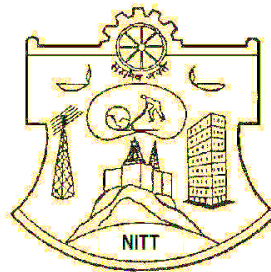# B. Tech. Degree

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS
FOR
CREDIT BASED CURRICULUM
(For students admitted in 2011)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI – 620 015
INDIA

CURRICULUM

III-SEMESTER

CODE	COURSE OF STUDY	L- T- P- C
MA207	Real Analysis and Partial Differential Equations	3 - 0 - 0 – 3
EC201	Signals and Systems	3 - 0 - 0 – 3
EC203	Network Analysis and Synthesis	3 - 0 - 0 – 3
EC205	Engineering Electromagnetics	3 - 0 - 0 – 3
EC207	Semiconductor Physics and Devices	3 - 0 - 0 – 3
EC209	Digital Circuits and Systems	3 - 0 - 0 – 3
EC211	Devices and Networks Laboratory	0 - 0 - 3 – 2
EC213	Digital Electronics Laboratory	0 - 0 - 3 – 2
		18 – 0 – 6 – 22

IV-SEMESTER

MA206	Probability theory and Random Processes	3 - 0 - 0 – 3
EC202	Digital Signal Processing	3 - 0 - 0 – 3
IC218	Control Systems	3 – 0 – 0 –3
EC204	Transmission Lines and Waveguides	3 - 0 - 0 – 3
EC206	Electronic Circuits	3 - 0 - 0 – 3
EC208	Microprocessors and Micro controllers	3 - 0 - 0 – 3
EC210	Electronic Circuits Laboratory	0 - 0 - 3 – 2
EC212	Microprocessor and Microcontroller Laboratory	0 - 0 - 3 – 2
		18 – 0 – 6 – 22

V-SEMESTER

EC301	Statistical Theory of Communication	3 - 0 - 0 – 3
EC303	Digital Signal Processors and Applications	3 - 0 - 0 – 3
EC305	Communication Theory	3 - 0 - 0 – 3
EC307	Antennas and propagation	3 - 0 - 0 – 3
EC309	Analog Integrated Circuits	3 - 0 - 0 – 3
EC311	Advanced Microprocessors	3 - 0 - 0 – 3
EC313	Analog Integrated Circuits Laboratory	0 - 0 - 3 – 2
EC315	Digital Signal Processing Laboratory	0 - 0 - 3 – 2
		18 – 0 – 6 - 22

VI-SEMESTER

EC302	Digital Communication	3 - 0 - 0 – 3
EC304	Mobile Communication	3 - 0 - 0 – 3
EC306	Microwave Components and Circuits	3 - 0 - 0 – 3
EC308	VLSI Systems	3 - 0 - 0 – 3
EC310	Embedded Systems	3 - 0 - 0 – 3
	Elective – 1	3 - 0 - 0 – 3
EC312	Communication Engineering Laboratory	0 - 0 - 3 – 2
EC314	VLSI and Embedded System Design Laboratory	0 - 0 - 3 – 2
		18 – 0 – 6 - 22

VII-SEMESTER

HM401	Industrial Economics	3 – 0 – 0 - 3
EC401	Communication Switching Systems	3 – 0 - 0 – 3
EC403	Fiber Optic Communication	3 - 0 - 0 – 3
EC405	Microwave Electronics	3 - 0 - 0 – 3
	Elective – 2	3 - 0 - 0 – 3
	Elective – 3	3 – 0 - 0 – 3
EC407	Fiber Optic Communication Laboratory	0 - 0 - 3 – 2
EC409	Microwave Laboratory	0 - 0 - 3 – 2
EC447	Comprehensive Evaluation	0 - 0 – 0 – 3
		18 – 0 - 6 – 25

VIII-SEMESTER

MB790	Management Concepts and Practices	3 – 0 - 0 – 3
EC402	Broadband Access Technologies	3 – 0 - 0 – 3
	Elective – 4	3 – 0 - 0 – 3
	Elective – 5	3 – 0 - 0 – 3
EC498	Project	0 - 0 – 12– 6
		12 – 0 - 12 –18

ELECTIVES

VI-SEMESTER

EC352	Networks and Protocols	3 - 0 - 0 – 3
EC354	Speech Processing	3 - 0 - 0 – 3
CS356	Data Structures and Algorithms	3 - 0 - 0 – 3

VII - SEMESTER

EC451	Image Processing	3 – 0 – 0 -3
EC453	ARM System Architecture	3 – 0 – 0 – 3
EC455	Microwave Integrated Circuit Design	3 – 0 – 0 – 3
EC457	Operating Systems	3 – 0 – 0 – 3
IC453	Virtual Instrumentation	3 - 0 - 0 – 3
Any other one elective course offered in the institute		

VIII - SEMESTER

EC452	Principles of Radar	3 - 0 - 0 – 3
EC454	Display Systems	3 - 0 - 0 – 3
EC456	Satellite Communication	3 - 0 - 0 – 3
EC458	Design of Cognitive Radio	3 – 0 – 0 – 3
CS454	Network Security	3 - 0 - 0 –3
Any other one elective course offered in the institute		

ADDITIONAL ELECTIVES APPROVED BY BoS

IC451	Automotive Control Systems	3 – 0 – 0 - 3
EC459	Pattern Recognition	3 – 0 – 0 - 3
EC460	Multimedia Communication Technology	3 – 0 – 0 - 3
EC462	RF MEMS Circuit Design	3 – 0 – 0 - 3
EC464	Electronic Packaging	3 – 0 – 0 - 3
EC466	RF Circuits	3 – 0 – 0 - 3

COURSES OFFERED TO OTHER DEPARTMENTS

Department	Code	Course of Study	L - T - P - C
MET	EC215	Applied Electronics	2 - 0 - 2 - 3
MECH	EC217	Applied Electronic Engineering	2 - 0 - 2 - 3
CHE	EC219	Digital Electronics	3 - 0 - 0 - 3
CSE	EC214	Basics of Communication	3 - 0 - 0 - 3
ICE	EC317	Principles of Communication Systems	3 - 0 - 0 - 3
EEE	EC319	Communication Systems	3 - 0 - 0 - 3
ICE	EC356	VLSI Systems	3 - 0 - 0 - 3

SYLLABUS

MA207 Real Analysis and Partial Differential Equations (3 -0- 0) 3

Real number system.Sets, relations and functions.Properties of real numbers. Numerical sequences. Cauchy sequences. Bolzano-Weierstrass and Heine-Borel properties.

Functions of real variables.Limits, continuity and differentiability.Taylor'sformula.Implicit and inverse function theorems.Extrema of functions.

Reimann integral. Mean value theorems. Differentiation under integral sign.Improper and multiple integrals.Change-of-variables formula.

Sequences and series of functions.Pointwise and uniform convergence.Power series and Taylor series.

Laplace and Helmholtz equations.Boundary and initial value problems. Solution by separation of variables and eigen function expansion.

Text Books:
Guenther,R..B. &Lee,J.W., Partial Differential Equations of Mathematical Physics and Integral Equations, Prentice Hall,1996.
Mattuck,A., Introduction to Analysis, Prentice-Hall,1998.

Reference Books:
Kreyszig,E., Advanced Engineering Mathematics,John Wiley,1999.
W.R. Parzynski& P.W. Zipse, Introduction to Mathematical Analysis, McGraw-Hill, (1/e), 1987.
G.B.Gustafson&C.H. Wilcox, Advanced Engineering Mathematics, Springer Verlag, 1998.

EC201 Signals and Systems (3 -0- 0) 3

Vector spaces.Inner Product spaces.Schwartzinequality.Hilbertspaces.Orthogonalexpansions.Bessel's inequality and Parseval's relations.

Continuous-time signals, classifications. Periodic signals. Fourier series representation.Hilbert transform and its properties.

Laplace transform. Continous - time systems: LTI system analysis using Laplace and Fourier transforms.

