Course Syllabi
Department of Electronics Engineering

ECL201 ELECTRONIC CIRCUITS (3-0-2-8)

Contents:

Semiconductor diodes V-I characteristics, modeling for various circuit applications, rectifier, Clipping and clamping circuits RC filters.

Introduction: Scope and applications of analog electronic circuits. Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations(such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Collpits, Clapp etc.), non-sinusoidal oscillators.

Digital circuit families DTL, TTL RTL, MOS, CMOS circuits.Basic CMOS circuits.

Text Books:

1. Sedra, A.S. and Smith, K.C., Microelectronic Circuits: Theory and Applications, 6th ed., Oxford University Press, 2013.
2. Boylestad, R.L. and Nashelsky,L., Electronic Devices and Circuit Theory, 10thed., Pearson Education, 2013.

Reference Books:

1. Bell, D.A., Electronic Devices and Circuits, 4thed., Prentice Hall of India,2001.
2. Meade, R.L., Foundations of Electronics: Circuits and Devices,5thed., Delmar Learning, 2007.
3. Horowitz, P. and Hill, W.,The Art of Electronics, 3rd ed., Cambridge University Press, 2011.
4. Wait, J.V., Huelsman, L.P. and Korn, G.A., Introduction to Operational Amplifier Theory and Applications, 2nd ed., Tata McGraw Hill, 1992.
5. Millman, J., Microelectronics, 2nd ed., Tata McGraw Hill, NewDelhi,2003.
6. Gray, P.R.et. al., Analysis and Design of Analog Integrated Circuits, 5th ed., John Wiley, 2010.

ECL202 DIGITAL CIRCUITS (3-0-2-8)

Contents:

Motivation for digital systems, number system and codes

Set relations, partially ordered sets and lattices.

Switching algebra: switching functions, isomorphic systems, electronic gate networks and Boolean algebra.

Minimization of switching functions, K map, minimal functions and their properties, QM method, two level minimization.

Introduction to synchronous sequential circuits and iterative networks,Sequential circuits – introductory example. The finite-state model – basic definitions, Memory elements and their excitation functions. Synthesis of synchronous sequential circuits, Iterative networks.

Decoders, multiplexers, and code converters, adders: ripple and carry look ahead addition. Storage elements, flip-flops and latches: D, T, J/K flip-flops, shift register, counter. Asynchronous and synchronous design using state and excitation tables.FSM implementation. Overview of VLSI designs process. PAL, CPLD, FPGA, ASIC structure overview.Introduction to hardware description language for digital circuit implementation.

Lab based on 6th unit: and Verilog based examples of M. Mano

Text Books:

1. Kohavi, Z. and Jha, N.K.,Switching and Finite Automata Theory, 3rded, Cambridge University Press, 2013.
2. Mano, M.M. and Ciletti, M.D., Digital Design: With an Introduction to the Verilog HDL, 5th ed., Pearson Education, 2013.

Reference Books:

1. Palnitkar, S., Verilog HDL: A guide to Digital Design and Synthesis, 2nd ed., Pearson, 2013.
2. Brown, S.D. and Vranesic, Z.G., Fundamentals of Digital Logic with VHDL Design, 3rd ed.,McGraw-Hill, 2009.
3. Bhaskar, J., VHDL Primer, 3rd ed., Prentice Hall of India, 2011.

ECL203 SIGNALS AND SYSTEMS (3-2-0-8)

Contents:

Introduction to Signals and Systems, Signal Properties, Convolution of Signals, System properties, Linear Shift Invariant Systems and their Properties and representation

Introduction to Transforms, Fourier series and Fourier Transform, Convergence of Fourier Transform, Properties of Fourier Transform.

Sampling theorem, Sampling/reconstruction of Signals, Realistic sampling, Aliasing.Introduction to Digital Signal Processing, Discrete Time Fourier Transform and Properties.

Introduction to Laplace Transform and Z-Transform, Region of Convergence, Properties of Laplace and Z Transform, Inverse Laplace and Z Transforms, Rational System Functions.

