ME Electronics - Syllabus

Course Name	**:**	**ELECTRONIC SYSTEM DESIGN**
Course Code	**:**	**ECN 511**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

This subject covers the basics of digital logic circuits and design. Through the basic understanding of Boolean algebra and number systems it introduces the student to the fundamentals of combinational logic design and then to sequential circuits (both synchronous and asynchronous). Memory systems are also covered. There is an introduction to VHDL. Students will be provided with to implement the PLD based designs (using both schematic capture and VHDL) in actual chips.

Lecture wise breakup	**No. of Lectures**

1	**DESIGN CONCEPTS** Digital Hardware, Design Process, Design of Digital Hardware.	**(02)**
2	**LOGIC CIRCUITS** Variables & Functions, Logic gates & Networks synthesis, Introduction to VHDL.	**(03)**
3	**OPTIMIZED IMPLEMENTATION OF LOGIC FUNCTIONS** Strategy for minimization, Incompletely specified functions, Multiple output circuits, Multilevel synthesis & Analysis.	**(06)**
4	**ASYNCHRONOUS SEQUENTIAL CIRCUITS** Analysis, Synthesis, State Reduction, State Assignment, Hazards.	**(08)**
5	**DIGITAL SYSTEM DESIGN** Building Block Circuits.	**(04)**
6	**TESTING OF LOGIC CIRCUITS** Fault Model, Path sensitizing, Random testing, Circuits with Tree Structure	**(04)**

Course Outcomes:

Students will be able to	
1	Design, simulate, build and debug complex combinational and sequential digital circuits based on an abstract functional specification.
2	Describe the algorithmic principles of a number of important EDA techniques, such as behavioral and logic synthesis, logic simulation, static timing analysis, and power analysis
3	Apply appropriate EDA tools to electronic system design and verification Problems

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	A VHDL Primer- Bhaskar	1998
2	An Engineering Approach to Digital Design – FLETCHER	2002
3	Logic and Computer Design Fundamentals – MANO	2007
4	Introduction to Logic Design – MARCOVITZ	Latest Edition

Course Name	**:**	**MICROELECTRONICS**
Course Code	**:**	**ECN 512**
Credits	**:**	**3**
L T P	**:**	**3 0 0**

Total number of lectures: 42

Course Objectives:

The students after attending this course will be able to understand advanced topics like:

- I.C. fabrication techniques.
- Different steps of fabrication like oxidation, diffusion, ion implantation, Epitaxial growth.Thin film deposition techniques like CVD.
- Design of Silicon Capacitor.

	Lecture wise breakup	No of lectures
1	**MICROELECTRONICSTECHNOLOGY** Introduction, and its use in I.C. fabrication. Scales of integration from SSI to ULSI.	**(3)**
2	**CRYSTAL GROWTH** Single Crystal growth of Silicon and Gallium Arsenide. Substroth slicing and polishing. Zen refining of Semiconductor crystals.	**(4)**
3	**OXIDATION** Oxide layer growth on Silicon wafer surface. Oxidation in the presence of dry oxygen & wet oxygen.Oxide layer growth along various crystal directions.	**(4)**
4	**DIFFUSION** Solution to Fick's Laws Junction formation. Diodes, transistors and MOSFETs.	**(3)**

5	**EPITAXY** VPE, LPE and MBE: Individual epitaxial units, their operation and quality of film growth.	**(4)**
6	**ION IMPLANTATION** The process and techniques for formation of ion-implanted doped layers and their characteristics.	**(4)**
7	**THIN FILM DEPOSITION** Growth of thin metallic films. Normal and ultra-high vacuum systems. Thickness monitors.	**(4)**
8	**CHEMICAL VAPOUR DEPOSITION** Growth of CVD films. Growth mechanism and characterization. MOCVD.	**(4)**
9	**STANDARD BIPOLAR, NMOS AND CMOS CIRCUITS** Processing and fabrication using circuit layout. Process evaluation.	**(4)**
10	**THE SI-MOS CAPACITOR** Its fabrication and characteristics.	**(4)**
11	**SUB MICRON DEVICE PHYSICS AND TECHNOLOGY** Review of basic device physics, MOS capacitor and transistor theory, Moore's law on technology scaling, MOS device scaling theory, Short channel effects, sub threshold leakage, Punch through, DIBL, High field mobility, Velocity saturation and overshoot, ULSI technology, Nano fabrication	**(4)**