Sampling and reconstruction of band limited signals. Low pass and band pass sampling theorems. Aliasing.Anti-aliasing filter.Practical Sampling-aperture effect.

Discrete-time signals and systems.Z-transform and its properties. Analysis of LSI systems using Z – transform

Text Books:
A.V.Oppenheim et al, Signals and Systems (2/e), Pearson 2003
S.Haykin and B.VanVeen "Signals and Systems, Wiley,1998
M.Mandal and A.Asif, "Continuous and Discrete Time Signals and Systems, Cambridge, 2007.

Reference Books:
D.C.Lay,Linear Algebra and its Applications (2/e), Pearson, 2008
K.Huffman&R.Kunz, Linear Algebra, Prentice- Hall,1971.
S.S.Soliman&M.D.Srinath, Continuous and Discrete Signals and Systems, Prentice- Hall, 1990

R.E.Ziemer et al :Signals and Systems : Continuous and Discrete, (4/e), Pearson Education, 2002.
D.K.Linder :Introduction to Signals and Systems, McGraw Hill, 1999.

EC203 Network Analysis and synthesis (3 -0- 0) 3

Network concept.Elements and sources.Kirchoff'slaws.Tellegen'stheorem.Network equilibrium equations.Node and Mesh method.Sourcesuperposition.Thevenin's and Norton's theorems.Networkgraphs .

First and second order networks.State equations. Transient response . Network functions. Determination of the natural frequencies and mode vectors from network functions.

Sinusoidal steady-state analysis.Maximum power-transfer theorem.Resonance.Equivalent and dual networks.Design of equalizers.

Two-port network parameters.Interconnection of two port networks.Barlett's bisection theorem.Image and Iterative parameters.Design of attenuators.

Two-terminal network synthesis. Properties of Hurwitz polynomial and Positive real function. Synthesis of LC, RC and RL Networks, Foster Forms and CauerForms.

Text Book:
Hayt W. H., Kemmerly J. E. and Durbin S. M., "Engineering Circuit Analysis", 6th Ed., Tata McGraw-Hill Publishing Company Ltd.,2008

Reference Book:
Valkenberg V., "Network Analysis", 3rd Ed., Prentice Hall International Edition.,2007.
Valkenberg V., "Network Synthesis,
Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India.,2008.

EC205 Engineering Electromagnetics (3- 0 - 0) 3

Electrostatics.Coulomb'slaw.Gauss's law and applications.Electricpotential.Poisson's and Laplace equations.Method of images.Multipole Expansion.

Electrostatic fields in matter. Dielectrics and dielectric polarization.Capacitors with dielectric substrates.Force and energy in dielectric systems.

Magnetostatics.Magnetic fields of steady currents. Biot-Savart's and Ampere's laws.Magnetic vector potential.Magnetic properties of matter.

Electrodynamics.Flux rule for motional emf.Faraday's law.Self and mutual inductances.Maxwell's equations.Poynting theorem.

Electromagnetic wave propagation.Uniform plane waves.Wave polarization.Reflection and refraction.Propagation in an ionized medium.Faraday rotation.

Text Books:
D.J.Griffiths, Introduction to Electrodynamics (3/e), PHI,2001
E.C. Jordan & G. Balmain: Electromagnetic Waves and Radiating Systems, PHI, 1995.

Reference Books:
W.H.Hayt: Engineering Electromagnetics, (7/e), McGraw Hill, 2006.
N.NarayanaRao, Elements of Engineering Electromagnetics, (6/e), Pearson, 2006.
R.E.Collin, Foundations for Microwave Engineering (2/e) McGraw –Hill, 2002.
R.E.Collin, Antennas and Radiowave Propagation, McGraw-Hill, 1985.

EC207 Semiconductor Physics and Devices (3 – 0 - 0) 3

Semiconductor materials, crystal growth, film formation, lithography, etching and doping.conductivity, charge densities, E-K relation, Fermi level, continuity equation, Hall effect and its applications.

P-N junction diodes, biasing, V-I characteristics, capacitances.Diodemodel.Various types of diodes.

BJT, modes of operation, BJT models, BJT switch, breakdown mechanisms, Photo devices.

MOSFET, operation, V-I characteristics, MOSFET as amplifier and switch, capacitance, equivalent model.CMOScircuits.Bi-CMOS circuits.CCDs.

Power devices, operation and characteristics.Thyristorfamily.Powerdiodes.Powertransistors.GTOs and IGBTs. Display devices, Operation of LCDs, LED, HDTV, Plasma displays.

Text Books:
S.M.Sze, Semiconductors Devices, Physics and Technology, (2/e), Wiley, 2002
A.S.Sedra&K.C.Smith, Microelectronic Circuits (6/e), Oxford, 2010
L.Macdonald&A.C.Lowe, Display Systems, Wiley, 2003
Reference Books:
J.Millman and C.C.Halkias : Electronic devices and Circuits, McGraw Hill, 1976.
Adir Bar-Lev: Semiconductors and Electronic Devices, (3/e), Prentice Hall,1993.
B.G.Streetman,S.K.Banerjee : Solid state Electronic devices, (6/e), PHI,2010.

EC209 Digital Circuits and Systems (3 - 0 - 0) 3

Review of number systems-representation-conversions,error detection and error correction. Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms-minterm and maxterm, Simplification of Boolean expressions-Karnaugh map, completely and incompletely specified functions, Implementation of Boolean expressions using universal gates.

Combinational logic circuits- adders, subtractors, BCD adder, ripple carry look ahead adders, parity generator, decoders, encoders, multiplexers, demultiplexers, Realisation of boolean expressions- using decoders-using multiplexers. Memories – ROM- organisation, expansion.PROMs.Types of RAMs – Basic structure, organization, Static and dynamic RAMs, PLDs, PLAs.

Sequential circuits – latches, flip flops, edge triggering, asynchronous inputs. Shift registers, Universal shift register, applications. Binary counters – Synchronous and asynchronous up/down counters, mod-N counter, Counters for random sequence.

Synchronous circuit analysis and design: structure and operation, analysis-transition equations, state tables and state diagrams, Modelling- Moore machine and Mealy machine- serial binary adder, sequence recogniser, state table reduction, state assignment. Hazard; Overview and comparison of logic families.

Introduction to Verilog HDL, Structural, Dataflow and behavioral modelling of combinational and sequential logic circuits.

Text Books
Wakerly J F, Digital Design: Principles and Practices, Prentice-Hall, 2nd Ed., 20022
D. D. Givone, Digital Principles and Design, Tata Mc-Graw Hill, New Delhi, 2003.
S.Brown and Z.Vranesic, Fundamentals of Digital Logic with Verilog Design, Tata Mc-Graw Hill, 2008.

Reference Books:
 D.P. Leach, A. P. Malvino, GoutamGuha, Digital Principles and Applications, Tata Mc-Graw Hill, New Delhi, 2011

M. M. Mano, Digital Design, 3rd ed., Pearson Education, Delhi, 2003
R.J.Tocci and N.S.Widner, Digital Systems - Principles& Applications, PHI, 10th Ed., 2007
Roth C.H., Fundamentals of Logic Design, Jaico Publishers. V Ed., 2009
T. L. Floyd and Jain ,Digital Fundamentals, 8th ed., Pearson Education, 2003

MA206 Probability Theory and Random Process   (3 -0- 0) 3

Axioms of probability theory.Probabilityspaces.Joint and conditional probabilities.Bayes' Theorem-Independent events.

Random variables and random vectors.Distributions and densities.Independent random variables.Functions of one and two random variables.

Moments and characteristic functions. Inequalities of Chebyshev and Schwartz.Convergence concepts.

Random processes. Stationarity and ergodicity.Strict sense and wide sense stationary processes.Covariance functions and their properties.Spectralrepresentation.Wiener-Khinchine theorem.

Gaussian processes. Processes with independent increments. Poisson processes. Lowpass and Bandpass noise representations.

