe-inspiring. Enter the realm of "**Drill Problems Solution Of Engineering Electromagnetics Chapter 1**," a mesmerizing literary masterpiece penned with a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve into the book is central themes, examine its distinctive writing style, and assess its profound impact on the souls of its readers.

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