MAHATMA GANDHI UNIVERSITY

SCHEME AND SYLLABI

FOR

M. Tech. DEGREE PROGRAMME

IN

COMMUNICATION ENGINEERING

(2013 ADMISSION ONWARDS)

SCHEME AND SYLLABI FOR M. Tech. DEGREE

PROGRAMME IN

COMMUNICATION ENGINEERING

SEMESTER – II

Sl. No.	Course No.	Subject	Hrs / Week			Evaluation Scheme (Marks)					Credits (C)
			L	T	P	Sessional			ESE	Total	
						TA	CT	Sub Total			
1	MECCE 201	Coding Theory	3	1	0	25	25	50	100	150	4
2	MECCE 202*	Estimation and Detection	3	1	0	25	25	50	100	150	4
3	MECCE 203	Wireless Networks	3	1	0	25	25	50	100	150	4
4	MECCE 204	Adaptive Signal Processing	3	1	0	25	25	50	100	150	4
5	MECCE 205	Elective II	3	0	0	25	25	50	100	150	3
6	MECCE 206	Elective IV	3	0	0	25	25	50	100	150	3
7	MECCE 207	Communication systems Engg Lab-II	0	0	3	25	25	50	100	150	2
8	MECCE 208	Seminar II	0	0	2	50	0	50	0	50	1
Total			**18**	**4**	**5**	**225**	**175**	**400**	**700**	**1100**	**25**

Elective – I (MECCE- 205)		Elective – II (MECCE-206)	
MECCE 205 –1**	Multicarrier Communication Systems	MECCE 206 – 1$	MIMO Communication Systems
MECCE 205 – 2#	Principles of Secure Communication	MECCE 206 - 2	Signal Compression Theory and Methods
MECCE 205 – 3	Speech and Audio Processing	MECCE 206 – 3**	Optimization Techniques
MECCE 205 – 4	Communication Switching and multiplexing	MECCE 206 – 4	Photonic Switching and Optical Networks

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 MAESP ** Common with MECCI And MECEC, $ Common with MECCI and MECEC and MECAE , # Common with MECCI, MECEC**

MECCE 201	CODING THEORY	L	T	P	C
		3	1	0	4

Module I

Finite Field Arithmetic : Introduction, Groups- Rings- Fields-Arithmetic of Galois Field- Integer Ring- Polynomial Rings- Polynomials and Euclidean algorithm, primitive elements, Construction and basic properties of Finite Fields- Computations using Galois Field arithmetic- sub fields- Minimal polynomial and conjugates- Vector space- Vector Subspace- Linear independence.

Module II

Linear Block Codes: Linear Block codes- Properties- Minimum Distance- Error detection and correction- Standard Array and Syndrome decoding- Hamming codes- Perfect and Quasi-perfect codes- Extended codes- Hadamard codes.

Module III

Cyclic Codes : Basic theory of Cyclic codes- Generator and Parity check matrices - Cyclic encoders- Error detection & correction- decoding of cyclic codes- BCH codes- Decoding of BCH codes-The Berlekamp- Massey decoding algorithm. Reed Solomon codes- Generalized Reed Solomon codes- MDS codes.

Module IV

Convolutional Codes: Generator matrices and encoding- state, tree and trellis diagram- Transfer function -- Maximum Likelihood decoding Hard versus Soft decision decoding- The Viterbi Algorithm- Free distance- Catastrophic encoders. Soft Decision and Iterative Decoding -Soft decision Viterbi algorithm- Two way APP decoding- Low density parity check codes- Turbo codes- Turbo decoding

References:

1. Shu Lin and Daniel. J. Costello Jr., “Error Control Coding: Fundamentals and applications”, Second Edition Prentice Hall Inc, 2004.
2. Neubauer, J. Freudenberger, V. Kuhn, “Coding Theory, - Algorithms, architectures and applications, Wiley India edition, 2012.
3. Robert H, Morelos-Zaragoza” The Art of Error Correcting Coding”, Wiley India Edition, 2013.
4. R.E. Blahut, “Theory and Practice of Error Control Coding”, MGH 1983.
5. W.C. Huffman and Vera Pless, “Fundamentals of Error correcting codes”, Cambridge University Press, 2003.

