MAHATMA GANDHI- UNIVERSITY

SCHEME AND SYLLABI

FOR

M. Tech. DEGREE PROGRAMME

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

WITH SPECIALIZATION IN

COMMUNICATION ENGINEERING

(2013ADMISSION ONWARDS)

SCHEME AND SYLLABI FOR M. Tech. DEGREE PROGRAMME IN COMMUNICATION ENGG

SEMESTER - I

Sl. No.	Course No.	Subject	Hrs / Week			Evaluation Scheme (Marks)					Credits (C)
			L	T	P	Sessional			ESE	Total	
						TA	CT	Sub Total			
1	MECCE 101	Analytical Foundations for Communication Engineering**	3	1	0	25	25	50	100	150	4
2	MECCE 102	Information Theory	3	1	0	25	25	50	100	150	4
3	MECCE 103	Advanced Digital Communication Techniques	3	1	0	25	25	50	100	150	4
4	MECCE 104	Communication Networks	3	1	0	25	25	50	100	150	4
5	MECCE 105	Elective – I	3	0	0	25	25	50	100	150	3
6	MECCE 106	Elective – II	3	0	0	25	25	50	100	150	3
7	MECCE 107	Communication Systems Engg. Lab-I	0	0	3	25	25	50	100	150	2
8	MECCE 108	Seminar – I	0	0	2	50	0	50	0	50	1
Total			**18**	**4**	**5**	**225**	**175**	**400**	**700**	**1100**	**25**

**** This course is to be offered by faculty from the ECE Department and the Question paper setting also to be done by ECE faculty.**

Elective – I (MECCE 105)		Elective – II (MECCE 106)	
MECCE 105 - 1	Optical Communication	MEC CE 106 - 1	Wireless Communications
MEC CE 105 - 2	Antenna Theory and Design	MEC CE 106 - 2	Advanced Digital Signal Processing
MEC CE 105 – 3*	Image and video Processing	MEC CE 106 - 3	Principles of Communication System Simulation
MEC CE 105 - 4	Computational Electromagnetics	MEC CE 106 - 4	High Frequency Circuit Design

L – Lecture, **T** – Tutorial, **P** – Practical

TA – Teacher's Assessment (Assignments, attendance, group discussion, Quiz, tutorials, seminars, etc.)

CT – Class Test (Minimum of two tests to be conducted by the Institute)

ESE – End Semester Examination to be conducted by the University

Electives: New Electives may be added by the department according to the needs of emerging fields of technology. The name of the elective and its syllabus should be submitted to the University before the course is offered.

- *** Common with MECCI and MECAE**

MECCE101	ANALYTICAL FOUNDATIONS FOR COMMUNICATION ENGINEERING	L	T	P	C
		3	1	0	4

Module 1:

Linear Algebra: Vector Spaces, Subspaces, Linear Independence, Basis And Dimension, Row pace, Column space, Null space, Rank and Nullity, Inner Product Spaces, Orthonormal Bases, Gram-Schmidt Procedure, Linear Transformations, Kernels And Images , Matrix Representation Of Linear Transformation, Change Of Basis, Eigen Values And Eigen Vectors, Diagonalization.

Module2:

Review of random processes: Classification of General Stochastic Processes, Jointly Gaussian Random Variables**,** Gaussian Random Process, Mean and Correlation of Random Processes, Stationary and Wide Sense Stationary Random Processes, Spectral Density Function, Low Pass and Band Pass Processes, White Noise and White Noise Integrals, Linear Predictions and Filtering, Random Processes as Input to LTI Systems.

Module 3:

Markov Process: Discrete Time Markov Chains- Definition, Examples, Transition Probability Matrices of a Markov Chain, Classification of States and Chains, Chapman Kolmogorov Equation, Basic Limit Theorem, Limiting Distribution of Markov Chains. Continuous Time Markov Chains: General Pure Birth Processes And Poisson Processes-Properties, Inter Arrival And Waiting Time Distributions, Birth And Death Processes.

Module 4:

Queuing Theory: Queuing models- Little's Theorem, Cost equations, steady state probabilities, exponential models- M/M/1, M/M/m, M/M/infinity, M/M/m/m models-balance equations, steady state distributions, Erlang's B and C formulae, Network of queues-basic concepts, M/G/1 system – basic concepts.

