IIP- B.Tech (EE Dept.)

	SEMESTER I		L	T	P	C			SEMESTER II		L	T	P	C
1	CE111	Engineering Drawing	1	0	3	5		1	CH101	Introduction Chemistry	3	1	0	8
2	EE101	Electrical Sciences	3	1	0	8		2	CS101	Programming & Data Structure	3	0	0	6
3	HS103	Communicative English for Engineers	2	0.5	1	6		3	CS110	Programming & Data Structure Lab.	0	0	3	3
4	MA101	Mathematics – I	3	1	0	8		4	EE103	Basic Electronics Laboratory	0	0	3	3
5	ME110	Workshop-I	0	0	3	3		5	MA102	Mathematics-II	3	1	0	8
6	PH103	Physics	3	1	0	8		6	ME102	Engineering Mechanics	3	1	0	8
7	PH110	Physics Laboratory	0	0	3	3		7	CB102 & CE102	Biology & Environmental Studies	3	0	0	6
		NCC/ NSS	0	0	0	0		8	CH110	Chemistry Laboratory	0	0	3	3
										NCC/NSS	0	0	0	0
TOTAL			**12**	**3.5**	**10**	**41**		**TOTAL**			**15**	**3**	**9**	**45**

	SEMESTER III		L	T	P	C			SEMESTER IV		L	T	P	C
1	MA201	Mathematics – III	3	1	0	8		1	XX2nn	Open Elective	3	0	0	6
2	HS2nn	HSS Elective	3	0	0	6		2	HS2nn	HSS Elective	3	0	0	6
3	EE200	Semiconductor Devices and Circuits	3	0	0	6		3	MA225	Probability Theory and Random Processes	3	1	0	8
4	EE201	Digital Circuits and Microprocessor	3	0	0	6		4	EE205	Network Analysis and Synthesis	3	0	0	6
5	EE221	Signals and Systems	3	0	0	6		5	EE203	Analog Integrated Circuits	3	0	0	6
6	EE202	Digital Circuits Laboratory	0	0	3	3		6	EE280	Electrical Machines	3	0	0	6
								7	EE204	Analog Circuits Laboratory	0	0	3	3
								8	EE281	Electrical Machines Laboratory	0	0	3	3
TOTAL			**15**	**1**	**3**	**35**		**TOTAL**			**18**	**1**	**6**	**44**

	SEMESTER V		L	T	P	C
1	XX3nn	Open Elective	3	0	0	6
2	EE350	Control Systems	3	0	0	6
3	EE370	Electronic Instrumentation	3	0	0	6
4	EE330	Communication Systems	3	0	0	6
5	EE381	Power Systems	3	0	0	6
6	EE331	Communication Laboratory	0	0	3	3
7	EE372	Control and Instrumentation Laboratory	0	0	3	3
TOTAL			**15**	**0**	**6**	**36**

	SEMESTER VI		L	T	P	C
1	HS3nn	HSS Elective	3	0	0	6
2	EE320	Digital Signal Processing	3	0	0	6
3	EE309	VLSI Design	3	0	0	6
4	EE382	Power Electronics	3	0	0	6
5	EE341	Electromagnetic Theory and Applications	3	0	0	6
6	EE311	VLSI Laboratory	0	0	3	3
7	EE305	Design Laboratory	0	0	3	3
8	EE321	DSP Laboratory	0	0	3	3
TOTAL			**15**	**0**	**9**	**39**

	SEMESTER VII		L	T	P	C
1	XX4nn	Open Elective	3	0	0	6
2	EE460/ EE483	Embedded Systems Laboratory/Power System Protection Laboratory	3	0	0	6
3	EEXXX	EE Elective I	3	0	0	6
4	EE484	Power Electronics Laboratory	0	0	3	3
5	EE461/ EE485	Embedded Systems Laboratory/Power System Protection Laboratory	0	0	3	3
6	EE493	Project-I	0	0	6	6
TOTAL			**9**	**0**	**12**	**30**

	SEMESTER VIII		L	T	P	C
1	EEXXX	EE Elective II	3	0	0	6
2	EEXXX	EE Elective III	3	0	0	6
3	EE496	Project - II	0	0	18	18
TOTAL			**6**	**0**	**18**	**30**

Grand Total	**105**	**8.5**	**73**	**300**

XX: Department offers the course
ynn: Year followed by 2digit coourse code
Total Credit : 280-300

BTech Courses, EE Department

EE101 Electrical Sciences (3-1-0-8) Pre-requisites: Nil

Circuit Analysis Techniques, Circuit elements, Simple RL and RC Circuits, Kirchoff's law, Nodal Analysis, Mesh Analysis, Linearity and Superposition, Source Transformations, Thevnin's and Norton's Theorems, Time Domain Response of RC, RL and RLC circuits, Sinusoidal Forcing Function, Phasor Relationship for R, L and C, Impedance and Admittance, Instantaneous power, Real, reactive power and power factor.

Semiconductor Diode, Zener Diode, Rectifier Circuits, Clipper, Clamper, Bipolar Junction Transistors, Transistor Biasing, Transistor Small Signal Analysis, Transistor Amplifier, Operational Amplifiers, Op-amp Equivalent Circuit, Practical Op-amp Circuits, DC Offset, Constant Gain Multiplier, Voltage Summing, Voltage Buffer, Controlled Sources, Instrumentation Circuits, Active Filters and Oscillators.

Number Systems, Logic Gates, Boolean Theorem, Algebraic Simplification, K-map, Combinatorial Circuits, Encoder, Decoder, Combinatorial Circuit Design, Introduction to Sequential Circuits.

Magnetic Circuits, Mutually Coupled Circuits, Transformers, Equivalent Circuit and Performance, Analysis of Three-Phase Circuits, Power measurement in three phase system, Electromechanical Energy Conversion, Introduction to Rotating Machines.

Text

- David V. Kerns, Jr. J. David Irwin, Essentials of Electrical and Computer Engineering, Pearson, 2004.

References:

- C. K. Alexander, M. N. O. Sadiku, Fundementals of Electric Circuits, 3rd Edition, McGraw-Hill, 2008.
- W. H. Hayt and J. E. Kemmerly, Engineering Circuit Analysis, McGraw-Hill, 1993.
- Donald A Neamen, Electronic Circuits; analysis and Design, 3rd Edition, Tata McGraw-Hill Publishing Company Limited.
- Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, 5th Edition, Oxford University Press, 2004. M
- R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, 6th Edition, PHI, 2001.
- M. M. Mano, M. D. Ciletti, Digital Design, 4th Edition, Pearson Education, 2008.
- Floyd, Jain, Digital Fundamentals, 8th Edition, Pearson.
- A. E. Fitzgerald, C. Kingsley Jr., S. D. Umans, Electric Machinery, 6th Edition, Tata McGraw-Hill, 2003.
- D. P. Kothari, I. J. Nagrath, Electric Machines, 3rd Edition, McGraw-Hill, 2004.

