COURSE STRUCTURE FOR M.E. (E and TC) [Microwave]

(w.e.f. June – 2008)

SEMESTER I

CODE	SUBJECT	TEACHING SCHEME		EXAMINATION SCHEME					CREDITS
		Lect.	Pr	Paper	TW	Oral	Pr	Total	
504222	Electromagnetics and Antenna Theory	3	-	100	-	-	-	100	3
504182	Principles and Practices for IT Management	3	-	100	-	-	-	100	3
504223	RF Wave and Microwave Circuit Design	3	-	100	-	-	-	100	3
504224	Elective I	3	-	100	-	-	-	100	3
504225	Elective II	3	-	100	-	-	-	100	3
504226	Lab Practice I	-	6	-	50	-		50	3
504227	Seminar I	-	4	-	50	-	-	50	2
Total of First Term		15	10	500	100	-	-	600	20

SEMESTER II

CODE	SUBJECT	TEACHING SCHEME		EXAMINATION SCHEME					CREDITS
		Lect.	Pr	Paper	TW	Oral	Pr	Total	
504228	Microwave Integrated Circuits	3	-	100	-	-	-	100	3
504229	Signal Processing for Wireless Communication	3	-	100	-	-	-	100	3
504230	Mobile Communication – GSM and CDMA	3	-	100	-	-	-	100	3
504231	Elective III	3	-	100	-	-	-	100	3
504232	Elective IV (Open)	3	-	100	-	-	-	100	3
504233	Lab Practice II	-	6	-	50	-		50	3
504235	Seminar II	-	4	-	50	-	-	50	2
Total of Second Term		15	10	500	100	-	-	600	20

SEMESTER III

CODE	SUBJECT	TEACHING SCHEME		EXAMINATION SCHEME					CREDITS
		Lect.	Pr	Paper	TW	Oral	Pr	Total	
604190	Seminar III	-	4	-	50	-	-	50	2
604191	Project Stage I	-	18	-	50	-		50	6
Total of Third Term		-	22	-	100	-	-	100	08

SEMESTER IV

CODE	SUBJECT	TEACHING SCHEME		EXAMINATION SCHEME					CREDITS
		Lect.	Pr	Paper	TW	Oral	Pr	Total	
604192	Project Stage II	-	18	-	150*	50		200	12
Total of Fourth Term		-	18	-	150	50	-	200	12

* The Term Work of Project stage II of semester IV should be assessed jointly by the pair of internal and external examiners. along with the oral examination of the same.

Note- The Contact Hours for the calculation of load of teacher

Seminar- 1 Hr / week / student &
Project - 2 Hr / week / student

Elective I:

1. **Applications of Microwaves to Radar and Satellite**
2. Digital Image Processing & Analysis
3. Communication Networks

Elective II:

a. Smart Antennas
b. Speech Processing And Application
c. Semiconductor Device Modelling and Technology

Elective III:

i) Fibre Optic Communication
ii) System Design
iii) EMI and EMC Techniques

Elective IV

Any one subject of Elective IV from the following branches

1. Electronics Engineering
2. Computer Engineering
3. Information Technology**)**

504222 ELECTROMAGNETIC AND ANTENNA THEORY

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

Various finite difference schemes, finite differencing of PDEs, accuracy and stability of FD solutions, Applications to guided structures such as transmission lines, wave-guides. Finite difference time domain methods: Yee's FD algorithm, Accuracy and stability, Lattice truncation conditions, initials fields, absorbing boundary conditions for FDTD. Method of moments: Introduction, integral equations, Green's function, applications to quasi-static problems, radiation problems, mutual impedance between linear elements, mutual coupling in arrays, rectangular arrays, grating lobe consideration, Applications of FDTD and method of moments to wave guide and planar antenna. Review of electromagnetic radiation, antenna basic concept and related definitions, formulation of radiation integrals and its applications to analysis of wire, loop and helix type antenna, Micro-strip antenna, rectangular and circular patch, feeding methods, circularly polarized micro-strip antenna. Linear arrays.