References:

1. Kenneth Hoffman and Ray Kunze, Linear Algebra, 2nd Edition, PHI. (Module 1)
2. Gilbert Strang, Linear Algebra and Its Applications, Thomson Learning (Module 1)
3. J.H. Kwak, S. Hong, "Linear algebra", 2nd edition, Springer India, 2010.
4. R. Bronson, G.B. Costa, 'Linear algebra- An Introduction", 2nd edition, Elsevier India, 2009

5. Alberto Leon Garcia, “Probability and Random Processes for Electrical Engineering”, Pearson Education, 2nd edition. (Modules 2, 3, 4)
6. S. M. Ross, Introduction to Probability Models, Elsevier, 8th edition (Modules 2, 3, 4)
7. A. Papoulis, S. U. Pillai, “Probability, Random Variables and Stochastic Processes” 4th Edition Tata-Mc Hill (4/E), 2001(Modules 2, 3)
8. D. Bertsekas and R. Gallager, “Data Networks”, Prentice Hall of India, 2/e, 2000 (Chapter 3 for Module 4)
9. S. Karlin & H.M Taylor, A First Course In Stochastic Processes, 2nd Edition, Academic Press, New York.
10. J. Medhi, Stochastic Processes, New Age International, New Delhi.

MECCE102 **INFORMATON THEORY**

L	T	P	C
3	1	0	4

Pre-requisite: A first course in Probability Theory and Communication

Module 1:

Information And Sources - Memory Less Sources- Markov Sources - Entropy - Entropy Of A Discrete Random Variable- Joint, Conditional And Relative Entropy- Mutual Information And Conditional Mutual Information- Chain Relation For Entropy, Relative Entropy And Mutual Information

Module 2:

Source Coding: Uniquely Decodable Codes-Instantaneous Codes- Kraft's Inequality– Mcmillan's Inequality-Average Length of a Code-Optimal Codes-Shannon Codes- Fano Codes-Huffman Coding – Optimality Of Huffman Codes-Lempel Ziv Codes-Shannon's Source Coding Theorem – Arithmetic Coding.

Module 3:

Channel Capacity**:** Examples, Symmetric channels**,** Properties **-**Data Transmission over Discrete Memory less Channels- Shannon's Channel Coding Theorem, Zero error codes, Fano's Inequality.

Module 4:

Differential Entropy-Joint, Relative and Conditional Differential Entropy-Mutual Information-Waveform Channels-Gaussian Channels-Mutual Information And Capacity Calculation For Band Limited Gaussian Channels-Shannon Limit.

Basic Concepts of Rate Distortion Theory: Rate Distortion Function - Properties – Calculation of Rate Distortion Function for Binary Source and Gaussian Source.

References

1. Thomas M. Cover and Joy A. Thomas, "Elements of Information Theory", Wiley India, 2011
2. R. Gallager, "Information Theory and Reliable Communication", John Wiley & Sons.
3. R. J. McEliece, "The Theory of Information & coding", Addison Wesley Publishing Co., 1977.

4. T. Bergu, “Rate Distortion Theory, a Mathematical Basis for Data Compression” PH Inc. 1971.
5. Special Issue on Rate Distortion Theory, IEEE Signal Processing Magazine, November 1998.

MECCE 103	ADVANCED DIGITAL COMMUNICATION TECHNIQUES	L	T	P	C
		3	1	0	4

Pre-requisite: A basic course in Digital Communication

Module 1: **Review**

Review of Random variables, probability distribution and density functions, statistical averages- Moment generating function, Upper bounds on tail probability- Chebyshev inequality, Chernoff bound, Central limit Theorem, Binomial, Gaussian, Chi square, Rayleigh, Rician, Nakagami and Multi variate Gaussian distributions – PDFs and moments, Characterization of Communication Signals and Systems- Signal space representation, Representation of digitally modulated signals, Memory less modulation methods, Multi dimensional signaling.