EE103 Basic Electronics Laboratory (0-0-3-3) Pre-requisites: Nil

Experiments using diodes and bipolar junction transistor (BJT): design and analysis of half -wave and full-wave rectifiers, clipping circuits and Zener regulators, BJT characteristics and BJT amplifiers;

Experiments using operational amplifiers (op-amps): summing amplifier, comparator, precision rectifier, Astable and Monostable Multivibrators and oscillators;

Experiments using logic gates: combinational circuits such as staircase switch, majority detector, equality detector, multiplexer and demultiplexer;

Experiments using flip-flops: sequential circuits such as non-overlapping pulse generator, ripple counter, synchronous counter, pulse counter and numerical display.

Power Measurement by two Watt meter; Efficiency of Transformer.

References:

- A. P. Malvino, Electronic Principles. New Delhi: Tata McGraw-Hill, 1993.
- R. A. Gayakwad, Op-Amps and Linear Integrated Circuits. New Delhi: Prentice Hall of India, 2002.
- R.J. Tocci: Digital Systems; PHI, 6e, 2001.

EE200 Semiconductor Devices and Circuits (3-0-0-6) Pre-requisites: Nil

Semiconductor fundamentals and Carrier Concentration: Crystal structure, Fermi level, energy-band diagram, intrinsic and extrinsic semiconductor, carrier concentration Direct and Indirect recombination of electrons and holes, Hall Effect, Steady-state carrier generation, Quasi-Fermi level;

Transport Phenomena: Drift and Diffusion of Carriers, Semiconductor in Equilibrium, Einstein Equation, generation, recombination and injection of carriers and lifetime, transient response, Deby length, continuity equations;

Junction and other Diodes: Physical description of p-n junction, Forward and reverse bias, depletion region, depletion and diffusion capacitance, transport equations, current voltage characteristics and temperature dependence, tunnelling current, Diode breakdown: Avalanche and Zener, Metal-Semiconductor Junction, Varactor Diodes, Tunnel Diode;

Bipolar Junction Transistor (BJT): Structure and basic operation, Small signal ac analysis, BJT carrier concentration and equivalent circuits, modelling frequency response of transistors, Analysis of CE, CB and CC amplifiers;

MOSFET: Construction and Operation of MOSFET, I-V Characteristics of FET, flat-band threshold voltages, small signal parameters and equivalent circuit, strong, moderate and weak inversion, short channel effects,scaling laws of MOS transistors, CMOS IC technology, CMOS latch up phenomenon, Body effect in CMOS, MIS diode heterojunctions devices, Analysis of CS and CD amplifiers.

Text Books:

- Sze and Lee, Semiconductor Devices: Physics and Technology, 3rd edition, Wiley, 2013
- Dutta, Semiconductor Devices and Circuits, Oxford University Press

References Books:

- Milman, Halkias and Jit, Electronics Devices and Circuits, Tata McGraw-Hill, 2nd wdition
- Sedra and Smith, Microelectronics Circuits, 6th edition, Oxford University Press.

EE201 Digital Circuits and Microprocessor (3-0-0-6) Pre-requisites: Nil

Introduction to digital circuits: Logic families (TTL and MOS), Number systems, Integer and floating point representation.

Logic gates representation and combinational circuit realization, Boolean functions and simplification. Karnaugh Maps and logic optimization. Macro level combinational circuits and their realization: Multiplexers, Code converters, Decoders, parity Generators, 7-segment display decoder; Digital Arithmetic Circuits: Adders, Subtractors, BCD adders.

Introduction to sequential elements (Latches and Flip-flops) and sequential circuit design, State machines. Finite state machines and examples: counters and shift registers.

Introduction to memory circuits.

Introduction to programmable and reconfigurable devices. Digital logic realization using programmable Logic devices.

Introduction to Microprocessor, Architecture, programming model and interfacings

Text/reference Books

- D. P. Leach, A. P. Malvino and G. saha, Digital Principal and Applications, 2/e, McGraw-Hill, 2006.
- J. F. Wakerly, Digital design principles and practices, 4/e, Pearson Education, 2006.
- Morris mano and Michael D. Cilietti, "Digital design", 4th Ed., Pearson Education, 2008.
- C. H. Roth, Fundamentals of logic design, 5th Ed., Cengage learning, 2004.
- David J. Corner, Digital logic and state machine design, Oxford university, 3rd Reprint, Indian Edition, 2012.
- R. K. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publishing (India), 2000.
- D. V. Hall, "Microprocessors and Interfacing: programming and hardware", TMH, 1995.

EE221 Signals and Systems (3-0-0-6) Pre-requisites: Nil

Signals: classification of signals; signal operations: scaling, shifting and inversion; signal properties: symmetry, periodicity and absolute integrability; elementary signals. Systems: classification of systems; system properties: linearity, time/shift-invariance, causality, stability; continuous-time linear time invariant (LTI) and discrete-time linear shift invariant (LSI) systems: impulse response and step response; response to an arbitrary input: convolution; system representation using differential and difference equations; Eigen functions of LTI/ LSI systems, frequency response and its relation to the impulse response. Signal representation: signal space and orthogonal bases; Fourier series representation of continuous-time and discrete-time signals; continuous-time Fourier transform and its properties; Parseval's relation, time-bandwidth product; discrete-time Fourier transform and its properties; relations among various Fourier representations. Sampling: sampling theorem; aliasing; signal reconstruction: ideal interpolator, zero-order hold, first-order hold; discrete Fourier transform and its properties. Laplace transform and Z-transform: definition, region of convergence, properties; transform-domain analysis of LTI/LSI systems, system function: poles and zeros; stability.

Texts

- A.V. Oppenheim, A.S. Willsky and H.S. Nawab, "Signals and Systems", Prentice Hall of India, 2006.
- Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons, 1998.

References

- B. P. Lathi,"Signal Processing and Linear Systems", Oxford University Press, 1998.
- M. J. Roberts, "Fundamentals of Signals and Systems", Tata McGraw Hill, 2007.
- R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4/e, Prentice Hall, 1998.
- L. F. Chaparro, “Signals and Systems Using MATLAB”, Academic press, Elsevier

EE202 Digital Circuits Laboratory (0-0-3-3) Pre-requisites: Nil

To setup circuits for Bipolar (RTL, DTL, TTL) and Unipolar (MOS, CMOS) Logic families, Logic Gate verification and introduction to Combinational circuits, Realization of Decoder, Design and realisation of a Multiplexer and Magnitude Comparator, Verification of basic Flip Flops using 74XXICS, Implementation of basic Latches, Asynchronous Counters, Synchronous Counters, Introduction to 8085 Kit, The 8085 Assembly Language Programming.

Texts/References:

1. Niklaus Wirth, Digital Circuit Design: An Introductory Textbook, Sringer, 1995.

2. D. P Leach, A. P. Malvino and G. Saha, Digital Principles and Applications, 2/e, Tata McGraw-Hill, 2006

3. R. S. Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”, Penram International Publishing (India), 2000.

4. TTL IC Data Sheets (www.datasheetarchive.com/).

EE205 Network Analysis and Synthesis (3-0-0-6) Pre-requisites: Nil

Overview of network analysis techniques, network theorems, transient and steady state sinusoidal response.

Two-port networks, Z, Y, h and transmission parameters, combination of two ports, Analysis of common two port networks.

Network functions, parts of network functions, obtaining a network function from a given part. Network transmission criteria; delay and rise time.

Elements of network synthesis techniques. Butterworth and Chebyshev Approximation

Graph theory: basic definitions of loop (or tie set), cut-set, mesh matrices and their relationships, applications of graph theory in solving network equations.