Course Outcome:

Students will be able to	
1	Understand I.C. fabrication processes, ULSI technology, nano fabtication.
2	Understand devices and Materials which are in recent trends in technology

	BOOKS:	**Year of Reprint**
1	Fundamentals of semiconductor Fabrication- S. M Sze , G May	**2000**
2	Physics of semiconductor devices- S.M Sze	**Latest Edition**
3	Microelectronics: Theory Design and Fabrication by Edward Keonjian	**Latest Edition**
4	Microelectronics –Jacob Millman	**Latest Edition**

Course Name	**:**	**ADVANCED DIGITAL SIGNAL PROCESSING**
Course Code	**:**	**ECN 523**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

Course Objectives: The purpose of this course is to provide in-depth treatment on methods and techniques in discrete-time signal transforms, digital filter design, optimal filtering, power spectrum estimation, multi-rate digital signal processing, DSP architectures, which are of importance in the areas of signal processing, control and communications.

Lecture wise breakup	**No. of Lectures**

1	**DIGITAL FILTERS** FIR filters, IIR filters. Digital filter design techniques: Impulse invariance. Bilinear transformation, finite difference, window design methods, frequency sampling optimization algorithms. MATLAB problems .	**05**
2	**WAVELET TRANSFORM:** Continuous & discrete wavelet transforms, Filter Banks. MATLAB problems, STFT (discreet and continuous time)	**04**
3	**EFFECTS OF FINITE WORD LENGTH IN DSP SYSTEM** Rounding and truncation errors, quantization effects in A/D converter, FIR and IIR filters	**04**
4	**MULTI-RATE SIGNAL PROCESSING** Integer sampling rate conversion. Interpolation and decimation filters. Design of practical sampling rate converters.Sampling rate conversion by an arbitrary factor. Applications of multi-rate signal processing in telecommunications.	**05**
5	**ADAPTIVE FILTERING:** Concepts, Adaptive filters as noise cancellers, adaptive line enhancer, in-system modeling. Basic Wiener filter.	**04**
6	**LINEAR PREDICTION**	**04**
7	**APPLICATIONS OF DSP**: Radar, sonar, biomedical, communications, speech and image processing.	**04**
8	**ADAPTIVE SIGNAL PROCESSING**	**04**
9	**BASIC CONCEPTS OF SPEECH SIGNAL PROCESSING**	**04**
10	**POWER SPECTRUM ESTIMATION**	**04**

Course Outcomes:

Students will be able to	
1	Understand concepts of digital filter design techniques.
2	Understand the advanced digital signal processing techniques such as wavelet transform, multirate signal processing, adaptive filtering.
3	Do MATLAB problems on like convolution, FIR Filter etc

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	Digital Signal Processing-E C fleacher& B W Jervis; PHI.	Latest edition
2	Digital Signal Processing-A.V. Oppenheim & B.W. Jervis; PHI.	2006
3	Digital Signal Processing-J.G. Prokis& D.G. Manolakis; PHI.	2006
4	Digital Signal Processing-M.H. Hayes; Schaum's Outlines.	2002
5	Digital Signal Processing-S Salivahanan, AVallavraj& C Gyanapriya; TMH.	2011
6	Applied Digital signal processing – Manolakis, Ingle.	Latest edition

Course Name	**:**	**FPGA BASED SYSTEM DESIGN**
Course Code	**:**	**ECN 524**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

The goal is to enable students to design and implement custom computing systems with FPGAs. Students will gain knowledge and understanding of:

- Different technologies to implement digital computing systems.
- Various FPGA architectures.
- Automated design flows supporting designs with FPGAs
- Fundamentals of the FPGA design tools.
- The reconfigurable computing systems and the roles of FPGAs in those systems.

