INTRODUCTION TO THE THEORY OF ELECTRICITY pdf

1: Full text of "An introduction to the theory of electricity"

This textbook of electromagnetic theory, written for an advanced undergraduate course, is characterized by its pedagogical excellence and by an abundance of novel material, problems, and illustrative examples based on the author's original research and on his contributions to Maxwell's theory of electric and magnetic phenomena.

The very term electronics evokes visions of exotic and complex devices that are quickly altering our individual and collective life styles. The study of electricity and electronics has opened the door to rewarding careers for multitudes of people. As you begin your studies of these subjects, you should know how to differentiate between the two. To begin, this is a book about electricity, not electronics. The study of electricity precedes the study of electronics. No one can hope to learn the concepts of electronics without having first mastered the principles of electricity. Then how do these two terms differ from each other? Electricity is best thought of as a form of energy. You may recall one of the cardinal rules of science, which states that energy can neither be created nor destroyed; thus, mankind cannot create electricity. All we can do is produce and utilize electricity by converting various forms of energy. Let us consider, by contrast, the word electronics. Electronics deals with specific applications of electrical principles that are earmarked by the following characteristics: In other words, an electronic device is designed to convey, collect, or transmit informational data in the form of small variations in electrical voltages or currents. The electrical energy may be wireless, or transmitted through space. Of the two, alternating current is the more prevalent form. This kind of electricity is commercially generated and distributed by public utilities. AC is available in two different versions: Direct current, by contrast, is not commercially available to the average consumer. It is used in batteries, such as in mobile equipment; in all electronic devices; and for special industrial applications, such as adjustable speed drives and electroplating. You may be curious about the difference between DC and AC. Current from DC sources flows steadily in one direction only. AC sources do not have such polarity markings. Current from such sources changes direction continually, flowing back and forth in a conductor. As stated before, direct current generally is not commercially available. If needed, it may be locally provided by use of: The first written records describing electrical behavior were made 2, years ago. These records show that the Greeks knew that amber rubbed on cloth attracted feathers, cloth fibers, and other lightweight objects. The Greek name for amber was elektron. A hard rubber comb and the plastic case of a pen both acquire a strange ability after being rubbed on a coat sleeveâ€”the ability to attract other objects. Long ago, the name charging was given to the rubbing process that gives the plastic or hard rubber its ability to attract. After rubbing, the object was said to be charged. The charge given to the object was thought to be an invisible load of electricity. They soon found that repulsion was just as important as attraction. Their experiments showed that charged materials could be divided into the two groups shown in Figure 1â€”1. Any item from List A attracts any item from List B and vice versa. Charged glass attracts charged rubber and vice versa. Charged glass repels charged mica. Charged rubber repels charged rubber. These results illustrate the law of attraction and repulsion: Unlike charges attract; like charges repel. Various names were suggested to describe List A and List B. They could have been called by any pair of opposite-sounding names: Up and Down, or Black and White. The pair of names finally accepted by scientists was suggested by Benjamin Franklin: The first item in each list was used as a standard and led to the original definition of the terms positive and negative: Anything that repels charged glass is like charged glass and has a positive charge; anything that repels charged rubber is like charged rubber and has a negative charge, as shown in Figure 1â€”2. Hard rubber simply pressed against wool no rubbing and then removed will get its negative charge although not as strongly as if it were rubbed. Carbon, oxygen, copper, iron, zinc, tin, chlorine, aluminum, gold, uranium, neon, lead, silver, nitrogen, and hydrogen are elements that most of us have heard of or have used. We do not often use the elements silicon, calcium, and sodium in the pure form, so their names may be less familiar. However, these three elements in combination with oxygen and other elements make up the largest part of the soil and