Module 2: Communication over Additive Gaussian Noise Channels

Optimum receivers for AWGN channels, Waveform and vector AWGN channel models- Optimal detection, Correlation receiver, Matched filter receiver, Optimal detection and error probabilities for Band limited and Power limited signaling, Non coherent detection, Comparison of digital signaling methods, Link budget analysis in radio communication systems

Module 3: Synchronization in Communication Systems

Carrier Recovery and Symbol Synchronization in Signal Demodulation- Signal parameter estimation, Carrier Phase Estimation-, Maximum Likelihood phase estimation, Phase locked loop, Effect of additive noise on the phase estimate; Symbol Timing Estimation- Maximum Likelihood timing estimation- Receiver structure with phase and timing recovery; Joint Estimation of Carrier phase and Symbol Timing.

Module 4: Communication over Band limited Channels

Characterization for band limited channels, Signal design - Optimum pulse shaping, Nyquist criterion for zero ISI, partial response signaling; Optimum receiver for channels with ISI and AWGN; Equalization Techniques- Linear Equalization, Decision feedback equalization, Turbo equalization; Adaptive Equalization - adaptive linear equalizer, zero forcing algorithm, LMS algorithm, adaptive decision feedback equalizer.

References:

1. J.G. Proakis, M. Salehi, “Digital Communication”, MGH 5th edition, 2008.

2. J.G. Proakis, M. Salehi, “Fundamentals of Communication systems”, Pearson, 2005.
3. John B. Anderson, “Digital Transmission Engineering”, Wiley India Reprint,2012.
4. Edward. A. Lee and David. G. Messerschmitt, “Digital Communication”, Allied Publishers (second edition).
5. J Marvin.K.Simon, Sami. M. Hinedi and William. C. Lindsey, “Digital Communication Techniques”, PHI.
6. William Feller, “An introduction to Probability Theory and its applications”, Wiley 2000.
7. Sheldon.M.Ross, “Introduction to Probability Models”, Elsevier, 9th edition, 2007.

MECCE104 COMMUNICATION NETWORKS

L	T	P	C
3	1	0	4

Pre-requisite: A basic course in Computer Networks

Module 1

Introduction to network architecture; Layering and protocols, OSI/Internet architecture, Performance parameters, Data link layer - Error detection and correction, multiple access protocols, Link layer addressing, Ethernet, CSMA/CD, Reliable Transmission-ARQ schemes and analysis.

Module 2

Internet Architecture: Layering in the Internet, Applications layer - HTTP, SMTP, Telnet, FTP; TCP/IP protocol stack. Transport layer -TCP and UDP- Congestion control and avoidance, Fairness; Network layer – IPV4 and IPV6, Routing algorithms-Link state, Distance vector, Hierarchical; Routing in the Internet.

Module 3

Wireless links and Network characteristics, IEEE 802.11 wireless LANs-architecture, protocol, framing- Mobility management principles- Mobile IP; Multimedia networking- streaming stored audio and video, protocols for real time interactive applications, Scheduling and policing; QOS- Integrated and Differentiated services.

Module 4

Principles of Network security and Cryptography – cryptographic tools- principles of ciphers, symmetric key and public key ciphers; Authentication protocols, Integrity_ Digital signatures, Hash functions, Key distribution – public key and symmetric key, Firewalls, Security systems- email, TLS, HTTPS, IPsec, 802.11i etc

References:

1. James. F. Kurose and Keith. W. Ross, “Computer Networks: A top-down approach featuring the Internet”, Pearson Education, 3/e, 2005.
2. L. L. Peterson & B. S. Davie, “Computer Networks: A System Approach”, Elsevier, 4/e, 2007
3. Jean Walrand & PravinVaraiya, “High Performance Communication Networks”, Morgan Kaufman Publishers, 2nd edition ,2000
4. Leon Gracia, IndraWidjaja, “Communication Networks”, Tata McGraw Hill, 2nd edition, 2005

5. Behrouz Forouzan, “Data Communications & Networking”, Tata McGraw-Hill, 2006
6. Stallings, W. “Cryptography and network security: principles and practice”. Pearsonl,5th edition, 2011.