Texts/ References:

1. F. F. Kuo, Network Analysis and Synthesis, John. Wiley, 2006.
2. M. E. Van Valkenburg, Network Analysis, Prentice Hall, 1980.
3. Introduction to Graph Theory (Dover Books on Mathematics) 2nd Edition by Richard J. Trudeau (Author)

EE203 Analog Integrated Circuits (3-0-0-6) Pre-requisite: Nil

Introduction to analog circuits;
Current source, sink and mirrors, multistage amplifiers;
Differential amplifiers: DC and small signal analysis, CMRR, current mirrors, active load and cascode configurations, frequency response;
Frequency response of amplifiers: high frequency device models, frequency response, GBW, methods of short circuit and open circuit time constants, dominant pole approximation;
Feedback amplifiers: basic feedback topologies and their properties, analysis of practical feedback amplifiers, stability;
Case study: 741 op-amp - DC and small signal analysis, frequency response, frequency compensation, GBW, phase margin, slew rate, offsets;
Signal generation and waveform shaping: sinusoidal oscillators- RC, LC, and crystal oscillators, Schmitt trigger;
Filter approximations: Butterworth and Chebyshev, first order and second order passive/active filter realizations.
Power amplifiers: class A, B, AB, C, D, output stages, short circuit protection, power transistors and thermal design considerations;

Texts:

- B Razavi, Fundamentals of Microeletronics, Wiley
- S. Smith, "Microelectronics Circuits", 5/e, Oxford, 2005
- B. Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill 2001.
- P. Gray, P. Hurst, S. Lewis, and R. Meyer, "Analysis & Design of Analog Integrated Circuits," 4/e, Wiley, 2001.

References:

- D. Johns, K. Martin, "Analog Integrated Circuit Design," Wiley, 1997.
- R. A. Gayakwad, Op-Amps and Linear Integrated Circuit, Prentice Hall of India, 2002.
- B. Razavi, RF Microelectronics, Prentice-Hall, 1998.
- A. K. Dutta, "Semiconductor Devices and Circuits," Oxford University Press, 2008
- P. E. Allen and D. R. Holberg, CMOS Analog Circuit Design, 2/e, Oxford University Press, 1997.

EE280 Electrical Machines (3-0-0-6) Pre-requisites: Nil

Magnetic circuits and transformer including 3-phase transformers; Fundamentals of D.C. machines; phasor diagram of cylindrical rotor and salient pole machines- electromagnetic and reluctance torque, response under short circuit conditions; Fundamentals of induction machines- derivation of equivalent circuits, dynamics under load change, speed reversal and braking, unbalanced and asymmetrical operation; Fundamentals of synchronous machines – equivalent circuit, d-q transformations, short circuit studies in synchronous machines

Texts:

- Stephen Chapman, Electric Machinery Fundamentals, McGraw-Hill, 4/e, 2003.
- B. S. Guru and H. R. Hiziroglu, Electrical Machinery and Transformers, 3/e, Oxford University Press, 2003.

References:

- I. L. Kosow, Electrical Machinery and Transformers, 2/e, Prentice- Hall of India Pvt. Ltd., 2003.
- R. K. Rajput, Electrical Machines, 3/e, Laxmi Publications (P) Ltd., 2003.

EE204 Analog Circuits Laboratory (0-0-3-3) Pre-requisites: Nil

Experiments using BJTs, FETs, op-amps and other integrated circuits: Multistage amplifiers, automatic gain controlled amplifiers, programmable gain amplifiers; frequency response of amplifiers; waveform generators; active filters.

Texts/References:

- A. P. Malvino, Electronic Principles, Tata McGraw-Hill, 1993.
- R. A. Gayakwad, Op-Amps and Linear Integrated Circuits, Prentice Hall of India, 2002

EE350 Control Systems (3-0-0-6) Pre-requisites: Nil

Basic concepts: Notion of feedback, open- and closed-loop systems;

Modeling and representations of control systems: Ordinary differential equations, Transfer functions, Block diagrams, Signal flow graphs, State-space representations;

Performance and stability: Time-domain analysis, Second-order systems, Characteristic-equation and roots, Routh-Hurwitz criteria;

Frequency-domain techniques: Root-locus methods, Frequency responses, Bode-plots, Gain-margin and phase-margin, Nyquist plots;

Compensator design: Proportional, PI and PID controllers, Lead-lag compensators;

State-space concepts: Controllability, Observability, pole placement result, Minimal representations.

Text/References

- Norman S. Nise, Control Systems Engineering, 4th edition, New York, John Wiley, 2003. (Indian edition)
- G. Franklin, J.D. Powell and A. Emami-Naeini, Feedback Control of Dynamic Systems, Addison Wesley, 1986.
- I.J. Nagrath and M. Gopal, Control System Engineering, 2nd Edn.Wiley Eastern, New Delhi, 1982.
- C.L. Phillips and R.D. Harbour, Feedback Control Systems, Prentice Hall, 1985
- B.C. Kuo, Automatic Control Systems, 4th Edn. Prentice Hall of India, New Delhi, 1985. (IIT BOMBAY)

EE370 Electronic Instrumentation (3-0-0-6) Pre-requisites: Nil

Definition of instrumentation. Static characteristics of measuring devices. Error analysis, standards and calibration. Dynamic characteristics of instrumentation systems. Electromechanical indicating instruments: ac/dc current and voltage meters, ohmmeter; loading effect. Measurement of power and energy; Instrument transformers. Measurement of resistance, inductance, capacitance. ac/dc bridges. Measurement of non electrical quantities: transducers classification; measurement of displacement, strain, pressure, flow, temperature, force, level and humidity. Signal conditioning; Instrumentation amplifier, isolation amplifier, and other special purpose amplifiers. Electromagnetic compatibility; shielding and grounding. Signal recovery, data transmission and telemetry. Data acquisition and conversion. Modern electronic test equipment: oscilloscope, DMM, frequency counter, wave/ network/ harmonic distortion/ spectrum analyzers, logic probe and logic analyzer. Data acquisition system; PC based instrumentation. Programmable logic controller: ladder diagram. Computer controlled test systems, serial and parallel interfaces, Field buses. Smart sensors.

Text:

- D. Helfrick and W. D. Cooper, Modern Electronic Instrumentation and Measuring Techniques, Pearson Education, 1996.
- M. M. S. Anand, Electronic Instruments and Instrumentation Technology, PHI, 2006.
- E. O. Deobelin, Measurement Systems - Application and Design, Tata McGraw-Hill, 1990.

References:

- B. E. Jones, Instrumentation, measurement, and Feedback, Tata McGraw-Hill, 2000.
- R. P. Areny and T. G. Webster, Sensors and Signal Conditioning, John Wiley, 1991.
- B. M. Oliver and J. M. Cage, Electronic Measurements and Instrumentation, McGraw-Hill, 1975.
- C. F. Coombs, Electronic Instruments Handbook, McGraw-Hill, 1995.
- R. A. Witte, Electronic Test Instruments, Pearson Education, 1995.
- B. G. Liptak, Instrument Engineers' Handbook: Process Measurement and Analysis, Chilton Book, 1995.