Part of tutorials will be based on MATLAB.

Text Books:

1. Oppenheim, A.V., Willsky, A.S. and Nawab, S.H., Signals and Systems, 2nd ed.,PHI Learning Private Limited., 2012.
2. Haykin, S.S. and Veen, B.V.,Signalsand Systems, 2nded.,Wiley, 2013.

Reference Books:

1. Oppenheim, A.V., Willsky, A.S. and Nawab, S.H., Signals and Systems, 2nd ed., PHI Learning Private Limited., 2012.
2. Phillips, C.L., Parr, J.M. and Riskin, E.A.,Signals, Systems and Transforms, 5th ed.,Pearson Education, 2014.
3. Carlson, G.E.,Signal and Linear System Analysis, 2nd ed., Allied Publishers Limited, 1993.

ECL204 ANALOG COMMUNICATION (3-0-2-8)

Contents:

Review of Signal analysis using Fourier transform, analysis of linear time invariant systems and basic analog ideal filters. Transmission of signals through systems, criteria for distortion less transmission, distortions in practical systems, power and energy of signals. Review of random process and noise.

Amplitude modulation: Need of modulation, AM, DSB-SC, SSB-SC and vestigial side band modulation and demodulation, AM transmitter (broadcast and low power), FDM. Angle modulation: FM and PM, reactance FET modulator Armstrong method, Foster-Seely discriminator, PLL detector, Stereophonic FM, Spectrum of FM, narrow band and wide band FM, FM transmitter (broadcast and low power).

Radio receivers: TRF and super-heterodyne receiver, AGC, FM receiver, sensitivity, selectivity, communication receiver and its special features.

Realization of communication systems.Noise in analog communication systems.SNR calculations for AM, FM systems. Analog pulse modulation: Sampling theorem, PAM, PWM, PPM, QAM generation & Detection of these pulse modulated signals, TDM

Text Books:

1. Haykin, S.S. and Moher, M., Introduction to Analog and Digital Communications, 2nd ed., Wiley, 2012.
2. Lathi, B.P. and Ding, Z., Modern Digital and Analog Communication Systems, 4th ed., Oxford University Press, 2012.

Reference Books:

1. Kennedy, G. and Davis, B., Electronic Communication Systems,4th ed., Tata McGraw Hill, 1999.
2. Schoenbeck, R.J., Electronic Communications: Modulation and Transmis sion, 2nd ed.,Prentice Hall, 1992.
3. Taub,H.,Schilling, D.L. and Saha, G., Principles of Communication Systems; 2nedition, Tata McGraw-Hill, 2008.

ECL205 ELECTROMAGNETIC WAVES (3-2-0-8)

Contents:

Review of Vector calculus.

Review of basic laws of electrostatics: Coulomb's law, Electric field intensity, Field of 'n' point charges, Field of line and sheet of charge. Electric flux density, Gauss's law and it's applications. Divergence and Divergence theorem.Definition of potential difference and potential, Potential of point charge and system of charges.Potential gradient, Energy density in electrostatic field. Poisson's and Laplace's equations.Current and current density, Continuity of current.Capacitance.

Review of basic laws of magnetostatics: Biot-Savart and Amperes circuital laws and their applications ,Curl, Stoke's theorem. Magnetic flux density, Scalar and Vector magnetic potential.Maxwell's equations in steady electric and magnetic fields.

Force on moving charge and differential current element, Force and torque on a closed circuit. Time varying fields and Maxwell's equations.
Uniform plane waves, wave motion in free space, perfect dielectric, lossy dielectric and good conductor, skin effect. Poynting vector and power considerations. Reflection of uniform plane waves, Standing ratio, boundry conditions. Transmission lines: S-parameters, telegraphers model of transmission line. Various terminations.Transmission line equations and their solutions. Transmission line parameters, Characteristic impedances, Propagation constant, Attenuation constant, Phase constant, Waveform distortion, Distortion less transmission lines, Loading of transmission lines, Reflection coefficient and VSWR. Equivalent circuits of transmission lines, Transmission lines at radio frequency. Open circuited and short circuited lines, Smith Chart, Stub matching.

