SYLLABUS FOR
VII SEMESTER
ELECTRONICS and COMMUNICATION ENGINEERING
<table>
<thead>
<tr>
<th>Course No</th>
<th>Name of subject</th>
<th>Credits</th>
<th>Weekly load, hours</th>
<th>C A Marks</th>
<th>Exam Duration Hrs</th>
<th>U E Max Marks</th>
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<td>13.701</td>
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### 13.705 Elective III

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<td>13.705.1</td>
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<td>13.705.2</td>
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### 13.706 Elective IV

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<td>MEMS (AT)</td>
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<td>13.706.3</td>
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<td>13.706.4</td>
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<td>13.706.5</td>
<td>Antenna Design                (T)</td>
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<tr>
<td>13.706.6</td>
<td>Cryptography                  (T)</td>
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13.701 NANO ELECTRONICS (AT)

Teaching Scheme: 2(L) - 1(T) - 0(P)  Credits: 3

Course Objective:

- Explain the fundamental science and quantum mechanical effects associated with low dimensional semiconductors.
- Identify the significance of nanolevel fabrication of particles and layers and their characterization.
- Correlate the concept of quantum level transport and tunnelling in similar structured nano devices.
- Analyze nanoscale devices like SET, QW laser, CNT Transistors, RTD etc.

Module – I

Introduction to nanotechnology and nanoelectronics, Impacts, Limitations of conventional microelectronics.

Mesoscopic Physics and Nanotechnologies - trends in Microelectronics and Optoelectronics, characteristic lengths in mesoscopic systems, Quantum mechanical coherence, Quantum wells, wires and dots, Density of states and dimensionality The physics of low dimensional structures - basic properties of two dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells, quantum wires and quantum dots.

Module – II

Introduction to methods of fabrication of nanomaterials-different approaches. fabrication of nano-layers -Physical Vapor Deposition, Chemical Vapor Deposition, Epitaxy- Molecular Beam Epitaxy, Ion Implantation, Formation of Silicon Dioxide.

Fabrication of nanoparticle- grinding with iron balls, laser ablation, reduction methods, sol gel, self assembly, precipitation of quantum dots.

Introduction to characterization tools of nano materials-principle of operation of STM, AFM, SEM, TEM, XRD, PL & UV instruments.

Module – III

Semiconductor quantum nanostructures and super lattices, MOSFET structures, Heterojunctions, modulation doped quantum wells, multiple quantum wells. The concept of super lattices Kronig - Penney model of super lattice.

Transport of charge in Nanostructures under Electric field - parallel transport, perpendicular transport, quantum transport in nanostructures Transport of charge in magnetic field and
quantum Hall effect - Effect of magnetic field on a crystal, the Aharonov-Bohm effect, the Shubnikov-de Hass effect, the quantum Hall effect.

**Module – IV**

Nanoelectronic devices and systems, MODFETS, heterojunction bipolar transistors, resonant tunnel effect, RTD, RTT, hot electron transistors, Coulomb blockade effect and single electron transistor, CNT transistors, heterostructure semiconductor laser, quantum well laser, quantum dot LED, quantum dot laser, quantum well optical modulator, quantum well sub band photo detectors, infrared detector, nanoswitches, principle of NEMS.

**References:**


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.
Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain 20% Analysis/Numerical Problems.

**Course Outcome:**

After the successful completion of the course the student will be able to

- Explain the fundamental science of low dimensional semiconductors.
- Know the fabrication of nanoparticles and their characterization.
- Correlate the concept of quantum level transport and tunneling in nano devices.
- Analyze nanoscale devices like SET, QW laser, CNT Transistors, RTD etc.
13.702 OPTICAL COMMUNICATION (T)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:

- Explain mode theory and parameters of different types of optical fibers.
- Discuss principle, characteristics and applications of optical sources and detectors.
- Illustrate different types of optical amplifiers.
- Design optical link and analyze performance.
- Describe different types of optical measuring instruments.
- Discuss different optical components of WDM.

Module – I

Classification of Light wave systems. Fibers- types and refractive index profiles, Mode theory of fibers- modes in Si and GI fibers. Impairments in fibers, Dispersion- Group Velocity Dispersion, modal, wave guide and Polarization Mode Dispersion. Attenuation- absorption, bending and scattering losses, fiber materials, fabrication of fibers, photonic crystal fiber, index guiding fiber, photonic bandgap fiber, hollow core fiber, fiber cables.