Text Books:
Davenport, Probability and Random Processes for Scientist and Engineers, McGraw-Hill
Papoulis,A.,Probability, Random variables and Stochastic Processes, McGraw Hill.

Reference Books:
E.Wong : Introduction to Random Processes, Springer Verlag.
W.A.Gardner : Introduction to Random Processes, (2/e), McGraw Hill.
H.Stark&J.W.Woods: Probability, Random Processes and Estimations Theory forEngineers, (2/e), Prentice Hall.

EC202 Digital Signal Processing   (3 – 0 - 0) 3

Review of LSI system theory. DTFT.Frequency response of discrete time systems. All pass, inverse and minimum phase systems.

DFT. Relationship of DFT to other transforms. FFT.DIT and DIF FFT algorithm.Linear filtering using DFT and FFT.

Frequency response of FIR filter types. Design of FIR filters. IIR filter design. Mapping formulas.Frequency transformations.

Direct form realization of FIR and IIR systems. Lattice structure for FIR and IIR systems.Finite-word length effects. Limit cycle oscillations.

Sampling rate conversion by an integer and rational factor.Polyphase FIR structures for sampling rate conversion.

Text Books:
J.G.Proakisetal, Digital Signal Processing, (4/e) Pearson, 2007
A.V.Oppenheim&R.W.Schafer, " Discrete Time Signal processing", (2/e),Pearson Education, 2003.
S.K.Mitra, Digital Signal Processing (3/e), TMH, 2006

Reference Books:
P.S.R.Diniz, E.A.B.da Silva and S.L.Netto, " Digital Signal Processing", Cambridge,2002

E.C.Ifeachor&B.W.Jervis : Digital Signal Processing, (2/e), Pearson Education, 2002.
J.R.Jhonson, Introduction to Digital Signal Processing, Prentice-Hall, 1989.

IC218 Control Systems   3 – 0 - 0) 3

Block-diagram algebra.Time response of poles.Routh – Hurwitz criterion.Basic feedback loop.Asymptotic tracking and performance.

Root loci. Properties.Stability range from the loci. Design using root loci, proportional controller, phase lead controller and PD controller.

Frequency domain techniques. Bode and Nyquist plots. Phase and gain margins.Frequency domain specifications.Controller design.

State - space techniques. Canonical form for SISO continuous-time and discrete-time systems.Solution of state equations. State models of MIMO systems. Stability analyses. Lyapunov criterion for stability.

Controllability and observability. Design of state feedback controllers. Full order and reduced order observers. Design of observers for continuous-time and discrete-time systems.

Text Books:
I. J. Nagrath, M. Gopal,Control Systems Engineering, New Age Publication(4/e), 2010
A.Ramakalyan, Control Engineering, Vikas, 2003
R.C.Dorf&R.H.Bishop, Modern Control Systems (8/e), Pearson, 1999

Reference Books:
K.Ogata : Modern Control Engineering, (3/e), PHI, 1998.
B.C.Kuo : Automatic Control Systems, (7/e), PHI, 1997.
K.Morris : An Introduction to Feedback Control, Academic Press, 2001

EC204 Transmission Lines and Wave guides   (3 – 0 - 0) 3

Classification of guided wave solutions-TE, TM and TEM waves.Field analysis transmission lines.

Rectangular and circular waveguides.Excitation of waveguides.Rectangular and circular cavity resonators.

Transmission line equations.Voltage and current waves.Solutions for different terminations.Transmission-line loading.

Impedance transformation and matching.Smith Chart, Quarter-wave and half-wave transformers.Binomial and Tchebeyshev transformers. Single, double and triple stub matching .

Microstriplines, stripline, slot lines, coplanar waveguide and fin line. Microstrip MIC design aspects. Computer- aided analysis and synthesis.

Text Books:
R.E.Collin, Foundations for Microwave Engineering (2/e), McGraw-Hill,2002.
S.Y.Liao : Microwave Devices and Circuits,(3/e) PHI.

Reference Books:
J.D.Ryder : Networks, Lines and Fields, PHI.
D.M.Pozar, Microwave Engineering (3/e) Wiley,2004.

T.C.Edwards : Foundations for Microstrip circuits design, (2/e), Wiley.

EC206 Electronic Circuits (3 – 0 - 0) 3

Rectifier circuits and filters.Transistor and FET Biasing, Low frequency models of BJT and FET.

BJT and FET amplifiers, High frequency models for BJT and FET, Frequency response of CS and CE amplifiers, Cascode amplifiers, Emitter follower.

MOS and BJT Differential amplifiers, CMRR, Differential amplifiers with active load, Two stage amplifiers.

Feedback concept, Properties, Feedback amplifiers, Stability analysis, Condition for oscillation, Sinusoidal oscillators.

 Power amplifiers- class A, class B, class AB, Biasing circuits, class C and class D.

Text Books:
A.S.Sedra&K.C.Smith, Microelectronic Circuits (5/e), Oxford, 2004.
D.L.Schilling&C.Belove : Electronic Circuits : Discrete and Integrated, (3/e),McGraw Hill.
Reference Books:
J.Millman&A.Grabel : Microelectronics, McGraw Hill, (1987).
K.V.Ramanan,Functional Electronics ,Tata Mc Hill ,1984

EC208 Microprocessors and Microcontrollers (3 – 0 - 0) 3

Microprocessor based personal computer system. Programmer's model for 8086.Segmented memory operation. Instruction set of 8086. Addressing modes supported by 8086 instruction set. Assembly language programming. Programming with DOS and BIOS function calls.

 Memory interface to 8086. Interrupts in 8086. Parallel and serial data transfer methods. 8255 PPI chip.I/o interface method.

Hardware detail of 8086.Bus timing.Minimumvs Maximum mode of operation.8259 Interrupt controller.8237 DMA controller.

8051 Microcontroller. Programming model and Instruction set of 8051 Microcontroller. Addressing mode supported by 8051 instruction set. Assembly language programming.Timer operation.

Serial data transfer using 8051. Interrupts in 8051.I/o ports and port expansion. DAC, ADC, Stepper motor, LCD and key board interfacing to 8051 Microcontroller.

Text Books:
J.L.Antonakos, An Introduction to the Intel Family of Microprocessors, Pearson, 1999.
Barry B. Brey, The Intel Microprocessors, (7/e), Eastern Economy Edition , 2006.
M.A.Mazidi&J.C.Mazidi Microcontroller and Embedded systems using Assembly & C. (2/e), Pearson Education, 200.7

Reference Books:
Kenneth J Ayala, The 8051 Microcontroller , (3/e),   Thomson Delmar Learning, 2004.
I. Scott MacKenzie and Raphael C.W.Phan. The 8051 Microcontroller.(4/e), Pearson education, 2008.

EC301 Statistical Theory of Communication   (3 -0- 0) 3

Information measure.Discreteentropy.Joint and conditional entropies.Uniquely decipherable and instantaneous codes.Kraft-Mcmillan inequality. Noiseless coding
theorem. Construction of optimal codes.

DMC. Mutual information and channel capacity. Shannon's fundamental theorem.Entropy in the continuous case.Shannon-Hartley law.

Binary hypothesis testing.Baye's, minimax and Neyman-Pearson tests. Random parameter estimation-MMSE,MMAE and MAP estimates. Nonrandom parameters – ML estimation.

Coherent signal detection in the presence of additive white and non-white Gaussian noise.Matched filter.

Discrete optimum linear filtering.Orthogonalityprinciple.Spectral factorization. FIR and IIR Wiener filters.

Text Books:
R.B.Ash, Information Theory, Wiley,1965.
M.D.Srinath,P.K.Rajasekaran&R.Viswanathan, Statistical Signal Processing with Applications, PHI 1999.

Reference Books:
H.V.Poor : An Introduction to Signal Detection and Estimation,(2/e), Spring Verlag.1994
M.Mansuripur : Introduction to Information Theory, Prentice Hall.1987
J.G.Proakis et al : Digital Signal Processing, (4/e), Pearson Education, 2007.