6. Ron M. Roth “Introduction to Coding Theory” Cambridge University Press, 2006
7. Elwyn R. Berlekamp, “Algebraic Coding Theory” ,McGawHill Book Company, 1984
8. Robert McEliece “The theory of Information and Coding”, Cambridge University Press, 2002
9. Sklar, ‘ Digital Communication’, Pearson Education.

MECCE/MAESP 202	ESTIMATION AND DETECTION	L	T	P	C
		3	1	0	4

Module I

Fundamentals of Detection Theory

Hypothesis Testing: Bayes' Detection, MAP Detection, ML Detection, Minimum Probability of Error Criterion, Min-Max Criterion, Neyman-Pearson Criterion, Multiple Hypothesis, Composite Hypothesis Testing: Generalized likelihood ratio test (GLRT), Receiver Operating Characteristic Curves

Module II

Fundamentals of Estimation Theory : Role of Estimation in Signal Processing, Unbiased Estimation, Minimum variance unbiased(MVU) estimators, Finding MVU Estimators, Cramer-Rao Lower Bound, Linear Modeling-Examples, Sufficient Statistics, Use of Sufficient Statistics to find the MVU Estimator

Module III

Estimation Techniques

Deterministic Parameter Estimation: Least Squares Estimation-Batch Processing, Recursive Least Squares Estimation, Best Linear Unbiased Estimation, Likelihood and Maximum Likelihood Estimation

Module IV

Estimation Techniques (contd)

Random Parameter Estimation: Bayesian Philosophy, Selection of a Prior PDF, Bayesian linear model, Minimum Mean Square Error Estimator, Maximum a Posteriori Estimation.

References:

1. M D Srinath, P K Rajasekaran, R Viswanathan, Introduction to Statistical Signal Processing with Applications, "Pearson"
2. Steven M. Kay, "Statistical Signal Processing: Vol. 1: Estimation Theory, Vol. 2: Detection Theory," Prentice Hall Inc., 1998.
3. Jerry M. Mendel, "Lessons in Estimation Theory for Signal Processing, Communication and Control," Prentice Hall Inc., 1995
4. Ralph D. Hippenstiel, "Detection Theory- Applications and Digital Signal Processing", CRC Press, 2002.

5. Bernard C. Levy, “Principles of Signal Detection and Parameter Estimation”, Springer, New York, 2008.
6. Harry L. Van Trees, “Detection, Estimation and Modulation Theory, Part 1 and 2," John Wiley & Sons Inc. 1968.
7. Neel A. Macmillan and C. Douglas Creelman, “Detection Theory: A User's Guide (Sec. Edn.)” Lawrence Erlbaum Associates Publishers, USA, 2004.
8. Monson H. Hayes, “Statistical Digital Signal Processing and Modelling," John Wiley & Sons Inc., 1996.
9. J. M. Wozencraft, I. M. Jacobs,"Principles of Communication Engineering",John Wiley,
10. U. Madhow, "Fundamentals of Digital Communication," Cambridge University Press.

MECCE 203	WIRELESS NETWORKS	L	T	P	C
		3	1	0	4

Module I

Overview of wireless communication; path loss and shadowing: Radio wave propagation, Transmit and receive signal models, Free space path loss, ray tracing4, Simplified path loss model, Empirical path loss model: okumura model - hata model - walfisch model - piecewise linear model- indoor propagation models, shadow fading, combined path loss and shadowing, Cell coverage area

Module II

Capacity of wireless channel : Capacity of flat fading channel, Capacity of frequency selective fading channels

Diversity: Receiver diversity: system model - selection combining - threshold combining - maximal ratio combining - equal gain combing, Transmitter diversity: channel known at transmitter - Alamouti scheme

Module III

Channel coding : Linear block codes: Cyclic codes - Block Coding and Interleaving for Fading Channels, Convolution codes: Trellis diagram - maximum likelihood decoding - Viterbi Algorithm - Convolution Coding and Interleaving for Fading Channels, Concatenated codes, Turbo codes, Low density parity check codes.

Module IV

Multiple Antenna and Space time communication: Narrow band MIMO Model, Parallel decomposition of MIMO, MIMO channel capacity: static and fading channel, MIMO diversity gain, Diversity/Multiplexing trade off, Spacetime modulation and coding, Frequency selective MIMO channels.

Equalization: Equalizer noise enhancement, equalizer types, folded spectrum and ISI-free transmission, linear equalizer.