Text Books:

1. Hayt, W.H. and Buck, J.A.,Engineering Electromagnetics, 7th ed., Tata McGraw Hill, 2013.
2. Sadiku, M.N.O.,Principles of Electromagnetics,4th ed., Oxford University Press, 2013.

Reference Books:

1. Jordan, E.C. andBalmain, K.G., Electromagnetic Waves and Radiating Systems, 2nd ed., Prentice Hall of India, 2013.
2. Rao, N.N., Elements of Engineering Electromagnetics, 6th ed., Prentice Hall of India, 2004.
3. Elgerd, O. I., Electric Energy Systems Theory: An Introduction, 2nd ed., Tata McGraw-Hill, New Delhi, 2007.
4. Grainger, J.J., Stevenson,W.D., Power System Analysis,22thed.,McGrawHill Education (India) Private Limited, New Delhi, 2014.
5. Saadat, H., Power System Analysis,PSA Publishing, 3rd ed., 2010.

ECL206 ELECTRONIC MATERIALS AND DEVICES (3-0-2-8)

Contents:

Introduction to SPICE Simulation, Analysis of complex electronic circuits, simulation and analysis using SPICE, AC/DC operation, DC sweep transfer function, frequency response, feedback control analysis, transient response, device models, simulation and analysis of electronic circuits and systems.
Review of semiconductor physics, pn junction, built-in voltage, Depletion width and junction capacitance, Diode current/voltage characteristic, Minority carrier charge storage
MOS transistors, Threshold voltage and the body effect, Current/voltage characteristics, Sub threshold current, Short channel effect and narrow width effect, Drain induced barrier lowering Channel length modulation, Hot carrier effects, Effective mobility and velocity saturation ,SPICE models, MOS inverter circuits Bipolar transistors, Current gain, Eber Molls model. Basic SPICE Models for electronic components Diode MOS and BJT. Small-signal, large-signal model, parameter extraction. Laboratory will be based on SPICE.

Text Book:

1. Streetman, B. and Banerjee, S.,Solid State Electronic Devices, 7th ed., Prentice Hall, 2014.

Reference Book:

1. Hodges, D., Jackson, H. and Saleh, R.,Analysis and Design of Digital Integrated Circuits, 3rd ed.,McGraw-Hill, 2003.

ECL301 LINEAR INTEGRATED CIRCUITS (3-0-2-8)

Prerequisite: ECL 201

Contents:

Differential amplifier and Opamp design, configurations (FET, BJT). DC & AC analysis, constant current bias, current mirror, cascaded differential amplifier stages, level translator.
OPAMP, inverting, non-inverting, differential amplifier configurations, negative feedback, voltage gain, input & output impedance, Bandwidth. Input offset voltage, input bias and offset current, Thermal drift, CMRR, PSRR, Frequency response.
Linear applications, DC, ac amplifiers, summing differential amplifier, instrumentation amplifier, V to I and I to V converters, Integrator, Differentiator. First/ second order low/ high/ band pass, band reject active filters, All pass filter Phase shift oscillator, Wein bridge oscillator, Square wave and triangular waveform generators. Nonlinear applications, Comparators, Schmitt Trigger, Clipping and Clamping circuits, Absolute value circuits, Peak detectors, Sample and hold circuits, Log and antilog amplifiers.
Sample Hold, R-2-R ladder DAC.Flash, successive approximation, dual slope ADC circuits.Introduction to sigma delta ADC.
Special ICs for communications systems: 555 Timer, Voltage Regulator.

Text Books:

1. Graeme, J.G., Tobey, G.E. and Huelsman, L.P., Operational Amplifiers: Design and Applications,McGraw Hill, 1986.
2. Gayakwad, R.A., Op-amps and Linear Integrated Circuits, 4th ed.,Prentice Hall of India, 2012.

