Electrical Engineering Dept
M.Tech in Communication System Engineering (2013)

Course Curriculum: Semester I

Sl. No.	Course Number	Course Title	L	T	P	C
1	EE530	Advanced Digital Communication	3	0	0	6
2	EE520	Advanced Digital Signal Processing	3	0	0	6
3	EE534	Wireless Communication (Elective-I)	3	0	0	6
4	EE535	Communication Network (Elective-II)	3	0	0	6
5	EE536	Wireless Communication Integrated Circuits (Elective-III)	3	0	0	6
6	EE531	Communication System Engineering Lab – I	0	0	6	6
7	EE590	Seminar-I	0	0	4	4
Total			15	0	10	40

Course Curriculum: Semester II

Sl. No.	Course Number	Course Title	L	T	P	C
1	EE532	Optical Communication	3	0	0	6
2	EE5XX	Information Theory and Coding	3	0	0	6
3	EE5XX	Elective-IV	3	0	0	6
4	EE5XX	Elective-V	3	0	0	6
5	EE5XX	Elective-VI	3	0	0	6
6	EE533	Communication System Engineering Lab – II	0	0	6	6
7	EE591	Seminar-II	0	0	4	4
Total			15	0	10	40

Course Curriculum: Semester III

Sl. No.	Course Number	Course Title	L	T	P	C
1	EE592	Comprehensive Viva				10
2	EE593	Project Part-I				40
Total						50

Course Curriculum: Semester IV

Sl. No.	Course Number	Course Title	L	T	P	C
1	EE594	Project Part-II				45
Total						45

Total Credit: 40+40+50+45=175

Course Details:

EE 530 ADVANCED DIGITAL COMMUNICATION 3 0 0 6

Mathematical Preliminaries. Communication Channel Models. Channel capacity. Source Coding: Fixed and Variable Length Codes, Kraft Inequality, Huffman Algorithm. Deterministic and Random Signal: Bandpass & Lowpass Signals, Signal Space Concepts, Orthogonal Representation of Signals, Gram-Schmidt Procedure. Digital Modulation Schemes: Binary and Advanced Digital Modulation: CPFSK, GMSK, QPSK/DQPSK/M-ary QAM. Optimum Receiver in Presence of Additive White Gaussian Noise: Coherent versus Non-coherent Detection, Binary Signal Detection in AWGN, M-ary Signal Detection in AWGN. Receiver Synchronization. Channel Coding: Linear Block Codes, Cyclic Codes, Convolutional Codes, Turbo and LDPC codes, Trellis Based Codes: Viterbi Decoding. Adaptive Equalization: LMS, MLSD, Kalman Filter, Blind Equalization. Spread Spectrum Communication: Direct Sequence Spread Spectrum Signals, Frequency-Hopped Spread Spectrum Signals. Multichannel Digital Communication: Orthogonal Frequency Division Multiplexing. Concepts of Multiuser Communication and Multiple Antenna Systems: CDMA, MIMO, Multiuser MIMO systems.

Text/References:

1. J. G. Proakis, M. Salehi, *Digital Communications*, McGraw Hill, 5th Edition, 2008.
2. R. G. Gallager, *Principles of Digital Communication*, Cambridge University Press, 2009
3. P. B Crilly, A. B. Carlson, *Communication Systems*, Tata McGraw-Hill Education, 5th Edition, 2011.
4. U. Madhow, *Fundamentals of Digital Communication*, Cambridge University Press, 2008
5. S. Haykin, *Digital Communications*, Wiley-India, 2011
6. J.M Wozencraft, I.M. Jacobs, Principles *of Communication Engineering*, John Wiley, 1965.
7. I. A. Glover, P. M. Grant, *Digital Communications*, Pearson, 5th Impression, 2012.
8. P. Z. Peeples*, Digital Communication Systems*, Prentice Hall International, 1987.

EE 520 ADVANCED DIGITAL SIGNAL PROCESSING 3 0 0 6

Discrete Time Signals: Sequences; representation of signals on orthogonal basis; Sampling and Reconstruction of signals;

Discrete systems: attributes, Z-Transform, Analysis of LSI systems, Frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform algorithm, Implementation of Discrete Time Systems.

Design of FIR Digital filters: Window method, Park-McClellan's method.

Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters.

Effect of finite register length in FIR filter design

Parametric and non-parametric spectral estimation: Introduction to multi-rate signal processing. Application of DSP to Speech and Radar signal processing.