EC303 Digital Signal Processors and Applications   (3 – 0 – 0) 3

Difference between DSP and other microprocessor architectures.An overview of Motorola and Analog Device DSPs.

TMS320C54X fixed point and TMS320C3X floating point DSP architectures, CPU, memory, buses and peripherals. Addressing modes, instruction sets , control operations, interrupts.

Repeat operations.Pipeline operation. Pipeline conflics and programming concepts.

Interfacing, serial interface, parallel interface, DMA operations, A/D and D/A converter interfaces.

DSP tools.DSP applications.MAC, filter design, implementation of DFT, echo cancellation, spectrum analyzer.Speech and video processing. Architecture of other DSPs

Text Books:
B.Venkataramani&M.Bhaskar,   Digital   Signal   Processor,   Architecture,   Programming   and Applications,(2/e), McGraw- Hill,2010
S.Srinivasan&Avtar Singh, Digital Signal Processing, Implementations using DSP Microprocessors with Examples from TMS320C54X, Brooks/Cole, 2004.

Reference Books:
SenM.Kuo&Woon-SengS.Gan, Digital Signal Processors: Architectures, Implementations, and Applications, Printice Hall, 2004
C.Marven&G.Ewers: A Simple approach to digital signal processing, Wiley Inter science, 1996.

R.A.Haddad&T.W.Parson: Digital Signal Processing: Theory, Applications and Hardware, Computer Science Press NY, 1991

EC305 Communication Theory   (3 – 0 – 0) 3

Basic blocks of Communication System. AM, Linear Modulation - DSB-SC, SSB and VSB. Frequency Translation, Frequency-Division Multiplexing, Methods of generation and detection.

Angle Modulation - Frequency and Phase modulation. Transmission Bandwidth of FM signals, Methods of generation and detection, FM Stereo Multiplexing, Superheterodyne receiver.

Tuner amplifiers - Design of Class A, B, AB, C, D, S and E power amplifiers. Use of power amplifiers in Transmission.

Circuits for generation and detection of AM, DSBSC, SSBSC, FM signal.

Noise in CW modulation systems - SNR calculations for synchronous detection of DSB and SSB and envelope detection of AM.SNR calculations for angle modulation system.Pre-emphasis and de-emphasis.Thresholdeffect.Noise in Communication subsystems - Internal and external noise.

Text Book:
S.Haykins, Communication Systems (4/e), Wiley, 2001
B.Carlson, Introduction to Communication Systems (4/e), McGraw-Hill, 2009

Reference Books:
Kennedy, Davis, Electronic Communication Systems (4/e), McGraw Hill, 1999
J.Smith, Modern Communication Circuits (2/e), McGraw Hill, 1997
J.S.Beasley&G.M.Miler, Modern Electronic Communication(9/e), Prentice-Hall, 2008

EC307 Antennas and Propagation   (3 – 0 - 0) 3

Radiation fundamentals.Potentialtheory.Helmholtzintegrals.Radiation from a current element.Basic antenna parameters.Radiation field of an arbitrary current distribution.Small loop antennas.

Receiving antenna.Reciprocityrelations.Receiving cross section, and its relation to gain.Reception of completely polarized waves.Linearantennas.Currentdistribution.Radiation field of a thin dipole.Foldeddipole.Feedingmethods.Baluns.

Antenna arrays.Arrayfactorization.Array parameters. Broad side and end fire arrays. Yagi-Uda arrays Log-periodic arrays.

Aperture antennas.Fields as sources of radiation.Hornantennas.Babinet'sprinciple.Parabolic reflector antenna.Microstrip antennas.

Wave Propagation :   Propagation in free space. Propagation around the earth, surface wave propagation, structure of the ionosphere, propagation of plane waves in ionized medium, Determination of critical frequency, MUF.Fading, tropospheric propagation, Super refraction.

Text Books:

R.E.Collin, Antennas and Radio Wave Propagation, McGraw – Hill,1985.
W.L.Stutzman&G.A.Thiele : Antenna Theory and Design, Wiley.
Reference Books:

K.F.Lee, Principles of Antenna Theory, Wiley,1984.
Frederick Emmons Terman , Electronic Radio Engineering (4/e). McGraw Hill.
J.R. James etal, Microstrip Antenna Theory and Design, IEE, 1981.

EC309 Analog Integrated Circuits   **(3 -0 - 0) 3**

Operational Amplifiers, DC and AC characteristics.Applications of Op-amp.Precisionrectifiers.Log and antilog amplifiers.Four quadrant multipliers.Instrumentation amplifier.

Active filters. Filter classification. Standard approximations. Butterworth, Chebyshev and Bessel filters. Switched capacitor filter.

Multivibrators using opamps. 555 timer. Triggering circuits for bistable and monostablemultivibrators.Programmable timer.

Data converters. Analog multiplexer.A/D and D/A converters..PLL-Applications of PLL.Frequencysynthesizers.Coherent synthesizers using PLL.Direct digital synthesis. Phase noise in oscillators.

Voltage regulators.Regulators using opamps.ICregulators.Protectioncircuits.Foldback current limiting.Current boosting of IC regulators.Switching regulators.

Text Books:

 S.Franco, Design with Operational Amplifiers and Analog Integrated Circuits (3/e) TMH, 2003.
R.Gayakwad, Op-amps and Linear Integrated Circuits (4/e), PHID.A.Bell, Solidstate Pulse Circuits (4/e), PHI,2009.

Reference Books:

R.F.Coughlin&F.F.Driscoll : Operational Amplifiers and Linear Integrated circuits, PHI, 1996.
D.A.Bell : Solid State pulse circuits, (4/e), PHI.
Milman Gravel: Micro-Electronics, McGraw Hill,1999.

EC311 Computer Architecture and Advanced Microprocessors.   **(3 – 0 - 0) 3**

Computer system architecture.Personal computer.Performance measures.CPU operation.User and supervisor modes.Pipeline operation.

Memory hierarchy in computers.Cache memory structure and operation. I/O interface circuit. DMA and interrupts.

Software model for Pentium. Real and Protected mode of operation. Instruction set and addressing modes supported by Pentium instruction set. Hardware details of Pentium. Pentium bus operation.Super scalar architecture.Pipeline.Branch prediction.
Instruction and data cache.Cache organization.Cache coherency in multi processor system.Floating point unit.Protected mode of operation. Segmentation.Paging.Protection.Multitasking.Exceptions.
Input and output.Virtual 8086 mode of operation.Protected mode applications.HDD. CD drive.
Video display system. Bus standards, ISA, PCI bus, USB bus.
Text Books:
John P Hayes, Computer Architecture and organization, McGraw-Hill 1998.

James L. Antonakos, The Pentium Microprocessor, (2/e), Pearson, 2002.

Reference Books:
John L.Hennessy& David APatterson Computer Architecture (3/e), Elsevier, 2003.
Barry B. Brey, The Intel Microprocessors, (7/e), Eastern Economy Edition , 2006.
A.K. Ray & K.M. Bhurchandi, Advanced Microprocessors and Peripherals, (2/e), Tata McGraw Hill, 2007.

EC302 Digital Communication   **(3 – 0 - 0) 3**

Base band transmission.Pulse Modulation techniques – PAM, PPM, PDM. Pulse code modulation (PCM), DM, Destination SNR in PCM systems with noise. Matched filter.Nyquistcriterion for zero ISI.Optimum transmit and receive filters. Correlative Coding, M-ary PAM. Equalization; zero-forcing and adaptive linear equalizers.

Digital modulation techniques – binary ASK, FSK, and PSK. Signal space diagram. Error probabilities.

M-ary PSK, FSK, QAM, MSK and GMSK.Optimum detector. Signal constellation, error probability.

Linear block codes, Encoding and decoding. Cyclic codes.Convolutionalcodes.Viterbidecoding.TCM.

Spread spectrum (SS) techniques; direct S.S and frequency hop S.S. Processing gain and jamming margin. CDMA

Text Books:
J.G.Proakis, Digital Communication (4/e), McGraw – Hill,2001.
S.Haykin, Communication Systems (4/e), Wiley,2001.