Reference

1. J.D.Karus, Antennas,Mc-Graw Hill,1988
2. C.A.Balanis, Antenna theory-Analysis and design, John Wiley,1982
3. R.E.Collin, Antennas and Microwave propagation, Mc-Graw Hill,1985
4. R.C.Johnson and H.Jasik,Antenna Engineering hand book, Mc-Graw Hill,1984
5. I.J.Bhal and P.Bhartia,Micro-strip antennas,Artech house,1980
6. O.P.Gandhi, Microwave design engineering and applications, Elsevier Science,1991

504182 PRINCIPLES AND PRACTICES FOR IT MANAGEMENT

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

1. Management Perspectives

Role and importance of management, process of management – planning, organizing, staffing, directing, controlling. Nature, purpose and principles of management, Business policy, tools and techniques of strategic management, business ethics and social responsibilities

2. Preliminary planning of an IT Project

Gathering project Information, defining the project goals, establishing project priorities, requirements analysis, risk management, budgeting a project, creating a work breakdown structure, estimation

3. Organizing an IT Project

Organizing a Project Team: - Assessing internal scales, creating a team, managing team issues, resources procurement

Preparing and Implementing the project plan: - Defining the project schedule, project network diagram creation and analysis, project constraints, tracking project progress and financial obligations

Revising the project plan:-need for revision, establishing change control, implementing the project changes, coping with project delays

4. Group Dynamics and Team Management

Theories of Group Formation –Formal and Informal Groups and their interaction, Importance of teams - Formation of teams – Team Work, Leading the team, Team Meeting. Conflict Management - Traditional vis-à-vis Modern view of conflict, Conflict Process - Strategies for resolving destructive conflict, Stress management, employee welfare, energy management and energy audit,

5. Modern approaches to management

Concept of Knowledge management**,** change management, technology management, supply chain management, introduction to Intellectual property Rights (IPR)and cyber laws, process and project quality standards – six sigma, CMM, CMMI, PCMM, Impact of IT quality management systems, learning organizations

6. Applications of IT in management

Application of IT in functions like finance and accounting, stores, purchase, product design and development, quality control, logistics, customer relationship, marketing, project management, health care, insurance, banking, agriculture and service sector.

Reference Books:

1. Joseph Phillips, “IT Project Management”, Tata McGraw-Hill 2003 Edition
2. Management-Tasks, Responsibilities and practices, Peter Drucker
3. Management Theory and Practice- Ernst Dale
4. Management Information System-Javadekar
5. Business Policy- Azhar Kazmi
6. Industrial Energy Conservation- D.A.Ray, Pergamon Press
7. Resisting Intellectual Property-Halbert, Taylor & Francis Ltd ,2007

504223 RF WAVE AND MICROWAVE CIRCUIT DESIGN

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs./Week	**Theory: 100 Marks**
	Credit: 3

Basic concepts in RF design: Nonlinearity and time variance, inter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion, Solid state devices: microwave semiconductor devices and models, PIN diode, Tunnel diodes, varactor diode, schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT and CCDs, Amplifiers: Power gain equations,stability,impedance matching, constant gain and noise figure circles, small signal, low noise ,high power and broadband amplifier design, oscillators, Mixers

Reference

1. S.Y. Liao, “Microwave circuit Analysis and Amplifier Design”, Prentice Hall 1987.
2. R.Ludwig and P.Bretchko, “R. F. Circuit Design”, Pearson.
3. G.D. Vendelin, A.M. Pavoi, U. L. Rohde, “Microwave Circuit Design Using Linear And Non Linear Techniques”, John Wiley 1990.
4. Y. Konishi, “Microwave Integrated Circuits”, Marcel Dekker,1991

504224 ELECTIVE I
APPLICATIONS OF MICROWAVE TO RADAR AND SATELLITE

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	**Theory: 100 Marks**
	Credit: 3

504224 ELECTIVE I
DIGITAL IMAGE PROCESSING AND ANALYSIS

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	**Theory: 100 Marks**
	Credit: 3

Digital image fundamentals: representation, elements of visual perception, image formation, Image digitization, digital image properties, data structures.Image transforms: Fourier transform, DCT, Walsh-Hadamard, Haar transform, K-L transform and Wavelet transforms. Image enhancement: Spatial domain methods - point processing, histogram processing, Spatial filtering - smoothing filters, sharpening filters, Frequency domain methods - low pass filtering, high pass filtering, homomorphic filtering. Image restoration: Degradation model, Inverse filtering, Wiener filter, Constrained Least squares restoration, Iterative Non-linear restoration, Geometric transformations. Fundamentals of Color image processing: color models - RGB, HSI, CMY, YIQ, Pseudo- color image processing, color transformations, spatial filtering of color images. Image compression: fundamentals- redundancy: coding, inter pixel, psycho visual, Elements of information theory, Lossless compression techniques, Lossy compression techniques, transform image coding techniques, Image Compression standards - JPEG, MPEG. Image segmentation: Point, line and edge detection, Edge linking and boundary description, Canny edge detection, Hough transform, Thresholding, Region based segmentation, Morphological Image Processing. Representation and Description: Representation, Boundary Descriptors, Regional Descriptors. Object Recognition: Deterministic methods, Clustering, Statistical Classification, Syntactic classification, Graph matching, Neural Nets, Fuzzy systems.