Multi carrier modulation: Data transmission using multiple carriers, Multi carrier modulation with overlapping sub channels, Mitigation of subcarrier fading

References

1. Andrea Goldsmith ,"Wireless Communications", Stanford University
2. ShuLin ,CostelloJr "Error control coding", Pearson Education
3. Andreas F Milosch, "Wireless Communication",WileyInterscience
4. T.S. Rappaport, "Wireless Communication, principles & practice", Prentice Hall of India
5. KamiloFeher, 'Wireless digital communication', Prentice Hall of India, 1995.

MECCE 204	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	1	0	4

Module I

Neural Networks: Supervised Learning Neural Networks – Perceptrons- Multilayer perceptrons-Backpropagation- Radial Basis Function Networks – Unsupervised Learning NeuralNetworks – Competitive Learning Networks – Kohonen Self-Organizing Networks –Learning Vector Quantization – Hebbian Learning

Module II

Fuzzy Set Theory : Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If- Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models–Input Space Partitioning and Fuzzy Modeling

Module III

Optimization : Derivative-based Optimization – Descent Methods – The Method of Steepest Descent –Classical Newton's Method – Step Size Determination – Derivative-free Optimization –Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

Module IV

Neuro Fuzzy Modeling : Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm –Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

Reference:

1. Satheeshkumar “Neural Networks: A class room approach”, Tata McGraw Hill, Seocnd Edition, 2012.
2. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.
3. S. N. Sivandan and S. N. Deepa "Priciples of soft computing", Wiley-India, second edition, 2011.
4. S. Rajasekaran, G. A. VijayalakshmiPai , “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications” .Prrentice Hall of India,2010
5. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004,Pearson Education 2004
6. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 1989

MECCI/EC/CE 205-1	MULTI CARRIER COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

Module I

Review of wireless channel characteristics – Multi carrier and OFDM system fundamentals – OFDM system model - Comparison with single carrier - Channel capacity and OFDM – FFT implementation – Power spectrum – Impairments of wireless channels to OFDM signals – Comparison with other multicarrier modulation scheme: MC CDMA

Module II

Synchronization in OFDM – Timing and Frequency Offset in OFDM, Synchronization & system architecture, Timing and Frequency Offset estimation – Pilot and Non pilot based methods, Joint Time & Frequency Offset estimation.

Module III

Channel Estimation in OFDM systems – Differential and Coherent detection; Pilot symbol aided estimation - Block type and Comb type pilot arrangement; Decision directed channel estimation – MMSE estimation using time and frequency domain correlation; MIMO channel estimation- basic concepts; Concepts of Time and Frequency domain equalization.

Module IV

Clipping in Multi carrier systems – Power amplifier non linearity – Error probability analysis – Performance in AWGN – PAPR properties of OFDM signals – PAPR reduction techniques with signal distortion; Techniques for distortion less PAPR reduction – Selective mapping and Optimization techniques.

References:

1. Ahmad R.S. Bahai, B.R. Saltzberg, M. Ergen, “ Multi carrier Digital Communications- Theory and Applications of OFDM”, Second Edition, Springer
2. Y. Li. G. Stuber, “ OFDM for Wireless Communication”, Springer, 2006.
3. R. Prasad, “ OFDM for Wireless Communication”, Artech House, 2006.

MECCI/CE 205-2	PRINCIPLES OF SECURE COMMUNICATION	L	T	P	C
		3	0	0	3

Module I

Rings and fields - Homomorphism- Euclidean domains - Principal Ideal Domains - Unique Factorization Domains - Field extensions- Splitting fields - Divisibility- Euler theorem - Chinese Remainder Theorem - Primality.

Module II

Basic encryption techniques-Concept of cryptanalysis, Shannon's theory.Perfect secrecy,Block ciphers, Cryptographic algorithms, Features of DES, Stream ciphers, Pseudo random sequence generators, linear complexity. Non-linear combination of LFSRs , Boolean functions

Module III

Private key and Public key cryptosystems - One way functions - Discrete log problem – Factorization problem - RSA encryption - Diffie Hellmann key exchange.