Module – II

Optical sources, LEDs and LDs, Structures, Characteristics, Modulators using LEDs and LDs. Coupling with fibers. Noise in Laser diodes, Amplified Spontaneous Emission (ASE) noise, effects of Laser diode nonlinearity, optical detectors, types and characteristics, structure and working of PIN and APD, noise in detectors and comparison of performance.

Module – III

Optical receivers- Ideal photo receiver and quantum limit of detection. Digital transmission systems, Design of IMDD links- power and rise time budgets, Coherent Systems, sensitivity of a coherent receiver, comparison with IMDD systems.

Optical Amplifiers- comparison of different types- doped fiber amplifiers, EDFA, structure and working, structure and working of semiconductor laser amplifier, amplifier configurations.

Optical Time Domain Reflectometer (OTDR), fault detection, length and refractive index measurements.

Module – IV

The WDM concept, WDM standards, Couplers, circulator, Add/ Drop Multiplexers, gratings, tunable filters, MZ interferometer, system performance parameters.

Introduction to soliton transmission, soliton links using optical amplifiers, GH effect, soliton-soliton interaction, amplifier gain fluctuations, design guide lines of soliton based links.
Introduction to optical networks. Introduction to free space optics, LiFi technology and VLC.

References:


Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours*  Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

*Note: Question paper should contain 20 % Analysis/Numerical Problems.

Course Outcome:

After the successful completion of the course the student will be able to

- explain mode theory and parameters of different types of optical fibers
- know principle, characteristics and applications of optical sources and detectors.
- Illustrate different types of optical amplifiers.
- design optical link and analyze the performance.
- explain different optical components of WDM and soliton based system.
13.703 MICROWAVE AND RADAR ENGINEERING (T)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objectives:
- Differentiate between conventional tubes & microwaves tubes.
- Explain the principle of microwave amplifiers and oscillators and analyze their parameters.
- Describe the principle and characteristics of microwave solid state devices.
- Recognize various microwave components
- Discuss the methods to measure various parameters.
- Explain different types of radars
- Discuss various navigation systems

Module – I
Microwaves: introduction, advantages, Cavity Resonators - Rectangular and Circular wave guide resonators- Derivation of resonance frequency of Rectangular cavity.
Microwave vacuum type amplifiers and sources: Klystron Amplifiers - Re-entrant cavities, Velocity modulation, Bunching (including analysis), Output power and beam loading.
Reflex Klystron Oscillators, Derivation of Power output, efficiency and admittance.

Module – II
Travelling Wave Tube - Slow wave structures, Helix TWT, Amplification process, Derivation of convection current, axial electric field, wave modes and gain. Magnetron oscillators - Cylindrical magnetron, Cyclotron angular frequency, Power output and efficiency.

Module – III
Solid state microwave devices – Microwave bipolar transistors – Physical structures, Power frequency limitations equivalent circuit. Principle of Tunnel diodes and tunnel diode oscillators. Gunn diodes – Different modes, Principle of operation Gunn Diode Oscillators. IMPATT and TRAPATT diodes, Microwave measurements.

Module – IV
Radar, simple Radar equation, Pulse Radar, CW Radar, CW Radar with non zero IF, Equation for doppler frequency, FM-CW Radar using sideband super heterodyne receiver, MTI Radar-
Delay line canceller, MTI Radar with power amplifier & power oscillator, Pulse Doppler Radar, Radar Transmitters, Radar Modulator, block diagram, Radar receivers- noise figure, low noise front ends, Mixers, Radar Displays, principle of Duplexers.


References:


Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: Question paper should contain 15% Analysis/Numerical Problems.
Course Outcome:

After the studying the course the students will be able to

- differentiate between conventional tubes & microwaves tubes.
- explain and analyze the microwave amplifiers and oscillators
- describe the principle and characteristics of microwave solid state devices.
- recognize various microwave components and the methods to measure various parameters.
- explain different types of radars
- explain of various navigation systems
13.704 INFORMATION THEORY AND CODING (T)

Teaching Scheme: 3(L) - 1(T) - 0(P)  
Credits: 4

Course Objective:

- To understand the concept of information
- To introduce to various aspects of error controlling and coding techniques for communication.
- To have idea on the different coding techniques.

Module – I


Module – II

Channel capacity – redundancy and binary symmetric channel (BSC), Binary erasure channel (BEC) – capacity of band limited Gaussian channels, Shannon – Hartley theorem – bandwidth – SNR trade off – capacity of a channel of infinite bandwidth, Shannon’s limit. Information Capacity of Coloured noise channel, Water-Filling Interpretation of Information Capacity Theorem, Rate Distortion Theory.