Reference Books:
B.Sklar, Digital Communications: Fundamentals & Applications, Pearson Education, (2/e), 2001.
A.B.Carlson : Communication Systems, 3/e McGraw Hill.
R.E.Zimer&R.L.Peterson : Introduction to Digital Communication, PHI, 2001.

EC304 Mobile Communication   **(3 – 0 - 0) 3**

Introduction to Wireless Communication.Cellularconcept.System design fundamentals.Coverage and Capacity improvement in Cellular system.Technical Challenges.

Mobile Radio Propagation; Reflection, Diffraction, Fading.Multipathpropagation.Statistical characterization of multipath fading.Diversity Techniques.

Path loss prediction over hilly terrain.Practicallink budget design using Path loss models. Design parameters at base station. Antenna location, spacing, heights and configurations.

Multiple access techniques; FDMA, TDMA and CDMA. Spread spectrum. Power control.WCDMA.CDMA network design.OFDM and MC-CDMA.

GSM.3G,4G(LTE), NFCsystems,.WLANtechnology.WLL.HiperLAN. Ad hoc networks. Bluetooth.

Text Books:
T.S.Rappaport, Wireless Communication Principles (2/e), Pearson, 2002.

A.F.Molisch, Wireless Communications, Wiley, 2005.

Reference Books:

P.MuthuChidambaraNathan, Wireless Communications, PHI, 2008.
W.C.Y.Lee, Mobile Communication Engineering. (2/e), McGraw- Hill,1998.
A.Goldsmith, Wireless Communications, Cambridge University Press, 2005.
S.G.Glisic, Adaptive CDMA, Wiley, 2003.

EC306 Microwave Components and Circuits   (3 – 0 - 0) 3

Scattering matrix formulation.Passive microwave devices; terminations, bends, corners, attenuators, phase changers, directional couplers and hybrid junctions. Basics and design considerations of Microstripline, strip line, coplanar waveguide, Slot line andFinline

Microwave measurements; frequency, wavelength, VSWR.Impedancedetermination.S-parameter measurements.Network analyzer.

Microwave network parameters.Basic circuit elements for microwaves.Transmission line sections and stubs.Richardtransformation.Kuroda identities.

MIC filter design. Low pass to high pass, band pass and band stop transformations. Realization using microstrip lines and strip lines.

Design and realization of MIC components.3 dB hybrid design.Ratrace Hybrid Ring, Backward wave directional coupler, power divider; realization using microstrip lines and strip lines.

Text Books:

I.J.Bahl&P.Bhartia, Microwave Solid state Circuit Design, Wiley, 2003.
D.M.Pozar, Microwave Engineering (2/e), Wiley, 2004.

Reference Books:

Annapoorna Das, Microwave Engineering, Tata McGraw Hill, 2000
BharathiBhat, Shiben K Koul,,Stripline like transmission lines for Microwave Integrated Circuits .New age International Pvt.Ltd. Publishers 2007.

EC308 VLSI Systems   (3 – 0 - 0) 3

VLSI design methodology, VLSI technology- NMOS, CMOS and BICMOS circuit fabrication. Layout design rules. Stick diagram. Latch up.

Characteristics of MOS and CMOS switches. Implementation of logic circuits using MOS and CMOS technology, multiplexers and memory, MOS transistors, threshold voltage, MOS device design equations. MOS models, small-signal AC analysis. CMOS inverters, propagation delay of inverters, Pseudo NMOS, Dynamic CMOS logic circuits, power dissipation.

Programmable logic devices- antifuse, EPROM and SRAM techniques. Programmable logic cells.Programmable inversion and expander logic. Computation of interconnect delay, Techniques for driving large off-chip capacitors, long lines, Computation of interconnect delays in FPGAs Implementation of PLD, EPROM, EEPROM, static and dynamic RAM in CMOS.

An overview of the features of advanced FPGAs, IP cores, Softcore processors, Various factors determining the cost of a VLSI, Comparison of ASICs, FPGAs , PDSPs and CBICs . Fault tolerant VLSI architectures

VLSI testing -need for testing , manufacturing test principles, design strategies for test, chip level and system level test techniques.

Text Books:

N.H.E.Weste et al,   CMOS VLSI design, (3/e), Pearson , 2005
J. Smith,   Application Specific Integrated Circuits,Pearson, 1997
M.M.Vai, VLSI design, CRC Press, 2001

Reference Books:

Pucknell&Eshraghian, Basic VLSI Design, PHI, (3/e)
Uyemura, Introduction to VLSI Circuits and Systems, Wiley, 2002.

EC310 Embedded Systems   **(3-0-0) 3**

Introduction to Embedded systems. Embedded system vs general Computing system.Classification of Embeddedsystem.Core of Embedded system.RISCvs CISC controllers.Harvardvs Van Neumen architecture.

IA 32: Block diagram description and functions of each unit. Atom processor-Addressing modes, Registers, Memory accesses, memory map, Instruction set, Segmentation

Task switching, Paging, Hyper-threading, Caches and TLB, Execution pipeline, Interrupts, Software optimization, VT. FSB Architecture.Chipset over view. BIOS Configuration and responsibilities. BOOT up sequence.

Operating   system   overview.Operating   system   concepts.Processes   and   Tasks   and Threads.Scheduling.Memoryallocation.Clocks and timers. Inter task synchronization. Device driver models.Bus drivers. Power management, Examples and overview of Real time OS

Case studies of embedded systems using Atom processors.

Text Books:
Raj Kamal, Embedded Systems Architecture, Programming, and Design. (2/e), Tata McGraw Hill, 2008.
K.V. Shibu, Introduction To Embedded Systems, Tata McGraw, 2009.
Peter Barry and Patric Crowley, Intel architecture for Embedded system .

Reference Books:
http://www.tomshardware.com/reviews: Pierre Dandumont, Intel and Declining Power Consumption, 2008.
http://download.intel.com/design/intarch/papers/323101.pdf: V.Sanjay, PrashantPaliwal, Guidelines
for migrating to Intel® AtomTM Processor from other Processor architecture, 2010.
Lori Matassa and Max Domeika, Break Away with Intel® Atom™ Processors,2010, Intel press.

HM401 Industrial Economics   **(3 – 0 - 0) 3**

Microeconomics.Demand and supply.Forecastingtechniques.Cost and revenues.Competitive nature of firms.

Keynesian economics.Aggregate demand and supply. Employment determination.National income.Trade cycle.Inflation.Index numbers.

Capital budgeting. Cash flow analysis. Balance sheet.Risk analysis and decision making.

Impact of liberalization, privatization and globalization.Locating the firm in a global economy.

Fiscal policy. Taxation-principles.Exchange rate determination.Monetarypolicy.Functions of banks.Credit creation by commercial banks.

Text Books:
M.Adhikari, Business Economics, Excel Books, 2004
S.K.Misra&V.K.Puri, Economic Environment of Business, HPH, 2003

Reference Books:
Dewett.K.K:Modern Economic Theory,Chand.S&co,1998.
Gupta C.B:BusinessOrganisation and Management, Chand.S& co,1998.
Philip Kotler:Marking Management,PHI,1999.

EC401 Communication Switching Systems (3 – 0 -0) 3

Basic elements of communication network.Switching systems. Signaling and signaling functions.

Digital telephone network.T1 Carrier systems.TDMhierarchy.Data under voice.Digital switching. Echo cancellers.

Synchronous versus asynchronous transmission. Line coding .Error performance.TDM.TDM loops and rings.

Space and time divided switches. Multistage switches. Design examples. Path finding.Switching matrix control.Digital time division switch. Time Space switching. Time Space Time switching. Digital Switching in analog environment.

Timing recovery. Jitter. Network synchronization.Digital subscriber access-ISDN network.ADSL.Traffic analysis.

