Analogue Electronics – prepared by Dr. Ricardo Mediavilla, UPR-Bayamón

Welcome to the analog electronics database! In it you will find the URL addresses of multiple Web sites with interesting information practically covering all areas of analog electronics. In this collection of Web sites you will find information spanning from components, to projects for the hobbyist, to system level descriptions and explanations, to on-line courses, to white papers on basically every aspect of analog electronics.

For each identified Web site a brief description of its content, presentation highlights, technical depth, and an evaluation of its potential as an educational resource is included.

Even though in many instances commercial or corporate Web sites were selected, great effort was placed to select Web sites not advertising any specific product or service. Another important selection criteria was that visitors should be able to obtain valuable technical information free of charge.

The listed topics are:

- Tutorials on analog electronics and related topics
- Amplifiers
- Design principles and recommendations
- Power Supplies
- Communications
- Transformers
- Filters
- On-line courses on analog electronics
- Products and materials
- Soldering
- Power electronics
- Printed circuit boards
- Projects
- Oscillators
- Resistors
- Capacitors
- Inductors
- Semiconductors
- Radio frequency / electromagnetics
- Test instruments
- Integrated circuits
- Wiring
- Links to other Web sites on analog electronics
- Terminology and acronyms
- Instrumentation/industrial electronics
- Vacuum tubes

Tutorials

http://www.eg3.com/WebID/elect/engineer/blank/resource/a-z.htm
Resources, tutorials, faq's on electronics

http://www.electronics-tutorials.com/basics/ohms-law.htm
Ohms law tutorial

http://www.electronics-tutorials.com/basics/electron-theory.htm
Electron theory and atoms.

http://www.electronics-tutorials.com/basics/current.htm
Current

http://www.electronics-tutorials.com/basics/voltage.htm
Voltage

http://www.electronics-tutorials.com/basics/resistance.htm
Resistance

http://www.electronics-tutorials.com/basics/resistor-color-code.htm
Resistor color code

http://www.electronics-tutorials.com/basics/attenuators.htm
Attenuators: design and principles

http://www.electronics-tutorials.com/basics/decibel.htm
decibels

http://www.electronics-tutorials.com/basics/reactance.htm
capacitive reactance

http://www.electronics-tutorials.com/basics/capacitance.htm
capacitance

http://www.electronics-tutorials.com/basics/factors-determine-capacitance.htm
Factors determining capacitance

http://www.electronics-tutorials.com/basics/working-voltage-capacitance.htm
Capacitor working voltage and dielectric strength.

http://www.electronics-tutorials.com/basics/energy-stored-capacitor.htm
Energy stored in a capacitor

http://www.electronics-tutorials.com/basics/modern-capacitors.htm
Modern capacitors

http://www.electronics-tutorials.com/basics/polarization-capacitor.htm
Polarization of capacitors

http://www.electronics-tutorials.com/basics/power-supply.htm
Power supplies

http://www.electronics-tutorials.com/basics/power-supply-regulated.htm
Low current regulated power supplies

http://www.electronics-tutorials.com/basics/power-supp-hi-regulated.htm
High current regulated power supplies.

http://www.electronics-tutorials.com/basics/power-supp-variable.htm
Variable power supplies

http://www.electronics-tutorials.com/test-equip/meters.htm
Meters

http://www.electronics-tutorials.com/basics/impedance.htm
Impedance

http://www.electronics-tutorials.com/basics/inductance.htm
Inductance

http://www.electronics-tutorials.com/basics/mobius-winding.htm
Special winding techniques

http://www.electronics-tutorials.com/basics/audio-transformers.htm
Audio transformers

http://www.electronics-tutorials.com/basics/impedance-matching.htm
Impedance matching

http://www.electronics-tutorials.com/filters/band-pass-filters.htm
Band-pass filters

http://www.electronics-tutorials.com/filters/if-amplifier-filters.htm
IF amplifier filters

http://www.electronics-tutorials.com/filters/high-pass-filters.htm
High-pass filters

http://www.electronics-tutorials.com/filters/low-pass-filters.htm
Low-pass filters

http://www.electronics-tutorials.com/filters/active-bandpass-filters.htm
Active band-pass filters

http://www.electronics-tutorials.com/filters/if-amplifier-transformers.htm
IF amplifier transformers

http://www.electronics-tutorials.com/basics/toroids.htm
Toroids

http://www.electronics-tutorials.com/amplifiers/tuned-circuits.htm
Tuned circuit amplifiers

http://www.electronics-tutorials.com/basics/chokes.htm
Chokes

http://www.electronics-tutorials.com/filters/filters.htm
LC filters

http://www.electronics-tutorials.com/basics/q.htm
Quality factor Q.

http://www.electronics-tutorials.com/basics/resonance.htm
Resonance

http://www.electronics-tutorials.com/filters/trap-filter.htm
Harmonic trap filters

http://www.electronics-tutorials.com/filters/filters.htm
Filters tutorial site

http://www.electronics-tutorials.com/filters/antenna-pre-selector-filters.htm
Antenna pre-selector filters

http://www.electronics-tutorials.com/amplifiers/buffer-amplifiers.htm
Buffer amplifiers

http://www.electronics-tutorials.com/oscillators/voltage-controlled-oscillators.htm
Voltage controlled oscillators

http://www.electronics-tutorials.com/oscillators/oscillators.htm
Oscillators tutorial site

http://www.electronics-tutorials.com/oscillators/oscillator-basics.htm
Principles of oscillator operation

http://www.electronics-tutorials.com/oscillators/hartley-oscillator.htm
Hartley oscillator

http://www.electronics-tutorials.com/amplifiers/broad-band-amplifiers.htm
Broad band amplifiers

http://www.electronics-tutorials.com/amplifiers/small-signal-amplifiers.htm
Small signal amplifiers

http://www.electronics-tutorials.com/amplifiers/emitter-degeneration.htm
Emitter degeneration

http://www.electronics-tutorials.com/amplifiers/negative-feedback.htm
Negative feedback

http://www.electronics-tutorials.com/oscillators/colpitts-oscillators.htm
Colpitts oscillators

http://www.electronics-tutorials.com/oscillators/crystal-oscillators.htm
Crystal oscillators

http://www.electronics-tutorials.com/oscillators/crystal-grinding.htm
Crystal grinding

http://www.electronics-tutorials.com/oscillators/oscillator-drift.htm
Oscillator drift

http://www.electronics-tutorials.com/oscillators/drift-correction.htm
Drift correction circuits

http://www.electronics-tutorials.com/basics/diodes.htm
Varactor diodes

http://www.electronics-tutorials.com/basics/transistors.htm
Transistors

http://www.electronics-tutorials.com/basics/diodes.htm
Tutorial on diodes

http://www.electronics-tutorials.com/receivers/trf-receiver.htm
Tuned radio frequency receivers

http://www.electronics-tutorials.com/receivers/am-radio-receivers2.htm
AM radio receivers - part II

http://www.electronics-tutorials.com/receivers/am-radio-receivers3.htm
AM radio receivers - part III

http://www.electronics-tutorials.com/receivers/regen-radio-receiver.htm
Regenerative radio receivers

http://www.electronics-tutorials.com/receivers/fm-radio-receivers2.htm
FM radio receivers - part II

http://www.electronics-tutorials.com/receivers/fm-radio-receivers.htm
FM radio receivers

http://www.electronics-tutorials.com/receivers/am-radio-receivers.htm
Tutorial on AM receiver design

http://www.electronics-tutorials.com/receivers/crystal-radio-set.htm
Basic crystal set

http://www.arrl.org/tis/info/pdf/129756.pdf
Crystal radio tutorial

http://www.electronics-tutorials.com/receivers/am-radio-receivers.htm
AM radio receivers

http://www.electronics-tutorials.com/receivers/superhetrodyne-radio-receivers.htm
Syperheterodyne radio receivers

http://www.electronics-tutorials.com/oscillators/clapp-oscillators.htm
Clapp oscillators

http://www.electronics-tutorials.com/filters/narrow-band-filters.htm
Narrow-band filters

http://www.electronics-tutorials.com/basics/coil-forms.htm
Coil formers and cores

http://www.electronics-tutorials.com/basics/wide-band-rf-transformers.htm
Wide band RF transformers

http://www.electronics-tutorials.com/basics/switched-mode-power-supplies.htm
Switched mode power supplies

http://www-groups.dcs.st-andrews.ac.uk/~history/Mathematicians/Ohm.html
Ohm's biography

http://www.electronics-tutorials.com/devices/devices.htm
Electronic devices: timers, mixers, etc. IC's

http://www.electronics-tutorials.com/links/links.htm
Links to sites of interest in electronics

http://www.electronics-tutorials.com/receivers/receivers.htm
Links to tutorials on receivers

http://www.electronics-tutorials.com/antennas/antenna-diplexer.htm
Antenna diplexer

http://www.twysted-pair.com/downloads.htm
Free electronics tutorial covering basic electronics, parallel and complex resistor circuits, AC and oscilloscopes, capacitors, inductors, LCR circuits, semiconductors, diodes and rectifier circuits, bipolar junction transistors, bipolar junction transistor amplifiers, operational amplifiers, digital electronics, TTL, CMOS

http://www.twysted-pair.com/hyster.htm
Hysteresis.

http://www.proaxis.com/~iguanalabs/basicdef.htm
Tutorial on basic electronic concepts.

http://www.iguanalabs.com/Compnets.htm
Tutorial on basic electrical components.

http://www.iguanalabs.com/ohmslaw.htm
Ohms law.

http://www.iguanalabs.com/1stled.htm
Learning about transistors and LED's.

http://www.physics.uoguelph.ca/tutorials/ohm/
Home page for DC circuits tutorials.

http://www.broadcast.net/hallikainen/theory.html
Good mini tutorials originally published in world radio magazine covering electronic theory.

http://www.sweethaven.com/acee/forms/toc01.htm
Textbook like mini-tutorial covering the basic elements of AC electricity

http://www.elec-toolbox.com/theory.htm
basic principles of electricity; electrons, conductors, insulators

http://www.iserv.net/~alexx/lib/tutorial.htm
List of educational tutorials on electricity and electronics.

http://www.owlnet.rice.edu/~engi202/electricity.html
minor work describing voltage, current, resistance, capacitance

http://www.mos.org/sln/toe/tennisballs.html
Interesting analogy using tennis balls as 'electrons' to teach the concepts of voltage, current and resistance

http://jever.phys.ualberta.ca/~gingrich/phys395/notes/phys395.html
Extensive notes from AC/DC basics to digital microcomputer component theory

http://www.thinkquest.org/library/lib/site_sum_outside.html?tname=10784&url=10784/
a tutorial collection including introduction, chemistry and physics of electronics

http://www.channel1.com/users/analog/tutor.html
Analog tutorials and frequently asked questions.
Articles:
Noise in PCB Design (16kB)
Design Techniques (11kB)
Passive Components (6kB)
Formulas & Numbers (5kB)

http://www.channel1.com/users/analog/formula.html
Formulas and numbers typically used in electronics.

http://www.analog.com/library/techArticles/mems/techOp.html
Using MEMS technology in optical switching.

http://www.analog.com/library/analogDialogue/archives/34-01/haystack/index.html
Measuring small differential voltages in the presence of large common-mode voltages

http://www.analog.com/technology/dataConverters/training/pdf/DDStutor.pdf
A technical tutorial on digital signal synthesis. (122 pages)

http://www.analog.com/technology/dataConverters/training/seminarMaterials/pdf/6.pdf
High Speed DAC's and DDS Systems - white paper - 30 pages.

http://www.analog.com/library/techArticles/dataConverters/pdf/analogfeedback_june2000.pdf
Mixed signal IC's combine analog and digital circuits to meter electrical energy and measure run time, while employing a precise RC time base.

http://www.analog.com/library/whitepapers/dsp/circle.html
Circle Surround® White Paper
Circle Surround was originally developed to offer the benefits of surround sound for music applications that had been available for cinematic use for years. There are side effects in the cinematic surround matrix systems that do not provide a high quality format for music. After first addressing the requirements of matrix surround for music, a video mode was developed which offers an improved stereo image for the front, as well as stereo surround channels.

http://www.analog.com/library/analogDialogue/archives/33-08/adc/index.html
Analog-to-Digital Converter Architectures and Choices for System Design

http://www.analog.com/library/analogDialogue/archives/34-06/imaging/index.html
Selecting an Analog Front End for Imaging Applications
Every imaging system starts with an image sensor. The signal from the sensor must be processed in the analog domain, converted to digital, and further processed in the digital domain. This allows the image to be analyzed, manipulated and enhanced, prior to storage, display, transmission, and/or further processing. Imaging applications typically involve three chips-an image sensor, an analog front-end (AFE), and a digital ASIC. The AFE conditions the analog signal received from the image sensor and performs the analog-to-digital (A/D) conversion. The digital ASIC contains image-processing and timing-generation circuitry. Figure 1 shows a block diagram of a typical imaging system. Additional application-specific circuitry following the digital image-processing ASIC depends upon whether the imaging system is a camera, scanner or copier.

http://howthingswork.virginia.edu/topics.html
How things work: The Physics of Everyday Life

http://howthingswork.virginia.edu/electronic_air_cleaners.html
How things work: electronics air cleaners.

http://howthingswork.virginia.edu/electronic_air_cleaners.html
How things work: Xerographic Copiers

http://howthingswork.virginia.edu/magnetically_levitated_trains.html
How things work: magnetically levitated trains

http://howthingswork.virginia.edu/flashlights.html
How things work: flashlights

http://howthingswork.virginia.edu/electric_power_distribution.html
How things work: electric power distribution

http://howthingswork.virginia.edu/electric_power_generation.html
How things work: electric power generation

http://howthingswork.virginia.edu/electric_motors.html
How things work: electric motors

http://howthingswork.virginia.edu/tape_recorders.html
How things work: tape recorders

http://howthingswork.virginia.edu/audio_amplifiers.html
How things work: audio amplifiers

http://howthingswork.virginia.edu/computers.html
How things work: computers

http://howthingswork.virginia.edu/radio.html
How things work: radio

http://howthingswork.virginia.edu/television.html
How things work: television

http://howthingswork.virginia.edu/microwave_ovens.html
How things work: microwave ovens.