Message authentication and hash functions -Digital signatures - Secret sharing -features of visual cryptography - other applications of cryptography

Module IV

Elliptic curves - Basic theory - Weirstrass equation - Group law - Point at Infinity Elliptic curves over finite fields - Discrete logarithm problem on EC - Elliptic curve cryptography - Diffie Hellmann key exchange over EC - Elgamal encryption over EC - ECDSA

References:

1. Douglas A. Stinson, "Cryptography, Theory and Practice", 2nd edition, Chapman & Hall, CRC Press Company, Washington
2. William Stallings, " Cryptography and Network Security", 3rd edition, Pearson Education
3. Lawrence C. Washington, " Elliptic Curves", Chapman & Hall, CRC Press
4. David S. Dummit, Richard M. Foote, " Abstract Algebra", John Wiley & Sons
5. Evangelos Kranakis, " Primality and Cryptography", John Wiley & Sons
6. Rainer A. Ruppel, " Analysis and Design of Stream Ciphers", Springer Verlag

MECCE 205-3 | **SPEECH TECHNOLOGY**

L	T	P	C
3	0	0	3

Module I

Speech Production and Categorization of Speech Sounds: Introduction to speech signal processing, overview of speech signal processing applications, human speech production mechanism, acoustic theory of speech production, nature of speech signal, spectrographic analysis of speech, categorization of speech sounds, coarticulation, prosody.

Module II

Speech Analysis and Synthesis: Time and frequency domain analysis, Review of DSP techniques-z-transform, Discrete Fourier transform, short-time analysis of speech, linear prediction analysis, cepstral analysis, Contrasting linear prediction analysis and cepstral analysis, vector quantization(VQ) methods.

Module III

Speech Recognition: Speech recognition, Bayes rule, segmental feature extraction, mel frequency cepstral coefficient(MFCC), dynamic time – warping(DTW), Gaussian mixture models (GMM), hidden Markov model(HMM), approaches for speech, speaker and language recognition.

Module IV

Speech Coding, Speech Synthesis and Enhancement: Speech coding, quality measures, speech redundancies, time-domain waveform coding, Linear predictive coding, LPC residual coding, principles of speech synthesis, fundamentals of speech enhancement.

References

1. Douglas O’Shaugnessy,“Speech Communication,Human and Machine”,IEEE Press, 2000.
2. L. Rabiner, B. H. Juang and B. Yegnanarayana, “Fundamentals of Speech Recognition”, Pearson India, 2009.
3. T.F Quatieri, “Discrete-Time Speech Signal Processing- Principles and Practice”, Pearson, 2002.
4. L.R. Rabiner and R. W. Schafer, "Theory and Applications of Digital Speech Processing", Pearson, 2010.
5. J R Deller, J H L Hansen, J G Proakis, “Discrete-time Processing of Speech Signals, IEEE, Wiley.

MECCE 205-4	MOBILE COMPUTING	L	T	P	C
		3	0	0	3

Module I

Introduction to Mobile Computing and Media acess control : Mobile Computing (MC) : Introduction to MC, novel applications, limitations, and architecture. **GSM :** Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

Module II:

Mobile Network Layer and Transport Layer : Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP). Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Module III

Mobile Network Layer and Transport Layer : Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP). Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Module IV

Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques**.**

References:

1. Jochen Schiller,"Mobile Communications",*Addison-Wesley*.,second edition, 2004.
2. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", *Wiley*, 2002, ISBN 0471419028.
3. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press, October 2004,
4. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden , Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw-Hill Professional, 2005.
5. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", *Springer*, 2nd edition, 2003.
6. Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley *DreamTech*, 2003.

MECCI /CE/EC/AE 206-1$	MIMO COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

Module I

Information Theoretic aspects of MIMO : Review of SISO fading communication channels, MIMO channel models, Classical i.i.d. and extended channels, Frequency selective and correlated channel models, Capacity of MIMO channels, Ergodic and outage capacity, Capacity bounds and Influence of channel properties on the capacity.

Module II

MIMO Diversity and Spatial Multiplexing : Sources and types of diversity, analysis under Rayleigh fading, Diversity and channel knowledge. Alamouti space time code, MIMO spatial multiplexing. Space time receivers. ML, ZF, MMSE and Sphere decoding, BLAST receivers and Diversity multiplexing trade-off.

Module III

Space Time Block Codes : Space time block codes on real and complex orthogonal designs, Code design criteria for quasi-static channels (Rank, determinant and Euclidean distance), Orthogonal designs, Generalized orthogonal designs, Quasi-orthogonal designs and Performance analysis.