Text Books:
J.C. Bellamy, Digital Telephony, (3/e), Wiley, 2000.
E.Keiser&E.Strange, Digital Telephony and Network Integration, (2/e), Van Nostrand, 1995.

Reference Books:
ThiagarajanViswanathan, Telecommunication Switching Systems and Networks, PHI, 2006.
J.E. Flood, Telecommunications Switching, Traffic and Networks, Prentice Hall, 1995
M.T. Hills ,Telecommunication Switching Principles, London : Allen and Unwin, 1979.

EC403 Fiber Optic Communication (3 – 0 - 0) 3

Optical Fibers: Structure, Waveguiding. Step-index and graded index optical fibers. Modal analysis.Classification of modes.Single Mode Fibers.

Pulse dispersion. Material and waveguide dispersion.Polarization Mode Dispersion.Absorption, scattering and bending losses. Dispersion Shifted Fibers, Dispersion Compensating Fibers.

Optical Power Launching and Coupling.Lensing schemes for coupling improvement.Fiber-to-fiber joints.Splicingtechniques.Optical fiber connectors.

Optical sources and detectors.Laser fundamentals. Semiconductor Laser basics. LEDs.PIN and Avalanche photodiodes.

Design considerations of fiber optic systems: Analog and digital modulation. Noise in detection process. Bit error rate. Optical receiver operation. Power Budget and Rise time Budget. WDM.

Text Books:
G.Keiser, Optical Fiber Communications (4/e),TMH,2008.
A.Ghatak&K.Thygarajan, Introduction to Fiber Optics, Cambridge, 1999.

Reference Books:
MMK.Liu, Principles and Applications of Optical Communications, TMH, 2010.
G.P.Agrawal, Fiber Optic Communication Systems, (3/e), Wiley, 2002.
J.Gowar, Optical Communication Systems, (2/e), PHI, 2001.

EC405 Microwave Electronics (3 – 0 -0) 3

Klystrons: Limitations of conventional vacuum tubes, Two cavity klystron - Reentrant cavities, Velocity modulation process, Bunching process ,Power output and efficiency; Multi-cavity klystron , Reflex klystron-Velocity modulation process, Bunching process, Power output and efficiency , Mode Characteristics ,Electronic admittance spiral.

Travelling-wave tubes: Slow-wave structures, Helix TWT- Amplification process, Convection current, Wave modes and gain; Coupled cavity TWT, Backward wave oscillator.

Crossed -field devices: Magnetrons- Principle of operation, characteristics, Hull cut-off condition; Carcinotron ,Gyrotron.

Microwave transistors and FETs: Microwave bipolar transistors-Physical structures, characteristics, Power-frequency limitations; Microwave tunnel diode,Microwave unipolar transistor – Physical structure, principle of operation, characteristics ,High electron-mobility transistors.

Transferred electron and Avalanche transit-time devices : Gunn diode, Gunn diode as an oscillator. IMPATT, TRAPATT and BARITT.

*Text Book***:**
S.Y.Liao, Microwave Devices and Circuits (3/e), PHI(2005)

*Reference Books***:**
R.E.Collin,Foundations for Microwave Engineering (2/e) ,Wiley India(2007)
D.M.Pozar, Microwave Engineering (3/e) Wiley India (2009)

MB790 Management Concepts and Practices (3 – 0 -0) 3

Introduction to management, evolution of scientific management, modern management.Principles. Elements of management;. Planning, organizing, staffing, directing, coordinating, reporting, budgeting.

Core concepts of marketing.need, want, demand, product, value, satisfaction, marketing mix- product, price, place, promotion.

Financial management, objectives, scope, techniques of investment analysis, pay back period, accounting rate of return, working capital, cost of capital.Sources of financing.

Technology management.Product design .Types of production system.Plant location-factors to be considered.Plantlayout.Types of layout.Inventory management.

Significance of HRM.HR planning job evaluation.Recruitment and selection.Placement and induction.Training.Performanceappraisal.Compensation.Industrial relations.

Text Books:

L.M.Prasad, Priciples and Practice of Management, S.Chand& Sons.
P.Kotler, Marketing Management (12/e), Pearson, 2005

Reference Books:

P.Chandra, Financial Management Theory and Practice (3/e), TMH, 2004
K.Ashwathappa, Human Resources and Personnel Management (3/e),TMH, 2005
E.S.Buffa&R.K.Sarin, Modern Production/Operation Management (8/e), Wiley, 1994.

EC402 Broadband Access Technologies (3-0-0) 3

Phone line modem-ISDN.Broadband technologies. Cable, DLS, fiber and wireless access technologies.

Digital subscriber lines.ADSL.RADSL.IDSL.HDSL.SDSL.VDSL.Standards for XDSL and comparison.

Cable modem.DOCSIS.Huboperation.Accesscontrol.Framing.Security, data link and higher layers. ATM and IP-centric modem.

Fiber access technologies and architectures.Hybrid fiber-coax systems.SDV.EPON,GPON.FTTX comparison.

Broadband wireless systems.Direct broadcast satellite.MMDS.LMDS.WIDIS. 3G wireless systems . IMT2000.

Text Books:

N.Ransom& A.A. Azzam, Broadband Access Technologies, McGraw Hill, 1999.
M.P. Clarke, Wireless Access Network, Wiley, 2000.

Reference Books:

W.J. Woralski, ADSL and DSL Technologies, McGraw Hill, 1998.
S. Mervana&C.Le, Design and Implementation of DSL-based Access Solutions, Cisco Press, 2001
W. Vermillion, End-to-End DSL Architecture, Cisco Press, 2003.

EC352 Networks and Protocols (3 – 0 - 0) 3

Network Components, Topologies, Cabling, Types of Network, OSI Model, TCP/IP Protocol stack, Physical Layer: Ethernet, FCOE, DHCP, FTP, SNMP, POP, SMTP, HTTP, DNS, Socket programming with TCP and UDP.

Transport Layer services, SCTP, TCP/UDP transport, Principles of reliable data transfer, Principles of congestion control, DCCP.

Network Layer services, Datagram and Virtual circuit service, Routing principles, CLNP, EGP, EIGRP, ICMP, IGRPP, IPV4, IPV6, RIP.

Data Link Layer services, Overview of Circuit and Packet switches , Comparison of OSI and Internet protocol stacks, ARP, RARP, FDDI, Frame Relay, HDLC, L2F, PPP, STP, Comparison wired and wireless LAN.

Network security threats, Types of Firewall, Cryptography, Network layer security, IPsec, TLS, SSL, SSH, Streaming stored video and audio, Internet phone, RTP, Network Troubleshooting.

Text Books:

J.F.Kurose&K.W.Ross, Computer Networking: A Top-Down Approach featuring the Internet, (5/e) Pearson, 2010.
Behrouz A. Forouzan, Data Communications & Networking, (4/e), Tata McGraw- Hill, 2007.

Reference Books:

W.Stallings, Data & Computer Communications, (9/e), PHI, 2011.
W.Stallings, Cryptography & Network Security, (5/e), Pearson, 2011.
Mansfield &Antonakos, An Introduction to Computer Networking, PHI, 2002.

EC354 Speech Processing (3-0-0) 3

Phonetic Representation of speech - Models of Speech production - Perception ofLoudness - Critical bands – Pitch perception – Auditory masking.

Short time Energy and Zero-crossing rate –Short time Autocorrelation function-ShortTime Fourier transform – The speech spectrogram –Relation of STFT to STACF withspeech signals .Shot-Time Cepstrum – Shot time Homomorphic Filtering of Speechsignal - Application to pitch detection and Pattern recognition.

Linear prediction and the speech model - Computing the prediction co-efficient-LPCspectrum – Applications to speech compression and pattern recognition.

Digital speech coding – Closed loop coders-Open loop coders - Frequency domaincoders.Text to Speech (TTS) analysis –Evolution of speech synthesis systems-Unitselection methods - TTS Applications.

Automatic speech recognition (ASR) –The Decision processes in ASR –Representativerecognition performance – Principle Component Analysis- Singular ValueDecomposition- Usage of Artificial Intelligence and Linear algebra in Speech processing.