EE330 Communication Systems (3-0-0-6) Pre-requisite: Nil

Basic blocks in a communication system: transmitter, channel and receiver; baseband and passband signals and their representations; concept of modulation and demodulation. Power spectral density, Correlation between waveforms. Signal Space Concepts, Orthogonal representation of signals, Gram-Schmidt procedure.

Amplitude modulation (AM), double sideband suppressed carrier (DSBSC), single sideband suppressed carrier (SSBSC) and vestigial sideband (VSB) modulation. Angle modulation - phase modulation (PM) & frequency modulation (FM); narrow and wideband FM. Pulse Modulation: sampling process; pulse amplitude modulation (PAM); pulse width modulation (PWM); pulse position modulation (PPM) ; pulse code modulation (PCM).

Elements of digital communication systems: source coding, Entropy , Matched Filter, Error Rate due to Noise. Optimum Linear Receiver. Coherent Detection of Signals in Noise, Probability of Error. Digital Modulation Schemes: MPSK, MFSK, MQAM; Error Analysis. Comparison of Digital Modulation Schemes, Bandwidth Efficiency, Pseudo-Noise Sequences and Spread Spectrum. Information and channel capacity.

Texts:

- H. Taub and D. L. Schilling, Principles of Communication Systems, 2/e, McGraw Hill, 1986.
- Proakis J.J., Digital Communications, 2nd edition, Mc Graw Hill 1989.
- B. P. Lathi, Modern Analog and Digital Communication systems, 3/e, Oxford University Press, 1998.
- R. G. Gallager, Principles of Digital Communication, Cambridge University Press, 2009.
- U. Madhow, Fundamentals of Digital Communication, Cambridge University Press, 2008.
- S. Haykin, Digital Communications, Wiley-India, 2011.

References:

- A. B. Carlson, Communication Systems,3/e, McGraw Hill, 1986.
- P. B Crilly, A. B. Carlson, Communication Systems, Tata McGraw-Hill Education, 5th Edition, 2011.
- J.M Wozencraft, I.M. Jacobs, Principles of Communication Engineering, John Wiley, 1965.
- I. A. Glover, P. M. Grant, Digital Communications, Pearson, 5th Impression, 2012.
- P. Z. Peeples, Digital Communication Systems, Prentice Hall International, 1987.
- K.S. Shanmugam, Digital and Analog Communication Systems, Wiley Int. Pub. 1980.
- M. Schwartz, Information Transmission, Modulation and Noise, McGraw Hill Int. Student Edition, 1980.
- S.S. Haykin, An Introduction to Analog and Digital Communication Systems, Wiley Eastern 1989

EE 381 Power Systems (3-0-0-6) Pre-requisite: Nil

Architecture of a power system: Components, network organization, breaker arrangement, voltage levels. Line parameter calculation: Calculation of series inductance and shunt capacitance, matrix representation of a line section, sequence transformation, transposition.

Performance analysis of an AC transmission line: Representation of short, medium-length and long transmission lines, wave propagation, surge impedance, Ferranti effect.

Load flow analysis: Numerical techniques for solving algebraic equations, matrix representation of the power system, load flow equations, application of Gauss-Seidel method for solving load flow equations, application of Newton-Raphson method for solving load flow equations, fast decoupled solution for load flow equations.

Short circuit analysis: System representation for short circuit analysis, balanced short circuit analysis, sequence modelling of transformers, unbalanced short circuit analysis.

Stability analysis: Basic concept of stability, numerical techniques for solving differential equations, swing equation, equal-area criterion, critical clearing time.

Economic load dispatch: Introduction to constrained optimization, optimal scheduling of generators, network loss modeling.

Introduction to the protection system: Components of the protection system, different kinds of protection, functional characteristics of a protective relay,distance protection, power swing, arc interruption in circuit breakers

Text/References:

- C. L. Wadhwa, Electrical Power Systems. New Delhi: New Age International Publishers.
- J. J. Grainger and W. D. Stevenson, Jr., Power System Analysis. New Delhi: Tata McGraw-Hill.
- H. Saddat, Power System Analysis. New Delhi: Tata McGraw-Hill.

EE281 Electrical Machines Laboratory (0-0-3-3) Pre-requisite: Nil

Open circuit and short circuit tests of single phase transformer, three phase transformer connections, open circuit test and load characteristics of DC generator, speed control and output characteristics of DC motor, no load, blocked rotor and load tests on induction motor, open circuit and short circuit tests of an alternator.

Text/References:

- Stephen Chapman, Electric Machinery Fundamentals, 4/e, McGraw-Hill, 2003.
- C. S. Indulkar, Laboratory Experiments in Electrical Power Engineering, Khanna Publishers, 2003.

EE331 Communication Laboratory (0-0-3-3) Pre-requisites: Nil

Amplitude modulation and demodulation (AM with carrier & DSBSC AM); frequency modulation and demodulation (using VCO & PLL); automatic gain control (AGC); pulse amplitude modulation (PAM); pulse code modulation (PCM); pseudo-random (PN) sequence generation; Amplitude shift keying (ASK), frequency shift keying (FSK), binary phase shift keying (BPSK); binary frequency shift keying (BFSK), Quadrature phase shift keying (QPSK), Code division multiple access (CDMA), direct sequence spread spectrum (DSSS) system .

Text/References:

- H. Taub and D. L. Schilling: Principles of Communication Systems; Tata McGraw-Hill, 2008.
- J. G. Proakis and S. Salehi: Communication Systems Engineering; Pearson, 2006.
- W. Tomasi, Electronic Communications Systems - Fundamentals through advanced, 4/e, Pearson, 2003.
- S.S. Haykin, An Introduction to Analog and Digital Communication Systems, Wiley Eastern 1989.

EE372 Control and Instrumentation Laboratory (0-0-3-3) Pre-requisite: Nil

1. a) Measurement of low resistance using Kelvin's double bridge

   b) Measurement of Capacitance and Inductance using AC bridges

2. To Study the FEEDBACK DC Modular Servo System and to obtain the characteristics of the constituent components. Also, to set up a closed loop position control system and study the system performance.

3. Design a PD/PID controller for the FEEDBACK Magnetic Levitation System

4. Determine the transfer function of black box from the Bode plot

5. Traffic light control by PLC

6. Measurement of strain by strain gauge

7. Study of temperature sensors: thermistor, thermocouple, RTD

8. Measurement of displacement by resistive, inductive and capacitive sensors

9. Study and design of controller for FEEDBACK Inverted Pendulum System

Text/References:

- C. D. Johnson, Process Control Instrumentation Technology, Prentice Hall, 2003.
- R. P. Areny and T. G. Webster, Sensor and Signal Conditioning, John Wiley, 1991.
- C. F. Coombs, Electronic Instruments Handbook, McGraw-Hill, 1995.
- K. Ogata, Modern Control Engineering, Prentice Hall India, 2002.
- G. F. Franklin, J. D. Powell and A. E. Emami-Naeini, Feedback Control of Dynamic Systems; Prentice Hall Inc., 2002.

EE320 Digital Signal Processing (3-0-0-6) Pre-requisites: Nil

Review of discrete time signals, systems and transforms.