http://howthingswork.virginia.edu/fluorescent_lamps.html
How things work: fluorescent lamps

http://howthingswork.virginia.edu/lasers.html
How things work: lasers

http://howthingswork.virginia.edu/compact_disc_players.html
How things work: CD players

http://www.howstuffworks.com/amplifier.htm
How amplifiers work.

http://www.howstuffworks.com/burglar-alarm.htm
How burglar alarms work.

http://www.howstuffworks.com/cable-tv.htm
How cable television works.

http://www.howstuffworks.com/cable-tv.htm
How cordless telephones work.

http://www.howstuffworks.com/gps.htm
How GPS receivers work.

http://www.howstuffworks.com/inkjet-printer.htm
How ink jet printers work.

http://www.howstuffworks.com/joystick.htm
How joysticks work.

http://www.howstuffworks.com/laptop.htm
How laptops work.

http://www.howstuffworks.com/camcorder-works.htm
How camcorders work.

http://www.howstuffworks.com/car-alarm.htm
How car alarms work.

http://www.howstuffworks.com/cd-burner.htm
How CD burners work.

http://www.howstuffworks.com/cd-burner.htm
How CD's work.

http://www.howstuffworks.com/cd-burner.htm
How cell phones work.

http://www.howstuffworks.com/cordless-telephone.htm
How cordless telephones work.

http://www.howstuffworks.com/fax-machine.htm
How fax machines work.

http://www.howstuffworks.com/laser-printer.htm
How laser printers work.

http://www.howstuffworks.com/led.htm
How light emitting diodes work.

http://www.howstuffworks.com/pc.htm
How PC's work.

http://www.howstuffworks.com/pda.htm
How personal digital assistants (PDA's) work.

http://www.howstuffworks.com/photocopier.htm
How photocopiers work.

http://www.howstuffworks.com/photocopier.htm
How plasma displays work.

http://www.howstuffworks.com/remote-entry.htm
How remote entry works.

http://www.howstuffworks.com/satellite-tv.htm
How satellite TV works.

http://www.howstuffworks.com/scanner.htm
How scanners work.

http://www.howstuffworks.com/smoke.htm
How smoke detectors work.

http://www.howstuffworks.com/speaker.htm
How speakers work.

http://www.howstuffworks.com/surge-protector.htm
How surge protectors work.

http://www.howstuffworks.com/tv.htm
How television works.

http://www.howstuffworks.com/vcr.htm
How VCR's work.

http://www.howstuffworks.com/webcam.htm
How web cameras work.

http://www.howstuffworks.com/inside-rc.htm
How the TV remote control works.

http://www.howstuffworks.com/radar-detector.htm
How radar detectors work.

http://www.howstuffworks.com/radar.htm
How radar works.

http://www.howstuffworks.com/air-traffic-control.htm
How air traffic control works.

http://www.howstuffworks.com/bluetooth.htm
How bluetooth works.

http://www.howstuffworks.com/rc-toy.htm
How radio controlled toys work.

http://www.howstuffworks.com/radio.htm
How radio transmission works.

http://www.howstuffworks.com/radio-spectrum.htm
How the radio spectrum works.

http://www.howstuffworks.com/wireless-internet.htm
How wireless Internet works.

http://www.thelearningpit.com/elec/bas/theory/etb-menu.html
Electrical DC Theory

http://www.uoguelph.ca/~antoon/gadgets/555/555.html
555 Timer Tutorial

http://www.privateline.com/

http://www.privateline.com/
Excellent hacker friendly site providing info on telephone, cellular basics, digital wireless and PCS basics, telephone system history and more

http://search.atomz.com/search/?sp-q=fuse&sp-a=000211ee-sp00000001
Set of white papers on protection and fusing.

http://www.dse.com.au/cgibin/dse.filereader?3d404f5a0978bafa273fc0a87f9c06f2+EN/catalogs/DTAGRP
Technical data on: Battery replacement guide; Capacitors; Digital and communications IC data
Formulae; constants and conversion factors; Inductors and fuses; LED's; Operational amplifiers; Optoelectronics; Other passive components; Other semiconductors; Passive component notes; Resistors and capacitors; RF; Communications; RS232 information; Semiconductor, FET's and diodes; Wire and cables

http://www.arduini.com/papers.html
Info in Word format covering a small variety of analog, power and R&D electronics topics.

http://www.wenzel.com/pdffiles/battery.pdf
Battery capacity information

http://www.radiodesign.com/legacy/pgrwrks.htm
How it works: Pagers

http://www.radiodesign.com/legacy/cellwrks.htm
How it works: Cellular Phones

http://www.radiodesign.com/legacy/radwrks.htm
How it works: Radios

http://www.radiodesign.com/legacy/remwrks.htm
How it works: Remote Control

http://www.radiodesign.com/legacy/tvwrks.htm
How it works: television

http://www.radiodesign.com/legacy/lanwrks.htm
How it works: wireless LAN

http://www.radiodesign.com/legacy/ltrbands.htm
How it works: Radio Spectrum Designations

http://ourworld.compuserve.com/homepages/Bill_Bowden/

'the best on the net' source of well drawn circuit schematics, including excellent textual theory of operation

http://www.dowcorning.com/content/etronics/etronics_si_matl2.asp?DCAPP=WCMMaterialsforElectronicsTutorial&DCWS=Electronics&DCWSS=
Materials and electronics tutorial.

http://www.sweethaven.com/acee/forms/toc01.htm
Elements of AC Electricity - Tutorial

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_005
Adjustable flashing LED

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_014
Bringing NiCd's from the dead
The failures the article talks about occur in mutli-cell Ni-Cd battery packs, and are due to the voltage differences between cells. Say you have four 1.25 V cells in a pack connected to a 200 ohm load. The load "sees" 5 volts and draws 25 mA. Since each cell must pass the entire 25 mA and each cell's potential is 1.25 volts, Ohm's Law tells us that each cell sees the equivalent load of 50 ohms. (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_013
Condenser microphone hook up circuit. Complete ASCII circuit.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_PC.html#ASCIISCHEMPC_006
Control 120 V AC relay with TTL. PC/Logic-related ASCII Schematics V1.00 -- (Complete ASCII Circuit)

http://www.sweethaven.com/acee/forms/frm1105.htm
Current and voltage in Xc circuits. When you complete this module, you should be able to: Describe the fact that the current of a capacitor always leads the voltage across the capacitor by 90 degrees. Sketch a vector diagram showing how the current leads the voltage.

http://www.sweethaven.com/acee/forms/frm0605.htm
Current and voltages in X_L circuits. When you complete this module, you should be able to: Describe the fact that the current through an inductor always lags the voltage across the inductor by 90 degrees. Sketch a vector diagram showing how the current lags the voltage.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_003
Frequency and capacitance meter circuit. An idea is to use the 555 as a monostable, and trigger it with a fixed frequency clock. Duty cycle will be proportional to capacitance.The ON time for the monostable is about 1.1RC, so component values that should work would be a 50 Hz clock, say a 1 Hz low-pass filter on the output, and R = 9.09K, 1%. That combination will give an output of one volt per microfarad. Switch R in decades for smaller capacitors. Trim R for calibration. (Complete ASCII Circuit)

http://www.sweethaven.com/acee/forms/frm0103.htm
Frequency and period of a sinusoidal waveform. When you complete this module, you should be able to: Define the period of a waveform. Cite the units of measure for the period of a waveform. Define the

frequency of a waveform. Cite the units of measure for the frequency of a waveform. Convert between values for the period and frequency of a waveform.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_019
Generating -5VDC from +5VDC. If you happen to have the March 1984 issue of Radio-Electronics, turn to page 78. This issue has the very first installment of Robert Grossblatt's "Designer's Notebook" column. In it, he shows a simple circuit which will supply a negative voltage, given a positive voltage. It's basically a 555-based oscillator, and a voltage-doubling rectifier. He claims the negative-voltage output should be good for about 60ma. No-load voltage should be pretty close to the input voltage (but negative), although the voltage will drop a bit, depending on the load. If you put +5V into the circuit, it'll give you around -5V out. load. If you put +5V into the circuit, it'll give you around -5V out. If the load makes the voltage drop too low (-3V or -4V), you could always just feed the circuit with a higher voltage (like maybe 9V or 12V) and then just regulate the output down to -5V using a 7905 regulator. I've used this circuit a couple of times for powering op-amp's, and it works great! (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_020
Ground loop circuits. When you have two circuits that are tied together electrically, but one of them is high current then you should direct the ground and power paths to "feed" them separately. You want the current of the driver to stay on the driver side and the current of the logic to stay on it's own side. The thin trace in between is still needed because this is not galvantic isolation. (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_001
Headlight reminder circuit. solution is to go from the +12 Switched sidelight feed, via a buzzer to the drivers door light switch, you then need to put a diode in the door circuit to stop the other doors operating the buzzer. Thus when you leave your lights on AND open the drivers door, the buzzer sounds. If you mean to leave your lights on, just shut the door and the buzzer stops! (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_Tel.html#ASCIISCHEMTEL_013
Hold function for telephone. Telephone-related ASCII Schematics V1.01 -- (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_018
High voltage supply: 12V DC in, 12 KV out. Simple High Voltage Generator - 12 V in, 12,000 V out inverter. Modify appropriately for 24 V in, 30,000+ out, lower power. (Complete ASCII Circuit)

http://www.sweethaven.com/acee/forms/frm0801.htm
Introduction to capacitance. When you complete this module, you should be able to: Define the term dielectric. Define capacitance in terms of two conductors and a dielectric. Cite some common dielectric materials. Describe how an electrical charge is stored in a dielectric material. Define the terms electrostatic field. Describe how electrostatic induction affects the charge on a capacitor.

http://www.sweethaven.com/acee/forms/frm0201.htm
Introduction to inductance. When you complete this module, you should be able to: Express in words Faraday's Law for a straight wire. Cite the meaning of each term in the mathematical expression of Faraday's Law for a straight wire and for a coil of wire. Express Lenz's Law in a single sentence.

http://www.sweethaven.com/acee/forms/frm0601.htm
Introduction to inductive reactance. When you complete this module, you should be able to: Define inductive reactance. Describe the effect that inductive reactance has upon the amount of current flowing in an AC circuit.

http://www.sweethaven.com/acee/forms/frm0602.htm
Inductive reactance formula. When you complete this module, you should be able to: Cite the equation for determining the value of inductive reactance, given the values of applied frequency and inductance. Solve the equation, given two of the three variables.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_007
Info on CO_2 lasers. NOTES: The laser used is a helium-neon one which emits a bright red beam. Pointing it in someone's eyes will probably blind them so be careful with where you point it - unless of course you intend to do damage (?!) It can't burn skin or paper or anything - it's only really useful in this case as laser sights - although in future issues I others will explain how you can use it for Data Snooping. (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_IR.html#ASCIISCHEMIR_001
Infra red remote transponder. IR-related ASCII Schematics V1.00 -- I built a remote-transponder, which lets me send signals from a small receiver into closed (opaque door) cabinets, and around corners, etc. Anyways, the chief problem is just stray environmental noise with any slowly changing amplitude modulated IR signal (lots of 60 Hz noise, and sunlight noise). Most IR remotes work around a 40KHz carrier, so that they can just pulse this digitally, and just bandpass filter it at the receiving end. This boosts the range of unfocused IR remotes to tens of feet (around 20-30 feet). Adding two IR Leds helps a lot, by sending out more IR signals. Anyways, the following is a cutout from the group sci.electronics. Most of which had been posted in the past month (I guess many news-servers might not go back one month, so I re-posted. Hope nobody minds). There is included transmitter and receiver modules. Personally, I find the Sharp IR Receiver module (available at Radio Shack) to be the easiest darn thing to use. You just pop in +5V and ground, and you get the demodulated signal out (a high/low version of whatever was riding on the 40KHz IR signal). It comes with simple application notes. Hope this info helps you out. Oh, lastly, if you're looking for ANALOG transmitters, I would look into Radio-Electronics recently for posts about their "Air-Hop" voice transmitter, or into Forrest Mims III "Circuit Cookbook." They both show how to do FM modulation onto IR (much, much better than AM). (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_IR.html#ASCIISCHEMIR_007
IR slotted switch sensor. IR-related ASCII Schematics V1.00 -- There is a type of detector known as a "slotted switch" that consists of a phototransistor/LED pair mounted on a solid frame with a small air gap between the two elements. When the air gap is unobstructed, the transistor saturates, pulling Vout to ground; when the gap is blocked, the transistor cuts off and Vout is +5 volts. (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_Tel.html#ASCIISCHEMTEL_003
Phone in use light. Telephone-related ASCII Schematics V1.01 -- (Complete ASCII Circuit)
http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_IR.html#ASCIISCHEMIR_004
Minimizing sun's noise in IR reception. IR-related ASCII Schematics V1.00 -- A 'baffle' is a perforated disk or disks spaced inside your 'shade tube'. The idea is to trap all reflections, leaving only the light coming in on the exact axis of the tube to strike the IR Detector. Off-axis light, 'noise', will be caught by the baffles and dissipated through reflection between the baffles. Paint the inside of your tube black ... in fact, check into what paints/coatings are 'black' to IR wavelenghts. Just because a paint LOOKS black does not mean it won't reflect IR.