Module – III


Module – IV


References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours* 
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain 20% Problems, derivations and proofs

**Course Outcome:**

After the course the student will be able to
- Understand the concept of Information
- Understand the concept of various theorems proposed by Shannon
- Understand the concept of channel capacity
- Understand the idea of groups, rings, field, and codes.
- Understand the different error codes for communication systems.
13.705.1 PATTERN RECOGNITION (AT) (Elective III)

Teaching Scheme: 2(L) - 1(T) - 0(P)  Credits: 3

Course Objectives:

- Introduce pattern classification and structural pattern recognition.
- Discuss topics like feature extraction, Bayesian decision theory, nearest-neighbour rules, clustering, support vector machines.
- Understand neural networks, classifier combination, and syntactic pattern recognition techniques such as stochastic context-free grammars.

Module – I


Module – II


Module – III

Principal component analysis. Non-parametric techniques for density estimation - Parzen-window method, K-Nearest Neighbour method.

Linear discriminant function based classifiers – Perceptron Support vector machines.

Module – IV


References:


**Internal Continuous Assessment** *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 3 hours  
Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A** (20 marks) - Ten short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B** (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain minimum 20% problems, derivations, proof and algorithms.

**Course Outcome:**

At the end of this course, students will be able to:

- Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
- Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
- Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
- Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
- Implement simple pattern classifiers, classifier combinations, and structural pattern recognition.
13.705.2 MOS DEVICE MODELING (T) (Elective III)

Teaching Scheme: 2(L) - 1(T) - 0(P)  Credits: 3

Course Objectives:
- Explain the equations, approximations and techniques available for deriving a model
- Offer clues to qualitative understanding of the physics of a new device and conversion
- Simulate characteristics of a simple device using MATLAB, SPICE and ATLAS / SYNOPSYS
- List mathematical functions representing various non-linear shapes

Module – I
Basics of MOS circuits: MOS Transistor structure and device modelling, MOS Inverters ,MOS combinational circuits - Different logic families, Sources of Power dissipation: Dynamic power dissipation, Short circuit power, Switching power, Glicking power, Static power Dissipation, Degrees of freedom.

Module – II

Module – III

Module – IV
Leakage Power minimization Approaches: Variable-threshold-voltage CMOS (VTCMOS) approach, Multi-threshold-voltage CMOS (MTCMOS) approach, Power gating, Transistor stacking, Dual-Vt assignment approach (DTCMOS).
Special Topics: Adiabatic Switching Circuits, Battery-aware Synthesis, Variation tolerant design CAD tools for low power synthesis.

References:
4. BSIM Manuals available on BSIM homepage on the internet.
Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours                      Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: Question paper should contain minimum 20% problems, derivations and proof.

Course Outcome:

After completion of the course the student will be able to:

- Explain the equations, approximations and techniques available for deriving a model
- with specified properties, for a general device characteristic with known qualitative theory
- Apply suitable approximations and techniques to derive the model referred to above starting from drift-diffusion transport equations (assuming these equations hold)
- Offer clues to qualitative understanding of the physics of a new device and conversion of this understanding into equations
- Simulate characteristics of a simple device using MATLAB, SPICE and ATLAS/SYNOPSYS
- List mathematical functions representing various non-linear shapes
13.705.3 REAL TIME OPERATING SYSTEMS (T) (Elective III)

Teaching Scheme: 2(L) - 1(T) - 0(P)  
Credits: 3

Course Objectives:

The course shall provide

- A fundamental knowledge about general operating systems.
- An introduction to Real Time Operating Systems, its basic structure, building blocks and various operations on it.
- An insight into the different scheduling algorithms used in RTOS
- An overview of the different applications of real time operating systems

Module – I


The shared data problem- atomic and critical section.

Module – II


Module – III

Inter task communication: message queues, mailboxes and pipes, events


Module – IV

Structure of a real-time kernel, Process states, Data Structures, Kernel primitives, Inter-task communication mechanisms, System overhead.

Real Time Operating Systems: MicroC/OS-II – Overview only. Commercial Real-time operating systems: General concepts -Unix and Windows as RTOS

Applications of RTOS: Real Time Communication – Architecture. Embedded systems - Block diagram.
References:


Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours                Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: Question paper should contain minimum 20 % problems, derivations, proof and algorithms.