Frequency selective filters: Ideal filter characteristics, lowpass, highpass, bandpass and bandstop filters, Paley-Wiener criterion, digital resonators, notch filters, comb filters, all-pass filters, inverse systems, minimum phase, maximum phase and mixed phase systems. Structures for discrete-time systems: Signal flow graph representation, basic structures for FIR and IIR systems (direct, parallel, cascade and polyphase forms), transposition theorem, ladder and lattice structures.

Design of FIR and IIR filters: Design of FIR filters using windows, frequency sampling, Remez algorithm and least mean square error methods; Design of IIR filters using impulse invariance, bilinear transformation and frequency transformations.

Discrete Fourier Transform (DFT): Computational problem, DFT relations, DFT properties, fast Fourier transform (FFT) algorithms (radix-2, decimation-in-time, decimation-in-frequency), Goertzel algorithm, linear convolution using DFT.

Finite word-length effects in digital filters: Fixed and floating point representation of numbers, quantization noise in signal representations, finite word-length effects in coefficient representation, round-off noise, SQNR computation and limit cycle.

Texts

- S. K. Mitra, Digital Signal Processing: A computer-Based Approach, TMH, 2/e, 2001.
- A. V. Oppenheim and R. W. Shafer, Discrete-Time Signal Processing, PHI, 2/e, 2004.
- J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, PHI, 1997.

References

- V.K. Ingle and J.G. Proakis, “Digital signal processing with MATLAB”, Cengage, 2008.
- T. Bose, Digital Signal and Image Processing, John Wiley and Sons, Inc., Singapore, 2004.
- L. R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall India, 2005.
- A. Antoniou, Digital Filters: Analysis, Design and Applications, Tata McGraw-Hill, New Delhi, 2003.
- T. J. Cavicchi, Digital Signal Processing, John Wiley and Sons, Inc., Singapore, 2002.
- E. C. Ifeachor and B. W. Jervis, Digital Signal Processing, Pearson Education, 2006.

EE309 VLSI Design (3-0-0-6) Pre-requisite: Digital Circuits and Microprocessors

Introduction VLSI. Basics on fabrication process. Design Methodologies: Full and Semi Custom design flow. MOS circuits: static and Dynamic logic and characteristics. Architectural design: examples, HDL and test bench writing, synthesis and Timing analysis, Introduction to Physical design and verification. Introduction to FPGA architectures, FPGA based digital Systems, Computer arithmetic, Semiconductor Memory circuits design, Introduction to memory refreshing circuits, Introduction to IC testing and validations: Fault model, DFT, Scanned FF, scan Chain method.

Texts:

- W. Wolf, Modern VLSI Design - System on Chip design, 3/e, Pearson Education, 2004.
- J.M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits- A Design Perspective, 2/e, Prentice Hall of India, 2003.
- N. Weste and D. Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3/e, Pearson Education India, 2007.
- "Application Specific Integrated Circuit", Michael John Sebastian Smith, Addison Wesley.

References:

- CMOS Circuit Design, Layout and Simulation, R. Jacob baker, Willey Publications.
- Kang and Leblevici, CMOS Digital Integrated Circuits Analysis and Design, 3/e, McGraw Hill, 2003.
- J. P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & Sons (Asia), 2002.

EE382 Power Electronics (3 0 0 6) Pre-requisite: Nil

Power semiconductor devices: structure and characteristics; snubber circuits, switching loss. Controlled rectifiers: full/half controlled converters, dual converters, sequence control. AC regulator circuits, reactive power compensators. de-de converters, switching dc power supplies. Inverters: square wave and pwm types, filters, inverters for induction heating and UPS.

Texts:

- N. Mohan: Power Electronics- Converters, Applications and Design, 3/e, John Wiley & Sons, 2003.
- G. K. Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 2003

References:

- Muhammad Rashid, Power Electronics- Circuits, Devices and Applications, 3/e, Prentice Hall, 2004.
- B. K. Bose, Modern Power Electronics and AC Drives, Pearson Education, 2003.
- Andrzej M. Trzynadlowski, Introduction to Modern Power Electronics, John Wiley & Sons, 1998.
- Muhammad Rashid, Power Electronics Handbook, Academic Press-Elsevier, 2001.

EE341 Electromagnetic Theory and Applications (3-0-0-6) Pre-requisite: Nil

Review of Maxwell's equations, Wave equation and plane waves: Helmholtz wave equation, Solution to wave equations and plane waves, Wave polarization, Poynting vector and power flow in em fields. Wave propagations in unbounded medium. Boundary conditions, reflection and refraction of plane, waves. Transmission Lines: distributed parameter circuits, travelling and standing waves, impedance matching, Smith chart. Waveguides: parallel-plane guide, TE, TM and TEM waves, rectangular waveguides, resonators. Planar transmission lines: stripline, microstripline, application of numerical techniques. Dielectric guides and optical fibres. Radiation: retarded potentials, Hertzian dipole, short loop, antenna parameters. Radio-wave propagation: ground-wave, sky-wave, space-wave.

Texts:

- M. N. O. Sadiku: Elements of Electromagnetics; Oxford University Press, 2000, 3/e.
- Samuel Y. Liao, Microwave Devices and Circuits, Pearson Education; 3 edition (2003)
- R. F. Harrington: Time-Harmonic Electromagnetic Fields, Wiley-IEEE, 2001, 2/e.
- J. Griffiths: Introduction to Electrodynamics, PHI, 1999, 3/e.
- David M. Pozar, Microwave Engineering, Wiley India Private Limited; Fourth edition (14 May 2013)
- C. A. Balanis: Antenna Theory: Analysis and Design, John Wiley, 2005, 3/e.
- R. E. Collin, Foundations for Microwave Engineering, Wiley-Blackwell; 2nd Edition edition

References:

- K. E. Lonngren & S. V. Savov: Fundamentals Electromagnetics with MATLAB, PHI, 2005, 1/e.
- D. K. Cheng: Field and Wave Electromagnetics; Pearson, 2001, 2/e.
- N. Ida, Engineering Electromagnetics, Springer, 2000, 1/e.
- D. M. Sullivan: Electromagnetic Simulation using the FDTD Method, Wiley-IEEE, 2000, 1/e.
- B. S. Guru & H. R. Hiziroglu: Electromagnetic Field Theory Fundamentals, Thomson, 1997, 1/e.

EE321 DSP Laboratory (0-0-3-3) Pre-requisites: Nil

Familiarization of DSP development environments, basic experiments on signal addition, multiplication, vector operations; sampling and quantization; periodic waveform generation; pseudo-random sequence and white noise generation; correlation and convolution;

Design and implementation of finite impulse response (FIR) and infinite impulse response (IIR) filters.

Real-time filtering of signals like speech/audio/biomedical signal.

Implementation of basic digital modulation schemes.

Applications of Digital Signal Processing in Medical Signal Processing, Digital Image Processing, Video Processing. The experiments can be done in Matlab.

The experiments are to be done on TMS320C6XXX DSP Trainer Kit.