Texts/ References

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
2. S. K. Mitra, Digital Signal Processing: A computer-Based Approach, 3/e, TMcHl, 2006.
3. John G. Proakis and D. G. Manolakis, Digital Signal Processing: Principle, Algorithms and Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss, Digital Signal Processing, J Wiley and Sons, Singapore, 1988.

EE 534 WIRELESS COMMUNICATION 3 0 0 6

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:

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

EE535 COMMUNICATION NETWORKS 3-0-0-6

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, simplex stop and wait, sliding window protocol, SONET/SDH, ISDN switches, 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, Network layer: Routing algorithms, IP protocol, ICMP, ARP, RARP, Mobile IP; Transport layer: Establishing and releasing connection, TCP and UDP, Sockets interface, sockets programming; Application Layer: SNMP, Authentication, Encryption, electronic mail, WWW; Admission control in Internet, Concept of Effective bandwidth, Measurement based admission control, Differentiated Services in Internet; MPLS switching, MPLS architecture and framework. MPLS Protocols. Traffic engineering issues in MPLS, Lamda Switching, DWDM Networks.

Texts:

1. W. Stallings, Data and Computer Communications, 7th Ed, Prentice Hall, 2004.
2. Alberto Leon Garcia, I. Widjaja, Communication Networks, 2nd Ed., Tata McGraw Hill, 2010

References:

1. J. F. Kurose and K. W. Ross, Computer networking: A Top-down Approach Featuring the Internet, 3rd Ed, Addison-Wesley, 2005.
2. A. S. Tenenbaum, Computer Networks, 4th Ed, Prentice Hall PTR, 2003.
3. B. A. Forouzan, Data Communications and Networking, 3rd Ed, McGraw Hill, 2004.
4. T. Ramteke, Networks, 2nd Ed, Prentice Hall, 2001.
5. G. Held, Ethernet Networks: Design, Implementation, Operation, Management, 4th Ed, John Wiley & Sons, 2002.
6. Stevens, D.L. et al., TCP/IP Illustrated, Volumes I, II and III, Addison Wesley, 1996.

EE 536 WIRELESS COMMUNICATION INTEGRATED CIRCUITS 3 0 0 6

Introduction to RF and Wireless technology; Basic concepts in RF & Wireless Integrated Circuits Design; Receiver and Transmitter Architectures.
Low Noise RF Amplifiers – LNA basic topologies, Linearity and Noise in amplifiers, Stability, Matching Considerations, Differential and Broadband Amplifier;
Mixers – Mixer Operation, Passive and Active Mixers, Single & Double-Balanced Mixers, Noise in Mixers, Image Reject and Single Sideband Mixers;
Oscillators – Voltage Controlled-Oscillator, Negative Resistance Oscillator, Oscillator as a Feedback System, Oscillator Analysis, Colpitts, Hartley, Clapp, Pierce crystal Oscillators, Noise in Oscillators, Quadrature Oscillators, Tunable Oscillator;
Frequency Synthesizers – Phase Locked Loop (PLL), Analysis of PLL Synthesizers, Phase Noise in PLL Synthesis, PLL Frequency Synthesizers, Integer-N and Fractional-N PLL Synthesizers, PLL System Frequency Response and Bandwidth;
RF Power Amplifiers – Efficiency, Matching Considerations, Analysis of Basic Classes – A, AB, B, C, Class B Push-Pull Arrangements, Switch mode Classes – D, E, F Amplifiers, Doherty Power Amplifier.

Prerequisite: Basic Electronics and Basic Electromagnetic Engineering.

Text:

1. Behzad Razavi, RF MicroElectronics, 3/e, Pearson India.
2. John W M Rogers and Calvin Plett, Radio Frequency Circuit Design, Artech House, Boston.
3. Les Besser and Rowan Gilmore, Practical RF Circuit Design for Modern Wireless Systems, vol. 2, Artech House, Boston
4. David M Pozar, Microwave and RF Design of Wireless Systems, John Wiley and Sons
5. Thomas H Lee, The Design of CMOS Radio Frequency Integrated Circuits, Cambridge University Press

Ref:

1. Guillermo Gonzalez, Microwave Transistor Amplifier- Analysis and Design, Prentice Hall, New Jersey.
2. Richard C-H Li, RF Circuits Design, John Wiley