rocks of our Earth and help form many manufactured products of everyday use. There are more than elements. Some of them we never hear of, either because they are very scarce or because people have not yet developed industrial uses for them. Because germanium, beryllium, and titanium are now being used in the electronics and aircraft manufacturing industries, their names are more familiar than they were a few years ago, whereas in few people had heard of aluminum because it was then a rare and precious metal. Since there are over different elements, there are over different kinds of atoms. The word atom is the name for the smallest particle of an element. We can talk about atoms of carbon, oxygen, and copper because these materials are elements. Single atoms are so small that there is no use wondering what one atom looks like. For example, it is estimated that there are about 30,,,,,,, atoms of copper in a penny and that the penny is about six million atoms thick. If an imaginary slicing machine sliced a penny into six million slices of copper, each slice one atom thick, then each slice would contain five million billion atoms. We do not talk about an atom of water, because water is not an element; it is a compound. The smallest possible speck of a compound is properly called a molecule, Figure 1â€”3. Each molecule of water is made of two atoms of hydrogen and one atom of oxygen. The word compound is the name for a material composed of two or more different elements combined. Water is a compound, and the smallest particle of water is a molecule. These particles are so completely different from any known material that any imaginative picture of them is sure to be inaccurate. Atoms of hydrogen gas are the simplest in structure of all atoms. Hydrogen atoms consist of a single positively charged particle in the center, with one negatively charged particle whizzing around it at high speed. The positively charged particle has been given the name proton; the negatively charged particle is called an electron. To show relative dimensions, a more exact representation would have a pinhead-sized electron revolving in an orbit feet across. It is more like a fuzzy wisp that ripples, spins, and pulses as it rotates around the proton in the center. An atom has no outer skin other than the surface formed by its whirling electrons. The proton that forms the center of the hydrogen atoms is smaller than the electron but 1, times as heavy. The most important properties of the proton are its positive charge and its weight. The number of protons determines the identity of the element. For example, an atom containing 29 protons must be an atom of copper. As we look at diagrams of other atoms, we need two new words to describe them. The nucleus of the atom is the name given to the tightly packed, heavy central core where the protons of the atom are assembled. Along with the protons are other particles called neutrons, as shown in Figure 1â€”5. The name neutron indicates that this heavy particle is electrically neutral; neutrality and weight are its most important properties. A neutron is probably a tightly collapsed combination of an electron and a proton. At first, it may be hard to realize that these three particlesâ€”electrons, protons, and neutronsâ€”make up all materials. All electrons are alike, regardless of the material from which they come or in which they exist; see Figure 1â€”6. All protons are alike, regardless of the material in which they exist. Neutrons, too, are all alike. Although the assumptions that Dalton used to prove his theory were later found to be factually incorrect, the idea that all matter is composed of atoms was adopted by most of the scientific world. Then, in , J. Thompson discovered the electron. Thompson determined that electrons have a negative charge and that they have very little mass compared to the atom. He proposed that atoms have a large, positively charged massive body with negatively charged electrons scattered throughout it. Thompson also proposed that the negative charge of the electrons exactly balanced the positive charge of the large mass, causing the atom to have a net charge of zero. In , Neils Bohr, a Danish scientist, presented the most accepted theory concerning the structure of an atom. These factors must equal the positive force of the nucleus. In theory there can be an infinite number of allowed orbits. Electrons, however, tend to return to a lower allowed orbit. The electrons of the atom are often pictured in distinct layers, or shells, around the nucleus. The innermost shell of electrons contains no more than 2 electrons. The next shell contains no more than 8 electrons; the third, no more than 18; and the fourth, Let us consider the model of a copper atom shown in Figure 1â€”7. The 29 electrons of the copper atom are arranged in four layers, or shells:

INTRODUCTION TO THE THEORY OF ELECTRICITY pdf

2: An Introduction to the Theory of Electricity

An Introduction To The Mathematical Theory of Electricity and Magnetism by W. T. A. Emtage Philosophy and the New Physics An Essay on the Relativity Theory and the Theory of Quanta by Louis Auguste Paul Rougier.

Topics in Vector Calculus This unit is a review of the mathematical background necessary to solve many problems in the study of electromagnetism. You may wish to refer to it as necessary as you work through the rest of the course. If you already feel comfortable with these topics, you may skip this unit. We will start PHYS by examining how objects of size â€" length, width, depth â€" behave. We will focus on vibrating systems and the propagation of mechanical waves through media; think of ripples traveling outward from a stone dropped into water. This course will also lay the basic foundation for the development of a classical theory of mechanics for extended solids. Completing this unit should take you approximately 7 hours. Electrostatics We are now beginning our study of electricity and magnetism. We will discover that electricity and magnetism are two different aspects of the same phenomenon, which is usually referred to as electromagnetism. Our starting place will be electrostatics or, more simply, the rules governing the behavior of static charges. He observed that one could generate a static charge on amber by rubbing it with wool. Completing this unit should take you approximately 20 hours. Electronic Circuit Theory Although the study of electric and magnetic fields is interesting in and of itself, it may not seem directly useful in the real world. However, the interplay between these phenomena is responsible for much of the technology you see in your everyday life. For example, all electronics apply various features of electromagnetism, so that computers, HDTV, iMacs and iPads, smartphones, motors, fans, lights, and so on are applied electromagnetic devices. In this unit, we will take a quick look at the foundations of electronics, while at the same time adding to our understanding of electromagnetism. Magnetism Earlier, we studied electric charges, potentials, and fields. We will now take a look at an important effect of moving charges: Thales of Miletus set the stage for the scientific exploration of magnetism back in Ancient Greek times, when magnetism could only be observed via the behavior of natural magnets, called lodestones. Hans Christian Oersted first noted the relationship between moving electric charges and magnetism much later, when he accidentally discovered that an electric current could deflect a nearby compass needle in Electromagnetic Induction You learned that stationary electric charges produce electric field, and moving electric charges that is, electric current produce magnetic field. In this unit, you will find out that the reverse is also true: This is the phenomenon of the electromagnetic induction, which is a basic principles in such devices as generators of electric power, electric motors, and transformers. Completing this unit should take you approximately 13 hours. Now we want to sit back and summarize our findings by identifying what they are, what they mean, and how we can use them. There are four Maxwell equations that describe all classical electromagnetism. Note that for most purposes, air is close enough to being a vacuum that the presence of an atmosphere can be ignored. There are four Maxwell free space equations. These state that the electric or magnetic flux through a closed surface is proportional to the electric or magnetic charge enclosed within that surface. Note that in the magnetic case, there are no magnetic charges also called magnetic monopoles , so that the magnetic flux through and closed surface is zero. Once again, these electric and magnetic equations have similar formalisms, thereby emphasizing the close relationship of the electric and magnetic fields. Optics An optical phenomenon involves the interaction between electromagnetic waves and matter. We will focus on visible, infrared, and ultraviolet light, but much of the study of optics will apply to some extent to radio waves and x-rays. The complete study of optics involves enormously complex mathematics, a thorough understanding of both classical and quantum optical effects, and a great deal of ingenuity for success. Even this level of description is quite complicated for most optical phenomena, so we will apply simplified models to develop a basic understanding of how optics works. In geometric optics, we assume that all light travels in straight lines. In paraxial optics, we assume that all optical systems handle light rays near a symmetry axis of the optical system, which allows us to largely ignore aberration, a vast array of terribly complex optical effects. Completing this unit should take you approximately 11 hours. Special Relativity The physical descriptions we have studied to this point were based on a notion of absolute space and time. A model for this point of view was that space is filled everywhere by a continuous medium called the ether. Light and other forms of electromagnetic radiation were waves in this ether, analogous to sound waves in air. Toward the end of the s, however, this model became associated with more and more hastily patched cracks. The detailed history of the gradual realization that ether models were not quite right is complex and technical. However, there is one rather clear indication of trouble. In , Albert Michelson and Edmund Morley of the Case Institute now Case Western University performed an experiment using an optical interferometer in which they compared the speed of light in two beams traveling at right angles to each other. If the speed of light relative to the ether was always the same, the measured speed of light would be larger or smaller depending on the direction the experiment was traveling through the ether. The motion of the Michelson-Morley experiment was provided by the rotation of the Earth on its axis and the orbital motion of the Earth around the Sun, as well as the absolute velocity if any of the Sun relative to the ether. They expected to see both diurnal changes and yearly changes in the relative velocities of light in the two paths. True, the changes expected by classical ether theory were small on the order of 0. To the surprise of all, there were no changes whatever observed. This experiment was widely repeated, using constantly improving equipment - a new version of the experiment carried out in established that the velocity of light is constant to better than 1 part in - one of the most precise physical measurements ever accomplished. Length contraction explained the Michelson-Morley result, the idea being that matter is held together by electromagnetic forces true , and so the actual size of objects will change with motion through the ether false. His primary postulate was to accept that the speed of light and the laws of physics are constant in all reference frames â€” including reference frames that are in motion. Completing this unit should take you approximately 10 hours. Study Guides and Review Exercises These study guides are intended to help reinforce key concepts in each unit in preparation for the final exam. Each unit study guide aligns with course outcomes and provides a summary of the core competencies and a list of vocabulary terms. The study guides are not meant to replace the readings and videos that make up the course. The vocabulary lists include some terms that might help you answer some of the review items, and some terms you should be familiar with to be successful in completing the final exam for the course.