Texts/References:

- TMS320C6XXX CPU and Instruction Set Reference Guide, Texas Instruments, 2000 (www.ti.com)
- V. K. Ingle and J. G. Proakis, Digital signal processing using MATLAB, Thompson Brooks/Cole, Singapore, 2007.
- MATLAB and Signal Processing Toolbox User's Guide (www.mathworks.com)

EE311 VLSI Laboratory (0-0-3-3) Pre-requisite: Nil

Introduction to EDA tools, Experiments on Full Custom Design, Semicustom Design and FPGA based digital system design and implementation

Texts/References:

- Muhammad H. Rashid, Introduction to PSpice Using OrCAD for Circuits and Electronics, 3/e, PHI, 2006
- Charles H Roth Jr., Digital systems design using VHDL, 8/e, Thomson Learning Inc, 2006
- Charles H Roth Jr., Fundamentals of Logic Design, 5/e, Thomson Learning Inc, 2007.
- J.M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits- A Design Perspective, 2/e, PHI, 2003.
- P. E. Allen and D. R. Holberg, CMOS Analog Circuit Design, 2/e, Oxford University Press, 1997.

EE305 Design Laboratory (0-0-3-3) Pre-requisite: Nil

A student has to do an electronic hardware mini-project in broad areas like communication, electronic systems design, control and instrumentation, computer, power systems and signal processing. The project involves laying down the specifications, design, prototyping and testing. The project must have major hardware modules involving active discrete components and integrated circuits.

Texts/References:

- P. Horowitz and W. Hill, Art of Electronics, Cambridge University Press, 2nd Edition, 1989.
- M. M. Mano, Digital Design, Pearson Education, 2002.
- The ARRL Handbook for Radio Communications- American Radio Relay League, 2008.
- C. F. Coombs, Electronic Instruments Handbook. McGraw-Hill, 2000.
- T. Williams, The Circuit Designer's Companion, Newnes, 2005.
- R. Pease, Trouble shootting Analog Circuits, Newnes, 1991.

EE460 Embedded Systems (3-0-0-6) **Pre-requisite: Digital Circuits and Microprocessor**

Introduction to embedded systems: Design and Development Challenges, Embedded System Models, Development Cycles; Introduction to Microcomputers, Computer Organizations and Design; Instruction Set Architecture; CISC and RISC Architecture; ARM processor, ARM instruction set: programming model, Assembly language and Embedded C, ARM memory organization and management, cache memory Architecture , Programmable I/O Architecture: Isolated and memory mapped IO; Introduction to interrupts and real time operations, ARM interrupts vectors, priorities Interrupt; Introduction to bus and communication protocols: UART, SPI, I2C, USB and Ethernet, Memory, DMA, AMBA bus; I/O devices controllers: timers, counters, ADC & DAC, keyboards, displays and touch screens, Introduction to Embedded software: Embedded OS, RTOS, Device Drivers; Introduction to FPGA Based embedded system.

Text/Reference Books:

- Embedded System Architecture: A Comprehensive Guide for Engineers and Programmers, Tammy Noergaard, Second Edition, 2014, Elsevier publishers.
- Embedded Systems: Architecture, Programming and design, Raj Kamal, Second Edition, 2010, Tata McGraw Hill publisher.
- ARM System-On-Chip Architecture, Steve Furber, Second Edition, Pearson Publisher.
- N. Sloss, D. Symes, and C. Wright, "ARM system developer's guide: Designing and optimizing system software", Elsevier, 2008.
- Michael Barr, “Programming Embedded Systems in C and C++”, O'Really, 1999.
- Kirk Zurell, “C Programming for Embedded Systems”, CMP Books, 2000.

EE483 Power System Protection (3-0-0-6) Pre-requisite: Nil

Requirement of circuit breakers, characteristics of electric arc, principle of A. C. and D. C. arc interruption, recovery and restriking voltages and effect of current asymmetry upon them, Interruption of capacitive currents, current chopping circuit breaker ratings. Circuit Breakers: Types of A. C. and D. C. circuit breakers in general. Oil Circuit breakers: Plain break and controlled break O. C. B. Minimum oil circuit breaker, Air blast circuit breakers of different type. Vacuum and Sulphur hexafluoride circuit breakers. Fuses: H. R. C. Fuse, Construction, Capacity and characteristics Arrangements of circuit breaker, isolators, arrangement of bus bars, Limiting reactors in power system, Calculation of fault MVA for symmetrical short circuits and determination of C. B. capacity. Protective Devices: Philosophy of protection, Methods of earthing and their effect on fault conditions. Different types of relays: attracted armature type, balanced beam type, induction type. Static relays: Generalised theory of phase and magnitude, comparator, realization of different relay characteristics of static devices, Feeder protection: Time graded over current and earth fault system, Directional relays and their connection. Calculation of graded time settings. Distance relaying; Distance, impedance reactance and mho-relays, Arrangement of relay contacts. Pilot wire protection system: Circulating current system Balanced beam type opposed voltage system – Merz price and translay system, Protection of split core and parallel feeders, carrier current protection.; Power transformer protection: Differential protection and magnetic balance protection, restricted earth fault protection, Buchholz relay, protection of combined alternator and transformer.; Bus bar protection: Frame leakage scheme, Translay scheme, circulating current scheme introduction to protection against surges.; Testing of relays: Primary and secondary injection, Method of testing a simple overcurrent relay and E. F. relay.

Text:

1. J. L. Blackburn and T. J. Domin, Protective Relaying: Principles & Applications, CRC Press, 2006.
2. B. Ravindranath and M. Chander, Power System Protection and Switchgear, New Age, 1988.

Referance:

1. S. S. Rao, Switchgear and protection, Khanna publishers, 1997.
2. T. S. MadhavaRao, Power system protection: Static Relays,Tata McGraw Hill, 1989

EE484 Power Electronics Laboratory (0-0-0-3) Pre-requisite: Nil

Rectifiers and applications, DC-DC Converters and applications, DC-AC Converters and applications, AC regulator circuits, Design of PWM generators and projects.

Texts:

- P Arora: *Power Electronics* Laboratory: Theory, Practice & Organization.Narosa Publishing House, 2003
- N. Mohan: Power Electronics- Converters, Applications and Design, 3/e, John Wiley & Sons, 2003.

EE461 Embedded Systems Laboratory (0-0-3-3) Pre-requisite: Nil

Introduction to Embedded development tools, Basic programming practices for basic and advanced Microcontrollers, Microcontroller Interfacing and applications: Display Devices, Sensors, low power Motors: Stepper, DC, Servo Motor.

Text/References:

- N. Sloss, D. Symes, and C. Wright, "ARM system developer's guide: Designing and optimizing system software", Elsevier, 2008.
- Product data sheet LPC 2141/42/44/46/48. NXP Semiconductors.
- Michael Barr, “Programming Embedded Systems in C and C++”, O'Really, 1999.
- Kirk Zurell, “C Programming for Embedded Systems”, CMP Books, 2000.

EE485 Power System Protection Laboratory (0-0-3-3) Pre-requisite: Nil

Directional Electromechanical over current relay, Distance Protection Relay, Earth Fault Warning Relay, Feeder Protection, IDMT Over current relay, Over-undervoltage relay, Percentage Biased Differential relay, Power factor control relay,Transformer protection, motor protection and generator protection.