Course Outcome:

At the end of the course the students will be familiar with operating systems. They will have an in depth knowledge about the real Time Operating systems and its applications.
13.705.4 OPTOELECTRONIC DEVICES (T) (Elective III)

Teaching Scheme: 2(L) - 1(T) - 0(P)  Credits: 3

Course Objectives:
• Explain the physics of absorption, recombination and photoemission from semiconductors.
• Analyse different types of photo detectors based on their performance parameters.
• Discuss different LED structures with material properties and reliability aspects.
• Explain optical modulators and optical components.
• Illustrate different types of lasers with distinct properties.

Module – I
Optical processes in semiconductors – electron hole recombination, absorption, Franz-Keldysh effect, Stark effect, quantum confined Stark effect, deep level transitions, Auger recombination. Lasers – threshold condition for lasing, line broadening mechanisms, axial and transverse laser modes, heterojunction lasers, distributed feedback lasers, quantum well lasers, modulation of lasers, nitride light emitters.

Module – II
Franz-Keldysh and Stark effect modulators, quantum well electro-absorption modulators, electro-optic modulators, quadratic electro-optic effect quantum well modulators, Ram-Nath modulators, optical switching and logic devices.

Module – III
Optical detection – PIN, APD, modulated barrier photodiode, Schottky barrier photodiode, wavelength selective detection, microcavity photodiodes. Optoelectronic ICs – hybrid and monolithic integration, integrated transmitters and receivers, guided wave devices.

Module – IV
Introduction to optical components, directional couplers, multiplexers, attenuators, isolators, circulators, tunable filters, fixed filters, add drop multiplexers, optical cross connects, wavelength convertors, optical bistable devices.

References:

**Internal Continuous Assessment** *(Maximum Marks-50)*

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern:**

- Examination duration: 3 hours  
- Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A** (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B** (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain 20% problems, derivations and proof

**Course Outcome:**

After completion of the course the student will be able to

- Explain the property of absorption, recombination and photoemission in semiconductors.
- Illustrate different types of lasers with distinct properties
- Explain different LED structures with material properties
- Analyse different types of photo detectors
- Explain optical modulators and optical components.
13.705.5 COMPUTER VISION (T) (Elective III)

Teaching Scheme: 2(L) - 1(T) - 0(P)  
Credits: 3

Course Objectives:

- To have a thorough understanding of the Computer vision and digital image processing.
- To study about Cameras used for sensing images, its parameters and its calibration.
- To study the different ways of Segmenting the images and Tracking.
- To have a thorough understanding of the Feature Selection, Classification and Recognition.
- To have a basic idea of motion analysis.

Module – I

Cameras- Pinhole Cameras, Camera with lenses, CCD cameras - Camera Parameters and Perspective Projections - Camera model and Camera calibration - Radiance, BRDF – sampling and quantization in 2D Light sources and its effects – Shadows – Shading - Shape from X - Shape from shading.

Module – II

Human color perception – model for image color - color constancy.
Linear Filters - smoothing filters and sharpening filters in spatial and frequency domain- Scaling – image pyramids - Texture – shape from texture - Stereopsis - Binocular Fusion.

Module – III

Segmentation – Line detection, Boundary detection, Curve detection – Background Subtraction – segmentation by Clustering, K – means clustering, graph-theoretic clustering- Hough transforms –fitting lines and curves - Expectation Maximization (EM) algorithm, Active Contours
Tracking – Kalman Filter, Data Association – Model based vision –pose consistency, pose clustering, geometric hashing.

Module – IV

Classification –bayes classifier, nearest neighbor classifier
Feature selection –Principal component Analysis, Gradient Decent algorithm, Support Vector machine, SIFT operator
Recognition –recognition of patterns - Hidden Markov model
Motion Analysis -Regularization theory, Optical computation, Motion estimation, Structure from motion.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

**University Examination Pattern:**

Examination duration: 3 hours  Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain minimum 20 % derivations, proof and algorithms.

**Course Outcome:**

After completion of the course the student will be able to know:

- To have a thorough understanding of the Computer vision and digital image processing.
- To study about Cameras used for sensing images, its parameters and its calibration
- To study the different ways of Segmenting the images and Tracking
- To have a thorough understanding of the Feature Selection, Classification and Recognition.
- To have a basic idea of motion analysis.
Teaching Scheme: 2(L) - 1(T) - 0(P)  
Credits: 3

Course Objectives:
- Understand CDMA and its evolution.
- Acquire the basic concepts and architecture of a CDMA network.
- Study the security processes and mobile identification parameters used in CDMA.
- Learn the concepts related to the quality of service in CDMA

Module – I

Module – II

Module – III
CDMA Networks- hand off strategy, Power control, erlang capacity of CDMA System. Interference Cancellation -SIC and PIC Multiuser Detection: Single user matched filter-hypothesis testing.