L	T	P	C
3	0	0	3

MECCE 105-1 **OPTICAL COMMUNICATION**

Module I:

Nature of Light, propagation through a medium, total internal reflection. Guided optical communication – wave representation in a dielectric slab wave guide, fibre- a cylindrical wave guide. Modes overview, modal concepts, Maxwell's equations, waveguide equations. Modal analysis, modal equations, modes in SI fibres, LP modes. Power flow in SI fibre, mode field diameter, attenuation, transmission window, Signal distortion in fibres.

Module II:

Optical sources – LED – spectrum, quantum efficiency, power. Laser diodes – modes and threshold conditions, Rate equations, external quantum efficiency, resonant frequency, radiation pattern. Light source linearity and reliability considerations. Photo detectors – photo detection principle, quantum efficiency, responsivity,. Photo detector noise, noise sources, response time. PIN, APD (structure and working only).

Module III:

Digital receivers – probability error, receiver sensitivity, quantum limit, BER and Q-factor measurements. Coherent detection – concepts, homodyne and heterodyne reception, BER comparison. Bust mode receiver. Analog receivers. Point-to-point link. Rise time budget, power budget. Power penalties. Error control.

Module IV:

WDM concepts and components – operation principle standards, Mach-Zehnder interferometer multiplexer. Isolators and circulators. Fibre grating filters – basics, FBG analysis and applications. Dielectric thin film filters, phased-array based devices, diffraction gratings. Active optical components – MEMs, variable optical attenuators, tunable optical filters, dynamic gain equalizers, optical add/drop multiplexers, polarization and dispersion controllers. Self phase modulation, cross phase modulation, four wave mixing, FWM mitigation, wave length convertors. Solitons – concept, parameters, width and spacing.

References:

1. Gerd Keiser, "Optical fibre communications", TMH, 4th Edition, 2008.

2. Harold Kolimbiris, “Fiber optics communications”, Pearson Education, 2nd Edition, 2009.
3. Govind P Agrawal, “Fiber optic communication systems”, 4th Edition, John Wiley, 2010.
4. J.M. Senior, “Optical fibre communications”, Pearson education, 3rd Edition, 2009.

MECCE 105-2	ANTENNA THEORY AND DESIGN	L	T	P	C
		3	0	0	3

Pre requisite: A basic course in electromagnetics, antennas, radiation and propagation.

Module I:

Basic concepts in Antenna theory: Radiation process- mechanism of radiation of EM energy from a dipole and horn (concept only) radiation pattern. Antenna parameters (concept and expressions) – radiation equation, pattern, beam width, aperture, effective height, antenna field region/zone. Reciprocity theorem (details).self-impedance and mutual impedance (concepts). Effect of ground plane –image theory, Small loop antenna, Duality theorem and applications. Communication link – receiving and transmitting antenna, electrical equivalent ckt., Point source concept.

Module II:

Antenna Synthesis: Continuous source – line-source, discretization of continuous sources, Schelkunoff Polynomial method, Fourier Transform method, Woodward-Lawson method, Taylor line-source-design procedure. Taylor line source (one-parameter),Triangular, cosine and cosine-squared amplitude distributions, Line-source phase distributions, Continuous aperture sources-Rectangular aperture, circular aperture.

Module III:

Microstrip antennas: Basic characteristics, feeding methods, methods of analysis. Rectangular patch- Transmission line model, Cavity model, Directivity –single slot and two slots, Circular patch, Quality factor, bandwidth and efficiency, Input impedance, Coupling.

Module IV:

Smart antennas: Smart antenna systems with analogy, Signal propagation, Smart antennas-benefits and drawbacks. Array Design- linear array, planar array. Antenna beam formation (detailed study) - direction-of-arrival (DOA) algorithms, adaptive beam formation, mutual coupling. Smart antenna system design, simulation and results- design process, single element patch, rectangular patch, array design, planar arrays comparison, adaptive beam forming.