Check into an astronomy or optics group to get the formula for the ideal spacing of the baffles and how big a hole should be in them. Getting this right will improve your system performance. (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_PC.html#ASCIISCHEMPC_004
More accurate PC/AT clock. PC/Logic-related ASCII Schematics V1.00 -- (Complete ASCII Circuit)

http://www.sweethaven.com/acee/forms/frm0902.htm
Parallel capacitor circuits. When you complete this module, you should be able to: Cite the equation for calculating the total capacitance of a parallel circuit. Explain how total capacitance increases with the number of capacitors connected in parallel. Calculate the total capacitance of a parallel circuit, given the values of individual capacitors. Describe how the voltage is the same across each capacitor. Describe how the charge and discharge current for each capacitor is proportional to is value.

http://www.sweethaven.com/acee/forms/frm0303.htm
Parallel inductor circuits. When you complete this module, you should be able to: Cite the inverse formulas for total inductance of a parallel circuit. Explain how total inductance decreases with each inductor that is added in parallel. Calculate the total inductance of a parallel circuit, given the values of individual inductors. Describe how the voltage is the same across each inductor. Describe how the current in each branch responds to changes in applied voltage.

http://www.sweethaven.com/acee/forms/frm1303.htm
Parallel L-C circuits. When you complete this module, you should be able to: Describe how to determine the total reactance of a parallel LC circuit. Describe how to determine the total current of a parallel LC circuit. Sketch the vector diagram for the total reactance of a series LC circuit. Describe how to use Ohm's Law to calculate the total reactive current in a series LC circuit. Explain how to determine the total reactive voltage and the voltages across the individual reactances in a series LC circuit. Sketch a vector diagram for the voltages in a series LC circuit. Describe how the current through a series LC circuit is maximum when $X_L = X_C$.

http://www.sweethaven.com/acee/forms/frm1203.htm
Parallel R-C circuits. When you complete this module, you should be able to: Cite the equation for determining the total current in a parallel RC circuit. Calculate the total current in a parallel RC circuit, given the values for the currents in each branch. Explain how to use the AC version of the product-over-sum rule to calculate the total impedance of a simple parallel RC circuit. Calculate the total impedance of a parallel RC circuit. Cite the equation for determining the total phase angle of a parallel RC circuit in terms of branch currents. Calculate the total phase angle of a parallel RC circuit. Describe how to go about doing a complete analysis of a parallel RC circuit. Completely analyze a parallel RC circuit, given the values of R, C, $V_{T,}$ and f.

http://www.sweethaven.com/acee/forms/frm0704.htm
Parallel R-C circuits. When you complete this module, you should be able to: Cite the equation for determining the total current in a parallel RL circuit. Calculate the total current in a parallel RL circuit, given the values for the currents in each branch. Explain how to use the AC version of the product-over-sum rule to calculate the total impedance of a simple parallel RL circuit. Calculate the total impedance of a parallel RL circuit. Cite the equation for determining the total phase angle of a parallel RL circuit in terms of branch currents. Calculate the total phase angle of a parallel RL circuit. Describe how to go about doing a complete analysis of a parallel RL circuit. Completely analyze a parallel RL circuit, given the values of R, L, V_T, and f.

http://www.sweethaven.com/acee/forms/frm0104.htm
Phase angle of a sinusoidal waveform. When you complete this module, you should be able to: Describe the meaning of phase angle. Expand the formula for instantaneous sine voltage and current to include a phase angle, then apply the formula to sketch accurate sinusoidal waveforms. Define the terms leading and lagging as they apply to sinusoidal waveforms. Determine whether a given waveform is leading or lagging a reference waveform.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_015
Phase shifter circuit. Here is a well known op-amp phase shifter. I am surprised no one has posted it yet, so I guess I will have to. (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_Tel.html#ASCIISCHEMTEL_008
Phone in use. Telephone-related ASCII Schematics V1.01 -- (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_Tel.html#ASCIISCHEMTEL_011
Phone in use indicator. Telephone-related ASCII Schematics V1.01 -- (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_Tel.html#ASCIISCHEMTEL_007
Phone line to audio. Telephone-related ASCII Schematics V1.01 -- (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_Tel.html#ASCIISCHEMTEL_005
Phone off hook indicator. Telephone-related ASCII Schematics V1.01 -- (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_Tel.html#ASCIISCHEMTEL_006
Phone rang indicator light. Telephone-related ASCII Schematics V1.01 -- (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_Tel.html#ASCIISCHEMTEL_004
Phone to audio interface. Telephone-related ASCII Schematics V1.01 -- (Complete ASCII Circuit)

http://www.sweethaven.com/acee/forms/frm0705.htm
Power in R-L circuits. When you complete this module, you should be able to: Sketch the AC waveforms for power, voltage, and current in a series RL circuit.

http://www.sweethaven.com/acee/forms/frm1106.htm
Power in X_C circuits. When you complete this module, you should be able to: Describe how AC power is absorbed by a capacitor for one-quarter cycle, then returned to the circuit during the next quarter cycle. Describe the differences between power in a resistor circuit and apparent power in a capacitor circuit.

http://www.sweethaven.com/acee/forms/frm0606.htm
Power in X_L circuits. When you complete this module, you should be able to: Describe how AC power is absorbed by an inductor for one-quarter cycle, then returned to the circuit during the next quarter cycle. Explain the meaning of each term in the equation for instantaneous power in an AC inductor circuit. Describe the differences between power in a resistor circuit and apparent power in an inductor circuit.

http://www.sweethaven.com/acee/forms/frm0703.htm
Q of an inductor. When you complete this module, you should be able to: Explain the meaning of the Q, or merit, of an inductor. Calculate the Q of an inductor. Describe how the Q of an inductor changes with the operating frequency. Describe the effects that the internal resistance of a coil has upon the Q of the coil.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_002
Quiz - Show inductor circuit. Here's a simple, cheap circuit that will let you conduct your very own quiz shows. It has a lamp and a button for each player. When a button is pressed, it lights that player's lamp and locks out the other button until the circuit is reset. Circuit Description: When the circuit is first powered up (or after a reset -- same thing), both SCR gates are held at ground potential by R1 and R6. Therefore, neither SCR will latch up, and both lamps will be off. When one of SW1 or SW2 is pressed, the corresponding SCR's gate is pulled high, so the SCR latches on. Even if the switch is released, the SCR remains latched, keeping the lamp illuminated. Diodes CR1 and CR2 ensure that only one lamp may be on at a time. Once an SCR turns on, it forces the other SCR's gate to remain at a low voltage, even if its switch is pressed. It is probably possible to change the bulbs and the power supply to 12V with no other circuit changes, but I have only built a 6V system. The circuit does not draw current when the lamps are off, so it may be battery powered with no additional cutoff switch. I built the whole thing in a plastic shoebox. Serving Suggestion: These are great fun in elementary school classes, and as the whole thing can be built for about $5, it's well worth letting the kids have fun while they destroy it! (Complete ASCII Circuit)

http://www.sweethaven.com/acee/forms/frm1002.htm
RC time constant. When you complete this module, you should be able to: Describe the equation for determining the time constant of a series RC circuit. Calculate the RC time constant of a circuit. Explain the significance of the percentage value 63.2% in the process of charging a capacitor through a resistance. Explain why a capacitor is considered fully charged at the end of 5 time constants. Calculate the amount of voltage on a capacitor after it has charged a given number of time constants. Explain the significance of the percentage value 63.2% in the process of discharging a capacitor through a resistance. Explain why a capacitor is considered fully discharged at the end of 5 time constants. Calculate the amount of voltage on a capacitor after it has discharged a given number of time constants.

http://www.sweethaven.com/acee/forms/frm0402.htm
RL time constant. When you complete this module, you should be able to: Describe the equation for determining the time constant of a series RL circuit. Calculate the L/R time constant of a circuit. Explain the significance of the percentage value 63.2% while current is building through an RL circuit. Explain why the build-up current of an inductor reaches its steady state the end of 5 time constants. Calculate the build-up current through an inductor after a given number of time constants. Explain the significance of the percentage value 63.2% while current is decaying through an RL circuit. Explain why the decaying current of an inductor reaches a steady state at the end of 5time constants. Calculate the amount of decay current through an inductor after a given number of time constants.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_PC.html#ASCIISCHEMPC_003
Rounding off a square wave. PC/Logic-related ASCII Schematics V1.00 -- (Complete ASCII Circuit)

http://www.sweethaven.com/acee/forms/frm0202.htm
Self inductance. When you complete this module, you should be able to: Explain self-inductance. Define inductance in terms of induced voltage. Cite the units of measure for inductance. Describe the voltage waveform across an inductor when a sine waveform of current is being applied.

http://www.sweethaven.com/acee/forms/frm1103.htm
Series and parallel X_C. When you complete this module, you should be able to: Explain the meaning of each term in the equation for total capacitive reactance in a series circuit. Calculate the total capacitive reactance of a series circuit, given the values of the individual reactances. Explain the meaning of each term in the equation for total capacitive reactance in a parallel circuit. Calculate the total capacitive reactance of a parallel circuit, given the values of the individual reactances.

http://www.sweethaven.com/acee/forms/frm0603.htm
Series and parallel X_L. When you complete this module, you should be able to: Explain the meaning of each term in the equation for total inductive reactance in a series circuit. Calculate the total inductive reactance of a series circuit, given the values of the individual reactanaces. Explain the meaning of each term in the equation for total inductive reactance in a parallel circuit. Calculate the total inductive reactance of a parallel circuit, given the values of the individual reactances.

http://www.sweethaven.com/acee/forms/frm0903.htm
Series capacitor circuits. when you complete this module, you should be able to: Cite the equation(s) for calculating the total capacitance of a series circuit. Explain how total capacitance decreases with the number of capacitors connected in series. Calculate the total capacitance of a series circuit, given the values of individual capacitors. Describe how the voltage across each capacitor is inversely proportional to the value of the capacitor. Describe how the charge and discharge current is the same for each capacitor in a series circuit.

http://www.sweethaven.com/acee/forms/frm0302.htm
Series inductor circuits. When you complete this module, you should be able to: Cite the equation for calculating the total inductance of a series circuit. Explain how total inductance increases with each inductor that is added in series. Calculate the total inductance of a series circuit, given the values of individual inductors. Describe how inductor voltage drops are distributed among inductors that are connected in series. Describe how changes in source voltage affect the current flowing through the circuit.

http://www.sweethaven.com/acee/forms/frm1302.htm
Series LC circuits. When you complete this module, you should be able to: Describe how to determine the total reactance of a series LC circuit. Sketch the vector diagram for the total reactance of a series LC circuit. Describe how to use Ohm's Law to calculate the total reactive current in a series LC circuit. Explain how to determine the total reactive voltage and the voltages across the individual reactances in a series LC circuit. Sketch a vector diagram for the voltages in a series LCcircuit. Describe how the current through a series LC circuit is maximum when $X_L = X_C$.

http://www.sweethaven.com/acee/forms/frm1202.htm
Series RC circuits. When you complete this module, you should be able to: Define the impedance of an RC circuit. Cite the equation for calculating the impedance of an RC circuit in terms of R and X_C. Calculate the value of impedance for a series RC circuit, given the values of R and X_C. Discuss the fact that the total voltage in a series RC circuit is greater than the sum of voltages across R and C. Cite the equation for determining the total voltage for a series RC circuit. Calculate the total voltage for a series RC circuit. Cite two different equations for determining the total phase angle for a series RC circuit. Calculate the total phase angle of a series RC circuit. Describe what is meant by a complete analysis of a series RC circuit. Completely analyze a series RC circuit.

http://www.sweethaven.com/acee/forms/frm0702.htm
Series RL circuits. When you complete this module, you should be able to: Define the impedance of an RL circuit. Cite the equation for calculating the impedance of an RL circuit in terms of R and X_L. Calculate the value of impedance for a series RL circuit, given the values of R and X_L. Calculate the

impedance of a series RL circuit, given the values of R, L, and f. Cite the equation for determining the total phase angle for a series RL circuit in terms of voltage drops. Given values of R and X_L, determine the phase angles for the resistor, inductor, and total circuit. Describe what is meant by a complete analysis of a series RL circuit. Completely analyze a series RL circuit, given the values of R, L, V_T, and f.

http://www.sweethaven.com/acee/forms/frm0105.htm
Sinusoidal Power Waveforms. When you complete this module, you should be able to: Sketch voltage, current, and power sine waveforms on the same axis. Explain why the power waveform is always positive as long as current and voltage are in phase. Cite the fact that average power is equal to the product of RMS current and RMS voltage.

http://www.sweethaven.com/acee/forms/frm0101.htm
Sinusoidal Waveform. When you complete this module, you should be able to: Define the terms voltage and current. Cite the units of measure for voltage and current. Describe the difference between DC and AC voltage and current. Describe the shape and main features of a sinusoidal waveform. Calculate the instantaneous value of a current or voltage sine waveform, given the maximum value and angular displacement.

http://www.alaska.net/~research/Net/NDRCElec.htm
X_C and Ohms Law. When you complete this module, you should be able to: Cite Ohm's Law for capacitive reactance. Explain how Ohm's Law for X_C is similar to Ohm's Law for R. Use Ohm's Law to solve for voltage, current, or capacitive reactance for a capacitor. Solve Ohm's Law for capacitance, given values of f and L rather than X_C.

http://www.sweethaven.com/acee/forms/frm0604.htm
XL and Ohms Law. When you complete this module, you should be able to: Cite Ohm's Law for inductive reactance. Explain how Ohm's Law for XL is similar to Ohm's Law for R. Use Ohm's Law to solve for voltage, current, or inductive reactance for an inductor. Solve Ohm's Law for inductance, given values of f and L rather than X_L.

http://www.electronics2000.com/page2.html
Basic electronics tutorials.
Chapter 1 - What is electricity, basic atom structure, charge fundamentals, COULOMB'S LAW OF ELECTROSTATIC FORCES, more laws, Source of Electricity and Common acceptable units of measurement used in Electronics, What is VOLT, EMF, AMP, OHM, WATT, CONDUCTORS, SEMICONDUCTORS and INSULATORS, RESISTANCE, How to measure Gauge in wire, Resistor basics. **Chapter 2**- Understanding Basic Circuits, and studying the relationships between resistance, volts and amperes. More on WATTAGE Conductance/MHOS/Siemens, more laws, series and parallel circuits and more. **Chapter 3**- The theory behind a Wheatstone Bridge Circuit, Switching, magnetism, permeability, magnetic induction and shielding, ANGLE of DECLINATION or VARIATION, magnetic laws, retentivity, residual magnetism, FERROMAGNETIC materials, PARAMAGNETIC materials, **DIAMAGNETIC** materials, FLUX, and much more...., RELAYS, Introduction to A/C. **Chapter 4**- A/C Frequency Information, laws and some History flashbacks, wavelength calculation table, RF/Microwave Terminology - Glossary of Wireless, RF and Microwave Terms, and lot's of terms and some formulas and pictures. GENERATORS, ALTERNATORS AND DYNAMO. **Chapter 5**- METERS AND INSTRUMENTS, OSCILLOSCOPE (what is rectification, briefly), MEASUREMENT OF AC AND DC, DIGITAL MULTIMETERS. **Chapter 6**-INDUCTANCE/what it is, the Theory of how a diode works. **Chapter 7**- Continuation of INDUCTANCE related component explanations (TRANSFORMER) and other information. Explained what MUTUAL INDUCTION is, how induction is measured in the unit of H = HENRYS. Named the coil windings parts. What COUPLING is. **Chapter 8**- What capacitance is, technical explanation of a capacitor, how it works and general capacitance tutorial. Also take a look at the