Text:

- J. L. Blackburn and T. J. Domin, Protective Relaying: Principles & Applications, CRC Press, 2006.
- B. Ravindranath and M. Chander, Power System Protection and Switchgear, New Age, 1988.
- S. S. Rao, Switchgear and protection, Khanna publishers, 1997.
- T. S. MadhavaRao, Power system protection: Static Relays,Tata McGraw Hill, 1989

Dept. Elective:1 EE430 Fiber Optic Transmission Systems and Networks (3-0-0-6) Pre-requisite: Nil

Introduction to optical fiber communications; Optical Fibers: Ray and Mode theories, Multimode and single-mode fibers, Fiber loss, Dispersions, Fiber manufacturing; Power coupling: splices, connectors, coupler; Optical transmitters: Light Emitting diode and Laser diodes, Laser modes; Optical receivers: PIN and APD; Optical Amplifier: Noises and Sensitivity; System Performance: Link analyses; Multiplexing schemes: WDM systems.

Introduction to optical network; Circuit switched paradigm, Packet switched paradigm; WDM network: Broadcast-and-Select WDM network, Wavelength-Routed Optical Network; Formulation of network optimization problem, Heuristic solution; WDM network elements: Optical line terminals, Optical add/drop multiplexers, Optical crossconnects; Survivability in WDM networks, 1+1, 1:1, 1: N protection, Dynamic Restoration; Overview of optical Packet Switching; Overview of Optical Access Networks, Passive Optical Network standards.

Texts:

- Gerd Keiser, Optical Fiber Communications, 4th Ed, McGrawHill, 2010.
- Joseph C. Palais, Fiber Optic Communications, 5th Ed, Pearson, 2009.
- Govind Agrawal, Fiber-Optic Communication Systems, 3rd Ed, Wiley.
- Rajiv Ramaswami, Kumar N. Sivarajan and Galen H. Sasaki, Optical Networks; A Practical Perspective, 3rd Ed, Elsevier, 2010.

References:

- Amnon Yariv, Pochi Yeh, Photonics: Optical Electronics in modern communications, 6th Ed, Oxford.
- John M. Senior, Optical Fiber Communications Principles and Practice, 3rd Ed, Pearson.
- Biswanath Mukherjee, Optical WDM Networks, Springer, 2006.
- C. Siva Ram Murthy, WDM Optical Networks: Concepts, Design and Algorithms, PHI Learning, 2001.
- Jun Zheng, Hussein T. Mouftah, Optical WDM Networks: Concepts and Design Principles, Wiley-interscience, 2004.

Dept. Elective-2: EE410 VLSI Technology (3-0-0-6) Prerequisite: Semiconductor Devices and Circuits

Integrated Circuit Technology–Basic classification and comparison. Monolithic Technolgy-wafer preparation .Oxidation, isolation, Diffusion, ion implantation and masking techniques. Design and fabrication of Bipolar and MOS active and passive devices. Thin –Film Technology-Different deposition techniques. Thinness measurement and monitoring. Design and fabrication of active and passive components. Thick-Film Technology-Material process, design and fabrication of thick film components. Hybrid Integrated Circuits. Application.

Texts/References:

- S.M Sze, VLSI Technology, McGraw-Hill Science/Engineering/Math; 2 edition
- S. K. Gandhi, VLSI Fabrication Principles : Silicon and Gallium Arsenide, Wiely, 2nd edition

Dept. Elective-3: EE450 Advanced Control Systems (3-0-0-6) Prerequisite: Control Systems

Root locus design: construction of root loci, phase-lead and phase-lag design, PID controller design;

Frequency response design: Design of lag, lead, lag-lead compensator. PID controllers design and tuning;

State space design: Solution of state space equation, Gramian matrix, controllability, reachability, detectability and observability, pole placement with state feedback, observer design, Luenberger observer, reduced order observer;

Optimal control design: Performance measure, calculus of variation, fundamental theorem of calculus of variation, Euler equation, constrained extrema (Lagrange's multipliers), variational approach to optimal control problem, Hamiltonian, solution under several boundary conditions, LQR, Ricatti equation;

Digital controllers: z-transform , impulse sampling and data hold, mapping between s plane and z plane, stability, Jury's stability test, introduction to discrete state space.

Texts/References:

- K. Ogata, Modern Control Engineering, Prentice Hall India, 2002.
- John Van de Vegte, Feedback Control Systems, Prentice Hall.
- Thomas Kailath , Linear Systems,) Prentice Hall US.
- Panos J. Antsaklis, Anthony N. Michel, A linear systems primer, Birkhäuser; 2007.
- Alok Sinha, Linear Systems: Optimal and Robust, CRC Press.
- Donald E. Kirk , Optimal Control Theory: An Introduction, Dover Publications Inc, 2004.
- M. Gopal: Digital Control and State Variable Methods, Tata McGraw Hill, 2003.
- K. J. Astrom and T. Hagglund: Advanced PID Control, ISA, Research Triangle Park, NC 27709, 2005.
- Benjamin C. Kuo, Digital Control Systems, Oxford University Press, 1995.
- Katsuhiko Ogata, Discrete-Time Control Systems, Prentice Hall, 1995.

Dept Elective-4: EE431 Computer Networks (3-0-0-6) Pre-requisites: Nil

Introduction; Protocol hierarchies: OSI and TCP/IP reference models; Physical layer: Transmission media and topology, circuit switching and packet switching, Telephone network; Data link layer: Framing, error control, stop and wait, sliding window protocol, medium access protocols: Aloha, slotted aloha, CSMA, CSMA CD, and collision - free protocols, FDDI, token ring, wireless LAN protocol, IEEE standard 802 for LANs and MANs, Bridges, Switches, Virtual LAN; Network layer: Routing algorithms (EGP, RIP, OSPF etc.), IP protocol; Transport layer: TCP and UDP, Sockets interface, sockets programming; Application Layer: Authentication, Encryption, electronic mail, WWW.

Texts:

- J. F. Kurose and K. W. Ross, Computer networking: A Top-down Approach Featuring the Internet, 3rd Ed, Addison-Wesley, 2005.
- Alberto Leon Garcia, I. Widjaja, Communication Networks, 2nd Ed., Tata McGraw Hill, 2010.

References :

- W. Stallings, Data and Computer Communications, 7th Ed, Prentice Hall, 2004.
- A. S. Tenenbaum, Computer Networks, 4th Ed, Prentice Hall PTR, 2003.
- B. A. Forouzan, Data Communications and Networking, 3rd Ed, McGraw Hill, 2004.
- Stevens, D.L. et al., TCP/IP Illustrated, Volumes I, II and III, Addison Wesley, 1996.
- G. Held, Ethernet Networks: Design, Implementation, Operation, Management, 4th Ed, John Wiley & Sons, 2002.