References:

1. Constantine A Balanis, ”Antenna theory: analysis and design”, Wiley India, 3rd Edition, 2011.

2. J. D Kraus, R. J Marhefka, A. S. Khan “Antennas for all applications”, MGH, 3rd Edition, 2003. (Module1, Module3)

3. W. L. Stutzman, G.A. Thiele, “Antenna theory and design”, Wiley, 3rd Edition, 2010. (Module 1, Module2)

4. Drabowitch, Papiernik, “Modern Antennas”, Springer, 2^{nd} Edition, 2005.

MECCE105-3*	IMAGE AND VIDEO PROCESSING	L	T	P	C
		3	0	0	3

Module 1:

Introduction To Digital Image Processing & Applications ,Elements Of Visual Perception-Mach Band Effect-,Sampling, Quantization, Basic Relationship Between Pixels, Color Image Fundamentals-RGB-HSI Models, Image Transforms-Two Dimensional Orthogonal And Unitary Transforms ,Separable Unitary Transforms -Basis Images, DFT, WHT, KLT, DCT And SVD.

Module 2:

Image Enhancement - Filters In Spatial And Frequency Domains, Histogram-Based Processing, Homomorphic Filtering. Image Restoration: Degradation Models, PSF, Circulant And Block - Circulant Matrices, Deconvolution, Restoration Using Inverse Filtering, Wiener Filtering And Maximum Entropy Based Methods. Image Segmentation: Pixel Classification, Bi-Level Thresholding, Multilevel Thresholding, Adaptive Thresholding, Spectral & Spatial Classification, Edge Detection, Hough Transform, Region Growing.

Module 3:

Representation- Boundary Representation: Chain Codes- Polygonal Approximation – Boundary Segments – Boundary Descriptors - Regional Descriptors–Relational Descriptors-Object Recognition-Pattern And Pattern Classes-Recognition Based On Decision Theoretic Methods-Matching-Optimum Statistical Classifiers-Structural Methods-Matching Shape Numbers-String Methods. Morphological Image Processing-Erosion And Dilation, Opening Or Closing, HIT Or MISS Transformation, Basic Morphological Algorithms, Grey Scale Morphology.

Module 4:

Video Processing - Display Enhancement, Video Mixing, Video Scaling, Scan Rate Conversion, Representation Of Digital Video, Spatio-Temporal Sampling; Video Compression-Motion Estimation, Intra And Interframe Prediction, Perceptual Coding, Standards - MPEG, H.264 .

References

1. K. Jain, Fundamentals Of Digital Image Processing, Prentice Hall Of India, 1989.
2. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education, 2007.
3. Iain E Richardson, H.264 and MPEG-4 Video Compression, John Wiley & Sons, September 2003
3. M. Tekalp, Digital Video Processing , Prentice-Hall of India
4. A Bovik, Handbook Of Image & Video Processing, Academic Press, 2000
5. W. K. Pratt, Digital Image Processing, Prentice Hall of India
6. Rosenfeld And A. C. Kak, Digital Image Processing,Vols. 1 And 2, Prentice Hall.
7. K.R.Rao, Zoran.S Bojkovic, Dragorad A Milovanovic, Multimedia Communication Systems: Techniques ,Standards And Networks , Prentice Hall of India

MECCE 105-4 | **COMPUTATIONAL ELECTROMAGNETICS**

L	T	P	C
3	0	0	3

Module 1:

Introduction To Electromagnetic Fields: Review Of Vector Analysis, Electric And Magnetic Potentials, Boundary Conditions, Maxwell's Equations, Diffusion Equation, PoyntingVector, Wave EquationFinite Difference Method (FDM): Finite Difference Schemes, Treatment Of Irregular Boundaries, Accuracy And Stability Of FD Solutions.

Module 2:

Finite-Difference Time-Domain (FDTD) Method ,Finite Element Method (FEM): Overview Of FEM, VariationalAnd Galerkin Methods, Shape Functions, Lower And Higher Order Elements, Vector Elements, 2D And 3D Finite Elements, Efficient Finite Element ComputationsMethod Of Moments (MOM): Integral Formulation, Green's Functions And Numerical Integration, Other Integral Methods: Boundary Element Method, Charge Simulation Method.

Module 3:

Special Topics: Hybrid Methods, Coupled Circuit - Field Computations, Electromagnetic - Thermal And Electromagnetic - Structural Coupled Computations, Solution Of Equations.

Module 4:

Applications: Low Frequency And High Frequency Electrical Devices, Static / Time-Harmonic / Transient Problems In Transformers, Rotating Machines, Waveguides, Antennas, Scatterers.