Technical Specifications of Capacitors. In Chapter 9 I will talk about how capacitors are used in circuits, the differences between them being used in A/C vs. D/C circuits, coming up...

http://www.amasci.com/amateur/elecdir.html
The real direction of electric current. - white paper.

http://www.amasci.com/tesla/spark.html
Sparks and lightning - white paper.

http://www.amasci.com/elect/elefaq.html
Frequently asked electricity questions - white paper.

http://www.amasci.com/esloud/eslhwto.html
How to make electrostatic loudspeakers - white paper.

http://www.amasci.com/amateur/whygnd.html
Why three prongs in an AC receptacle.

http://www.amasci.com/miscon/elect.html
Electricity misconceptions - white paper.

http://www.amasci.com/miscon/speed.html
Speed of electricity - white paper.

http://www.amasci.com/amateur/led.txt
How does an LED emit light? - white paper.

http://www.bobblick.com/techref/techref.html
Battery charge, pseudo adc, dtmf decoder, scrolling sign and more

http://www.lowrance.com/Tutorials/sonar/sonar_tutorial_01.asp
Sonar tutorial

http://www.lowrance.com/Tutorials/gps/gps_tutorial_01.asp
GPS Tutorial

http://www.eaglegps.com/tutorial/sonar/default.htm
Sonar tutorial

http://www.eaglegps.com/tutorial/gps/default.htm
GPS Tutorial

http://www.cs.uiowa.edu/~jones/step/
Control of Stepping Motors, A Tutorial

http://www.perry-lake.k12.oh.us/phs/Classdept/ScienceDept/Physics/Tutorials/e_m/dc1/dc.htm
DC Electronics Tutorial

http://www.perry-lake.k12.oh.us/phs/Classdept/sciencedept/physics/tutorials/e_m/mag1/mag1.htm
Magnetics and electromagnetic induction

http://ourworld.compuserve.com/homepages/g_knott/
Electronics for beginners.

http://ledmuseum.home.att.net/
LED museum

http://ledmuseum.home.att.net/
Capacitors tutorial

http://homepage.ntlworld.com/g.knott/index21.htm
Electronics for beginners

http://homepage.ntlworld.com/g.knott/index7.htm
Intermediate electronics

http://courses.ncsu.edu:8020/ece480/common/htdocs/
NCSU electronics tutorials - excellent diagrams and animations.

http://www.colomar.com/Shavano/intro_opamp.html
Introduction to op-amps

http://www.colomar.com/Shavano/intro_opamp.html
Basic electronics: operational amplifiers

http://www.ee.surrey.ac.uk/Personal/D.Jefferies/
Antennas and microwave engineering tutorials.

http://www.epanorama.net/documents/wiring/cable_impedance.html
Describes what is cable characteristic impendance and how to calculate it.

http://www.circuit-magic.com/laws.htm
Basic electrical laws and circuits analysis techniques

http://www.mitedu.freeserve.co.uk/Design/design.htm
Tutorial on circuit design techniques and building blocks.

http://www.williamson-labs.com/480_com.htm
Tutorial Overview of Electronic Communications

http://pweb.netcom.com/~chip.f/Viterbi.html
Describes commonly used forward-error-correction algorithms used in wireless communications. Provides a worked-out example and C-language simulation source code for a digital communications link using the algorithms.

http://www.williamson-labs.com/480_emc.htm
Tutorial on Electro-Magnetic Compatibility

http://www.4p8.com/eric.brasseur/receiv.html
How do radio receivers manage to communicate over huge distances? An explanation of the fundamental mechanism.

http://www.williamson-labs.com/480_opam.htm
Operational Amplifiers Use & Operation. Includes animations.

http://www.radio-electronics.com/
Information and tutorials about all aspects of radio and related electronics components.

http://www.williamson-labs.com/480_555.htm
555 Timer Tutorials

http://www.williamson-labs.com/480_xtor.htm
transistors tutorials

http://members.tripod.com/michaelgellis/tutorial.html
Tutorials for EE's. Mixers, Directional Couplers, Bartlett's Bisection Theorem, Constant Current Sources, Phase-Locked Loop, etc.

http://members.tripod.com/michaelgellis/ads.html
ADS tutorials

http://www.national.com/apnotes/apnotes_all_1.html
Complete list of application notes from National Semiconductor.

http://sss-mag.com/ss.html
The ABCs of Spread Spectrum - A Tutorial on SS

http://www.tek.com/Measurement/cgibin/framed.pl?Document=/Measurement/App_Notes/XYZs/&FrameSet=oscilloscopes
Tektronix guide describing how oscilloscope works and how to take simple measurements.

Amplifiers

http://www.electronics-tutorials.com/amplifiers/tuned-circuits.htm
Tuned circuit amplifiers

http://www.electronics-tutorials.com/amplifiers/buffer-amplifiers.htm
Buffer amplifiers

http://www.electronics-tutorials.com/amplifiers/broad-band-amplifiers.htm
Broad band amplifiers

http://www.electronics-tutorials.com/amplifiers/small-signal-amplifiers.htm
Small signal amplifiers

http://www.electronics-tutorials.com/amplifiers/emitter-degeneration.htm
Emitter degeneration

http://www.electronics-tutorials.com/amplifiers/negative-feedback.htm
Negative feedback

http://www.analog.com/library/techArticles/amplifiersLinear/LogAmps/technote1.html
A 10.7 MHz, 120 dB Logarithmic Amp

http://www.analog.com/library/techArticles/amplifiersLinear/LogAmps/technote4.html
Effect of Signal Waveform on the Transfer Function of a Logarithmic Amp

http://www.analog.com/library/techArticles/amplifiersLinear/LogAmps/technote3.html
Log Amp Applications in Wireless Receive Channels

http://www.analog.com/library/techArticles/amplifiersLinear/LogAmps/rssi.html
Received Signal Strength Indication (RSSI)

http://www.analog.com/library/techArticles/amplifiersLinear/LogAmps/trans_power.html
Transmit Power Control

http://www.analog.com/technology/amplifiersLinear/precisionamps/white_autozero.html
Auto-Zero Amplifiers

http://www.analog.com/library/analogDialogue/archives/33-03/ask28/index.html
Logarithmic Amplifiers - Explained - white paper

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_011
Video amplifier circuit. " Got some questions about video amps. I've seen an NE592 used as a video buffer amp at the end of a 75 ohm line. Used so that the 75 ohm line could drive all kinds of neat processing stuff without affecting the signal (that's what a buffer is after all, right?) Now National Semiconductor makes an LM592 that's also a video amp. Do these two chips cross reference to each other? " They are the same chip. Sources for NE/SE/LM/uA592 include TI, Harris, Philips (Signetics) and Motorola. Be aware that there are 8 and 14 pin versions of it, the difference being that the larger package has two additional gain control pins. It's not really an op-amp, so you can't use feedback to control the gain. Additionally, they're _fast_ circuits, so use a ground plane and ceramic bypassing caps as close as possible to the supply pins. " Also, is there a relatively simple video buffer amp I could make with discrete components? I really don't want capacitive coupling, since video has DC components. " The DC components in video are normally a non-issue. Most video equipment are AC coupled (at least the input), which is the reason why you can't get away without black level clamping if you plan to process the video signal. Nothing is said about the actual voltage levels of the video signal, they are just referenced to the black level which may float anywhere (well if I remember right, you're guaranteed to have less than 1W power dissipation in the terminating resistor with standard video...). A typical video input has a 75 ohm terminating resistor to ground and then the signal is fed to the input buffer via a ~50uF electrolytic cap. (Complete ASCII Circuit)

Design

http://www.designnotes.com/
To the only **Free** Interactive Site on the web for Electronic Design Engineers, Programmers and Enthusiasts to Share, Earn and Learn.

http://www.electronics-tutorials.com/basics/attenuators.htm
Attenuators: design and principles

http://www.channel1.com/users/analog/tutor.html
Analog tutorials and frequently asked questions.
Articles: Noise in PCB Design (16kB) ; Design Techniques (11kB); Passive Components (6kB); Formulas & Numbers (5kB)

http://www.channel1.com/users/analog/noise.html
Noise in PCB design. A guide for PCB designers (white paper).

http://www.channel1.com/users/analog/techniq.html
Design techniques for PCB's.

http://www.smpstech.com/
Switching mode power supply design - collection of resources: tutorials, questions, books, vendors, design aids.

http://www.smpstech.com/tutorial/t00con.htm
Tutorial on switching mode power supply design

http://www.smpstech.com/aids.htm
Links to design aids for power supply design.

Power Supplies

http://www.electronics-tutorials.com/basics/power-supply.htm
Power supplies

http://www.electronics-tutorials.com/basics/power-supply-regulated.htm
Low current regulated power supplies

http://www.electronics-tutorials.com/basics/power-supp-hi-regulated.htm
High current regulated power supplies.

http://www.electronics-tutorials.com/basics/power-supp-variable.htm
Variable power supplies

http://www.electronics-tutorials.com/basics/switched-mode-power-supplies.htm
Switched mode power supplies

http://www.semiconductors.philips.com/acrobat/applicationnotes/AN120.pdf
An overview of switched mode power supplies

http://www.iguanalabs.com/7805kit.htm
Building a 5 V power supply.

http://www.ee.uts.edu.au/~venkat/pe_html/pe07_nc8.htm
Switch mode power supply.

http://www.ee.uts.edu.au/~venkat/pe_html/ch07s1/ch07s1p1.htm
Step-down, SMPS/Buck Converter: Ideal Circuit

http://www.ee.uts.edu.au/~venkat/pe_html/ch07s2/ch07s2p1.htm
Step-down, SMPS/Buck Converter: Practical Circuit

http://www.ee.uts.edu.au/~venkat/pe_html/ch07s3/ch07s3p1.htm
Step-up, switch mode power supply: ideal boost converter.

http://www.smpstech.com/
Switching mode power supply design - collection of resources: tutorials, questions, books, vendors, design aids.

http://www.smpstech.com/tutorial/t00con.htm
Tutorial on switching mode power supply design

http://www.smpstech.com/aids.htm
Links to design aids for power supply design.

Communications

http://www.eevl.ac.uk/vts/elec/index.htm
We're now going to take you on a "site-seeing" tour of Web sites for electrical, electronic and communications engineering.

http://www.electronics-tutorials.com/antennas/antenna-basics.htm
Antenna basic theory.

http://www.electronics-tutorials.com/basics/radio-terminology-M-Z.htm#M.F.
Radio terminology: medium frequency, ohms law, oscillator, low power transmission, signal to noise ratio, single side band, standing wave ratio, S meter, transceiver, transistor, transmitter, ultra high frequency, upper side band, very high frequency, watt, wavelength.

http://my.integritynet.com.au/purdic/dbl_bal_mix.htm
Double balanced mixers

http://www.electronics-tutorials.com/antennas/active-receiving-antennas.htm
Active receiving antennas tutorial

http://www.electronics-tutorials.com/receivers/fm-radio-receivers.htm
FM radio receivers

http://www.electronics-tutorials.com/receivers/receiver-basics.htm
Radio receiver basics

http://www.electronics-tutorials.com/receivers/am-radio-receivers.htm
Tutorial on AM receiver design

http://www.electronics-tutorials.com/receivers/crystal-radio-set.htm
Basic crystal set

http://www.arrl.org/tis/info/pdf/129756.pdf
Crystal radio tutorial
http://www.electronics-tutorials.com/receivers/am-radio-receivers.htm
AM radio receivers

http://www.electronics-tutorials.com/receivers/superhetrodyne-radio-receivers.htm
Syperheterodyne radio receivers

http://www.electronics-tutorials.com/receivers/receiver-basics.htm
Radio receiver basics

http://www.electronics-tutorials.com/receivers/trf-receiver.htm
Tuned radio frequency receivers

http://www.webex.net/~skywaves/xtalset102/headsets.htm
Headsets for crystal radios

http://www.electronics-tutorials.com/receivers/am-radio-receivers2.htm
AM radio receivers - part II

http://www.electronics-tutorials.com/receivers/am-radio-receivers3.htm
AM radio receivers - part III

http://www.electronics-tutorials.com/receivers/regen-radio-receiver.htm
Regenerative radio receivers

http://www.electronics-tutorials.com/receivers/fm-radio-receivers2.htm
FM radio receivers - part II

http://www.primenet.com/~ctrask/actant.html
Active antenna references

http://www.electronics-tutorials.com/antennas/antenna-diplexer.htm
Antenna diplexer

http://my.integritynet.com.au/purdic/passive-antenna-reradiators.htm
Passive antenna re-radiators to function as Q multipliers

http://www.analog.com/library/techArticles/dataConverters/pdf/AD9854_tech_note.pdf
800 to 2500 MHz Single-Sideband Upconversion of Quadrature DDS Signals (white paper - 5 pages)

http://www.analog.com/library/analogDialogue/archives/30-3/single_chip.html
Single-Chip Direct Digital Synthesis vs. the Analog PLL - white paper

http://www.analog.com/library/whitepapers/dsp/content.html
Discrete Multitone (DMT) vs. Carrierless Amplitude/ Phase (CAP) Line Codes
This paper describes why discrete multitone (DMT) modulation is the best choice for asymmetric digital subscriber lines (ADSL), and why the international experts and standards bodies chose DMT when they analyzed the matter. In terms of communications speed, bandwidth efficiency, spectral compatibility, performance, robustness and power consumption, DMT is a better choice than alternative single-carrier technologies.

http://www.analog.com/library/whitepapers/dsp/xDSL.html
Status and Issues in xDSL - white paper.

http://www.einsite.net/ednmag/index.asp?layout=article&stt=000&articleid=CA220399&pubdate=6/13/2002
Fractional-N synthesis improves reference-frequency implementations.

Advances in fractional-N synthesis and digital-temperature-sensor accuracy improve frequency stability for reference-frequency implementations at a reduced cost and current consumption.

http://www.analog.com/library/analogDialogue/archives/33-03/phase/index.html
Phase-locked loops for high-frequency receivers and transmitters - Part 1

http://www.borg.com/~warrend/guru.html
How to become an antenna guru.

http://www.scott-inc.com/
A variety of short articles concerning antennas, grounding, dB conversion and more.

http://www.scott-inc.com/html/timesync.htm
Pulse delay circuit for sub-second timing adjustment. The TIMESYNC allows you to tweak your radio automation PC time to network time with .1 second granularity rather than integer seconds.

http://www.scott-inc.com/html/fmant.htm
Will a new FM antenna help my coverage? - white paper

http://www.scott-inc.com/html/80db.htm

Breaking the 80 dB barrier with the LOW-LOSS AM band notch filter...