References:

1. Gonzalez, Woods & Eddins, “Digital Image Processing using MATLAB”, Pearson Education.
2. Chanda & Majumdar, “Digital Image Processing and Analysis”, PHI.
3. Kenneth Castleman, “Digital Image Processing”, Pearson Education.
4. M.Sonka,V. Hlavac, R. Boyle, “Image Processing, Analysis and Machine Vision”, Vikas Publishing House

504224 ELECTIVE I
COMMUNICATION NETWORK

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

Network Design Issues: Scope, Manageability, node placement, Link topology, Routing Protocol selection. Network Performance Issues: Network Terminology, centralized and distributed approaches for networks. Networks performance, Analysis Traffic classes, Traffic Control, Queuing Theory, Poisson's Model. Protocol & Applications: TCP/IP, Frame relay, ATM, Routing algorithm, IPv6, SNMP, LAN, MAN, WAN, INTERNET, INTRANET, Protocol analyzer, Network monitoring & troubleshooting, Wireless networks: fundamentals of wireless networks, WPAN (Bluetooth), WLAN, Wi-MAX. Network Security: Cryptography Firewalls, Security on Emails, Audio/Video data Services on IP: streaming video basics, VoIP, Video conferencing, Digital library.

References

1. Aaron Kershenbaum, "Telecommunication Network Design Algorithms", McGraw Hill, International Editions.
2. Vijay Ahuja, "Communications Network Design and Analysis"
3. William Stallings "Cryptography and Network Security"
4. Behrouz Forouzan, "Data Communications And Networking"
5. Andrew Tannenbaum, "Computer Networks", 4th Edition

504225 ELECTIVE II
SMART ANTENNAS

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	**Theory: 100 Marks**
	Credit: 3

Applications of Antenna Arrays to Mobile Communications, Part I: Performance Improvement, Feasibility, and System Considerations (Complete contents of reference 1)

Application of Antenna Arrays to Mobile Communications, Part II: Beam-Forming and Direction-of-Arrival Considerations (Complete contents of reference 2)

Introduction to Smart Antennas:

Spatial Processing for Wireless Systems, Key Benefits of Smart Antenna Technology Introduction to Smart Antenna Technology, The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beamforming Networks, Switched Beam Systems, Adaptive Antenna Systems, Wideband Smart Antennas, Spatial Diversity, Diversity Combining, and Sectoring, Digital Radio Receiver Techniques and Software Radios for Smart Antennas, Transmission Beamforming

Smart Antennas Techniques for CDMA

Non-Coherent CDMA Spatial Processors, Coherent CDMA Spatial Processors and the Spatial Processing Rake Receiver, Multi-User Spatial Processing, Dynamic Re-sectoring Using Smart Antennas, Downlink Beamforming for CDMA

CDMA System Range and Capacity Improvement Using Spatial Filtering

Range Extension in CDMA, Single Cell Systems with Spatial Filtering at the IS-95 Base Station, Reverse Channel Performance of Multi-cell Systems with Spatial Filtering at the Base Station, Reverse Channel Spatial Filtering at the WLL Subscriber Unit, Range and Capacity Analysis Using Smart Antennas – A Vector Based Approach

References

1. L.C. Godara, "Applications of antenna arrays to mobile communications, Part I: Performance improvement, feasibility, and system considerations," *Proc. IEEE*, vol. 85,no.7, pp.1031-1060,1997
2. L.C. Godara, "Applications of antenna arrays to mobile communications, Part II:

Beamforming and direction-of-arrival considerations," *Proc. IEEE*, vol. 85, no.8, pp.1193-1245,1997.