References:

1. M. V. K. Chari AndS. J. Salon, Numerical Methods in Electromagnetism, Academic Press, 2000.
2. M. N. O. Sadiku, Numerical Techniques in Electromagnetics, CRC Press, 1992.
3. N. Ida, Numerical Modeling for Electromagnetic Non-Destructive Evaluation, Chapman and Hall, 1995.
4. S. R. H. Hoole, Computer Aided Analysis and Design of Electromagnetic Devices, Elsevier Science Publishing Co., 1989.
5. J. Jin, The Finite Element Method In Electromagnetics, 2nd Ed., John Wiley And Sons, 2002.

6. P. P. SilvesterAnd R. L. Ferrari, Finite Elements For Electrical Engineers, 3rd Ed., Cambridge University Press, 1996.

MECCE 106-1

WIRELESS COMMUNICATION

L	T	P	C
3	0	0	3

Module I

Fading and Diversity: Wireless Channel Models- path loss and shadowing models, statistical fading models- Narrow band and wideband fading models. **Diversity-** Time diversity, Frequency and Space diversity, Receive diversity, Concept of diversity branches and signal paths, Performance gains, Combining methods- Selective combining, Maximal ratio combining, Equal gain combining, Transmit Diversity - Alamouti Scheme.

Module II

Performance of digital modulation over wireless channels- AWGN Channels, Fading channels, Doppler spread, Inter symbol interference. Capacity of Wireless Channels- Capacity in AWGN, Capacity of flat fading and frequency selective fading channels

Module III

Cellular Communication: Cellular Networks- Multiple Access: FDM/TDM/FDMA/TDMA- Spatial reuse, Co-channel interference analysis- Hand-off, Erlang Capacity Analysis- Spectral efficiency and Grade of Service, Improving capacity - Cell splitting and sectorization. Overview of second generation cellular wireless systems: GSM and IS-95 standards, 3G systems: UMTS & CDMA 2000 standards and specifications, LTE & 4G proposals.

Module IV

Spread spectrum and CDMA: Overview of CDMA systems: Direct sequence and frequency hopped systems-spreading codes-code synchronization-Channel estimation-power control-Multiuser detection- Spread Spectrum Multiple Access- CDMA Systems- Interference Analysis for Broadcast and Multiple Access Channels- Capacity of cellular CDMA networks.

References:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University press, 2008.
2. A.M. Molisch, " Wireless Communications", Wiley India, 2010.
3. T.S. Rappaport, "Wireless Communication, Principles & Practice", Pearson Education, 2010.
4. G.L Stuber, "Principles of Mobile Communications", 2nd Edn, Kluwer Academic Publishers.

5. R.L Peterson, R.E. Ziemer and David E. Borth, “Introduction to Spread Spectrum Communication”, Pearson Education, 2009.

MECCE 106-2	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

Module 1: Transform theory

Generalized Fourier theory, Discrete Fourier transform, Uncertainty principle, Short time (windowed) Fourier transforms (STFT), Properties of STFT, Discrete STFT, Time-frequency window, Gabor Transform, Discrete Gabor Transform

Module 2: Multi resolution analysis

Wavelets: The basic functions, Specifications, Admissibility conditions, Continuous wavelet transform (CWT), Discrete wavelet transform (DWT). The multi resolution analysis (MRA), MRA axioms, Construction of an MRA from scaling functions - The dilation equation and the wavelet equation, Compactly supported orthonormal wavelet bases - Necessary and sufficient conditions for orthonormality.

Module 3: Multirate Signal Processing

Fundamentals of Multi rate Theory, The sampling theorem, sampling at sub Nyquist rate, Basic formulations and schemes, Basic multi rate operations, sampling rate conversion-multi stage implementation of sampling rate conversion, Decimation, interpolation, Digital filter banks, DFT filter bank, Identities, Polyphase representation, maximally decimated filter banks: Errors in the QMF bank, Perfect reconstruction QMF bank, Design of an alias free QMF

Module 4: Spectral Estimation

Power Spectral Density, Spectral factorization, Filtering Random Processes, Special types of Random Processes – ARMA, AR, MA – Yule-Walker equations.Estimation of spectra from finite duration signals, Nonparametric methods – Periodogram, Modified periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric methods – ARMA, AR and MA model based spectral estimation, Solution using Levinson-Durbin algorithm

REFERENCES

1. Stephen G. Mallat, “A wavelet tour of signal processing” 2nd Edition Academic Press, 2000.
2. J.C. Goswami, A.K. Chan, “Fundamentals of Wavelets”, Wiley India, 1999
3. P.P. Vaidyanathan, “ Multirate systems and Filter Banks”, Pearson Education, 2004.