AM NRSC Measurements with a spectrum analyzer

http://www.scott-inc.com/html/nrsc.htm
NRSC AM bandwidth measurements with the loop antenna

http://www.scott-inc.com/html/nist.htm
Measuring E-fields 25-1000 MHz with the NIST dipole-detector.

http://www.scott-inc.com/html/eri.htm
Field tuning ERI (and other slug-tuned) FM broadcast antennas.

http://www.scott-inc.com/html/ufer.htm
A new look at the Ufer ground system

http://www.scott-inc.com/html/smith.htm
Exploring the secrets of the Smith chart* - an indispensable tool

http://www.scott-inc.com/html/gpsant.htm
Adventures in amplified GPS antenna construction; an experiment...

http://www.rfglobalnet.com/content/misc/sitemap.asp

a nice variety of radio frequency, microwave, electronics and miscellaneous technical articles and information

http://www.wa4dsy.net/

RF modem technical paper: theory of operation including schematics for this 56K digital device

http://www.ee.washington.edu/circuit_archive/circuits/activeant.html
AM/FM/SW active antenna

http://www.sweethaven.com/acee/forms/frm0102.htm
AC Waveforms: Amplitude of a sinusoidal waveform

http://www.ee.washington.edu/circuit_archive/circuits/yagi.txt
Build a Yagi-Uda antenna
Often one needs to improve reception of a particular radio or television station. One effective way to do this is to build a Yagi-Uda, or Yagi, antenna. This is a traveling-wave structure which, as the number of elements increases, has improved directivity, gain, and front-to-back ratio (and additional sidelobes). The basic antenna is composed of one reflector (in the rear), one driven element, and one or more directors (in the direction of transmission/reception). The "zero-order" version of the Yagi has all elements one-half wavelength long and spaced one-quarter wavelength apart. The two designs presented here - a 3-element and a 6-element antenna - have been optimized for improved all-around performance, so their lengths and spacings are non-uniform. Each design's parameters (element lengths and spacings) are given in terms of wavelength, so an antenna for any given frequency is easy to design. Moreover, these antennas' gains rise slowly up to the design frequency and fall off sharply thereafter. It is therefore easier (and smarter) to make the design frequency a little higher (dimensions a little smaller) than desired, so that the antenna will work despite "manufacturing tolerances". One final note: all the following performance figures are theoretical calculations! That means, for instance, that the actual gain will be slightly less than that given.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_IR.html#ASCIISCHEMIR_005
Build an Infrared Night Scope
IR-related ASCII Schematics V1.00 -- Building a night scope is easy if you have the heart of it which is the image intensifier part. I would recommend using the PVS-5 module that uses 'MCP' or Micro Channel Plate technology. This is a U.S. 2nd generation device and is rated at 15,000 times light gain. The resolution is one of the best on the market. It was used in Desert Storm and released to the surplus market about 2 1/2 years ago. However, it can't be exported out of the U.S. (The device can be found for between $350 to $700 depending on the quality you want in terms how new it is or if it used. I will list a couple of vendors at the end. I have built several of these scopes with and without targeting lasers. The laser will kill your battery in no time and I recommend not using one for normal use as the PVS-5 has excellent response without it (unless you want to scare the crap out of someone in total darkness running around your yard. Just put a laser dot on his forehead and let him figure out where it came from and what is at the end of it like a 30.30 :-) (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/transmit.html
Small radio transmitter. This ZIP file contains information about building a small radio transmitter, which has a PCB 1.75" x 2.5" (45mm x 68 mm) and has a range of about 30 yards or so. The documentation with the circuit says the freq range is 100-108 MHz, but I have found it to be more like 85-100 MHz. The circuit is (of course) only mono, and accepts an audio input from either a microphone or other source. The input impedance is 1Mohm. The input sensitivity is 5mV and the max input signal is 10mV. The transmitted signal can be picked up on a FM radio. The circuit can be used for short-range transmission, eg. for wireless microphones.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_Tel.html#ASCIISCHEMTEL_010
Use old phones as an intercom. Telephone-related ASCII Schematics V1.01 -- (Complete ASCII Circuit)

http://www.williamson-labs.com/480_com.htm
Tutorial Overview of Electronic Communications

http://pweb.netcom.com/~chip.f/Viterbi.html
Describes commonly used forward-error-correction algorithms used in wireless communications. Provides a worked-out example and C-language simulation source code for a digital communications link using the algorithms.

http://www.4p8.com/eric.brasseur/receiv.html
How do radio receivers manage to communicate over huge distances? An explanation of the fundamental mechanism.

http://www.radio-electronics.com/
Information and tutorials about all aspects of radio and related electronics components.

http://members.tripod.com/michaelgellis/tutorial.html
Tutorials for EE's. Mixers, Directional Couplers, Bartlett's Bisection Theorem, Constant Current Sources, Phase-Locked Loop, etc.

http://members.tripod.com/michaelgellis/ads.html
ADS tutorials

http://we.home.agilent.com/cgibin/bvpub/agilent/search/r2v2/generalSearchResults.jsp?prevSearchString=&prevSearchInterestArea=&LANGUAGE_CODE=eng&NAV_ID=11144.0.00&COUNTRY_CODE=US&searchString=application+notes&searchInterestArea=000&search_for_go=Go
Agilent application notes. AM, ATM/Parallel Test Systems, Acoustic, Agilent function generators, amplifiers, amplitude modulation, anechoic chamber, synthesizers, battery testing, CDMA, coaxial systems, communications, compliance testing, component test, crystals, data acquisition, group delay, digital communications, digital modulation, oscilloscopes, distortion, electronic counter measures, electronic warfare, error analysis, fiber optics, Fourier analysis, frequency modulation, GSM 900, LCR meters, lightwave, logic analyzers, manufacturing, materials measurement, microwave, mixers, mobile radio, RF, network analyzer, noise figure, noise, oscillators, phase linearity, phase modulation, phase noise testers, phase shift modulation, phase stability, phase locked loops, power meters, power transistors, radar, protocol analysis, receivers, reflectometers, s-parameters, satellite communications, semiconductors, signature analysis, Smith chart, spectrum analysis, standards, stripline, system verification, TDMA, television, telecommunications, transistors, vector measurements, video, voltage controlled oscillators, wireless communications

http://e-www.motorola.com/brdata/PDFDB/docs/AN1539.pdf
An IF communication circuit tutorial from Motorola.

http://sss-mag.com/ss.html
The ABCs of Spread Spectrum - A Tutorial on SS

Transformers

http://www.electronics-tutorials.com/basics/baluns.htm
Balun transformers

http://www.electronics-tutorials.com/basics/audio-transformers.htm
Audio transformers

http://www.electronics-tutorials.com/basics/transformers.htm
Transformers

http://www.electronics-tutorials.com/filters/if-amplifier-transformers.htm
IF amplifier transformers

http://www.electronics-tutorials.com/basics/wide-band-rf-transformers.htm
Wide band RF transformers

http://www.sweethaven.com/acee/forms/frm0502.htm
Transformer ratios. When you complete this module, you should be able to: Cite the equation for the voltage-turns ratio of a transformer. Describe exactly how the turns ratio of a transformer is related to its voltage ratio. Explain the meaning of the terms step-up transformer and step-down transformer. Cite the equation for the current-turns ratio of a transformer. Describe exactly how the turns ratio of a transformer is related to its current ratio. Cite the equation for the current-voltage ratio of a transformer. Describe exactly how the current ratio of a transformer is related to its voltage ratio.

Filters

http://www.electronics-tutorials.com/filters/band-pass-filters.htm
Band-pass filters

http://www.electronics-tutorials.com/filters/if-amplifier-filters.htm
IF amplifier filters

http://www.electronics-tutorials.com/filters/high-pass-filters.htm
High-pass filters

http://www.electronics-tutorials.com/filters/low-pass-filters.htm
Low-pass filters

http://www.electronics-tutorials.com/filters/active-bandpass-filters.htm
Active band-pass filters

http://www.electronics-tutorials.com/filters/filters.htm
LC filters

http://www.electronics-tutorials.com/filters/trap-filter.htm
Harmonic trap filters

http://www.electronics-tutorials.com/filters/filters.htm
Filters tutorial site

http://www.electronics-tutorials.com/filters/antenna-pre-selector-filters.htm
Antenna pre-selector filters

http://www.electronics-tutorials.com/filters/narrow-band-filters.htm
Narrow-band filters

Courses

http://ourworld.cs.com/gknott5413/
Access to two courses: 1. Electronics for Beginners, 2. Intermediate Electronics

http://www.ee.duke.edu/~cec/final/final.html
electrical engineering for beginners (class notes)

http://zebu.uoregon.edu/~imamura/203/
class notes and study guide in raw form

http://ece-www.colorado.edu/~pwrelect/book/slides/slidedir.html
pdf files loaded with graphs, theory and math, intended for classroom use with engineering textbook

http://www.st-and.ac.uk/~www_pa/Scots_Guide/intro/electron.htm
This course is designed to help you learn about components, circuits, and the use of electronics. You can explore the contents in whatever order you wish. The emphasis is on providing information starting at the 'absolute beginners' level, but we hope eventually to provide material of use to anyone interested in electronics and its applications .

Topics covered include:
A
Amplifier - simple JFET amp
Amplifiers and Power
Amplifier Classes (A, B, and AB) and their limitations
Amplitude Modulation and Demodulation
AM Waves and their spectrum
Analog Signals
Analog to Digital Conversion
ASCII Code
Antennas
Antenna Arrays
Audio and Analog
Audio Amplifiers

B
Barkhausen Criterion (for oscillators)
Beam/Waveguide Coupling
Black and White TV
Binary Logic and Switches
Bipolar Transistors
Bits
Bi-Wiring Loudspeakers
Broadcasting
Buffers

C

D

T
Terahertz Heterodyne Receivers
Transconductance of a JFET
Transformers in power supplies
Transformers and Inductors
Transmission Line
Twin Feeder EH Field Patterns
Twin Feed and Loudspeakers (Java model)

V
Variable Resistors
Video Signals
Voltage Amplifiers

W
Waveguide
Waveguides and Modes
Whip Antennas

Y
Yagi-Uder Antennas

Z
Zener Diodes and d.c. stabilisation

http://www.electronics2000.com/basics/basics.html
Basics of electronics - part I
Contains: What is electricity, basic atom structure, charge fundamentals, COULOMB'S LAW OF ELECTROSTATIC FORCES, more laws, Source of Electricity and Common acceptable units of measurement used in Electronics, What is VOLT, EMF, AMP, OHM, WATT, CONDUCTORS, SEMICONDUCTORS and INSULATORS, RESISTANCE, How to measure Gauge in wire, Resistor basics.

http://www.electronics2000.com/basics/basics2.html
Basics of Electronics - part II
Contains: Understanding Basic Circuits, and studying the relationships between resistance, volts and amperes. More on WATTAGE. Conductance / MHOS / Siemens, more laws, series and parallel circuits and more.

http://www.electronics2000.com/basics/basics3.html
Basics of Electronics - part III
Contains: The theory behind a Wheatstone Bridge Circuit, Switching, magnetism, permeability, magnetic induction and shielding, ANGLE of DECLINATION or VARIATION, magnetic laws, retentivity, residual magnetism, FERROMAGNETIC materials, PARAMAGNETIC materials, DIAMAGNETIC materials, FLUX, and much more...., RELAYS, Introduction to A/C.

http://www.electronics2000.com/basics/basics4.html
Basics of Electronics - Part IV

Contains: A/C Frequency Information, laws and some History flashbacks, wavelength calculation table, RF/Microwave Terminology - Glossary of Wireless, RF and Microwave Terms, and lot's of terms and some formulas and pictures. GENERATORS, ALTERNATORS AND DYNAMO.

http://www.electronics2000.com/basics/chapter5.html
Basics of Electronics - Part V
Contains: METERS AND INSTRUMENTS, OSCILLOSCOPE (what is rectification, briefly), MEASUREMENT OF AC AND DC, DIGITAL MULTIMETERS.

http://www.electronics2000.com/basics/chapter6.html
Basics of Electronics - Part VI
Contains: INDUCTANCE/what it is, the Theory of how a diode works.

http://www.electronics2000.com/basics/chapter7/index.html
Basics of Electronics - Part VII
Contains so far: Continuation of INDUCTANCE related component explanations (TRANSFORMER) and other information. Explained what MUTUAL INDUCTION is, how induction is measured in the unit of H = HENRYS. Named the coil windings parts. What COUPLING is.

http://www.electronics2000.com/basics/chapter8/index.html
Basics of Electronics - Part VIII
Contains so far: What capacitance is, technical explanation of a capacitor, how it works and general capacitance tutorial. Also take a look at the Technical Specifications of Capacitors.

http://ourworld.compuserve.com/homepages/g_knott/index12.htm
Course on operational amplifiers

http://www.csupomona.edu/~apfelzer/
Classes in basic electronics, circuit analysis, discrete systems in PDF format and interactive computer demos.

http://science-ebooks.com/electronics/basic_electronics.htm
Basic Electronics is an online E-book covering subjects from ohms law to logic circuits. Lots of animation and troubleshooting simulations included.

Products and Materials

http://www.eio.com/stepindx.htm
EIO is a source associating information with the distribution of electronics, computer and optical materials. Technical forums on liquid crystal displays, charge couple devices, stepper motors, lasers, laser light shows, micro controllers, holography, fiber optics, electro-optics and ECSC products consist of a body of information and a hyper-email discussion group. There are catalogues of products, details of events, and links to sites of related interest.