3. T.S. Rappaport and J.C. Liberti, *Smart Antennas for Wireless Communications*, *Prentice Hall*, NJ: Prentice Hall,1999

504225 ELECTIVE II
SPEECH PROCESSING AND APPLICATION

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

SPEECH PROCESSING AND APPLICATION

Speech production and Perception: Anatomy and physiology of speech production; Articulatory, Linguistic, acoustic and perceptual descriptions. Speech coding and analysis: Speech digitization techniques,PCM,DPCM,ADPCM, Sub band coding,LPC,Formant synthesis, Speech digitization direction, Physical features of Speech signals, feature extraction, signal preprocessing, windowing, Spectral analysis, Filter bank processing, log energy computation, Mel frequency Cepstrum computation, Cepstrum analysis. Speech Recognition: Issues in Speech recognition, Spectrum distance measures for speech recognition, auditory measures for speech recognition, auditory nerve representation as a basic for speech processing; Dynamic programming based speech recognition algorithms, HMM models for speech recognition, Neural network approach.Speaker Recognition: Issues in speaker recognition and speech synthesis of different speakers. Text to speech conversion, Letter to sound rules, Dictionaries, prosody, Intonation, Calculating acoustic parameters, synthesized speech output performance and characteristics of text to speech, application of text to speech technology products. Voice processing hardware and software architectures. Speech Enhancement: Noise suppression with pattern matching, adaptive echo cancellation for speech signals.

References

1. Furui S,Sondhi.M, “Advances in Speech Signal Processing”, Dekker
2. Syrdal A,Benett R,Greenspan.S, “Applied Speech Technology”, CRC Press
3. TestSchner W, “Voice Processing”, Artech House.
4. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, Wiley
5. L.R.Rabiner, R.W.Schafer, “Digital Processing of Speech Signals”, Pearson Education.

504225 ELECTIVE II

SEMICONDUCTOR DEVICE MODELING AND TECHNOLOGY

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs./Week	**Theory: 100 Marks**
	Credit: 3

504226 LAB PRACTICE I

Teaching Scheme	Examination Scheme
Practical: 6 Hrs./Week	**TW: 50 Marks**
	Credit: 3

The faculty associate with instruction of these subjects shall assign laboratory practices to the students, minimum three per course.

The laboratory practices shall encompass implementation/ deployment of the course work in terms of the hardware setup, algorithm development and programming assignment. The student shall submit a document as a bonafide record of such assignment in the hard/soft copy format to the concerned faculty for further evaluation.

504228 MICROWAVE INTEGRATED CIRCUITS

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

Basic concepts of microwave integrated circuits: Wave propagation and circuit theory, transmission lines, planar circuits, Analytical methods associated with MIC theory, Passive elements, components and devices: Filters, couplers, circulators, isolators, antenna elements, Basic circuits: Method of MIC synthesis, matrix representation, network matrix decomposition, Basic linear and non linear circuits, MICs: filters, oscillators, Mixers, frequency divider, Digital modulators, switches, phase shifters, multipliers and up-converters MIC Measurement: Device and circuit measurement techniques, measurement in MIC media, MIC test system, System applications of MICs: Radio system, satellite communication, Broadcast system, Future trend in MICs

Reference

1. Ivan Kneppo, Kluwer , “Microwave Integrated Circuits”.
2. Yoshihiro Konishi CRC press, “Microwave Integrated Circuits”

504229 SIGNAL PROCESSING FOR WIRELESS COMMUNICATION

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

504230 MOBILE COMMUNICATION – GSM AND CDMA

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

Introduction and evolution of wireless and mobile communication, Multiple Access Techniques and Traffic engg- TDMA, FDMA, CDMA, Spectral efficiency, Traffic measurement units, Traffic distribution, Grade of service, Blocking probability, Erlang Distribution, Poisson's model, queuing theory, Cellular Systems- Fundamentals, cell structure, frequency reuse, co channel interference reduction, propagation and path loss models, Handoff mechanisms, cell splitting, cell planning, intelligent cell concept and applications. Global system for mobile communication- GSM standards and architecture, Interfaces, GSM logical channels frame structure, speech coding in GSM, privacy and security in GSM, GPRS and EDGE, CDMA- CDMA standards, IS-95 architecture, physical and logical channels of IS-95, power control, call processing, soft handoff, security and identification, CDMA-2000, CDMA WLL, Modulation Techniques- QAM, QPSK, MSK, GMSK, OFDM, spread spectrum modulation techniques, modulation performance in fading and multipath channels, Equalization and diversity- Adaptive equalization: LMS, RLS algorithms, MLSE equalizer, Timing and carrier recovery, Diversity techniques, RAKE receiver.