3: Concept of a Legal System: An Introduction to the Theory of Legal System, Raz, J | eBay

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History of electromagnetic theory Originally, electricity and magnetism were considered to be two separate forces. There are four main effects resulting from these interactions, all of which have been clearly demonstrated by experiments: Electric charges attract or repel one another with a force inversely proportional to the square of the distance between them: Magnetic poles or states of polarization at individual points attract or repel one another in a manner similar to positive and negative charges and always exist as pairs: An electric current inside a wire creates a corresponding circumferential magnetic field outside the wire. Its direction clockwise or counter-clockwise depends on the direction of the current in the wire. A current is induced in a loop of wire when it is moved toward or away from a magnetic field, or a magnet is moved towards or away from it; the direction of current depends on that of the movement. As he was setting up his materials, he noticed a compass needle deflected away from magnetic north when the electric current from the battery he was using was switched on and off. This deflection convinced him that magnetic fields radiate from all sides of a wire carrying an electric current, just as light and heat do, and that it confirmed a direct relationship between electricity and magnetism. However, three months later he began more intensive investigations. Soon thereafter he published his findings, proving that an electric current produces a magnetic field as it flows through a wire. The CGS unit of magnetic induction oersted is named in honor of his contributions to the field of electromagnetism. James Clerk Maxwell His findings resulted in intensive research throughout the scientific community in electrodynamics. This unification, which was observed by Michael Faraday , extended by James Clerk Maxwell , and partially reformulated by Oliver Heaviside and Heinrich Hertz , is one of the key accomplishments of 19th century mathematical physics. It has had far-reaching consequences, one of which was the understanding of the nature of light. Unlike what was proposed by the electromagnetic theory of that time, light and other electromagnetic waves are at present seen as taking the form of quantized , self-propagating oscillatory electromagnetic field disturbances called photons. Different frequencies of oscillation give rise to the different forms of electromagnetic radiation , from radio waves at the lowest frequencies, to visible light at intermediate frequencies, to gamma rays at the highest frequencies. In , Gian Domenico Romagnosi , an Italian legal scholar, deflected a magnetic needle using a Voltaic pile. The factual setup of the experiment is not completely clear, so if current flew across the needle or not. An account of the discovery was published in in an Italian newspaper, but it was largely overlooked by the contemporary scientific community, because Romagnosi seemingly did not belong to this community. The owner emptying the box on a counter where some nails lay, the persons who took up the knives, that lay on the nails, observed that the knives took up the nails. On this the whole number was tried, and found to do the same, and that, to such a degree as to take up large nails, packing needles, and other iron things of considerable weight Whittaker suggested in that this particular event was responsible for lightning to be "credited with the power of magnetizing steel; and it was doubtless this which led Franklin in to attempt to magnetize a sewing-needle by means of the discharge of Leyden jars. The electromagnetic force is one of the four known fundamental forces. The other fundamental forces are: In particle physics though, the electroweak interaction is the unified description of two of the four known fundamental interactions of nature: All other forces e. Roughly speaking, all the forces involved in interactions between atoms can be explained by the electromagnetic force acting between the electrically charged atomic nuclei and electrons of the atoms. Electromagnetic forces also explain how these particles carry momentum by their movement. This includes the forces we experience in "pushing" or "pulling" ordinary material objects, which result from the intermolecular forces that act between the individual molecules in our bodies and those in the objects. The electromagnetic force is also involved in all forms of chemical phenomena. As a collection of electrons becomes more confined, their minimum momentum necessarily increases due to the Pauli exclusion principle. The behaviour of matter at the molecular scale including its density is determined by the balance between the electromagnetic force and the force generated by the exchange of momentum carried by the electrons themselves. Classical electrodynamics In , William Gilbert proposed, in his De Magnete , that electricity and magnetism, while both capable of causing attraction and repulsion of objects, were distinct effects. Mariners had noticed that lightning strikes had the ability to disturb a compass needle. One of the first to discover and publish a link between man-made electric current and magnetism was Romagnosi , who in noticed that connecting a wire across a voltaic pile deflected a nearby compass needle. A theory of electromagnetism, known as classical electromagnetism , was developed by various physicists during the period between and when it culminated in the publication of a treatise by James Clerk Maxwell , which unified the preceding developments into a single theory and discovered the electromagnetic nature of light. This violates Galilean invariance , a long-standing cornerstone of classical mechanics. One way to reconcile the two theories electromagnetism and classical mechanics is to assume the existence of a luminiferous aether through which the light propagates. However, subsequent experimental efforts failed to detect the presence of the aether. For more information, see History of special relativity. In addition, relativity theory implies that in moving frames of reference, a magnetic field transforms to a field with a nonzero electric component and conversely, a moving electric field transforms to a nonzero magnetic component, thus firmly showing that the phenomena are two sides of the same coin. Hence the term "electromagnetism". For more information, see Classical electromagnetism and special relativity and Covariant formulation of classical electromagnetism. Extension to nonlinear phenomena[edit] Magnetic reconnection in the solar plasma gives rise to solar flares , a complex magnetohydrodynamical phenomenon. The Maxwell equations are linear, in that a change in the sources the charges and currents results in a proportional change of the fields. Nonlinear dynamics can occur when electromagnetic fields couple to matter that follows nonlinear dynamical laws. This is studied, for example, in the subject of magnetohydrodynamics , which combines Maxwell theory with the Navierâ€”Stokes equations. Quantities and units[edit].