Reference Books:

1. Franco, S.,Design with Operational Amplifiers and Analog Integrated Circuits, 4th ed.,McGrawHill Education, 2014.
2. Fiore, J.M., Op amps and Linear Integrated Circuits: Theory and Application,Delmar Thomson Learning, 2001.

ECL302 DIGITAL COMMUNICATION (3-0-2-8)

Contents:

Comparison of analog and digital communication.Advantages and disadvantages of digital communication. Source Coding of Analog Sources: PCM-TDM, Delta modulation, Adaptive DM, DPCM, ADPCM. Source coding of digital sources: Information, entropy, Shannon's source coding theorem, Huffman algorithm, prefix codes .General digital transmitter and receiver, signal constellation and geometric interpretation of signals, performance of matched filter receiver and correlator receiver in the presence of white noise. Threshold setting and error probability. Baseband transmission: Line coding fundamentals, transmission formats, spectral requirements, error probabilities, types of noise and other impairments. Inter-symbol interference, Nyquist's results for ISI, Eye pattern and adaptive equalization. Pass-band transmission methods: Binary ASK, PSK and FSK, Quadrature multiplexing, QPSK and QAM methods, MSK and GMSK. Basic detection algorithms, error probability and spectral requirements.Constellations and their applications in study of communication channels. Error control coding: Shannon's channel capacity theorem, significance of the theorem. Linear block codes generation and decoding, hamming distance considerations, cyclic codes and their applications, convolutional codes and viterbi decoding algorithm.
Basics of TDMA, FDMA, OFDM.

Text Books:

1. Haykin, S.S. and Moher, M., Communication Systems, 5th ed., John Wiley and Sons, 2012.
2. Lathi, B.P. and Ding, Z., Modern Digital and Analog Communication Systems, 4th ed., Oxford University Press, 2012.

Reference Books:

1. Proakis, J.G. and Salehi, M., Digital Communications, 5th ed.,McGraw Hill, 2010.
2. Taub, H., Schilling, D.L. and Saha, G., Principles of Communication Systems, 2nd edition, Tata McGraw-Hill, 2008.

ECL303 MICROWAVE & ANTENNAS (3-0-2-8)

Prerequisite: ECL 205

Contents:

Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant, TE10 mode, Field Distribution, Power, Attenuation. Circular Waveguides: TE, TM modes, Wave Velocities.
Field due to a current element, power radiated and radiation resistance for field due to a dipole, power radiated and radiated resistance. Reciprocity theorem applied to antennas. Antenna terminology: Gain, Aperture, Radiation intensity, Directivity, Directive gain, Beam width, Radiation patterns, FBR, Antenna bandwidth etc. Concept of antenna arrays, Two element arrays and their directional characteristics, Linear array analysis, Broadside and end fire arrays, Principles of pattern multiplication & their application. Polynomial representation, Binomial arrays, Design of broadcast array for a specific pattern, Chebyshev array synthesis. Analysis of power patterns of various antennas like parabolic reflectors, Lens antenna, folded dipole, Turnstile antenna, Yagi antenna, Log-periodic antenna, Horn antenna & feeding.

Text Books:

1. Jordan, E.C. and Balmain, K.G., Electromagnetic Waves and Radiating Systems, 2nd ed., Prentice Hall of India, 2013.
2. Kraus, J.D., Marhfeka, R. and Khan, A.S., Antennas and Wave Propagation, 4th ed.,Tata McGraw-Hill, 2013.

Reference Books:

1. Prasad, K. D., Antennas and Wave Propagation, Satya Prakash, 2012.
2. Raju, G.S.N., Antennas and Wave Propagation, Pearson Education, Delhi, 2006.
3. Shevgaonkar, R.K., Electromagnetic Waves, 6th ed.,Tata McGraw-Hill, 2011.