Module – IV
Optimal receiver- matched filter in CDMA Channel, Coherent single user matched filter in Rayleigh fading channel. Optimum detector for synchronous channels- (Two-user and K-user) and asynchronous channel. Decorrelating Detector (DD)- DD in synchronous and asynchronous channels. Non Decorrelating linear multiuser detection- optimum linear multiuser detection. MMSE Linear multiuser detection.

References:

**Internal Continuous Assessment** *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours*  
*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain minimum 20% problems, derivations and proof.

**Course Outcome:**

*Upon successful completion of this course, students will be able to:*

- describe CDMA and its evolution.
- explain the basic concepts and architecture of a CDMA network.
- describe the security processes and mobile identification parameters used in CDMA.
- describe the concepts related to the quality of service in CDMA.
Course Objectives:

- To study general features of intellectual property rights.
- To study IPR acts of patents, trademarks, design, copyright, layout design of ICs.
- To know Indian position in the global IPR structure.
- To know the features of TRIPS, PCT, WIPO, EPO, WTO etc.

Module – I

Intellectual property rights-Introduction, importance, need of IPR, forms of IPR-Trade mark, Patent, Copyright, Design, Semiconductor IC layout design, geographical indication of goods, Trade secret, Protection of plant varieties and farmers rights, biodiversity and traditional knowledge, Indian position in global IPR structure.

Module – II

Trademarks-Introduction, condition and procedure for registration, rights and limitations of registration, infringement of trade mark, remedies against infringement, offences and penalties.

Patents- Meaning and purpose of patent, advantage of patent to inventor, invention not patentable, application for patent, provision for secrecy of certain inventions, grant of patent, rights of patent holder, infringement of patent, offences and penalties, international arrangements.

Module – III

Copyrights- introduction, meaning of copyrights ownership, rights of owner, subject matter of copyrights, international copyrights, infringement, offences and penalties.

Industrial design- Introduction, registration of design, copyrights in registered design Industrial and international exhibitions, infringement, offences and penalties.

Semiconductor IC layout design- Introduction, condition and procedure for registration, Effects of registration, offences and penalties.

Module – IV

IPRs in cyber space, IT related IPR, Computer software and IPR, database and protection, domain name protection, IPRs in pharmaceutical sector, IPRs in fashion industry, IPRs in biotechnology sector.

International treaties- Introduction, TRIPS, PCT, WIPO, EPO, WTO.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Course Outcome:**

At the end of the course, students will be able to

- Explain the importance of IPR.
- Practice in filing trademarks, patents, copyrights, industrial designs and semiconductor IC layout design applications.
- Explain the situations of infringement of rights and penalties and other legal aspects.
- Write the importance of IT related IPR like domain name and data base protection etc
- Review the role of IPR related organizations like PCT, WIPO, EPO, WTO, TRIPS etc
- Apply proficiency in communication and documentation.
Course Objective:

- To introduce MEMS and micro fabrication.
- To study the essential electrical and mechanical concepts of MEMS.
- To study various sensing and actuating technique.
- To know about the polymer and optical MEMS

Module – I


Points of consideration for processing. Anisotropic wet etching, Isotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), and Surface micromachining process-structural and sacrificial material.

Module – II

Conductivity of semiconductors, crystal plane and orientation, stress and strain - definition - Relationship between tensile stress and strain - mechanical properties of Silicon and thin films, Flexural beam bending analysis under single loading condition - Types of beam-longitudinal strain under pure bending - deflection of beam - Spring constant, torsional deflection, intrinsic stress, resonance and quality factor.

Module – III


Module – IV

References:-


**Internal Continuous Assessment** *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A** (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B** (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain minimum 10% problems, derivations and proof

**Course Outcome:**

At the end of the course, students will be able

- To explain the principle of MEMS and micro fabrication.
- To know the essential electrical and mechanical concepts of MEMS.
- To study various sensing and actuating technique.
- To know about the polymer and optical MEMS
13.706.3 EMBEDDED SYSTEMS (AT ) (Elective IV)

Teaching Scheme: 2(L) - 1(T) - 0(P)  
Credits: 3

Course Objectives:

- To have a thorough understanding of the basic structure and design of an Embedded System.
- To study the different ways of communicating with I/O devices and standard I/O interfaces.
- To study the basics of RTOS for Embedded systems.
- To study the programming concepts of Embedded Systems.