Lecture wise breakup	**No. of Lectures**

1	**INTRODUCTION:** VLSI Design Flow, Structured Design Strategies, VLSI Design Styles, Chip Design Options.Role of FPGAs, FPGA Type, FPGA vs Custom VLSI, FPGA Based System Design. Type of ASIC, Full custom ASIC, Gate Array Based ASIC, Standard Cell Based ASIC, Different Types of Array, Design Flow, Case Study, Economics of ASIC.	**12**

2	**ASIC LIBRARY DESIGN:** Transistor as Resistor, Transistor Parasitic Capacitance, Logical Effort, Predicting Delay, Logical Area, Logical paths, multistage cells, Optimum Delay, Library Cell Design, Library.	**06**
3	**PROGRAMMABLE ASICS:** Anti-fuse**,** Static RAM, EPROM & EEPROM, Practical Issues, Specification and Programmable.	06
4	**FPGA:** FPGA Architectures, SRAM-Based FPGA, Permanently Programmed FPGAs, Chip I/O, Circuit Design of FPGA fabrics. ASIC I/O Cells.	**06**
5	**HDL:** An overview of VHDL and verilog HDL, Basic concepts of hardware description languages. Structural, Data-flow and Behavioral styles, Delay modeling. Control statements, FSM modeling of hardware description. Architecture of event driven simulators.	**06**
6	**LOGIC SYNTHESIS:** Physical design compilation, simulation, and implementation. Floor planning and placement,Commercial EDA tools for synthesis.	06

Course Outcomes:

Students will be able to	
1	Design ASIC library, programmable ASICs and FPGA.
2	Design and model digital circuits with VHDL at behavioral, structural, and RTL Levels and logic synthesis

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Wayne Wolf, "FPGA- Based System Design" Pearson education,LPE 1st Indian Reprint,	2000
2	J. Bhaskar, "VHDL Primer", Pearson Education Asia	2001.
3	Z. Navabi, "VHDL", McGraw Hill International Ed.	1998
4	S. Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall NJ, USA), 1996.	Latest Edition
5	John V. oldfield,Richard C. Dorf "Field Programmable Gate Arrays" John Wiley & Sons (1995)	Latest Edition
6	Michad John, Sebastian Smith "Application Specific Integrated Circuit",Pearson Education, LPE 2006.	Latest Edition

Course Name	**:**	**ADVANCED VIRTUAL INSTRUMENTATION**
Course Code	**:**	**ECN 525**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

The goal is to provide students with the ability to develop a fully virtual instrument (VI), capable of acquiring, processing, displaying and storing real time bio-signals, by the end of the semester. Covers the basics of virtual instrumentation including use of IEEE GPIB, RS232 interfaces, and data acquisition boards. Interfacing of a computer to various instruments for data acquisition and instrument control using a state of the art software platform such as National instrument's LABVIEW.

Lecture wise breakup	**No. of Lectures**

1	**GRAPHICAL SYSTEM DESIGN:** Graphical system design model (GSD),Design with GSD, Virtual instrument & Traditional Instrument, Virtual Instrumentation in engineering process, LabVIEW and VI, Comparison between conventional programming and graphical programming.	03
2	**INTRODUCTION TO LABVIEW:** Components of LabVIEW, front panel, Tools and other Palettes, controls and indicators, data types and conversions, operations on numbers, loops (FOR, WHILE), Feedback, Auto indexing, Local Variable, Global Variables, Shift Registers, sub-VI creation, sequence structure, case structure, Formula Node,Arrays and cluster, Inter-conversion of arrays and clusters, charts and graphs and property nodes, state machines, strings and string manipulation, output to files and input from files.	08
3	**DATA ACQUISITION:** Basic of data acquisition (Classification of signals, Real World signals, Analog Interfacing, Connecting the signal to board, Practical Vs. Ideal interfacing), Signal conditioning, DAQ Hardware Configuration, Measurement and Automation Explorer, Interfacing with assistants (DAQ assistant, analysis assistants, Instrument assistants).	06
4	**INSTRUMENT CONTROL:** Introduction, GPIB communication, Hardware specifications, Software Architecture, Instrument I/O assistant, VISA, Instrument Drivers, Serial Port Communication.	05
5	**IMAQ VISION:** Vision Basics, Image processing and analysis, particle analysis, Machine Vision, Machine Vision Hardware and Software.	05
6	**MOTION CONTROL:** Components of motion control system. Software for configuration, prototyping and development, motion controller, move types, motion amplifier and drives, feedback devices and motion I/O.	07