Module IV

Space Time Trellis Codes : Representation of STTC, shift register, generator matrix, state-transition diagram, trellis diagram, Code construction, Delay diversity as a special case of STTC and Performance analysis.

References:

1. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press 2005
2. Hamid Jafarkhani, “Space-Time Coding: Theory and Practice”, Cambridge University Press 2005
3. Paulraj, R. Nabar and D. Gore, “Introduction to Space-Time Wireless Communications”, Cambridge University Press 2003
4. E.G. Larsson and P. Stoica, “Space-Time Block Coding for Wireless Communications”, Cambridge University Press 2008
5. Ezio Biglieri, Robert Calderbank et al “MIMO Wireless Communications” Cambridge University Press 2007

MECCE 206-2	SPREAD SPECTRUM COMMUNICATION AND CDMA SYSTEMS	L	T	P	C
		3	0	0	3

Module I

Fundamentals of Spread Spectrum: Introduction to spread spectrum communication, direct sequence spread spectrum, frequency-hop spread spectrum system. Spreading sequences- maximal-length sequences, gold codes, Walsh orthogonal codes- properties and generation of sequences. Synchronization and Tracking: delay lock and tau-dither loops, coarse synchronization principles of serial search and match filter techniques

Module II

Performance Analysis of SS system: Performance of spread spectrum system in jamming environments- Barrage noise jamming, partial band jamming, pulsed noise jamming and single tone jamming. Error probability of DS-CDMA system under AWGN and fading channels, RAKE receiver

Module III

Capacity, Coverage and multiuser detection: Basics of spread spectrum multiple access in cellular environments, reverse Link power control, multiple cell pilot tracking, soft and hard handoffs, cell coverage issues with hard and soft handoff, spread spectrum multiple access outage, outage with imperfect power control, Erlang capacity of forward and reverse links. Multi-user Detection -MF detector, decorrelating detector, MMSE detector. Interference Cancellation: successive, Parallel Interference Cancellation, performance analysis of multiuser detectors and interference cancellers.

Module IV

CDMA Systems: General aspects of CDMA cellular systems, IS-95 standard, Downlink and uplink, Evolution to Third Generation systems, WCDMA and CDMA-2000 standards, Principles of Multicarrier communication, MCCDMA and MC-DS-CDMA

References :

1. Valery P. Ipatov, Spread Spectrum and CDMA Principles and Applications, Wiley, 2005
2. R. L. Peterson, R. Ziemer and D. Borth, “Introduction to Spread Spectrum Communications,” Prentice Hall, 1995.
3. J. Viterbi, “CDMA - Principles of Spread Spectrum Communications,” Addison-Wesley, 1997.

4. S. Verdu, “ Multiuser Detection” , Cambridge University Press- 1998
5. M. K. Simon, J. K. Omura, R. A. Scholts and B. K. Levitt, “ Spread Spectrum Communications Handbook”, McGraw- Hill, Newyork-1994
6. Cooper and McGillem, “Modern Communications and Spread Spectrum” McGraw- Hill, 1985
7. S. Glisic and B. Vucetic, “Spread Spectrum CDMA Systems for Wireless Communications,” Artech House, 1997

MECCE 206-3	OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

Module I

Unconstrained optimization: Necessary and sufficient conditions for local minima, one dimensional search methods, gradient methods - steepest descent, Inverse Hessian, Newton's method, conjugate direction method, conjugate gradient algorithm, quasi Newton methods

Module II

Linear Programming: Convex polyhedra, standard form of linear programming, Basic solutions,Simplex algorithm, Matrix form of the simplex algorithm, Duality, non simplexmethods :Khachiyan method, Karmarkar's method

Module III

Nonlinear Constrained Optimization: Equality constraints – Lagrange multipliers, inequalityconstraints – Kuhn-Tucker conditions,Convex optimization, Geometric programming, Projected gradient methods, Penalty methods

Module IV

Introduction to Graph Theory and Combinatorial Optimization: Routing-traveling salesman; Assignment – satisfiabilty, constraint saisfiabilty, graph coloring; Subsets- set covering, partitioning; Scheduling; Shortest path and Critical path algorithms