Text Books:

Lawrence R.Rabiner and Ronald.W.Schafer: Introduction to Digital speechprocessing,now publishers USA,2007
E.S.Gopi: Algorithm collections for digital signal processing using matlab, Springer,2007.

Reference Books:

L.R.Rabiner and R.W.Schafer:Digital processing of speech signals, Prentice Hall,1978
T.F.Quatieri: Discrete-time Speech Signal Processing, Prentice-Hall, PTR, 2001
L.Hanzaetal, Voice Compression and Communications, Wiley/ IEEE , 2001

EC451 Image Processing (3-0-0)3

Linearity and space-invariance. PSF, Discrete images and image transforms, 2-D sampling and reconstruction, Image quantization, 2-D transforms and properties.

Image enhancement- Histogram modelling, equalization and modification. Image smoothing , Image crispening. Spatial filtering, Replication and zooming, Generalized cepstrum and homomorphic filtering.

Image restoration- image observation models.Inverse and Wiener filtering. Filtering using image transforms. Constrained least-squares restoration. Generalized inverse, SVD and interactive methods. Recursive filtering.Maximum entropy restoration. Bayesian methods.

Image data compression- sub sampling, Coarse quantization and frame repetition. Pixel coding - PCM, entropy coding, runlength coding Bit-plane coding. Predictive coding. Transform coding of images. Hybrid coding and vector DPCM. Interframe hybrid coding.

Image analysis- applications, Spatial and transform features. Edge detection, boundary extraction, AR models and region representation. Moments as features. Image structure.Morphological operations and transforms.Texture.Scene matching and detection. Segmentation and classification

Text Books:
 A.K. Jain, Fundamentals of Digital Image Processing , PHI, 1995.
R.C.Gonzalez& R.E. Woods; Digital Image Processing, (2/e), Pearson,2002
Reference Books:
J.C. Russ, The Image Processing Handbook, (5/e), CRC, 2006
E.S.Gopi,"Digital Image processing using Matlab", Scitech publications,2006.

EC453 ARM System Architecture   (3-0-0) 3

RISC machine.ARM programmer's model. ARM Instruction Set. Assembly level language programming. Development tools.

ARM organization.ARM instruction execution.ARMimplementation.ARM coprocessor interface. . Interrupt response.

Floating point architecture.Expressions.Conditionalstatements.Loops.Functions and procedures. Run time environment.

Thumb programmer's model. Thumb Instruction set. Thumb implementation.

Memory hierarchy.Architectural support for operating system.Memory size and speed.Cache memory management.Operatingsystem.ARM processor chips.

Text Books:
S. Furber, ARM System Architecture, Addison-Wesley,1996.
Andrew Sloss, Dominic Symes& Chris Wright, ARM system Developer's guide, Elsevier.2005.

Reference Books:
Technical reference manual for ARM processor cores, including Cortex, ARM 11, ARM 9 & ARM 7 processor families.
User guides and reference manuals for ARM software development and modeling tools.
David Seal, ARM Architecture Reference Manual, Addison-Wesley.

EC455   Microwave Integrated Circuit Design   (3-0-0)3

Design and realization of power dividers, hybrids, directional couplers etc using strip lines and microstrip lines.

Filter design; Kuroda identities. K and J inverters. Filter transformations. Realization using strip lines and microstrip lines.

Transistor amplifiers; Power gain equations.Stabilityconsiderations.Analysis.Design using MICs.

Transistor oscillators.Active devices for microwave oscillators. Three port S parameter characterization of transistors. Oscillation and stability conditions.

Diode mixers.Mixer design. Single ended mixer. Balanced mixer.Image rejection mixer. Phase shifter design. PIN diode. Phase shifter.

Text Books:

I.J.Bahl&Bhartia, Micrwave Solid State Circuit Design, Wiley, 1987.
G.D.Vendelin, Design of Amplifiers and Oscillators by the S Parameter Method, Wiley, 1982.

Reference Books:

T.C.Edwards, Foundations for MicrostripCircuir Design (2/e), Wiley, 1992.

EC457 Operating Systems (3-0-0) 3

Types of operating systems, Different views of the operating system, Principles of Design and Implementation. The process and threads. System programmer's view of processes, Operating system's views of processes, Operating system services for process management. Process scheduling, Schedulers, Scheduling algorithms.Overview of Linux operating system.

Interprocess synchronization, Mutual exclusion algorithms, Hardware support, Semaphores, Concurrent programming using semaphores.

Conditional critical regions, Monitors, Interprocess communication: Messages, Pipes. Deadlocks: Characterization. Prevention.Avoidance.detection and recovery. Combined approach to deadlock handling.

Contiguous allocation. Static and dynamic partitioned memory allocation. Segmentation.Non-contiguous allocation. Paging, Hardware support, Virtual Memory

Need for files. File abstraction. File naming. File system organization. File system optimization. Reliability.Security and protection.I/O management and disk scheduling.Recent trends and developments.

Text Books :

Gary: Operating Systems- A modern Perspective, (2/e), Addison Wesley, 2000.
M.Milenkovic: Operating systems, Concepts and Design, McGraw Hill, 1992.

Reference Books :

C. Crowley: Operating Systems, Irwin, 1997
J.l. Peterson & A.S. Chatz: Operating System Concepts, Addison Wesley, 1985.
W. Stallings: Operating Systems, (2/e), Prentice Hall, 1995

EC452 Principles of Radar (3-0-0) 3

Radar equation.Radar cross section.Cross section of small targets.Target scattering matrices.Area and volume targets.

Radar signals. Ambiguity function and its properties.Uncertainty principle. Pulse compression. linear FM pulse. Pulse compression by Costas FM and binary phase coding.

Radar detection.Optimum Bayesian decision rules.Detection criteria for different target models.

Range and Doppler measurements and tracking.Range and Doppler frequency resolutions.Optimum receivers. Optimum filters for Doppler measurements. Coherent and non coherent implementations.

Angle measurement and tracking. Angle measurement and tracking by conical scan and monopulse. Optimum monopulse systems.

Text Books:
P.Z.Peebles, Radar Principles, Wiley, 1998.
Merrill I. Skolink, Introduction to Radar Systems, (3/e), Tata MG Graw Hill, 2001

Reference Books:
N.Levanon, Radar Signals, Wiley, 2005.
D.Wehnar : High Resolution Radar (1987), Artech House.
D.K.Barton : Radar systems Analysis (1976), Prentice Hall.

EC454 Display Systems   **(3-0-0)3**

Introduction to displays.Requirements of displays. Display technologies, CRT, Flat panel and advanced display technologies. Technical issues in displays.

Head mounted displays. Displays less than and greater than 0.5 m diagonal.Low power and light emitting displays.

Operation of TFTs and MIMS. LCDs, Brightness. Types of LCD displays.

Emissive displays, ACTFEL, Plasma display and Field emission displays, operating principle and performance.

Types of Displays: 3D, HDTV, LED, Touch screen.

Text Books:
L.W. Mackonald& A.C. Lowe,Display Systems, Design and Applications, Wiley, 2003.
E.H. Stupp&M. S. Brennesholtz, Projection Displays, Wiley, 1999

Reference Books:
Peter A. Keller, Electronic Display Measurement: Concepts, Techniques, and Instrumentation, Wiley-Interscience, 1997

EC456 Satellite Communication   **(3 – 0 - 0) 3**

Elements of orbital mechanics.Equations of motion. Tracking and orbit determination. Orbital correction/control.Satellitelaunch systems.Multistage rocket launchers and their performance.

Elements of communication satellite design. Spacecraft subsystems.Reliabilityconsiderations.Spacecraft integration.

Multiple access techniques. FDMA,TDMA,CDMA. Random access techniques.Satellite onboard processing.

Satellite link design: Performance requirements and standards. Design of satellite links – DOMSAT, INSAT, INTELSAT and INMARSAT. Satellite - based personal communication.