References

1. William C.Y.Lee, "Mobile Cellular Telecommunications, Second Edition, Tata McGraw-Hill Edition
2. T.S. Rappaport, "Wireless Communications Principles And Practice", Pearson Education
3. Vijay Garg and Joseph Wilkes, "Principles And Applications Of GSM", Pearson Education
4. Vijay Garg, "IS-95 CDMA and CDMA-2000", Pearson Education
5. Vijay Garg, "Wireless Network Evolution" 2G to 3G, Pearson Education
6. Client Smith and Daniel Collins, "3G Wireless Networks", Tata McGraw- Hill Edition

504231 ELECTIVE III
FIBER OPTICS COMMUNICATION

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

504231 ELECTIVE III
SYSTEM DESIGN

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

Basics of system hardware design. Hierarchical design using top-down and bottom-up methodology. System partitioning techniques, interfacing between system components. Handling multiple clock domains, Synchronous and asynchronous design styles. Interface between synchronous and asynchronous blocks. Meta-stability and techniques for handling it. Interfacing linear and digital systems, data conversion circuits. Design of finite state machines, state assignment strategies. Design and optimization of pipelined stages. Use of data flow graphs, Critical path analysis, retiming and scheduling strategies for performance enhancement. Implementation of DSP algorithms. Signal integrity and high speed behavior of interconnects: ringing, cross talk and ground bounce. Layout strategies at IC and board level for local and global signals. Power supply decoupling. Test strategies: Border Scan, Built In Self Test and signature analysis. Introduction to RF and Wireless Technology**:** Complexity, design and applications. Choice of Technology. Analog and Digital Modulation for RF circuits: Comparison of various techniques for power efficiency. Coherent and Non-coherent detection. Receiver: Architectures and Testing of heterodyne, Homodyne, Image-reject, Direct-IF and sub-sampled receivers. Transmitter: Direct Conversion and two steps transmitters. BJT and MOSFET behaviour at RF frequencies, Modelling of the transistors and SPICE models. Noise performance and limitation of devices. Integrated parasitic elements at high frequencies and their monolithic implementation. Basic blocks in RF systems and their VLSI implementation: Low Noise Amplifier design in various technologies, Design of Mixers at GHz frequency range. Various Mixers, their working and implementations. Oscillators: Basic topologies VCO and definition of phase noise. Noise-Power trade-off. Resonator-less VCO design. Quadrature and single-sideband generators, Radio Frequency Synthesizes: PLLS, Various RF synthesizer architectures and frequency dividers. Power Amplifiers design: Linearization techniques, Design issues in integrated RF filters.

Reference

1. Jan M. Rabaey, "Digital Integrated Circuits", Prentice Hall of India, (New Delhi), 1997.
2. M.J.S. Smith, "Application Specific Integrated Circuits", Addison Wesley (Reading, MA), 1999
3. Vijay K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. B.Razavi, RF Microelectronics, Prentice-Hall PTR,1998
5. T.H.Lee, The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 1998.
6. R.Jacob Baker,H.W.Li, and D.E. Boyce, “CMOS Circuit Design ,Layout and Simulation”, Prentice-Hall of India,1998.
7. Y.P. Tsividis “Mixed Analog and Digital VLSI Devices and Technology”, McGraw Hill,1996

504231 ELECTIVE III
EMI AND EMC TECHNIQUES

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs./Week	Theory: 100 Marks
	Credit: 3

Microwave Measurement Techniques

Unit 1

Transmission Lines: Basic principles, Structures and Properties of Transmission Lines. Scattering Parameters and Circuit Analysis, Uncertainty and Confidence in measurements, Using Coaxial Connectors in Measurement

Unit 2

Attenuation Measurement: Basic principles, Measurement systems, important considerations when making attenuation measurements

Unit 3

RF Voltage Measurement: RF voltage measuring instruments, impedance matching and mismatch errors.

Unit 4

Noise Measurements: Types of noise, types of noise source, measuring noise, measurement accuracy, mismatch effects, automated noise measurements.

Unit 5

Network Analyzers: Spectrum Analyzer Measurements and Applications. Elements of network analyser, MMIC measurement techniques, calibration and verification of automatic network analysers, spectrum analyser basic principle, applications of spectrum analyzer

Unit 6

RF Power Measurement: Power sensors, power measurements and calibration, calibration and transfer standards, power splitters, couplers and reflectometers

References

1. Richard Collier & Douglas Skinner, “Microwave Measurements” 3rd Edition, IET, 2007

504235 LAB PRACTICE II

Teaching Scheme	Examination Scheme
Practical: 6 Hrs./Week	**TW: 50 Marks**
	Credit: 3

The faculty associate with instruction of these subjects shall assign laboratory practices to the students, minimum three per course.

The laboratory practices shall encompass implementation/ deployment of the course work in terms of the hardware setup, algorithm development and programming assignment. The student shall submit a document as a bonafide record of such assignment in the hard/soft copy format to the concerned faculty for further evaluation.