Module – I

Introduction to Embedded Systems– Components of an embedded system hardware– Software embedded into the system
Embedded Processors - CPU architecture of PIC and ARM processors
Design and Development life cycle model - Embedded system design process – Challenges in Embedded system design.

Module – II


Module – III


Module – IV

References:


Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, problems based on MATLAB / any other software packages covering the syllabus etc.

20% - Regularity in the class

University Examination Pattern:

*Examination duration: 3 hours Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

*Note: Question paper should contain minimum 20 % problems, derivations and proof.*

Course Outcome:

At the end of the course, students will have

- Thorough understanding of the basic structure and design of an Embedded System.
- Knowledge on the different ways of communicating with I/O devices and standard I/O interfaces.
- Knowledge on the basics of RTOS for Embedded systems and on programming concepts of Embedded Systems.
13.706.4 LOW POWER VLSI DESIGN (T) (Elective IV)

Teaching Scheme: 2(L) - 1(T) - 0(P)  
Credits: 3

Course Objectives:

• To study the concepts on different levels of power estimation and optimization techniques.
• To introduce the concept of Low power microelectronics.
• To introduce Low voltage technologies and circuits.
• To understand circuit and logic styles.

Module – I

Introduction- Need for low power VLSI chips, Sources of power dissipation, Dynamic power dissipation, Charging and discharging of capacitance, Short circuit current in CMOS circuits, CMOS leakage current, Static current. Power analysis - Gate-Level, Architecture level and Data correlation analysis. Monte Carlo Simulation. Probabilistic power analysis.

Module – II

Low voltage CMOS VLSI technology - BiCMOS and SOI CMOS technology. 
Power reduction at the circuit level - Transistor and gate sizing, Equivalent pin ordering, Network restructuring and reorganization, Special latches and Flip Flops, Low power digital cell library, Adjustable device threshold voltage-Low voltage circuits-voltage scaling-sub threshold operation of MOSFETs.

Module – III

Power reduction at the logic level - Gate reorganization, Signal gating, Logic encoding, State machine encoding, Precomputation logic Power reduction at the architecture and system level - Power and performance management.

Module – IV

Power reduction at the architecture and system level - Power and performance management, Switching activity reduction, Parallel architecture with voltage reduction, Flow graph transformation. Low power SRAM architectures. Software design for low power architecture. Recent trends in low-power design for mobile and embedded application.

References:


**Internal Continuous Assessment (Maximum Marks-50)**

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours**

*Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain minimum 25% problems, derivations and proof.

**Course Outcome:**

After successful completion of the course, students will be able to

- Understand the concepts of Low power microelectronics, low voltage technologies logic styles and circuits.
- Design chips used for battery-powered systems and high-performance circuits.
Course Objectives:

- Recall the fundamentals of antenna.
- Learn different types of antenna and antenna arrays
- Understand antenna matching techniques.
- Study measurements of different antenna parameters

**Module – I**

Introduction to various methods of antenna synthesis such as Schelkunoff Polynomial, Fourier transform, Woodward Lawson. Introduction to antenna analysis methods: Integral equation method, Moment method, Finite Difference Time Domain methods; Applications of these methods to the practical antennas such as dipole, loop, helical, microstrip patch, and PIFA.

**Module – II**

Various optimization techniques (OT) such as Genetic algorithm, Artificial Intelligence, Fuzzy logic. Comparative analysis of the OT’s for particular application and antenna type.

Various impedance matching techniques such as Quarter wavelength transformer, T match, Gamma Match, Omega match, Baluns and Transformers. Analytical comparative study of wire type and aperture type, narrow band and wide band, element and antenna array antennas.

**Module – III**

Designing an antenna with a set of given specifications using standard software. Material selection for antenna to be designed, understanding the specifications – errors responses – corrections methods. Concepts of antenna coupling, coupling methods, interferences and effects on performance of the antenna system.

**Module – IV**

Techniques to miniaturize an antenna for wireless LAN and Blue tooth applications, Wide-band and multi-band antennas, Mobile antennas and antenna diversity, Reconfigurable antennas.

Practical consideration in designing antennas for wireless communications (such as the interaction between mobile antenna and human body). Measurement of various antenna parameters necessarily needed for practical antennas. Understanding the working and design of anechoic chamber.
References:


**Internal Continuous Assessment (Maximum Marks-50)**

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern:**

- Examination duration: 3 hours          Maximum Total Marks: 100

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain minimum 25% problems, derivations and proof

**Course Outcome:**

At the end of the course, students will be able to

- design different types of antenna and antenna arrays
- explain antenna matching techniques.
- explain different antenna parameters measurements.
13.706.6 CRYPTOGRAPHY (T) (Elective IV)

Teaching Scheme: 2(L) - 1(T) - 0(P)                Credits: 3

Course Objectives:

• To understand the mathematical concepts of various Encryption,
• To discuss authentication and digital signature algorithms.
• To study the design of different general purpose and application specific security
  Protocols and standards.