4. John J. Proakis, Dimitris G. Manolakis,” Digital Signal Processing’, Pearson Education, 2002

5. Monson H. Hayes, ‘Statistical Digital Signal Processing and Modeling”, John Wiley and Sons, Inc, Singapore, 2002

MECCE 106-3	PRINCIPLES OF COMMUNICATION SYSTEM SIMULATION	L	T	P	C
		3	0	0	3

Pre-requisite: A first course in communication engineering, signals and system theory and random processes

Module 1:

Introduction To Simulation And Modeling Methodology-Role Of Simulation-Basic Concepts of Modeling- Error Sources In Simulation- Validation –Performance Evaluation.Fundamental Concepts Of Sampling, Quantization, Reconstruction, Simulation Sampling Frequency. Simulation Models For Bandpass Signals And Systems - Linear Bandpass Systems, Non Linear And Time Varying Systems.

Module 2:

Simulation Of Filter Models – IIR And FIR Filters – Synthesis And Simulation, IIR And FIR Filter Implementation, Filter Characteristics, Case Study: Simulation Of A PLL And Solution Of Differential Equations

Module 3:

Generation Of Random Signals, Uniform Random Number Generators, Mapping Uniform Rvs To An Arbitrary Pdf, Generating Uncorrelated And Correlated Gaussian Random Numbers, PN Sequence Generators

Module 4:

Introduction To Monte Carlo Methods- Relative Frequency, Unbiased And Consistent Estimators**,** Application To Communications Systems—The AWGN Channel, Convergence And Confidence Intervals, Monte Carlo Simulation Of Communication Systems, Basic Methodology Of Simulation Of A Wireless System

References:

1. W.Tranter, K. Shanmugan, T. S. Rappaport, K L. Kosbar, “Principles of Communication Systems Simulation With Wireless Applications”, Pearson Education, 2004.
2. M. C. Jeruchim, P. Balaban, AndK. S. Shanmugan, "Simulation Of Communication Systems: Modeling, Methodology, And Techniques", 2nd Edition, Kluwer Academic/Plenum Publishers, 2000.

3. J. G. Proakis, M. Salehi, G. Bauch, **“**Contemporary Communication Systems Using MatlabAnd Simulink**”,** 2nd Edition, Thomson Engineering, 2004.
4. P. Balaban, K. S. Shanmugan, and B. W. Stuck, Eds., **“**Computer-Aided Modeling, Analysis, And Design Of Communication Systems”**,** Vol. 6. IEEE Journal On Selected Areas In Communications, Jan. 1984.

MECCE 106-4	HIGH FREQUENCY CIRCUITS DESIGN

L	T	P	C
3	0	0	3

Module 1: Review of Transmission Line Theory and Scattering Parameters

General Transmission Line Equation, Terminated Lossless Transmission Line, Special Termination Conditions, Sourced and Loaded Transmission Line;Review of Scattering Parameters and Smith Chart;Impedance Matching Networks**:** Impedance Matching using Discrete Components, Microstripline Matching Networks, Single Stub Matching Network , Double Stub Matching Network. Quarter-Wave Transformers, Multi-Section and Tapered Transformers.

Module 2: RF Filter Design

Basic Resonator and Filter Configurations: Filter Types and Parameters, Low-Pass Filter, High-Pass Filter, Band pass and Band stop Filters, Insertion Loss, Special Filter Realizations: Butterworth - Type Filters, Chebyshev - Type Filters, Denormalization of Standard Low-Pass Design, Filter Implementation**:** Unit Elements, Kuroda's Identities, Examples of Micro strip Filter Design, Coupled Filter**:** Odd and Even Mode Excitation, Band pass Filter Section, Cascading band pass filter elements.