7	**VIRTUAL INSTRUMENTATION APPLICATIONS (BASED ON LABVIEW):** Development of a complete application in any of these fields like communication system (analog and digital communication), control system (motion control, temperature, current control etc.), Digital Signal Processing (Fourier transforms, power spectrum, correlation methods, windowing & filtering), Image acquisition and processing etc.	08

Course Outcomes:

The students will be able to	
1	Create virtual instrument (VI), Edit and debug virtual instruments
2	Build Arrays loops, formulas and sequence structures using LabVIEW software
3	Customize charts and graphs utilizing LabVIEW software, design a complete data acquisition system
4	Accommodate PC interfacing principles and instrument driver for computer measurement and control, Employ PC ports for real time programming, using data sockets to control a stepper motor over the network.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1.	Sanjay Gupta &J.John, "Virtual Instrumentation Using LabVIEW", Electrical Engineering Series, The Tata McGraw-Hill, New Delhi, India.	2006
2	Jeffrey Travis,JimKring, "LabVIEW for everyone",3rd edition Pearson Education, Delhi, India.	2008
3	LabVIEW manual.	
4	Gary Johnson, "LabVIEW Graphical Programming", 2nd Edition, McGraw Hill, New York.	1997
5	Robert H.Bishop, "Learning with LabVIEW™ 7 Express", Pearson Education, Delhi, India.	2005
6	Lisa K. wells & Jeffrey Travis, "LabVIEW for everyone", Prentice Hall, New Jersey.	1997
7	Jovitha Jerome, "Virtual Instrumentation using LabVIEW",PHI Learning ,New Delhi	2012
8	www.ni.com	
9	www.ltrpub.com	

Course Name	**:**	**EMBEDDED NETWORKING**
Course Code	**:**	**ECN 526**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

The students after attending this course will be able to understand the functioning of microcontrollers. The importance of architecture of device and the programming shall help the students use the devices. The role of support chips and their functioning in a programmable system will become clear.

Lecture wise breakup	**No. of Lectures**

1	**INTRODUCTION TO CAN:** The CAN bus - General - Concepts of bus access and arbitration - Error processing and management - From concept to reality -Patents, licenses and certification - CAN protocol: 'ISO 11898-1'-Content of the different ISO/OSI layers of the CAN bus- Compatibility of CAN 2.0A and CAN 2.0B.	08
2	**ETHERNET BASICS:** Elements of a network – Inside Ethernet – Building a Network: Hardware options Cables, Connections and network speed – Design choices: Selecting components – Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet protocol.	08
3	**EMBEDDED ETHERNET:** Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network secure.	08
4	**INDUSTRIAL NETWORKING PROTOCOL:** LIN – Local Interconnect Network - Basic concept of the LIN 2.0 protocol - Fail-safe SBC – Gateways - Managing the application layers - Safe-by-Wire - Safe-by-Wire Plus - Audio-video buses - I2C Bus - D2B (Domestic digital) bus - MOST (Media oriented systems transport) bus - IEEE 1394 bus or 'FireWire'- profi-bus.	08
5	**RF COMMUNICATION:** Radio-frequency communication: internal and external - Remote control of opening parts - PKE (passive keyless entry) and passive go- TPMS (tyre pressure monitoring systems) - Wireless networks- GSM-Bluetooth - IEEE 802.11x - NFC (near-field communication).	10

Course Outcomes:

Students will be able to	
1	Understand the functioning of microcontrollers. The importance of architecture of device and the programming shall help the students use the devices.
2	The role of support chips and their functioning in a programmable system will become clear.

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1.	Dominique Paret , "Multiplexed Networks for Embedded Systems- CAN, LIN, Flexray, Safe-by-Wire..." John Wiley & Sons Ltd.	2007
2	Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications.	2003
3	GlafP.Feiffer, Andrew Ayre and Christian Keyold, "Embedded networking with CAN and CAN open". Embedded System Academy.	2005
4	Gregory J. Pottie, William J. Kaiser "Principles of Embedded Networked Systems Design", Cambridge University Press, Second Edition.	2005

Course Name	**:**	**ADVANCED COMMUNICATION SYSTEM**
Course Code	**:**	**ECN 531**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

By the end of this course, the students should be able to

1. Explain the communication process and the various advanced digital modulation techniques.
2. To describe advanced multiplexing techniques in a communication system.
3. Explain the concepts of various latest technologies in the area of wireless optical communication and all optical processing.
4. Study integrated optical circuits and its building block devices such as waveguide, modulators and couplers etc.

