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-An alysis and design, John Wiley,1982
3. R.E.Collin, Antennas and Microwave p ropagation, 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 In formation, 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, Imp act 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

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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”, Pr entice 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 Dekk er,1991

504224 ELECTIVE I

APPLICATIONS OF MICROWAVE TO RADAR AND SATELLITE

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

Radar System: Radar equation and Radar Cross Section. **Methods for RCS estimation**: GO, PO, GTD and PTD techniques. Ray tracing. RCS of simple and complex targets.

RCS enhancement. Scattering by imperfectly conducting surfaces; Maliuzhinets Formulation and characterization of Absorbers. Methods of RCS reduction. Frequency domain target signatures. Real array Imaging radars. Synthetic array Radars. Signal processing methods.

Introduction to satellite systems: Evolution and growth of communication satellites, Kepler's laws of motion, Orbiting satellites, orbits, altitude control; Satellite launch vehicles – Arianne, SLV space shuttle ; Sub systems of communication satellite; Satellite frequency bands, Spectrum allocation and bandwidth considerations; Propagation characteristics

Communication satellite systems: Satellite transponders and other sub system; Satellite system in India; Satellite receiving systems, Earth station technology; G/T ratio;

Satellite uplink and downlink analyses in C Ku and ka bands; Spot beam, multiple beams, frequency reuse; Satellite transponder; Satellite front end. Analog and digital design;

Multiple access techniques FDMA, TDMA, SS-TDMA; Interference in FDMA systems. Power budget analysis;

Texts/ Reference:

1. A.K. Jain, Fundamentals of Digital Signal Processing, PHI, 1995.
2. R. C. Gonzalez and R.E. Woods, Digital Image Processing, Addition- Wesley , 1992.
3. G.A. Baxes, Digital Image processing, John Wiley International edition, 1994.
4. R.J. Schalkoff, Digital Image processing and Computer Vision, John Wiley, 1989.
5. Sid Ahmed, Image processing, McGraw –Hill, 1994.
6. S.J. Solari, Digital video and audio Compression, McGraw –Hill, 1996.
7. MATLAB Users Guide, Maths Works Inc., 1997.

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, and 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 NE TWORK

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 ANTE NNAS

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 Beam forming 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 Beam forming
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 Beam forming 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: Beam forming 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 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,Green span.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

p-n junction: fabrication of p-n junctions, equilibrium conditions, forward and reverse biased junctions, reverse-bias breakdown, and transient and a-c conditions.

Metal semiconductor junction: Schottky barriers, rectifying and ohmic contacts. Bipolar junction transistors: minority carrier distribution and terminal currents, generalized biasing, switching, secondary effects, frequency limitations of transistors.

Field effect transistor : JFET-current-voltage characteristics, effect in real devices , high - frequency and high speed issues; MOSFET – basic operation and fabrication ; ideal MOS capacitor; effects of real surfaces; threshold voltages; output and transfer characteristics, of MOSFET.

SPICE Models of Semiconductor Devices: MOSFET Level 1, Level 2 and Level 3 model, and Model parameters; SPICE models p-n diode and BJT.

Issues of digital IC design: general overview of design hierarchy, integration density and Moore's law, MOSFET scaling. VLSI fabrication principles crystal growth and doping, diffusion, epitaxy, ion implantation, film deposition, lithography, etching. **MOSFET fabrication:** basic step of fabrication, CMOS p-well and n-well processes, layout design rules, Bi-CMOS fabrication process; basic electrical properties of MOS and Bi-CMOS circuits: MOS transistor operation in linear and saturated regions, MOS transistor threshold voltage, MOS switch and inverter, Bi-CMOS inverter, latch-up in CMOS inverter.

Laboratory Component

De vice simulation in SPICE using level 1 and higher level- models, incorporation of different technology nodes, process simulation using SUPREME.

Texts

1. N. DasGupta, and A. DasGupta, Semiconductor devices:

   Modeling and technology, Prentice Hall of India Private

   Limited, New Delhi, 2004

2. B.G. Streetman and S. Banerjee, Solid State Electronic Devices, 5th edition, Prentice Hall of India Private

   Limited, New Delhi, 2000

References:

1. Y.Taur, and T.H.Ning , Fundamentals of Modern VLSI devices , Cambridge University press ,1998

2. S.M.Sze, VLSI technology, 2nd edition , McGraw-Hill, 1998

3. S.K. Dieter, Semiconductor material and Device Characterization, by John Wiley and Sons, New York, 1990.

4. G.W. Roberts and A.S. Sedra SPICE 2nd edition , Oxford University Press , 1997

504226 L AB 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 micro wave 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

1. **Overview of statistical signal processing**
   Discrete random signals, Representation of signals as random vectors, fundamentals of estimation, stochastic process, representation of stochastic process, Gauss markov model, likelihood and sufficiency.

2. **Signal detection**
   Introduction, signal detection, signal classification, detection of known signals in white noise, correlation receiver, detection of known signals in colored noise, maximum SNR criterion, solution of integral equations.

3. **Spectrum estimation and modeling**
   Definitions, problem of power spectrum estimation, non parametric and parametric spectral estimation, least mean square estimation, Wiener and Kalman filter.

4. **Adaptive filter**
   Introduction, steepest descent adaptive filter, LMS algorithm, application-noise cancellation, RLS algorithm.

5. **Applications to communications and Radar system**
   Digital communication, spread spectrum communication, Radar target detection and parameter estimation, Dynamic target tracking.

Reference Books:

1.'The digital signal processing handbook' by *Vijay K Madisetti, Douglas B Williams*, IEEE press.

2.'Introduction to statistical signal processing with applications' by *M.D Srinath, P. K. Rajasekaran and R.Vishwanathan*, Pearson education.

3.'Signal processing handbook' by *C.H Chen*, CRC press.

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, C DMA, Spectral efficiency, Traffic measurement units, Traffic distribution, Grad e of service, Blocking probability, Erlang Distribution, Poisson's model, queuing theory, Cellular Systems- Fun damentals, 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, GPR S and EDGE, CDMA- CDMA standards, IS-95 architectu re, ph ysical 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, Equ alization and diversity- Adaptive equalization: LMS, R LS algorithms, MLSE equalizer, Timing and carrier r ecover y, 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

Fiber Optic Communication

Introduction:

Vector nature of light, propagation of light, propagation of light in cylindrical dielectric rod, Ray model, and wave model. Different type of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

Optical sources – LEDs and Lasers, Photo- detectors-pin-detectors, detector responsivity, noise, and optical receivers.

Optical link design – BER calculation, quantum limit, power penalties.

Optical switches - coupled mode analysis of directional couplers, electro-optic switches.

Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solution based communication. Optical amplifiers –EDFA, Raman amplifier, and WDM systems.

Texts/References

J. Keiser, Fiber optic communication, McGraw-Hill, 2nd Ed.1992.

J.E. Midwinter, Optical fibers of transmission, John Wiley, 1979.

T.Tamir , Integrated optics, (Topic in applied physics Vol.7), Springer –Verlag, 1975

J. Gower, Optical communication systems, Prentice Hall India 1987.

S.E. Miller and A.G. Chynoweth, eds., Optical fiber telecommunications, Academic Press, 1979.

G. Agrawal, Fiber optic communication systems, John Wiley and sons, New York, 1992.

F.C. Allard, Fiber optics Handbook for engineers and scientists, McGraw Hill, New York 1990.

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-Frequ ency 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 an alyser 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.