Soldering

http://www.epemag.wimborne.co.uk/solderfaq.htm
Basic soldering guide

http://www.epemag.wimborne.co.uk/solderpix.htm

The ***Basic Soldering Guide Photo Gallery*** is a high quality photo sequence to show you how to make the perfect solder joint; "dry joints" and more "hot tips"!

http://www.epemag.wimborne.co.uk/
Everyday Practical Electronics Magazine is based in Dorset, UK. It specializes in electronics technology and computer projects. The site includes links to related pages. There are details of how to subscribe to the magazine. Resources such as a guide to soldering, user applications for TENS and information on intelligent LCDs is provided.

http://www.electronics-tutorials.com/basics/soldering.htm
Soldering techniques

High Temperature Electronics

http://www.hiten.com/
The High Temperature Electronics Network of Excellence (HITEN) was launched in 1992 as part of the European Unions information technologies research and technological development program (Esprit). Its main objectives include the dissemination of information concerning high temperature electronics, the demonstration of devices and systems operating at temperatures greater than 125°C, and the development of an education and training base within Europe for high temperature electronics. The web server includes background information about HITEN, articles from the HITEN bi-monthly newsletter, lists of relevant conferences, and pointers to related sites. A WWW version of the HITEN technical and bibliographic database is available on a subscription basis.

Power Electronics

http://www.pels.org/pels.html
The Power Electronics Society is part of the IEEE, based in the USA. It specializes in the development and application of power electronics technology, for example in cars, computers, microwave ovens, telephones, stereos, or power tools. The site includes basic descriptions of the operation of power electronic devices and their applications. Issues of the society newsletter are available on-line, as is a list of contents for technical papers in the Transactions journal. Events and conferences are listed along with links to conference web sites. Membership information is provided.

http://www.ee.uts.edu.au/~venkat/pe_html/ch01/ch01_p1.htm
Introduction to power electronics.

http://www.ee.uts.edu.au/~venkat/pe_html/pe03_nc2.htm
Simple SCR circuits.

http://www.ee.uts.edu.au/~venkat/pe_html/pe03_nc2.htm
Simple SCR circuits.

http://www.ee.uts.edu.au/~venkat/pe_html/pe04_nc6.htm
Fully controlled one phase SCR bridge rectifier.

http://www.ee.uts.edu.au/~venkat/pe_html/pe05_nc6.htm
Fully controlled three phase SCR bridge rectifier.

http://www.ee.uts.edu.au/~venkat/pe_html/pe06_nc2.htm
Semi-controlled rectifiers.

http://www.ee.uts.edu.au/~venkat/pe_html/pe07_nc8.htm
Switch mode power supply.

http://www.ee.uts.edu.au/~venkat/pe_html/ch07s1/ch07s1p1.htm
Step-down, SMPS/Buck Converter: Ideal Circuit

http://www.ee.uts.edu.au/~venkat/pe_html/ch07s2/ch07s2p1.htm
Step-down, SMPS/Buck Converter: Practical Circuit

http://www.ee.uts.edu.au/~venkat/pe_html/ch07s3/ch07s3p1.htm
Step-up, switch mode power supply: ideal boost converter.

http://www.ee.uts.edu.au/~venkat/pe_html/contents.htm
a detailed theory of operation for diode and SCR based dc converters in single and three phase applications

http://www.irf.com/technical-info/guide/
basic circuit and power semiconductor applications and theory

http://www.analog.com/library/whitepapers/dataConverters/pdf/solid_state.pdf
Solid state solutions for electricity metrology.

http://www.analog.com/library/analogDialogue/archives/33-02/power/index.html
All-Electronics Power and Energy Meters - white paper

http://www.analog.com/library/techArticles/marketSolutions/motorControl/pdf/ADI_Tech_Paper.pdf
High efficiency, Low Cost, Sensorless Motor Control - white paper - 8 pages.

http://www.e-insite.net/ednmag/index.asp?layout=article&articleId=CA46325
Modify your switching-supply architecture for improved transient response.
By taking a different approach to switching-supply design, you can develop an architecture that improves overall supply performance in critical transient specifications.

http://www.analog.com/library/techArticles/dataConverters/pdf/substitute_soic8.pdf
The Do's and Don’ts When Substituting SOIC-8 Voltage Reference.

http://www.analog.com/library/techArticles/dataConverters/pdf/Publication_V-Ref.pdf
Voltage References and Low Dropout Linear Regulators - 57 pages white paper.

http://www.smpstech.com/
Switching mode power supply design - collection of resources: tutorials, questions, books, vendors, design aids.

http://www.smpstech.com/tutorial/t00con.htm
Tutorial on switching mode power supply design

http://www.smpstech.com/papers/index.htm
Collection of links to power electronics papers.

http://ece-www.colorado.edu/~pwrelect/publications.html

Publications of the Colorado Power Electronics Center.

http://www.smpstech.com/aids.htm
Links to design aids for power supply design.

http://www.cs.uiowa.edu/~jones/step/
Control of Stepping Motors, A Tutorial

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_PC.html#ASCIISCHEMPC_005
Filtering a PC bus power. PC/Logic-related ASCII Schematics V1.00 -- (Complete ASCII Circuit)

Printed Circuit Boards (PCB's)

http://www.insidelectronics.com/
Inside electronics is the Inside Communications Electronics Group website which comprises electronic versions of the magazines The Good PCB Guide, Electronic Production, Test and its related Exhibition.
Electronic Production concentrates on the assembly of components and PCBs into functioning circuit boards. Test covers all aspects of electronics testing and design verification at wafer, board and system level, while The Good PCB Guide considers all aspects of the design, manufacture and marketing of PCBs. It also takes a view on the global business climate as it pertains to PCB fabrication.
All three titles offer an indication of the current issue's features, together with an archive of full-text items from past issues. A news section and a services directory are also available. On the Electronic Production and Test pages, buyers guides are given, while the Electronic Production site also contains an encyclopedia covering all aspects of electronic production.
Keywords: *electronics assembly, PCB assembly, printed circuit boards*

http://www.iguanalabs.com/breadboard.htm
Using a breadboard.

http://www.channel1.com/users/analog/tutor.html
Analog tutorials and frequently asked questions.
Articles:
Noise in PCB Design (16kB)
Design Techniques (11kB)
Passive Components (6kB)
Formulas & Numbers (5kB)

http://www.channel1.com/users/analog/noise.html
Noise in PCB design. A guide for PCB designers (white paper).

http://www.channel1.com/users/analog/techniq.html
Design techniques for PCB's.

http://www.williamson-labs.com/480_prot.htm
Prototyping/Breadboarding Tutorial

Projects

http://www.epemag.wimborne.co.uk/
Everyday Practical Electronics Magazine is based in Dorset, UK. It specializes in electronics technology and computer projects.

The site includes links to related pages. There are details of how to subscribe to the magazine. Resources such as a guide to soldering, user applications for TENS and information on intelligent LCDs is provided.

http://my.integritynet.com.au/purdic/lc-meter-project.htm
Describes, including parts list, how to build an LC meter.

http://www.lerc.nasa.gov/Other_Groups/K-2/Sample_Projects/Ohms_Law/ohmslaw.html
NASA Ohms Law Page

http://www.electronics-tutorials.com/test-equip/test-equip.htm
Links to web sites that show how to build test equipment projects.

http://www.iguanalabs.com/7805kit.htm
Building a 5 V power supply.

http://www.boondog.com/tutorials/tutorials.htm
complete project plans & instructions for 8255, printer port and infrared I/O boards
http://hem2.passagen.se/sm0vpo/
Well documented projects for antennas, receivers, transmitters and other RF related circuits.

http://www.geocities.com/CapeCanaveral/5322/
Complete DC solid state load, AC inverter, HV pulse generator projects and more.

http://www.halcyon.com/sciclub/kidproj1.html
Links to kid's science projects, including some related to electronics.

http://headwize.com/projects/noise_prj.htm
Wave canceling headphones project.

Oscillators

http://www.electronics-tutorials.com/oscillators/voltage-controlled-oscillators.htm
Voltage controlled oscillators

http://www.electronics-tutorials.com/oscillators/oscillators.htm
Oscillators tutorial site

http://www.electronics-tutorials.com/oscillators/oscillator-basics.htm
Principles of oscillator operation

http://www.electronics-tutorials.com/oscillators/hartley-oscillator.htm
Hartley oscillator

http://www.electronics-tutorials.com/oscillators/colpitts-oscillators.htm
Colpitts oscillators

http://www.electronics-tutorials.com/oscillators/crystal-oscillators.htm
Crystal oscillators

http://www.electronics-tutorials.com/oscillators/crystal-grinding.htm
Crystal grinding

http://www.electronics-tutorials.com/oscillators/oscillator-drift.htm
Oscillator drift

http://www.electronics-tutorials.com/oscillators/drift-correction.htm
Drift correction circuits

http://www.electronics-tutorials.com/oscillators/clapp-oscillators.htm
Clapp oscillators

http://www.iguanalabs.com/555kit.htm
Pulses, oscillators, clocks.

http://www.wenzel.com/oscillators.html
Crystal oscillator information

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_IR.html#ASCIISCHEMIR_002
Cheap 40 kHz clock
IR-related ASCII Schematics V1.00 -- Use a 40KHz Xtal and a 74C14 schmitt trigger: This circuit has worked for me in many applications. (it might be an idea to buffer the signal before using it. (There are still 5 unused gates in the 'C14.. :-) (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_004
CMOS oscillator circuit
What I am looking for is a low power oscillator (<.5 mA @ 5V) running at a frequency of roughly 1 MHz. However, the frequency-determining component should be an inductor with a value of approx. 75 uH The circuit below uses a single CMOS low speed 74C14 inverting Schmitt trigger chip, your 75uH inductor, and two 10K resistors. It draws about 400uA and oscillates at about 4MHz. The oscillator period will be approximately linearly related to the inductor value, Period ~=~ K1 + (K2 * L) [Note also that K1 will not be zero] (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_008
Crystal 32.768 kHz CMOS Oscillator
Try a Pierce oscillator, with the following specific component values: (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_009
Crystal oscillator circuit.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_010
FM oscillator circuit. Here's a dandy circuit for a VCO and buffer that operates across the entire FM broadcast band (88-108 MHz). I stole the main idea from the local oscillator in a radio shack scanner (pro2004). I like this design because it doesn't require a tapped coil, it tunes very broadly, it's stable, and it has a nice, hot output. (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem_IR.html#ASCIISCHEMIR_003
A very stable 40 kHz generator. IR-related ASCII Schematics V1.00 -- A circuit that I have used before is based on the CD4060 (14stage binary counter) and a 640Khz ceramic resonator. The CD4060 is basically an oscillator and a ripple counter to divide the 640khz down to something more usable. A nice part about this circuit is that it delivers a STABLE 40khz signal, as well as delivering several other frequencies that can be used to modulate the 40khz carrier. For example, the person that designed this circuit (Ken Boone, member of Triangle Amateur Robotics) used it to build several beacons in his yard to serve as navigation

points for a robotic lawnmower. By diode-OR'ing the results of the 40khz carrier and one of the lower frequencies (such as the 125Hz) line to drive a ring of IR-LEDs, he could locate the beacon and tell which, of several, beacons he had found. This circuit has proven to be VERY stable, and is fairly inexpensive (about $1.50 for the CD4060 and 640Khz ceramic resonator). (Complete ASCII Circuit)

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_016
Ultrasonic transducer oscillator circuit. Allows the transducer to oscillate at its self-resonating point, with no tedious setup. (Complete ASCII Circuit)

Resistors

http://www.electronics-tutorials.com/basics/resistor-color-code.htm
Resistor color code

http://www.iguanalabs.com/resistors.htm
Resistor color codes.

http://www.williamson-labs.com/resistors.htm
Basics: Resistors

Capacitors

http://www.electronics-tutorials.com/basics/working-voltage-capacitance.htm
Capacitor working voltage and dielectric strength.

http://www.electronics-tutorials.com/basics/energy-stored-capacitor.htm
Energy stored in a capacitor

http://www.electronics-tutorials.com/basics/modern-capacitors.htm
Modern capacitors

http://www.electronics-tutorials.com/basics/polarization-capacitor.htm
Polarization of capacitors

http://www.faradnet.com/deeley/book_toc.htm
Electrolytic capacitors - theory, construction, characteristics and applications. Free on-line book.

http://www.capacitors.com/consider/consider.htm
Considerations for high performance capacitors

http://www.twysted-pair.com/capidcds.htm
Capacitor identification codes.

http://www.electronics2000.com/basics/chapter8/technical.html
Technical specifications of capacitors

http://www.sweethaven.com/acee/forms/frm0803.htm
Capacitance Formulas
When you complete this module, you should be able to: Cite the units of measure and common ranges of values for capacitance. Describe how charge, capacitance, and voltage are related in a capacitor circuit.

Calculate the amount of charge on a capacitor, given the values of capacitance and voltage. Define the term dielectric constant. Describe how the common area of the plates of a capacitor affect its capacitance value. Describe how the spacing of the plates of a capacitor affect its capacitance value. Calculate the value of a capacitor, given the values for plate area, plate spacing, and the dielectric constant.

http://www.sweethaven.com/acee/forms/frm1102.htm
Capacitive Reactance Equation
When you complete this module, you should be able to: Cite the equation for determining the value of capacitive reactance, given the values of applied frequency and capacitance. Solve the equation, given two of the three variables.

http://www.sweethaven.com/acee/forms/frm0802.htm
Capacitor Action
When you complete this module, you should be able to: Describe the meaning of charging capacitor and discharging a capacitor. Explain how AC current flows in a capacitor circuit, but with none flowing through the capacitor, itself.

http://www.sweethaven.com/acee/forms/frm1003.htm
Capacitor charging events
When you complete this module, you should be able to: Explain the meaning of instantaneous capacitor voltage. Describe each of the terms in the equation for determining the instantaneous capacitor-charging voltage in an RC circuit. Calculate the instantaneous capacitor charge voltage. Describe each of the terms in the equation for determining the instantaneous capacitor-charging current in an RC circuit. Calculate the instantaneous capacitor charge current. Describe the curves for instantaneous resistor voltage and current in a capacitor-charging circuit.

http://www.sweethaven.com/acee/forms/frm1105.htm
Current and voltage in Xc circuits. When you complete this module, you should be able to: Describe the fact that the current of a capacitor always leads the voltage across the capacitor by 90 degrees. Sketch a vector diagram showing how the current leads the voltage.

http://www.sweethaven.com/acee/forms/frm0801.htm
Introduction to capacitance. When you complete this module, you should be able to: Define the term dielectric. Define capacitance in terms of two conductors and a dielectric. Cite some common dielectric materials. Describe how an electrical charge is stored in a dielectric material. Define the terms electrostatic field. Describe how electrostatic induction affects the charge on a capacitor.

http://www.sweethaven.com/acee/forms/frm1106.htm
Power in X_C circuits. When you complete this module, you should be able to: Describe how AC power is absorbed by a capacitor for one-quarter cycle, then returned to the circuit during the next quarter cycle. Describe the differences between power in a resistor circuit and apparent power in a capacitor circuit.