Earth station design.Configiration.Antenna and tracking systems.Satellite broadcasting.

Text Books:
D.Roddy, Satellite Communication (4/e), McGraw- Hill, 2009.
T.Pratt&C.W.Bostain, Satellite Communication, Wiley 2000.

Reference Book:
B.N.Agrawal, Design of Geosynchrons Spacecraft, Prentice- Hall,1986.

EC458 Design of Cognitive Radio   (3 - 0 - 0) 3

Filter banks-uniform filter bank. direct and DFT approaches. Introduction to ADSL Modem.Discretemultitone modulation and its realization using DFT. QMF.STFT.Computation of DWT using filter banks.

DDFS- ROM LUT approach. Spurious signals, jitter. Computation of special functions using CORDIC.Vector and rotation mode of CORDIC.CORDIC architectures.

Block diagram of a software radio. Digital downconverters and demodulators Universal modulator and demodulator using CORDIC. Incoherent demodulation - digital approach for I and Q generation, special sampling schemes. CIC filters. Residue number system and high speed filters using RNS. Down conversion using discrete Hilbert transform. Undersampling receivers, Coherent demodulation schemes.

Concept of Cognitive Radio, Benefits of Using SDR, Problems Faced by SDR, CognitiveNetworks, Cognitive Radio Architecture. Cognitive Radio Design, Cognitive Engine Design,

A Basic OFDM System Model, OFDM based cognitive radio, Cognitive OFDM Systems, MIMO channel estimation, Multi-band OFDM, MIMO-OFDM synchronization and frequency offset estimation. Spectrum Sensing to detect Specific Primary System, Spectrum Sensing for Cognitive OFDMA Systems.

*Reference Books***:**

S. K. Mitra, Digital Signal processing, McGrawHill, 1998
J. H. Reed, Software Radio, Pearson, 2002.
U. Meyer – Baese , Digital Signal Processing with FPGAs, Springer, 2001
"Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems" by HüseyinArslan,University of South Florida, USA, Springer
"Cognitive Radio Networks" by Kwang-Cheng Chen, Ramjee Prasad, Wiley, 2009-06-15
"Artificial Intelligence in Wireless Communications" by Thomas W. Rondeau, Charles W.Bostian

EC459 Pattern Recognition   (3-0-0)3

Fundamental concepts and blocks of a typical pattern recognition system. Decision functions- role and types, pattern and weight space, properties and implementation of decision functions.

Feature identification, selection and extraction. Distance measures, clustering transformation and feature ordering, clustering in feature selection, feature selection through maximization and approximations.

Pattern classification by distance functions. Clusters and cluster seeking algorithms. Pattern classification by likelihood functions. Baye's classifier and performance measures.

Artificial neural network model, Neural network-based pattern associators, Feed forward networks and training by back-propagation- ART networks.

Applications of statistical and neural network – based pattern classifiers in speech recognition, image recognition and target recognition.

Text Books:
J.I.Tou&R.C.Gonzalez, Pattern Recognition Priciples, Addition –Wesley.
R.Schalkoff, Pattern Recognition –Statistiucal, Structural and Neural Approaches, John Wiley, 1992.

Reference Books:
P.A.Devijer&J.Kittler, Pattern Recognition-A Statistical Approach , Prentice –Hall.
Christopher.M.Bishop,"Pattern recognition and machine learning",Springer,2006.

EC460 Multimedia Communication Technology   **(3-0-0)3**

Components of multimedia system.Desirablefeatures.Applications of multimedia systems.Introduction to different types.Multimedia storage device.

Digital audio representation and processing-time domain and transform domain representations. Coding standards, transmission and processing of digital audio. Musical instrument synthesizers.

Still image coding-JPEG. Discrete cosine Transform. Sequential and Progressive DCT based encoding algorithms, lossless coding, hierarchical coding. Basic concepts of discrete wavelet transform coding and embedded image coding algorithms. Introduction to JPEG 2000.

Feature of MPEG 1, structure of encoding and decoding process, MPEG 2 enhancements, different blocks of MPEG video encoder.

Content based video coding-overview of MPEG 4 video, motion estimation and compensation. Different coding techniques and verification models. Block diagram of MPEG 4 video encoder and decoder. An overview of H261 and H263 video coding techniques.

Text Books:
Y.Q.Shi&H.Sun, Image and Video Compression for Multimedia Engineering, CRC Press, 2000.
S.V.Raghavan&S,K,Tripathi, Networked Multimedia Systems, Prentice-Hall, 1998.

Reference Book:
J.F.K.Buford, Multimedia Systems, Pearson, 2000.

EC462 RF MEMS Circuit Design   **(3-0-0) 3**

Introduction to MichomachiningProcesses.RF MEMS relays and switches. Switch parameters. Actuation mechanisms.Bistable relays and micro actuators.Dynamics of switching operation.

MEMS inductors and capacitors.Micromachinedinductor.Effect of inductor layout. Modeling and design issues of planar inductor. Gap-tuning and area-tuning capacitors.Dielectric tunable capacitors.

MEMS phase shifters. Types.Limitations. Switched delay lines. Fundamentals of RF MEMS Filters.

Micromachined transmission lines.Coplanarlines.Micromachined directional coupler and mixer.

Micromachinedantennas.Microstrip antennas – design parameters.Micromachining to improve performance.Reconfigurable antennas.

Text Book:
Vijay.K.Varadanetal, RF MEMS and their Applications, Wiley-India, 2011.

Reference Book:
H.J.D.Santos, RF MEMS Circuit Design for Wireless Communications, Artech House, 2002.
G.M.Rebeiz, RF MEMS Theory, Design, and Technology, Wiley, 2003.

EC464 Electronic Packaging   **(3-0-0) 3**

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends, Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates

Electrical Anatomy of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Transmission Lines , Clock Distribution, Noise Sources, power Distribution, signal distribution, EMI, Digital and RF Issues. Processing Technologies, Thin Film deposition, Patterning, Metal to Metal joining.

IC Assembly – Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging , reliability, wafer level burn – in and test.Single chip packaging : functions, types, materials processes, properties, characteristics, trends.Multi chip packaging : types, design, comparison, trends. Passives: discrete, integrated, embedded –encapsulation and sealing : fundamentals, requirements, materials, processes

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements.

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures – thermo mechanically induced – electrically induced – chemically induced. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.

Text Books :
Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill, 2001

Reference Books :
Blackwell (Ed), The electronic packaging handbook, CRC Press
Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill
Bosshart, Printed Circuit Boards Design and Technology,TataMcGraw Hill
R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011
R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005

EC 466 RFIC DESIGN   **(3-0-0) 3**

Characteristics of passive IC components at RF frequencies – interconnects, resistors, capacitors, inductors and transformers – Transmission lines. Noise – classical two-port noise theory, noise models for active and passive components

High frequency amplifier design – zeros as bandwidth enhancers, shunt-series amplifier, f_T doublers, neutralization and unilateralization

Low noise amplifier design – LNA topologies, power constrained noise optimization, linearity and large signal performance

Mixers – multiplier-based mixers, subsampling mixers, diode-ring mixers

RF power amplifiers – Class A, AB, B, C, D, E and F amplifiers, modulation of power amplifiers, linearity considerations

Oscillators & synthesizers – describing functions, resonators, negative resistance oscillators, synthesis with static moduli, synthesis with dithering moduli, combination synthesizers – phase noise considerations.

Text Books:
Thomas H. Lee, The Design of CMOS Radio-Frequency Integrated Circuits, 2nd ed., Cambridge, UK: Cambridge University Press, 2004.
BehzadRazavi, RF Microelectronics,2nd Ed., Prentice Hall, 1998.

Reference Books:
A.A. Abidi, P.R. Gray, and R.G. Meyer, eds., Integrated Circuits for Wireless Communications, New York: IEEE Press, 1999.
R. Ludwig and P. Bretchko, RF Circuit Design, Theory and Applications, Pearson, 2000.