ECL304 DIGITAL SIGNAL PROCESSING (3-0-2-8)

Prerequisite: ECL 203

Contents:

Discrete time signals and systems, Sampling process, Classification of LTI, Discrete time systems, Linear convolution, Inverse systems, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), theorems, DFT symmetry relations, Circular convolution, Linear convolution using DFT, overlap add

method, overlap save method. Fast Fourier Transform (FFT) algorithms, decimation in time and frequency domain and algorithms, Goertzel algorithms
Signal flow graph representation, parallel and cascade form. Design of FIR digital filter using window method, Park-McClellans method.Design of IIR digital filter, Butterworth and chebyshev with bilinear transformation and impulse invariant method.
Group delay, phase delay and effect of finite word length in FIR filter design. Digital Signal Processors.
Lab experiments based on MATLAB and DSP processor kits.

Text Books:

1. Oppenheim, A.V. and Schafer, R.W.,Discrete-Time Signal Processing, 3rd ed.,Pearson, 2013.
2. Mitra S. K., Digital Signal Processing: a Computer based Approach, 3rd ed.,Tata McGraw-Hill, 2012.

Reference Books:

1. Proakis, J.G. and Manolakis, D.G., Digital Signal Processing: Principles, Algorithms and Applications, 4th ed.,Pearson, 2011.
2. Chen, C-T, Digital Signal Processing: Spectral Computation and Filter Design, Oxford University Press, 2001
3. Salivahanan, S. and Gnanapriya, C., Digital Signal Processing, 2nd ed., TataMcGraw Hill, 2011.

ECL305 MICROCONTROLLERAND INTERFACING (3-0-2-8)

Prerequisite: ECL 202

Contents:

Tuning machine, von Neumann and Harvard architecture.
Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, instruction sets of microprocessors (with examples of 8085 and C51 architecture);
Interfacing with peripherals - timer, serial I/O, parallel I/O, A/D and D/A converters; Arithmetic Coprocessors; System level interfacing design; Bus architectures- Concepts of virtual memory, Cache memory.
Microprocessor v/s Microcontroller, overview of various microcontrollers.Architecture & hardware description of signals of 8051/PIC. Instruction set and timing diagrams. Assembly language programming of 8051.Developing an application using 8051.Introduction to ARM microcontroller architecture & organization.
Lab experiments will be based on 8085 and C51 architecture.

Text Books:

1. Hall, D.V., Microprocessors & Interfacing, 3rd ed.,Tata McGraw-Hill, 2012.
2. Mazidi, M.A.,The 8051 Microcontroller And Embedded Systems Using Assembly And C, 2/E, Pearson Education, 2013.

Reference Books:

1. Gaonkar, R., Microprocessor Architecture, Programming and Applications with the 8085, 5th ed., Penram International Publishing, 2011.
2. Predko, M., Programming and Customizing the 8051 Microcontroller, McGraw Hill, 1999

ECL402 FINITE AUTOMATA (3-2-0-8)

Prerequisite: ECL 202

Contents:

Review of combinational circuit design and optimization, functional decomposition and symmetric functions, identification of symmetric functions. Threshold logic, synthesis of threshold networks. Fault detection in combinational circuits, Boolean differences and Path sensitization. Synchronous sequential circuits and iterative networks, memory elements and their excitation functions, synthesis of synchronous sequential circuits, Moore and Mealy machines, Applications to controller design, finite state machine flow charts, tables, ASM charts. Machine minimization, Asynchronous Sequential circuits, synthesis, state assignment, minimization.

Text Book:

1. Kohavi, Z. and Jha, N.K., Switching and Finite Automata Theory, 3rd ed. Cambridge University Press, 2013.

Reference Books:

1. Kohavi, Z., Switching and Finite Automata Theory, 2nd ed., Tata McGraw Hill, 1978.
2. Taub, H., Digital Circuits and Microprocessors, McGraw Hill, 1986.
3. Mano, M.M., Digital Logic and Computer Design,Pearson, 2011.
4. Lee, S.C., Modern Switching Theory and Digital Design, Prentice-Hall, 1978.