4: Electromagnetism - Wikipedia

Electrical Engineering The Theory and Characteristics of Electrical Circuits and Machinery by Clarence V. Christie The Theory of Experimental Electricity by William Cecil Dampier Whetham Cosmos and Diacosmos The Processes of Nature Psychologically Treated by Denton J. Snider.

If a similar ball is charged by the same glass rod, it is found to repel the first: Two balls that are charged with a rubbed amber rod also repel each other. However, if one ball is charged by the glass rod, and the other by an amber rod, the two balls are found to attract each other. These phenomena were investigated in the late eighteenth century by Charles-Augustin de Coulomb , who deduced that charge manifests itself in two opposing forms. This discovery led to the well-known axiom: Electric charge gives rise to and interacts with the electromagnetic force , one of the four fundamental forces of nature. The most familiar carriers of electrical charge are the electron and proton. Experiment has shown charge to be a conserved quantity , that is, the net charge within an electrically isolated system will always remain constant regardless of any changes taking place within that system. The charge on electrons and protons is opposite in sign, hence an amount of charge may be expressed as being either negative or positive. By convention, the charge carried by electrons is deemed negative, and that by protons positive, a custom that originated with the work of Benjamin Franklin. Charge is possessed not just by matter , but also by antimatter , each antiparticle bearing an equal and opposite charge to its corresponding particle. Electric current The movement of electric charge is known as an electric current , the intensity of which is usually measured in amperes. Current can consist of any moving charged particles; most commonly these are electrons, but any charge in motion constitutes a current. Electric current can flow through some things, electrical conductors , but will not flow through an electrical insulator. Current defined in this manner is called conventional current. The motion of negatively charged electrons around an electric circuit , one of the most familiar forms of current, is thus deemed positive in the opposite direction to that of the electrons. The positive-to-negative convention is widely used to simplify this situation. An electric arc provides an energetic demonstration of electric current The process by which electric current passes through a material is termed electrical conduction , and its nature varies with that of the charged particles and the material through which they are travelling. Examples of electric currents include metallic conduction, where electrons flow through a conductor such as metal, and electrolysis , where ions charged atoms flow through liquids, or through plasmas such as electrical sparks. While the particles themselves can move quite slowly, sometimes with an average drift velocity only fractions of a millimetre per second, [27]: That water could be decomposed by the current from a voltaic pile was discovered by Nicholson and Carlisle in , a process now known as electrolysis. Their work was greatly expanded upon by Michael Faraday in Current through a resistance causes localised heating, an effect James Prescott Joule studied mathematically in The level of electromagnetic emissions generated by electric arcing is high enough to produce electromagnetic interference , which can be detrimental to the workings of adjacent equipment. These terms refer to how the current varies in time. Direct current, as produced by example from a battery and required by most electronic devices, is a unidirectional flow from the positive part of a circuit to the negative. Alternating current is any current that reverses direction repeatedly; almost always this takes the form of a sine wave. The time-averaged value of an alternating current is zero, but it delivers energy in first one direction, and then the reverse. Alternating current is affected by electrical properties that are not observed under steady state direct current, such as inductance and capacitance. Electric field See also: Electrostatics The concept of the electric field was introduced by Michael Faraday. An electric field is created by a charged body in the space that surrounds it, and results in a force exerted on any other charges placed within the field. The electric field acts between two charges in a similar manner to the way that the gravitational field acts between two masses , and like it, extends towards infinity and shows an inverse square relationship with distance. Gravity always acts in attraction, drawing two masses together, while the electric field can result in either attraction or repulsion. Since large bodies such as planets generally carry no net charge, the electric field at a distance is usually zero. Thus gravity is the dominant force at distance in the universe, despite being much weaker. As the electric field is defined in terms of force , and force is a vector , so it follows that an electric field is also a vector, having both magnitude and direction. Specifically, it is a vector field. The field may be visualised by a set of imaginary lines whose direction at any point is the same as that of the field. The field lines are the paths that a point positive charge would seek to make as it was forced to move within the field; they are however an imaginary concept with no physical