http://www.sweethaven.com/acee/forms/frm1002.htm
RC time constant. When you complete this module, you should be able to: Describe the equation for determining the time constant of a series RC circuit. Calculate the RC time constant of a circuit. Explain the significance of the percentage value 63.2% in the process of charging a capacitor through a resistance. Explain why a capacitor is considered fully charged at the end of 5 time constants. Calculate the amount of voltage on a capacitor after it has charged a given number of time constants. Explain the significance of the percentage value 63.2% in the process of discharging a capacitor through a resistance. Explain why a capacitor is considered fully discharged at the end of 5 time constants. Calculate the amount of voltage on a capacitor after it has discharged a given number of time constants.

http://www.sweethaven.com/acee/forms/frm1103.htm
Series and parallel X_C. When you complete this module, you should be able to: Explain the meaning of each term in the equation for total capacitive reactance in a series circuit. Calculate the total capacitive reactance of a series circuit, given the values of the individual reactances. Explain the meaning of each term in the equation for total capacitive reactance in a parallel circuit. Calculate the total capacitive reactance of a parallel circuit, given the values of the individual reactances.

http://www.sweethaven.com/acee/forms/frm0903.htm
Series capacitor circuits. when you complete this module, you should be able to: Cite the equation(s) for calculating the total capacitance of a series circuit. Explain how total capacitance decreases with the number of capacitors connected in series. Calculate the total capacitance of a series circuit, given the values of individual capacitors. Describe how the voltage across each capacitor is inversely proportional to the value of the capacitor. Describe how the charge and discharge current is the same for each capacitor in a series circuit.

http://www.sweethaven.com/acee/forms/frm1302.htm
Series LC circuits. When you complete this module, you should be able to: Describe how to determine the total reactance of a series LC circuit. Sketch the vector diagram for the total reactance of a series LC circuit. Describe how to use Ohm's Law to calculate the total reactive current in a series LC circuit. Explain how to determine the total reactive voltage and the voltages across the individual reactances in a series LC circuit. Sketch a vector diagram for the voltages in a series LCcircuit. Describe how the current through a series LC circuit is maximum when $X_L = X_C$.

http://www.sweethaven.com/acee/forms/frm1202.htm
Series RC circuits. When you complete this module, you should be able to: Define the impedance of an RC circuit. Cite the equation for calculating the impedance of an RC circuit in terms of R and X_C. Calculate the value of impedance for a series RC circuit, given the values of R and X_C. Discuss the fact that the total voltage in a series RC circuit is greater than the sum of voltages across R and C. Cite the equation for determining the total voltage for a series RC circuit. Calculate the total voltage for a series RC circuit. Cite two different equations for determining the total phase angle for a series RC circuit. Calculate the total phase angle of a series RC circuit. Describe what is meant by a complete analysis of a series RC circuit. Completely analyze a series RC circuit.

http://www.alaska.net/~research/Net/NDRCElec.htm
X_C and Ohms Law. When you complete this module, you should be able to: Cite Ohm's Law for capacitive reactance. Explain how Ohm's Law for X_C is similar to Ohm's Law for R. Use Ohm's Law to solve for voltage, current, or capacitive reactance for a capacitor. Solve Ohm's Law for capacitance, given values of f and L rather than X_C.

http://www.amasci.com/emotor/cap1.html
How capacitors really work. - white paper.

http://ledmuseum.home.att.net/
Capacitors tutorial

http://www.capacitors.com/pickcap/pickcap.htm
Choosing capacitors

http://www.williamson-labs.com/480_rlc-c.htm
Capacitors: What are they good for?

Inductors

http://www.electronics-tutorials.com/basics/mobius-winding.htm
Special winding techniques

http://www.electronics-tutorials.com/basics/toroids.htm
Toroids

http://www.electronics-tutorials.com/basics/chokes.htm
Chokes

http://www.electronics-tutorials.com/filters/filters.htm
LC filters

http://www.electronics-tutorials.com/basics/coil-forms.htm
Coil formers and cores

http://www.sweethaven.com/acee/forms/frm0605.htm
Current and voltages in X_L circuits. When you complete this module, you should be able to: Describe the fact that the current through an inductor always lags the voltage across the inductor by 90 degrees. Sketch a vector diagram showing how the current lags the voltage.

http://www.sweethaven.com/acee/forms/frm0201.htm
Introduction to inductance. When you complete this module, you should be able to: Express in words Faraday's Law for a straight wire. Cite the meaning of each term in the mathematical expression of Faraday's Law for a straight wire and for a coil of wire. Express Lenz's Law in a single sentence.

http://www.sweethaven.com/acee/forms/frm0601.htm
Introduction to inductive reactance. When you complete this module, you should be able to: Define inductive reactance. Describe the effect that inductive reactance has upon the amount of current flowing in an AC circuit.

http://www.sweethaven.com/acee/forms/frm0602.htm
Inductive reactance formula. When you complete this module, you should be able to: Cite the equation for determining the value of inductive reactance, given the values of applied frequency and inductance. Solve the equation, given two of the three variables.

http://www.sweethaven.com/acee/forms/frm0705.htm
Power in R-L circuits. When you complete this module, you should be able to: Sketch the AC waveforms for power, voltage, and current in a series RL circuit.

http://www.sweethaven.com/acee/forms/frm0606.htm
Power in X_L circuits. When you complete this module, you should be able to: Describe how AC power is absorbed by an inductor for one-quarter cycle, then returned to the circuit during the next quarter cycle. Explain the meaning of each term in the equation for instantaneous power in an AC inductor circuit. Describe the differences between power in a resistor circuit and apparent power in an inductor circuit.

http://www.sweethaven.com/acee/forms/frm0703.htm
Q of an inductor. When you complete this module, you should be able to: Explain the meaning of the Q, or merit, of an inductor. Calculate the Q of an inductor. Describe how the Q of an inductor changes with

the operating frequency. Describe the effects that the internal resistance of a coil has upon the Q of the coil.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_002
Quiz - Show inductor circuit. Here's a simple, cheap circuit that will let you conduct your very own quiz shows. It has a lamp and a button for each player. When a button is pressed, it lights that player's lamp and locks out the other button until the circuit is reset. Circuit Description: When the circuit is first powered up (or after a reset -- same thing), both SCR gates are held at ground potential by R1 and R6. Therefore, neither SCR will latch up, and both lamps will be off. When one of SW1 or SW2 is pressed, the corresponding SCR's gate is pulled high, so the SCR latches on. Even if the switch is released, the SCR remains latched, keeping the lamp illuminated. Diodes CR1 and CR2 ensure that only one lamp may be on at a time. Once an SCR turns on, it forces the other SCR's gate to remain at a low voltage, even if its switch is pressed. It is probably possible to change the bulbs and the power supply to 12V with no other circuit changes, but I have only built a 6V system. The circuit does not draw current when the lamps are off, so it may be battery powered with no additional cutoff switch. I built the whole thing in a plastic shoebox. Serving Suggestion: These are great fun in elementary school classes, and as the whole thing can be built for about $5, it's well worth letting the kids have fun while they destroy it! (Complete ASCII Circuit)

http://www.sweethaven.com/acee/forms/frm0402.htm
RL time constant. When you complete this module, you should be able to: Describe the equation for determining the time constant of a series RL circuit. Calculate the L/R time constant of a circuit. Explain the significance of the percentage value 63.2% while current is building through an RL circuit. Explain why the build-up current of an inductor reaches its steady state the end of 5 time constants. Calculate the build-up current through an inductor after a given number of time constants. Explain the significance of the percentage value 63.2% while current is decaying through an RL circuit. Explain why the decaying current of an inductor reaches a steady state at the end of 5time constants. Calculate the amount of decay current through an inductor after a given number of time constants.

http://www.sweethaven.com/acee/forms/frm0202.htm
Self inductance. When you complete this module, you should be able to: Explain self-inductance. Define inductance in terms of induced voltage. Cite the units of measure for inductance. Describe the voltage waveform across an inductor when a sine waveform of current is being applied.

http://www.sweethaven.com/acee/forms/frm0603.htm
Series and parallel X_L. When you complete this module, you should be able to: Explain the meaning of each term in the equation for total inductive reactance in a series circuit. Calculate the total inductive reactance of a series circuit, given the values of the individual reactances. Explain the meaning of each term in the equation for total inductive reactance in a parallel circuit. Calculate the total inductive reactance of a parallel circuit, given the values of the individual reactances.

http://www.sweethaven.com/acee/forms/frm0302.htm
Series inductor circuits. When you complete this module, you should be able to: Cite the equation for calculating the total inductance of a series circuit. Explain how total inductance increases with each inductor that is added in series. Calculate the total inductance of a series circuit, given the values of individual inductors. Describe how inductor voltage drops are distributed among inductors that are connected in series. Describe how changes in source voltage affect the current flowing through the circuit.

http://www.sweethaven.com/acee/forms/frm1302.htm
Series LC circuits. When you complete this module, you should be able to: Describe how to determine the total reactance of a series LC circuit. Sketch the vector diagram for the total reactance of a series LC

circuit. Describe how to use Ohm's Law to calculate the total reactive current in a series LC circuit. Explain how to determine the total reactive voltage and the voltages across the individual reactances in a series LC circuit. Sketch a vector diagram for the voltages in a series LCcircuit. Describe how the current through a series LC circuit is maximum when $X_L = X_C$.

http://www.sweethaven.com/acee/forms/frm0702.htm
Series RL circuits. When you complete this module, you should be able to: Define the impedance of an RL circuit. Cite the equation for calculating the impedance of an RL circuit in terms of R and X_L. Calculate the value of impedance for a series RL circuit, given the values of R and X_L. Calculate the impedance of a series RL circuit, given the values of R, L, and f. Cite the equation for determining the total phase angle for a series RL circuit in terms of voltage drops. Given values of R and X_L, determine the phase angles for the resistor, inductor, and total circuit. Describe what is meant by a complete analysis of a series RL circuit. Completely analyze a series RL circuit, given the values of R, L, V_T, and f.

http://www.sweethaven.com/acee/forms/frm0604.htm
XL and Ohms Law. When you complete this module, you should be able to: Cite Ohm's Law for inductive reactance. Explain how Ohm's Law for XL is similar to Ohm's Law for R. Use Ohm's Law to solve for voltage, current, or inductive reactance for an inductor. Solve Ohm's Law for inductance, given values of f and L rather than X_L.

http://www.williamson-labs.com/480_rlc-l.htm
Inductors: What are they good for?

Semiconductors

http://www.electronics-tutorials.com/basics/diodes.htm
Varactor diodes

http://www.electronics-tutorials.com/basics/transistors.htm
Transistors

http://www.electronics-tutorials.com/basics/diodes.htm
Tutorial on diodes

http://www.iguanalabs.com/breadboard.htm
Using transistors and LED's.

http://www.iguanalabs.com/1stled.htm
Learning about transistors and LED's.

http://www.ee.uts.edu.au/~venkat/pe_html/pe02_nc2.htm
Simple diode circuits.

http://www.ee.washington.edu/circuit_archive/circuits/F_ASCII_Schem.html#ASCIISCHEM_021
Peltier coolers/heaters. A typical peltier device consists of a number of series-connected N- and P-type semiconductors sandwiched between two ceramic plates, such that the flow of majority carriers (electrons or holes) in each semiconductor occurs in a single direction. (Complete ASCII Circuit)

http://www.amasci.com/amateur/transis.html
How transistors really work - white paper.

http://www.williamson-labs.com/480_xtor.htm
transistors tutorials

Radio Frequency/Electromagnetism

http://www.electronics-tutorials.com/basics/wide-band-rf-transformers.htm
Wide band RF transformers

http://www.electronics-tutorials.com/basics/s-meters.htm
S meters

http://www.analog.com/technology/dataConverters/training/pdf/DDStutor.pdf
Digital Upconverter IC Tames Complex Modulation (paper published in Microwaves & RF magazine)

http://www.analog.com/library/techArticles/amplifiersLinear/LogAmps/technote1.html
A 10.7 MHz, 120 dB Logarithmic Amp

http://www.analog.com/library/techArticles/amplifiersLinear/LogAmps/technote2.html
Controlling RF Power Transmission using a Demodulating
Logarithmic Amp

http://www.analog.com/library/techArticles/amplifiersLinear/LogAmps/technote3.html
Log Amp Applications in Wireless Receive Channels

http://www.analog.com/library/analogDialogue/archives/33-03/ask28/index.html
Logarithmic Amplifiers - Explained - white paper

http://www.scott-inc.com/html/smith.htm
Exploring the secrets of the Smith chart* - an indispensable tool

http://www.scott-inc.com/html/gpsant.htm
Adventures in amplified GPS antenna construction; an experiment...

http://www.rfglobalnet.com/content/misc/sitemap.asp

a nice variety of radio frequency, microwave, electronics and miscellaneous technical articles and information

http://www.wa4dsy.net/

RF modem technical paper: theory of operation including schematics for this 56K digital device

http://www.wenzel.com/documents/tutorial.html
insulating materials, battery capacity, SWR and electrostatics info

http://www.wenzel.com/pdffiles/losschrt.pdf
Return loss conversion chart. (reflected and transmitted power, VSWR, etc.)

http://www.wenzel.com/documents/swr.html
SWR, Return Loss, and Reflection Coefficient - white paper.

http://www.wenzel.com/pdffiles/static1.pdf
Fundamentals of Electrostatics I

http://www.wenzel.com/pdffiles/static2.pdf
Fundamentals of Electrostatics II

http://bwcecom.belden.com/college/college.htm
Audio, video, data and RF wiring applications explained.

http://www.radiodesign.com/legacy/hwitwrks.htm
Easy to read descriptions of various RF technologies including cell phones, radio, TV, pagers and more.

http://www.perry-lake.k12.oh.us/phs/Classdept/sciencedept/physics/tutorials/e_m/mag1/mag1.htm
Magnetics and electromagnetic induction

http://www.ee.surrey.ac.uk/Personal/D.Jefferies/
Antennas and microwave engineering tutorials.