Module 3: RF Transistor Amplifier Designs

Characteristics of Amplifiers; Amplifier Power Relations; Stability Considerations**:** Stability Circles, Unconditional Stability, Stabilization Methods; Constant Gain**:** Unilateral Design, Unilateral Figure of Merit, Bilateral Design, Operating and Available Power Gain Circles; Noise Figure Circles; Constant VSWR Circles; Broadband, High-Power and Multistage Amplifiers.

Module 4: Oscillators and Mixers

Basic Oscillator Model**:** Negative Resistance Oscillator, Feedback Oscillator Design, Design Steps, Quartz Oscillators; High-Frequency Oscillator Configuration**:** Fixed-Frequency Oscillators, Dielectric Resonator Oscillators, YIG-Tuned Oscillator, Voltage-Controlled Oscillator, Gunn Element Oscillator; Mixers**:** Characteristics of Mixers, Basic Concepts, Frequency Domain Considerations, Single-Ended Mixer Design, Single-Balanced Mixer, Double-Balanced Mixer.

Reference

1. Reinhold Ludwig & Gene Bogdanov, “RF Circuit Design – Theory and Applications”, 2nd Ed., Pearson Education., 2009.
2. David M. Pozzar , “ Microwave Engineering”, 4th Ed., Wiley India, 2013.
3. Mathew M. Radmanesh, “Radio Frequency and Microwave Electronics”, 2nd Ed. Pearson Education Asia, 2006.
4. Ulrich L. Rohde & David P. NewKirk, “RF / Microwave Circuit Design”, John Wiley & Sons, 2000.
5. Davis W. Alan, “Radio Frequency Circuit Design”, Wiley India, 2009.
6. Christopher Bowick, John Blyer& Cheryl Ajluni “ RF Circuit Design”, 2nd Ed., Newnes, 2007.
7. Cotter W. Sayre, “Complete Wireless Design”, 2nd Ed., McGraw-Hill, 2008.
8. Joseph J. Carr, “RF Components and Circuits”, Newnes, 2002.

MECCE-107 | **COMMUNICATION SYSTEMS ENGG. LAB**

L	T	P	C
0	0	3	2

Course objective:

To experiment the concepts introduced in the core and elective courses offered this semester with the help of simulation tools and related hardware.

Tools:

Computing and Simulation Environments **– GNU Octave / MATLAB/ Lab View/NS 2 or any other equivalent tool.**

Suitable Hardware Tools like USRP (Universal Software Radio Peripheral) to supplement the simulation tools.

Suggested flow of experiments: (These are minimum requirements; Topics could be added in concurrence with the syllabus of core and elective subjects)

Generation of discrete time i.i.d. random processes with different distributions (Bernoulli, Binomial, Geometric, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Rician etc)

Visualization of Central Limit Theorem, Whitening Filter.

Implementation of digital modulation schemes and performance comparison, Constellation diagrams, Simulation of BER curves for the various schemes, comparison with analytical results.

Implementation of Matched filter, Correlation receiver & Equalizer.

Communication System Design for Band limited Channels - Signal Design for Zero ISI and Controlled ISI - Partial Response Signaling.

Synchronization in Communication Systems: Carrier and Clock Synchronization- Frequency Offset Estimation and Correction.

Modeling and Simulation of Networks using NS 2/similar tools.

References

1. W.H. Tranter, K. Sam Shanmugham, T.S. Rappaport, and K.L. Kosbar, " Principles of Communication System Simulation with Wireless Applications," Pearson, 2004.
2. J.G. Proakis, and M. Salehi, "Contemporary Communication Systems using MATLAB, Bookware Companion Series, 2006.
3. E. Aboelela, "Network Simulation Experiments Manual," The Morgan Kaufmann Series in Networking, 2007.

MEC CE 108	SEMINAR – I				
		L	**T**	**P**	**C**
		0	**0**	**2**	**1**

Each student shall present a seminar on any topic of interest related to the core / elective courses offered in the first semester of the M. Tech. Programme. He / she shall select the topic based on the References: from international journals of repute, preferably IEEE journals. They should get the paper approved by the Programme Co-ordinator / Faculty member in charge of the seminar and shall present it in the class. Every student shall participate in the seminar. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report submitted.