Lecture wise breakup	**No. of Lectures**

1	**INTRODUCTION** The communication process, sources of information, communication networks, communication channels/ resources, analog vs digital communication, analysis and design of communication systems	**05**
2	**DIGITAL CARRIER MODULATION SCHEMES** Baseband binary PAM systems, Duo-binary baseband PAM system, M-ary signaling schemes, Binary ASK, PSK, FSK signaling schemes, Coherent and non-coherent, M-ary QAM, Continuous phase modulation (QPSK and variants, MSK, GMSK), comparison of digital modulation schemes	**12**
3	**ADVANCED MULTIPLEXING TECHNIQUES**	**12**

	Time division multiplexing, Wavelength division multiplexing, Dense Wavelength division multiplexing (DWDM), Ultra dense Wavelength division multiplexing, coarse DWDM, Orthogonal frequency division multiplexing, Polarization division multiplexing, Duty-cycle division multiplexing, OCDMA, 2D and 3D codes	
4	**ADVANCED COMMUNICATION TECHNIQUES** Wireless optical communication: Radio over fiber, free space optics (FSO), losses in FSO, passive optical networks, All Optical signal processing	**07**
5	**INTEGRATED OPTICS** Types of waveguide, Polymer and fiber integrated optics, losses in waveguide, couplers, electro-optic modulators, Integrated optic detectors, resonators, Optical integrated circuits	**06**

Course Outcomes:

Students will be able to	
1	Explain the advanced modulation techniques in communication systems.
2	Analyze the advanced multiplexing techniques of communication systems.
3	Explain the design of advanced wireless communication networks.
4	Study and investigate Integrated optical circuits and devices

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Taub and Schilling, "Principles of Communication systems", McGraw Hill	Latest Edition
2	B.P.Lathi, Modern Digital and analog communication systems,3rd Edition ,Oxford University Press	Latest Edition
3	Proakis, "Communication Systems", 2nd Edition, Prentice Hall.	Latest Edition
4	K. Sam Shanmugam, "Digital and analog communication systems", John Wiley and Sons Inc.	Latest Edition
5	Olivier Bouchet, "Wireless Optical Communications", Wiley	Latest Edition
6	Integrated Optics Theory and Technology, Authors:Robert G. Hunsperger, Springer	Latest Edition

Course Name	**:**	**SATELLITE COMMUNICATION**
Course Code	**:**	**ECN 532**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

- Spacecraft structure
- Different communication bands.
- Different types of interferences
- Different modulation and carrier recovery techniques.
- Different multiple access techniques like CDMA, FDMA and TDMA.
- Satellite applications like TV, mobile, internet.

Lecture wise breakup	**No. of Lectures**

1	**INTRODUCTION AND BACKGROUND** Historical Background, basic concepts, communication satellites, communication networks and services, satellite description	**2**
2	**ORBITAL ASPECTS AND LAUNCHING** Orbital mechanics, orbital elements, geostationary orbit, other orbits for satellite communications, rocket propulsion, injection into final orbit, launch vehicle.	**4**
3	**SPACECRAFT SUBSYSTEMS** Spacecraft structure, primary power, various subsystems of a satellite	4
4	**FREQUENCY & PROPAGATION ASPECTS:** Frequency spectrum, communication bands, frequency reuse, propagation aspects.	**4**
5	**LINK INTERFERENCE ANALYSIS** General considerations, rain induced attenuation, different types of interferences	**4**
6	**THE RF LINK DESIGN** The basic RF link, limits on link performance, satellite links-up and down, optimization of the link, temperature considerations, propagation factors, rain attenuation model.	4
7	**MODULATION AND CARRIER RECOVERY:** Source signals, digital modulation techniques-PSK,QPSK,M-array PSK& FSK.PLL, carrier recovery with narrowband filter and AFC loop	4
8	**MULTIPLE ACCESS** System engineering considerations, FDMA, TDMA, CDMA, comparison of multiple access techniques.	4
9	**CODING AND ERROR CORRECTION** Error correction techniques, coding	4
10	**CODING AND ERROR CORRECTION** Error correction techniques, coding	4