References

1. Edwin K. P. Chong, Stanislaw H. ZAK, "An Introduction to Optimization ",2nd Ed, John Wiley & Sons
2. Stephen Boyd, LievenVandenberghe, " Convex Optimization", CUP, 2004.
3. R. Fletcher, "Practical methods of Optimization", Wiley, 2000
4. Jonathan L Grosss, Jay Yellen, Chapmamn and Hall, "Graph theory and its application", 2e,CRC pub,
5. Alan Tucker, "Applied Combinatorics", John wiley and Sons
6. Dimitri P. Bertsekas, "Nonlinear programming", Athena Scientific
7. Belegundu, "Optimization Concepts and Applications in Engineering", Prentice Hall, 2000

8. N Christofied, A Mingoss, P Toth, C Sandi, "Combinatorial Optimization", John wiley& Sons
9. Sivan Pemmaraju, S Skiens, "Computational Discrete Mathematics", CUP, 2003

MECCE 206-4	RADAR COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

Module I

Radar Block Diagrams and operations : Radar frequencies , Pulse operations , Pulse repetitions , Frequency , Radar range equations , Minimum detectable signal , Receiver noise, Signal to noise ratio , Integration of radar pulses , Radar cross section , Propagation losses.

Radar Systems : Pulse , CW, FM- CW , MTI , Non-coherent MTI , Doppler Radar ,Tracking radar , Synthetic Aperture Radar.

Module II

Detection of Radar Signals : Matched filter receiver , Correlation Detection , Likelihood function , Detection Characteristics , Inverse probability , Optimum Design Criteria , Binary Integrators , Delay line Integrators

Module III

Target Parameter Estimation : Statistical Estimation of Parameters , Maximum Likelihood estimation , Theoretical accuracy of range and Doppler velocity measurements , Uncertainty relation , Angular Accuracy , Ambiguity function and radar transmitted Waveform design , Pulse compression Radar.

Module IV

Radar Applications : Direction finders , Instrument landing systems , Ground controlled approach , Radar beacons , Biostatic Radar , Detection and tracking of extraterrestrial objects, Ionized media , Earth satellites and Space vehicles , Airborne weather avoidance Radar , Electronics War fare (ECM & ECCM)

References:

1. Skolnik M.M “Introduction to Radar systems” ,McGraw Hill 2nd Edn 1981.
2. F.E. Terman “Electronic and Radio Engineering”, McGraw Hill 4th Edn 1981.
3. D. Curtis Schleher “Introduction to Electronic Warfare”,Artech House Inc.,1986.
4. Wheeler .G.J “Radar Fundamentals “,Prentice Hall Inc.N.J 1967.
5. Lavanon Nadav “Radar Principles “,John Wiley & Sons , 1988 .

MECCE 207	COMMUNICATION SYSTEMS AND NETWORKING LAB	L	T	P	C
		0	3	0	2

1. Modeling and Simulation of Radio Channels - Multipath Fading Channels- Jake's Model
2. Frequency non-selective and frequency selective fading channels realization.
3. OFDM system simulation, BER performance in fading channels
4. Channel estimation in OFDM
5. Synchronization in OFDM
6. Source Coding: Hamming code, Huffmann coding
7. Arithmetic Coding
8. Channel Coding- Linear Block Code
9. Convolutional codes , Viterbi decoding
10. Cyclic codes
11. Ethernet and Token Ring simulation and Evaluation
12. Scheduling and Queuing Disciplines in Packet Switched Networks: FIFO, Fair Queuing, RED
13. TCP Performance analysis with and without RED.
14. Modelling of Wireless Networks : Physical layer and MAC layer
15. Simple Sensor Networks Simulation and Evaluation
16. Mobile Adhoc Network Simulation and Evaluation

Tools: Numerical Computing Environments – GNU Octave or MATLAB, Simulink, LabVIEW or any other equivalent tool and specialized tools like OPNET/NS-2 etc.

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

Minimum 10 experiments from the above list should be completed.

*** Topics could be added in concurrence with the syllabus of elective subjects offered

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
4. Larry. L. Peterson and Bruce s. Davice, “Computer Networks a System Approach. Network Simulation experiments Manual. Elsevier Edition 4”

MECCE 208	SEMINAR II	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 1st 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.

Goals: This course is designed to improve written and oral presentation skills and to develop confidence in making public presentations, to provide feedback on the quality and appropriateness of the work experience, and to promote discussions on design problems or new developments.