Dept. Elective: 5 EE534 Wireless Communication (3-0-0-6) Pre-requisite: Communication Systems

Random Signal Theory: Joint Probability, Statistical independence, Cumulative Distribution function and Probability Density function, Error function, Rayleigh and Gaussian Probability Density, Stationary and Ergodic Process, Power Spectral Density of digital data.
Base band Data Transmission: Base band Signal receiver, Probability of error, Optimum filter, Matched filter, Coherent reception, ISI and Turbo Equalization. Digital Modulation Techniques: Performance Analysis of BPSK, DPSK, QPSK, Mary PSK, BFSK, M-ary FSK, MSK, QAM,OFDM for wireless transmission.
Propagation & Fading: Propagation path loss, Free-space propagation model, Outdoor propagation models (Okumura model & Hata model), Indoor propagation models (Partition Losses in the same floor and between floors), Multipath fading, time dispersive and frequency dispersive channels, delay spread and coherence bandwidth, LCR and ADF.
Mobile Radio Interferences & System Capacity: Co-channel Interference and System Capacity, Channel planning for Wireless Systems, Adjacent channel interferences, Power control for reducing interference, Inter-symbol Interference; The Cellular Concept: Frequency Assignment and Channel Assignment, Frequency Reuse, Handoff, Sectoring, Microcell zone, Spectral efficiency.
Multiple Access techniques: FDMA, TDMA, CDMA, OFDMA, OFDM-CDMA, MIMO-OFDM and QOS issues. Multiuser Detection: Linear and Non-Linear Multiuser Detectors, BER Analysis, Turbo Multiuser Receiver, Iterative Interference Cancellation, Capacity Analysis, BER Analysis, Multiuser Detection for 4G wireless Systems.

Texts/References

- D. Tse, P. Viswanath, Fundamentals of Wireless Communications, Cambridge Press, (2005)
- G. L. Stuber, Principles of Mobile Communication, Kluwer Acdemic, (1996)
- J. G. Proakis, Digital Communications, McGraw-Hill, (1995).
- T. S. Rappaport, Wireless Communications: Principles and Practice, Prentice Hall, (1996).
- A. J. Viterbi, CDMA Systems: Principles of Spread Spectrum Communication, Addison Wesley, (1995)
- S. Verdu, Multiuser Detection, Cambridge University Press, (1998)
- H. Wymeersch, Iterative Receiver Design, Cambridge University Press, (2007)

Dept. Elective: 6 EE490 Image Processing (3-0-0-6) Pre-requisite: Signals and Systems

Human visual system and image perception; monochrome and colour vision models; image acquisition and display: video I/O devices; standard video formats; image digitization, display and storage; 2-D signals and systems; image transforms- 2D DFT, DCT, KLT, Harr transform and discrete wavelet transform; image enhancement: histogram processing, spatial-filtering, frequency-domain filtering; image restoration: linear degradation model, inverse filtering, Wiener filtering; image compression: lossy and lossless compression, entropy coding, transform coding, subband coding, image compression standards, video compression- motion compensation, video compression standards; image analysis: edge and line detection, segmentation, feature extraction, classification; image texture analysis; morphological image processing: binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations; colour image processing: colour models and colour image processing Experiments are based on MATLAB implementation of algorithms covered in the course.

Texts/References:

- A. K. Jain, Fundamentals of Digital Image processing, Pearson Education, 1989.
- R. C. Gonzalez and R. E. Woods: Digital Image Processing, Pearson Education, 2001
- R. C. Gonzalez , R. E. Woods and S. L. Eddins: Digital Image Processing using MATLAB, Pearson Education, 2004.
- G. A. Baxes: Digital Image Processing; John Wiley, 1994
- R.J. Schalkoff: Digital Image Processing and Computer Vision; John Wiley, 1989.
- Sid Ahmed: Image Processing; McGraw -Hill, 1994.
- S.J. Solari: Digital Video and Audio Compression; McGraw-Hill, 1996.

Dept. Elective: 7 EE491 Visual Surveillance Systems (3-0-0-6) Pre-requisite: Nil

Basics of Image and Video Processing: Introduction to Image Processing methods, Image Transforms, Color spaces, An overview of Video Compression Standards: H. 261, H. 263, MPEG-1, MPEG-2, MPEG-4, MPEG-7, and MPEG-21, Video shot boundary detection, motion modeling and segmentation techniques.

Object Detection and Classification- Shape based object classification, motion based object classification, Silhouette-Based Method for Object Classification, Haar like feature based object detection, Viola Jones object detection framework, Multiclass classifier boosting.

Multi-Object Tracking- Classification of multiple interacting objects from video, Region-based Tracking, Contour-based Tracking, Feature-based Tracking, Model-based Tracking, Hybrid Tracking, Particle filter based object tracking, Mean Shift based tracking, Tracking of multiple interacting objects.

Human Activity Recognition- Template based activity recognition, Sequential recognition approaches using state models (Hidden Markov Models), Human Recognition Using Gait, HMM Framework for Gait Recognition, View Invariant Gait Recognition, Syntactic and Statistical approaches, Description based approaches, Human interactions, group activities, Applications and challenges.

Camera Network Calibration - Types of CCTV (closed circuit television) camera- PTZ (pan-tilt zoom) camera, IR (Infrared) camera, IP (Internet Protocal) camera, wireless security camera, Multiple view geometry, camera network calibration, PTZ camera calibration, camera placement, smart imagers and smart cameras

Security and Privacy of visual surveillance- Reliable visual data protection technique without sacrificing perceptual utility, secure authentication and privacy of visual surveillance.

Implementation of algorithms based on OpenCV (or Matlab) is covered in the course.

Texts:

- Murat A. Tekalp, “Digital Video Processing”, Prentice Hall, 1995.
- Y. Ma and G. Qian (Ed.), “Intelligent Video Surveillance: Systems and Technology”, CRC Press, 2009.
- Q. Huihuan, X. Wu, Y. Xu, “Intelligent Surveillance Systems”, Springer Publication, 2011.
- H. Aghajan and A. Cavallaro (Ed.), Multi-Camera Network: Principles and Applications”, Elsevier, 2009.
- A senior (Ed.), “Privacy Protection in Video Surveillance”, Elsevier, 2009.

References:

- Dr. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer Publication, 2010.

Dept. Elective: 8 EE570 FACTS Controllers in Power System (3-0-0-6) Pre-requisite: Power Electronics and Power System

Introduction to FACTS and Concepts: Flow of Power in an AC System, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Basic Types of FACTS Controllers, Brief Description and Definitions of FACTS Controllers.

Static Shunt Compensators: Objectives of Shunt Compensation, Methods of Controllable Var Generation, Static Var Compensators: SVC and STATCOM, Comparison Between STATCOM and SVC, Static Var Systems.

Static Series Compensators: Objectives of Series Compensation, Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators, External (System) Control for Series Reactive Compensators.

Static Voltage and Phase Angle Regulators: Objectives of Voltage and Phase Angle Regulators, Approaches to Thyristor-Controlled Voltage and Phase Angle Regulators (TCVRs and TCPARs), Switching Converter-Based Voltage and Phase Angle Regulators, Hybrid Phase Angle Regulators

Combined Compensators: The Unified Power Flow Controller, The Interline Power Flow Controller (IPFC),Generalized and Multifunctional FACTS Controllers

Text

- N. G. Hingorani&LazsloGyugi, “Understanding FACTS”, Wiley-IEEE Press.December 1999.
- K. R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd. Publishers, 2009.
- By Yong-Hua Song, Allan Johns, “Flexible Ac Transmission Systems (FACTS)”, IET, London, 1999.

References

- Erwin Kreyszig, “Advanced Engineering Mathematics”, McGraw Hill, 1995.
- John J D'Azzo& Constantine H Houpis, “Linear Control Systems Analysis & Design”, McGraw Hill, 2009.
- T. J. E Miller, “Reactive Power Control in Electric Systems”, John Wiley & Sons, 2005.
- N. Mohan, T. M. Undeland& W. P. Robbbins, “Power Electronics”, John Wiley, 1999.