existence, and the field permeates all the intervening space between the lines. The field is therefore zero at all places inside the body. The principles of electrostatics are important when designing items of high-voltage equipment. There is a finite limit to the electric field strength that may be withstood by any medium. Beyond this point, electrical breakdown occurs and an electric arc causes flashover between the charged parts. This principle is exploited in the lightning conductor , the sharp spike of which acts to encourage the lightning stroke to develop there, rather than to the building it serves to protect [45]: Voltage and Battery electricity A pair of AA cells. The concept of electric potential is closely linked to that of the electric field. A small charge placed within an electric field experiences a force, and to have brought that charge to that point against the force requires work. The electric potential at any point is defined as the energy required to bring a unit test charge from an infinite distance slowly to that point. It is usually measured in volts , and one volt is the potential for which one joule of work must be expended to bring a charge of one coulomb from infinity. An electric field has the special property that it is conservative , which means that the path taken by the test charge is irrelevant: For practical purposes, it is useful to define a common reference point to which potentials may be expressed and compared. While this could be at infinity, a much more useful reference is the Earth itself, which is assumed to be at the same potential everywhere. This reference point naturally takes the name earth or ground. Earth is assumed to be an infinite source of equal amounts of positive and negative charge, and is therefore electrically unchargedâ€”and unchargeable. It may be viewed as analogous to height: The equipotentials cross all lines of force at right angles. The electric field was formally defined as the force exerted per unit charge, but the concept of potential allows for a more useful and equivalent definition: Moreover, the interaction seemed different from gravitational and electrostatic forces, the two forces of nature then known. The force on the compass needle did not direct it to or away from the current-carrying wire, but acted at right angles to it. A current was allowed through a wire suspended from a pivot above the magnet and dipped into the mercury. The magnet exerted a tangential force on the wire, making it circle around the magnet for as long as the current was maintained. Exploitation of this discovery enabled him to invent the first electrical generator in , in which he converted the mechanical energy of a rotating copper disc to electrical energy. Electrochemistry The ability of chemical reactions to produce electricity, and conversely the ability of electricity to drive chemical reactions has a wide array of uses. Electrochemistry has always been an important part of electricity. From the initial invention of the Voltaic pile, electrochemical cells have evolved into the many different types of batteries, electroplating and electrolysis cells. Aluminium is produced in vast quantities this way, and many portable devices are electrically powered using rechargeable cells. Electric circuits Main article: Electric circuit A basic electric circuit. The voltage source V on the left drives a current I around the circuit, delivering electrical energy into the resistor R. From the resistor, the current returns to the source, completing the circuit. An electric circuit is an interconnection of electric components such that electric charge is made to flow along a closed path a circuit , usually to perform some useful task. The components in an electric circuit can take many forms, which can include elements such as resistors , capacitors , switches , transformers and electronics. Electronic circuits contain active components , usually semiconductors , and typically exhibit non-linear behaviour, requiring complex analysis. The simplest electric components are those that are termed passive and linear: The resistance is a consequence of the motion of charge through a conductor: It consists of two conducting plates separated by a thin insulating dielectric layer; in practice, thin metal foils are coiled together, increasing the surface area per unit volume and therefore the capacitance. The unit of capacitance is the farad , named after Michael Faraday , and given the symbol F: A capacitor connected to a voltage supply initially causes a current as it accumulates charge; this current will however decay in time as the capacitor fills, eventually falling to zero. A capacitor will therefore not permit a steady state current, but instead blocks it. When the current changes, the magnetic field does too, inducing a voltage between the ends of the conductor. The induced voltage is proportional to the time rate of change of the current. The constant of proportionality is termed the inductance. The unit of inductance is the henry , named after Joseph Henry , a contemporary of Faraday. One henry is the inductance that will induce a potential difference of one volt if the current through it changes at a rate of one ampere per second. The SI unit of power is the watt , one joule per second. Electric power, like mechanical power , is the rate of doing work , measured in watts , and represented by the letter P. The term wattage is used colloquially to mean "electric power in watts.