http://www.williamson-labs.com/480_emc.htm
Tutorial on Electro-Magnetic Compatibility

http://members.tripod.com/michaelgellis/ads.html
ADS tutorials

http://we.home.agilent.com/cgibin/bvpub/agilent/search/r2v2/generalSearchResults.jsp?prevSearchString=&prevSearchInterestArea=&LANGUAGE_CODE=eng&NAV_ID=11144.0.00&COUNTRY_CODE=US&searchString=application+notes&searchInterestArea=000&search_for_go=Go
Agilent application notes. AM, ATM/Parallel Test Systems, Acoustic, Agilent function generators, amplifiers, amplitude modulation, anechoic chamber, synthesizers, battery testing, CDMA, coaxial systems, communications, compliance testing, component test, crystals, data acquisition, group delay, digital communications, digital modulation, oscilloscopes, distortion, electronic counter measures, electronic warfare, error analysis, fiber optics, Fourier analysis, frequency modulation, GSM 900, LCR meters, lightwave, logic analyzers, manufacturing, materials measurement, microwave, mixers, mobile radio, RF, network analyzer, noise figure, noise, oscillators, phase linearity, phase modulation, phase noise testers, phase shift modulation, phase stability, phase locked loops, power meters, power transistors, radar, protocol analysis, receivers, reflectometers, s-parameters, satellite communications, semiconductors, signature analysis, Smith chart, spectrum analysis, standards, stripline, system verification, TDMA, television, telecommunications, transistors, vector measurements, video, voltage controlled oscillators, wireless communications

Testing Instruments

http://www.electronics-tutorials.com/basics/s-meters.htm
S meters

http://we.home.agilent.com/cgibin/bvpub/agilent/search/r2v2/generalSearchResults.jsp?prevSearchString=&prevSearchInterestArea=&LANGUAGE_CODE=eng&NAV_ID=11144.0.00&COUNTRY_CODE=US&searchString=application+notes&searchInterestArea=000&search_for_go=Go
Agilent application notes. AM, ATM/Parallel Test Systems, Acoustic, Agilent function generators, amplifiers, amplitude modulation, anechoic chamber, synthesizers, battery testing, CDMA, coaxial systems, communications, compliance testing, component test, crystals, data acquisition, group delay,

digital communications, digital modulation, oscilloscopes, distortion, electronic counter measures, electronic warfare, error analysis, fiber optics, Fourier analysis, frequency modulation, GSM 900, LCR meters, lightwave, logic analyzers, manufacturing, materials measurement, microwave, mixers, mobile radio, RF, network analyzer, noise figure, noise, oscillators, phase linearity, phase modulation, phase noise testers, phase shift modulation, phase stability, phase locked loops, power meters, power transistors, radar, protocol analysis, receivers, reflectometers, s-parameters, satellite communications, semiconductors, signature analysis, Smith chart, spectrum analysis, standards, stripline, system verification, TDMA, television, telecommunications, transistors, vector measurements, video, voltage controlled oscillators, wireless communications

http://www.tek.com/Measurement/cgibin/framed.pl?Document=/Measurement/App_Notes/XYZs/&FrameSet=oscilloscopes
Tektronix guide describing how oscilloscope works and how to take simple measurements.

Integrated Circuits

http://www.electronics-tutorials.com/devices/devices.htm
Electronic devices: timers, mixers, etc. IC's

http://www.xs4all.nl/~ganswijk/chipdir/
Chip directory. This site contains: Numerically and functionally ordered chip lists, chip pinouts and lists of chip manufacturers, manufacturers of controller embedding tools, electronics books, CDROM's, magazines, WWW sites and much more.

http://www.twysted-pair.com/74xx.htm
Standard TTL logic levels.

http://et.nmsu.edu/ETCLASSES/vlsi/files/AUTHOR.html
A VLSI tutorial.

Wires

http://www.drzyzgula.org/bob/text/fr.tom/awg.txt
Everything you ever wanted to know about wire sizes and currents.

Links

http://www.electronics-tutorials.com/links/links.htm
Links to sites of interest in electronics

http://www.electronics-tutorials.com/receivers/receivers.htm
Links to tutorials on receivers

http://www.electronics-tutorials.com/test-equip/test-equip.htm
Links to web sites that show how to build test equipment projects.

http://www.smpstech.com/aids.htm
Links to design aids for power supply design.

http://amasci.com/ele-edu.html
Links to a collection of articles on electricity.

http://www.amasci.com/emotor/statelec.html
Links to articles on static electricity.

http://www.amasci.com/tesla/tesla.html
Links related to Tesla's contributions.

http://www.halcyon.com/sciclub/kidproj1.html
Links to kid's science projects, including some related to electronics.

http://www.amasci.com/ele-edu.html
Links to articles on electricity, electronics, and projects.
Electronics Hobbyist

http://dmoz.org/Science/Technology/Electronics/Tutorials/
Links to electronics tutorials.

Terms and Abbreviations

http://www.twysted-pair.com/dictionary.htm
Dictionary of electronic terms.

http://www.twysted-pair.com/abbreviations.htm
Abbreviations used in electronics.

Instrumentations/ Industrial Electronics

http://www.analog.com/library/analogDialogue/archives/33-02/ask27/index.html
Q. *What problems am I most likely to run into when instrumenting an industrial system?*

http://www.analog.com/library/techArticles/amplifiersLinear/SEN5247e.pdf
Protecting Instrumentation Amplifiers - white paper - 6 pages.

http://www.analog.com/library/techArticles/marketSolutions/ios/5probs.html
The Five Most Common Industrial Measurement Problems*
- Which do you need to solve?

1. Ground loops
2. Damaged data acquisition hardware through mis-wiring or over-voltage signal levels.
3. Too little resolution in your measurement.
4. How to handle a wide variety of signals.
5. Too much interference from outside sources.

http://www.jashaw.com/pid/tutorial/
PID algorithms and tuning methods

http://www.jashaw.com/pid/description.htm
The PID control algorithm

http://www.jashaw.com/pid/code.htm
Suggested code for the PID algorithm.

http://www.jashaw.com/pid/code.htm
The Ziegler-Nichosl Closed Loop Tuning Method

http://members.aol.com/pidcontrol/pid_algorithm.html
PID algorithm

http://www.expertune.com/artCE87.html
descriptive article explaining how different manufacturers equipment implements control loops

http://www.expertune.com/tutor.html
a concise tutorial covering general PID characteristics

http://www.expertune.com/articles.html
Gain from using one of process control's emerging tools: power spectrum - white paper

http://www.expertune.com/articles.html
Poor controller tuning drives up valve costs - white paper.

http://www.expertune.com/articles.html
How to measure and combat valve stiction on line - white paper.

http://www.expertune.com/articles.html
Stiction: The Hidden Menace - white paper.

http://www.expertune.com/articles.html
Comparison of PID Control Algorithms. - white paper

http://instserv.com/pid.htm
PID technical notes

http://www.piezo.com/bendedu.html
Introduction to Piezo Transducers

http://www.piezo.com/history.html
History of Piezoelectricity

http://www.plcs.net/contents.shtml

PLC tutorial

http://www.thelearningpit.com/
PLC and ladder logic simulators

Tubes

http://www.ee.ualberta.ca/~schmaus/elect/tdex.html
The vacuum tube web page.

http://www.ee.ualberta.ca/~schmaus/vacf/index.html
Vacuum technology page.

http://www.ee.ualberta.ca/~schmaus/elect/tdex.html
How vacuum tubes work

http://www.ee.ualberta.ca/~schmaus/elect/tdex.html
Vacuum tube theory.

Digital Electronics – prepared by Prof. Rafael Arce, UPR-Humacao

KV-diagram applet
http://tech-www.informatik.uni-hamburg.de/applets/kvd
Applet de Mapas de Karnaugh. Usuario llena la tabla, agrupa los terminos y el programa presenta el circuito que implementa la función booleana (y lo modifica de acuerdo a los cambios que realiza el usuario en el mapa). Apoya simplificación de funciones booleanas (OR de ANDs ó AND de ORs). El applet trae ejemplos, tutorial y la posibilidad de descargar el programa para uso en computadora 'standalone'.

Switch Level Design
http://ww.ece.gatech.edu/research/ccss/education/Java/ASEE/logic/index.html
Esta página incluye un applet en el que el usuario puede diseñar y simular compuertas lógicas utilizando estructuras tipo CMOS. El usuario coloca las compuertas en area de trabajo, las conecta y asigna variables a las entradas. Con cada cambio, la simulación muestra cuales interruptores conducen y el paso de corriente a través del sistema. Además, el programa trae ejemplos de compuertas ya hechas.

Simcir - Java Logic Circuit Simulator Applet
Http://www.cs.hmc.edu/~keller/javaExamples/simcir121/
Simulador de circuitos lógicos simples. Incluye compuertas básicas (NAND, AND, NOR, OR, XOR, XNOR, NOT), interruptores y LEDs. Capaz de simular feedack (como para simulaciones de Flip/Flops) Fácil de usar y rápido.

DIGital
http://library.thinkquest.org/2723/lessons.html
Curso en linea de circuitos digitales. Cubre los tópicos de: algebra Booleana, tablas veritativas y compuertas Booleanas. Cada lección incluye discusión y prueba diagnóstica automaticamente corregida.

Microprocessor Simulator 8085 for Windows
http://www.insoluz.com/Micro/Micro.html
Excelente simulador del microprocesador 8085, muy práctico para cursos instroductorios a microprocesadores. El programa escribe en lenguage de ensamblador o escogiendo las instrucciones de un menu. La simulación muestra el contenido de los registros, status flags, stack, memoria, entradas y salidas. Descargue gratuitamente, pague $10 para continuar usando.

Base Conversion
http://library.thinkquest.org/10784/
Applet para conversion de números a diferentes bases comúnes en sistemas digitales: decimal, binario, hexadecimal y octal.

Pre-Written Labs in Computer Engineering
http://www.educatorscorner.com/experiments/comp_eng.shtml
Experimentos de electrónica digital sometidos al website 'Educators Corner' de Hewlett Packard.

HowStuffWorks - Learn how Everything Works! http://www.howstuffworks.com
Como dice el nombre, este websitio da explicaciones sobre como funciona desde una computadora hasta las predicciones de Nostradamus de forma muy amena y didactica. Entre los temas relacionados a la electrónica digital se encuentran los siguientes:

- "How Boolean Logic Works" http://www.howstuffworks.com/boolean.htm - Compuertas lógicas, sumadores, Flip/Flops
- "How Bits and Bytes Work" http://www.howstuffworks.com/bytes.htm - Sistemas numéricos, bits, bytes y aritmética binaria.
- "How Microprocessors Work" http://www.howstuffworks.com/microprocessor.htm - Historia de los microprocesadores, memorias e instrucciones.
- "How PCs Work" http://www.howstuffworks.com/pc.htm
- "How RAM Works" http://www.howstuffworks.com/ram.htm
- "How ROM Works" http://www.howstuffworks.com/rom.htm
- "How Computer Memory Works" http://www.howstuffworks.com/computer-memory.htm
- "How Flash Memory Works" http://www.howstuffworks.com/flash-memory.htm

Physiscs Lecture Notes: Digital Circuits
http://www.phys.ualberta.ca/~gingrich/phys395/notes/node117.html
Notas sobre muchos temas de electronica digital básica. Buenas como referencia para un curso univesitario.

Boondog Automation
http://www.boondog.com/tutorials/tutorials.htm
Boondog ofrece una serie de tutoriales y proyectos que utilizan circuitos digitales para control e interface con la computadora: controlar aparatos por el internet, tarjetas ISA para conversion analogo-digital y digital-analogo, entre otras.

555.EXE
http://home.att.net/~BillBowden/555.exe)
Programa sencillo para diseño oscilador aestable usando un circuito 555, resistores y capacitor.

Lessons In Electric Circuits -- Volume IV (Digital)
http://www.ibiblio.org/obp/electricCircuits/Digital/index.html
Libro de texto en linea completo sobre circuitos digitales.

Bowden's Hobby Circuits
http://ourworld.compuserve.com/homepages/Bill_Bowden/
Muy buena página de recursos para electrónica: esquemáticos, información, software, vendedores.

Martindale's Reference Desk: Calculators On-Line Center - cientos de programas online de calculadoras para todo tipo aplicación. Contiene sección especializada para Ingenieria de Computadoras y Electrica.

DIGITAL.ZIP

http://home.att.net/~BillBowden/digital.zip
Digital Challenge v2.10 - Software de entrenamiento para aprender circuitos digitales y temas de computadoras. Consiste de 10 ejercicios que se auto corrigen.
PC System Builder Recommendations
http://www.geek.com/htbc/glanbui.htm
Recomendaciones para los que desean construir su propia computadora. Piezas y precios estimados.

xComputer Lab 1
http://math.hws.edu/TMCM/java/labs/xComputerLab1.html
Contiene el applet XComputer, que simula una computadora simple. El estudiante puede cargar programas y datos a la computadora y observar como estos se ejecutan la XComputer. La página incluye ejercicios de práctica.
zdnet.com - de todo sobre computadoras y equipo relacionado. Buen website para conseguir evaluaciones de equipo y software.
pricewatch.com - maquina de búsqueda para precios de piezas de computadora. Escriba el nombre de la pieza que busca y pricewatch le regresa los suplidores y los precios.

Geek.com - The Online Technology Resource!
http://www.geek.com
Mucha información sobre muchos temas de tecnologia de computadoras (procesadores, PDA's, juegos, redes inalámbricas)

ETCAI.ZIP (DOS 528K)

ePanorama.net
http://www.epanorama.net
Gran cantidad de links útiles para muchas areas de la electrónica (digital y analoga): digital signal processing, hardware de computadoras, estándares para periferales, microcontroladores y CPUS, etc..

FindChips.com Search
http://www.findchips.com
Máquina de busqueda para encontrar chips en distintos proveedores: Digikey, Jameco, etc. La máquina se encarga de buescar en las bases de datos de los proveedores y le informa si los chips estan o no disponibles.

Computerize Your Room/House
http://www.aaroncake.net/circuits/crombuld.htm
Proyecto para controlar los enseres eléctricos de un cuarto o casa usando el puerto paralelo de la computadora. Esta página es parte de una colección de proyectos en electrónica ofrecidos en la página

Electronic Circuits

Fil's FAQ-Link-In Corner: MailOrder List - Lista larga de compañias que venden chips por catalogo.

Tomi Engdahl's Electronics Pages
http://www.hut.fi/Misc/Electronics/circuits/index.html
Algunos proyectos interesantes utilizando los puerto comúnes de la computadora.