Module – I

Introduction to cryptology- stream and block ciphers- secret and public key cryptography.
Mathematical Proof Methods: direct, indirect, by cases, contrapositive, contradiction,
induction, existence. Introduction to Complexity of Algorithm- P, NP, NP-Complete classes.
Number theory- primes, divisibility, liner diophantine equations, congruences, system of
linear congruences.

Module – II

Wilson theorem, Fermat’s little theorem, Euler’s theorem. Multiplicative functions, Primitive
roots, Quadratic congruences- quadratic residues, Legrende symbol.
Review of algebraic structures -groups, rings, finite fields, polynomial rings over finite field.

Module – III

Affine cipher, Hill cipher, Enciphering matrices. Public key cryptography- One way functions-
RSA - Discrete Log- Deffie-Helman Key Exchange system, Digital signature standards.
Knapsack Crypto system - Zero-knowledge protocols.

Module – IV

Primality testing- pseudo primes- the rho method. Elliptic curves and elliptic curve
cryptosystems. Data Encryption standard (DES), Advanced Encryption standard (AES).
Cryptanalysis methods- linear, differential, higher order differential, quadratic. Factoring
Algorithms- Trial Division, Dixon’s Algorithm.

References:


**Internal Continuous Assessment** *(Maximum Marks-50)*

- 50% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
- 20% - Regularity in the class

**University Examination Pattern:**

- *Examination duration: 3 hours*  
- *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

**Part A (20 marks)** - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

**Part B (80 Marks)** - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

**Note:** Question paper should contain minimum 20% problems, derivations and proof.

**Course Outcome:**

At the end of the course, students will be able to explain

- *mathematical concepts of various Encryption.*
- *authentication and digital signature algorithms.*
- *design of different general purpose and application specific security Protocols and standards.*
13.707 MICROWAVE & OPTICAL COMMUNICATION LAB (T)

Teaching Scheme: 0(L) - 0(T) - 3(P)  
Credits: 3

Course Objective

- To understand all basic Microwave and Optical devices and components.
- To learn few microwave measurements and analyze parameters.
- To understand the principles of fiber-optic communications and the different kind of losses, signal distortion and other signal degradation factors.
- To assess the performance of optical communication components.

List of Experiments:

A. Microwave Experiments:
   1. GUNN diode characteristics.
   2. Reflex Klystron Mode Characteristics
   3. VSWR and Frequency measurement.
   4. Verify the relation between Guide wave length, free space wave length and cut off wave length for rectangular wave guide.
   5. Measurement of E-plane and H-plane characteristics.
   6. Directional Coupler Characteristics.
   7. Unknown load impedance measurement using smith chart and verification using transmission line equation.
   8. Measurement of dielectric constant for given solid dielectric cell.

B. Optical Experiments:
   1. Measurement of Numerical Aperture of a fiber, after preparing the fiber ends.
   2. Preparation of a Splice joint and measurement of the splice loss.
   3. Power Vs Current (P-I) characteristics and measure slope efficiency of Laser Diode.
   4. Voltage Vs Current (V-I) characteristics of Laser Diode.
   5. Power Vs Current (P-I) characteristics and measure slope efficiency of LED.
   6. Voltage Vs Current (V-I) characteristics of LED.
   7. Characteristics of Photodiode and measure the responsivity.
   8. Characteristics of Avalanche Photo Diode (APD) and measure the responsivity.
   9. Measurement of fiber characteristics, fiber damage and splice loss/connector loss by OTDR.

Internal Continuous Assessment (Maximum Marks-50)

40% - Test
40% - Class work and Record
20% - Regularity in the class

**University Examination Pattern:**

*Examination duration: 3 hours  Maximum Total Marks: 100*

Questions based on experiments prescribed in the list.