5: Course: PHYS Introduction to Electromagnetism

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6: Electricity - Wikipedia

Static electricity and current electricity are like potential energy and kinetic energy. When electricity gathers in one place, it has the potential to do something in the future. Electricity stored in a battery is an example of electrical potential energy.

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The ideal mining safety and health research program Medicaid waivers : license to shape the future of fiscal federalism Carol S. Weissert and William G. Weis 3ilingualism Language Disability For the Love of Pete (Seascape (St. Martins)) The forest tree culturist Quality management at the federal level Analyzing the roots of postmodernism Women dreamt horses Daniel Veronese Spotting Trees in Britain and Europe (Spotting Trees) The Land Is a Map Heart-to-heart (Aoi) How the brain learns 4th edition Upton Sinclair finds God Combinatorial Search Learning canadian criminal law Blue Himalayan poppies Online stops you dont want to miss Encyclopedia of Fluid Mechanics: Supplement 1: American material culture and the Texas experience Introductory biophysics Hiring and employment practices and the law Awards, Honors And Prizes, 2 Volume Set (AWARDS, HONORS PRIZES) How does the Fourteenth Amendment promote equal protection of the laws? Wombat who talked to the stars Surgical disease in pregnancy Official email writing books Brides Book (Keepsake Books) XI. Talk and talkers: second paper In-line color monitoring of polymers during extrusion using a charge coupled device spectrometer Dental decks part 2 2016 2017 Kwrd Come and Have Fun Is (Kinderwords) Lonely Hearts Club (Masks) Hydrology of Laguna Joyuda, Puerto Rico Londons Augustan age, 1603-1830 Fifth grade math minutes 2002 creative teaching press Boat launch ramp design The New Romanticism Modifying Paths and Points God Made Me Special (Wear em Award Badges) Conclusion: of fortresses and film cultures.