### COURSE STRUCTURE FOR M.E. (E and TC) [Microwave]
**(w.e.f. June – 2008)**

#### SEMESTER I

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**SEMESTER IV**

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* 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:**
1. Smart Antennas
2. Speech Processing And Application
3. Semiconductor Device Modelling and Technology

**Elective III:**
1. Fibre Optic Communication
2. System Design
3. 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
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

2. C.A.Balanis, Antenna theory-An alysis and design, John Wiley,1982
5. I.J.Bhal and P.Bhartia, Micro-strip antennas,Artech house,1980
### 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 vs-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:
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
Teaching Scheme
Lectures: 3 Hrs./Week

Examination Scheme
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
504224  ELECTIVE I
APPLICATIONS OF MICROWAVE TO RADAR AND SATELLITE

Teaching Scheme
Lectures: 3 Hrs./Week
Credit: 3

Examination Scheme
Theory: 100 Marks

RCS enhancement. Scattering by imperfectly conducting surfaces; Maliuzhinets Formulation and characterization of Absorbers. Methods of RCS reduction.

Introduction to satellite systems: Evolution and growth of communication satellites, Kepler’s laws of motion, Orbiting satellites, orbits, altitude control; Satellite launch vehicles – Ariane, 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:

References:

2. Chanda & Majumdar, “Digital Image Processing and Analysis”, PHI.

References

2. Vijay Ahuja, “Communications Network Design and Analysis”
4. Behrouz Forouzan, “Data Communications And Networking”
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

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


References

504225 ELECTIVE II
SEMICONDUCTOR DEVICE MODELING AND TECHNOLOGY

Teaching Scheme
Lectures: 3 Hrs./Week

Examination Scheme
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**
Device simulation in SPICE using level 1 and higher level- models, incorporation of different technology nodes, process simulation using SUPREME.

**Texts**

**References:**
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.
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”.
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:**


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

2. T.S. Rappaport, “Wireless Communications Principles And Practice”, Pearson Education
3. Vijay Garg and Joseph Wilkes, “Principles And Applications Of GSM”, Pearson Education
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.


Texts/References


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


Reference

2. M.J.S. Smith, "Application Specific Integrated Circuits", Addison Wesley (Reading, MA), 1999
EMI AND EMC TECHNIQUES

Teaching Scheme
Lectures: 3 Hrs./Week
Credit: 3

Examination Scheme
Theory: 100 Marks
Credit: 3

Microwave Measurement Techniques

Unit 1
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

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