*The following guidelines should be followed regarding award of marks*

- 25% - Design and Implementation
- 50% - Result
- 25% - Viva voce

*Candidate shall submit the certified fair record for endorsement by the external examiner.*

**Course Outcome:**

After completion of the course student will be able to

- understand all basic Microwave and Optical devices and components.
- learn few microwave measurements and analyze parameters.
- understand the principles of fiber-optic communications and the signal degradation factors.
- assess the performance of optical communication components
13.708 MODELLING AND SIMULATION OF COMMUNICATION SYSTEMS LAB (T)

Teaching Scheme: 0(L) - 0(T) - 3(P)  
Credits: 3

Course Objective:
- To generate digital modulated signals, detect and evaluate their performance.
- To study the performance of error checking and correcting code.
- To simulate a AM, FM, PM and other digital modulation schemes and estimate their performance.

List of Experiments:

Part A: Hardware Experiments:
1. Delta Modulation & Demodulation.
2. PCM (using Op-amp and DAC).
3. BASK (using analog switch) and demodulator.
4. BPSK (using analog switch).
5. BFSK (using analog switch).
6. Error checking and correcting codes.
7. 4 Channel digital multiplexing (using PRBS signal and digital multiplexer).

Part B: Matlab Experiments:
1. Simulate Analog modulation schemes like AM, FM and PM.
2. Sampling and reconstruction of signals in time domain and frequency domain.
4. Time delay estimation using correlation function.
5. Simulate Delta modulation and demonstrate the effect of step size for avoiding slope overload error and granular noise.
6. Study of eye diagram of PAM transmission system.
7. Generation of QAM signal and constellation graph.
8. Mean Square Error estimation of a signal.

Internal Continuous Assessment (Maximum Marks-50)
- 40% - Test
- 40% - Class work and Record
- 20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours  
Maximum Total Marks: 100
Questions based on experiments prescribed in the list.
The following guidelines should be followed regarding award of marks

Circuit and design – 25% (Logical design and flow diagram in case of software experiments.)
Implementation - 10% (Coding in case of Software experiments.)
Result - 40% (Including debugging of Program in case of Software experiments.)
Viva voce - 25%

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome

After completion of the course student will be able to
- detect and evaluate the performance of digital modulated signals generated.
- study the performance of error checking code.
- estimate the performance of simulated AM, FM and other digital modulation schemes.
13.709 SEMINAR (AT)

Teaching Scheme: 0(L) - 0(T) - 1(P)  
Credits: 1

Course Objective:

- To do a detailed study of a selected topic based on current journals or published papers and present a seminar based on the study done.
- The seminar provides students adequate exposure to public presentations to improve their communication skills.

The student is expected to present a seminar in one of the current topics in Electronics, Communication, Electronic Instrumentation and related areas based on current publications. The student will undertake a detailed study on the chosen subject and submit a seminar report in a soft bound form at the end of the semester. While preparing the report, at least three cross references must be used. This report shall be submitted for evaluation for the viva-voce in 8th semester. The report shall be endorsed by the Guide, Seminar coordinator and the HOD. Evaluation of presentation and report shall be conducted by a committee of the Seminar coordinator, Guide and a senior faculty.

Internal Continuous Assessment (Maximum Marks-50)

40% - 20 Marks is to be awarded for the presentation
40% - 20 marks is to be awarded for the report.
20% - 10 marks for the attendance.

Course Outcome:

At the end of the course, the students would have acquired the basic skills to for performing literature survey and paper presentation. This course shall provide students better communication skills.
13.710 PROJECT DESIGN (AT)

**Teaching Scheme:** 0(L) - 1(T) - 0(P)  
**Credits:** 1

**Course Objective:**
- To identify a problem for the final-year project, outline a solution, and prepare a preliminary design for the solution.
- To improve the ability to perform as an individual as well as a team member in completing a project work.

The student is expected to select a project in one of the current topics in Electronics, Communication, Electronic Instrumentation and related areas based on current publications. He/She shall complete the design of the project work and submit the design phase report. This shall be in soft bound form. This report shall be submitted for evaluation in 7th semester as well as for the viva-voce in 8th semester. The report shall be endorsed by the Guide, Project coordinator and the HOD. Evaluation of report and viva will be conducted by a committee consisting of the Project coordinator, Guide and a senior faculty. The number of students in a project batch shall be limited to a maximum of four.

**Internal Continuous Assessment (Maximum Marks-50)**
- 50% - 20 Marks is to be awarded for the Viva Voce
- 50% - 20 Marks is to be awarded for the report.
- 20% - 10 marks for the attendance

**Course Outcome:**
At the end of the course, the students would have acquired the basic skills to for performing literature survey and paper presentation. This course shall provide students better communication skills and improve their leadership quality as well as the ability to work in groups, and thus aid them in building a successful career as an engineer.