ECL403 HARDWARE DESCRIPTION LANGUAGES (3-0-2-8)

Prerequisite: ECL 202

Contents:

Modeling digital systems, Hardware design environment, Design Flow, Hard ware description languages, Various design styles.
Introduction to Verilog, elements of Verilog, basic concepts in Verilog, simulation, synthesis.
Dataflow modeling, Concurrent signal assignment, delays, Behavioral modeling, processes.
Design organization, Structural specification of hardware, parameterization, hierarchy, abstraction, configurations, utilities.
Subprogram, packages, libraries, Basic I/O, Programming mechanics
Synthesis, RTL description, constraints attributes, FPGA, CPLD structure, technology libraries.
Introduction to VHDL Programming

Text Books:

1. Palnitkar, S., Verilog HDL: A guide to Digital Design and Synthesis, 2nd ed., Pearson, 2013.
2. Bhasker, J., A System Verilog Primer, 1st Indian ed., B.S. Publication, 2013.

Reference Books:

1. Navabi, Z., VHDL: Analysis and Modeling of Digital Systems, 2nd ed., McGraw Hill, 2000.
2. Weste, N.H.E., Harris, D.and Banerjee, A., CMOS VLSI Design: A Circuits and Systems Perspective, 3rd ed.,Pearson Education, 2012.
3. Pucknell, D.A. and Eshraghian, K.,3rd ed., Basic VLSI Design,PHI Learning Private Limited, 2011.

ECL404 INDUSTRIAL ELECTRONICS (3-0-0-6)

Contents:

Review of switching regulators and switch mode power supplies-Uninterrupted power supplies- solid state circuit breakers–programmable logic controllers Analog Controllers-Proportional controllers, Proportional–Integral controllers, PID controllers, Feed forward control. Signal conditioners-Instrumentation amplifiers–voltage to current, current to voltage, voltage to frequency, frequency to voltage converters, Isolation circuits– cabling; magnetic and electro static shielding and grounding.
Opto-Electronic devices and control, Applications of opto isolation, interrupter modules and photo sensors.Fibre optics- barcode equipment, application of barcode in industry. Stepper motors and servo motors- control and applications. Servo motors– servo motor controllers– servo amplifiers– selection of servo motor– applications of servo motors.

Text Book:

1. Kissell, T.E., Industrial Electronics:Applications for Programmable Controllers Instrumentation,3rd ed., Prentice Hall of India, 2012.

Reference Books:

1. Kissell, T.E., Industrial Electronics: Applications for Programmable Controllers Instrumentation, 3rd ed., Prentice Hall of India, 2012.
2. Maas, J.W., Industrial Electronics, Prentice Hall, 1995.

ECL405 ADAPTIVE SIGNAL PROCESSING (3-2-0-8)

Prerequisite: ECL 304

Contents:

Vectors, Matrices and Eigen Analysis.Application to adaptive signal processing. Stochastic Processes, Ensemble average, mean, average power, auto and cross correlation functions, stationarity and white noise, Auto-regressive process. Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued signals.
Least Squares and LMS algorithms, Normal equations, properties.Eigen System decomposition.Gradient search technique, convergence properties of LMS.Normalized LMS algorithm.Recursive solution techniques, RLS algorithm.Application to noise cancellation, modeling of physicalprocesses, communications.

Text Book:

1. Haykin, S., Adaptive Filter Theory,4th ed., Pearson Education, 2012.

Reference Books:

1. Treichler, J.R., Theory and Design of Adaptive Filters, Prentice Hall of India, 2010.
2. Widrow B., Stearns S.D., Adaptive Signal processing, Prentice Hall 1985.

ECL406 WIRELESSDIGITAL COMMUNICATION (3-0-2-8)

Prerequisite: ECL 302

Contents:

Cellular engineering concepts; frequency reuse, frequency management and channel assignment, handoff and handoff strategies, trunking theory, coverage and capacity improvements, medium access techniques, FDMA, TDMA, CDMA, SDMA.