11	**EARTH STATION & VSATS:** Transmitters, receivers, components of an earth station, VSAT-types, uses	4
12	**APPLICATIONS:** GPS, Mobile, Internet, etc.	4

Course Outcomes:

Students will be able to	
1	Identify the fundamentals of orbital mechanics, the characteristics of common orbits used by communications and other satellites
2	Understand the systems required by a satellite communications to function and the trade-offs and limitations encountered in the design of a satellite communications system.
3	Be able to calculate an accurate link budget for a satellite or other wireless communications link.
4	Understand the concept of multiple access techniques like CDMA,FDMA and TDMA

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Wilbur L.Pritchard,HenryG.Suyderhoud ,Robert A.Nelson; Satellite communication system engineering, 2nd edition, Pearson.	2014
2	Tri T. Ha, Digital Satellite Communication McGraw-Hill	2011
3	M. Richharia, Satellite Communication Systems, McGraw Hill, 1999.	1999
4	G. Maral& M. Bousquet, Satellite Communication Systems, John Wiley and Sons, Inc.,	1999
5	G. Maral& M. Bousquet, Satellite Communication Systems, John Wiley and Sons, Inc.,	1999
6	B. Elbert, Introduction to Satellite Communications, Artech House,	1999
7	Pratt, Bostian, and Allnutt, Satellite Communication Systems, 2nd Edition, John Wiley & Sons, .	2003

Course Name	**:**	**BIOMEDICAL ENGINEERING**
Course Code	**:**	**ECN 533**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

With the introduction of this subject, students would be able to understand the basics of biomedical engineering and realize the problem encountered in the medical field, encouraging them to find the solution and application in this area and to make the student understand the working and application of Biomedical devices and instrument.

Lecture wise breakup	**No. of Lectures**

1	**INTRODUCTION TO BIOMEDICAL INSTRUMENTATION** Basic Anatomy and Physiology: Circulatory system, Nervous system and Respiratory system, Review of development of biomedical instrumentation and Biometrics, Review of transducers, Sensors and electrodes.	**4**
2	**BIOMEDICAL DEVICES AND MEASUREMENTS** Cardiovascular Measurement: The heart out cardio vascular system, Electrocardiography, Photocardiography, Ballistocardiography, Plethymography, MagnetaCardiography, Pacemakers, Defibrillators and computer applications. Respiratory system measurement: Respiratory mechanism, measurement of gas volume, flow rate, measurement of gas concentration in inhaled aided respiratory controller. Measurement of electrical activities in muscles and brain: Electromyography, Electroencephalograph and their interpretation.	**6**
3	**MODERN IMAGING SYSTEM** Introduction to Ionising and Nonionising radiation, principles of X-ray production and interaction, special techniques, CAT, mammography, Ultrasound Imaging Systems and its interaction, Magnetic Resonance Imaging System, Basic NMR components different imaging methods, image processing, filters, enhancements and restoration and image segmentation.	6
4	**BIOMEDICAL TELEMETRY AND TELEMEDICINE** Introduction to Biotelemetry, Physiological parameters, Wireless telemetry, Single channel telemetry systems, Multichannel wireless telemetry system, Multipatient telemetry, Implantable telemetry systems, transmission of analog physiological signals over telephone, Telemedicine, Application of Telemetry in Patient care .	**7**
5	**CARDIAC PACEMAKERS AND DEFIBRILLATORS** Cardiac pacemakers: External pacemakers, Implantable pacemakers, Progammable Pacemakers, Performance aspects of Implantable pacemakers, Power sources, Pacing system analyzers Cardiac Defibrillators: Dc defibrillator, Defibrillator electrodes, Performance aspects, Implantable Defibrillator analyzer.	**9**
6	**OTHER THERAPEUTIC QUIPMENTS** Hemodialysis machine: Functions of Kidenys, Artificial Kidney, Dialysers,	10

	Portable kidney Machines Instruments for Surgery: Surgical diathermy machine, Safety aspects in Electrosurgical units, Surgical diathermy analyzers, Physiotheraphy and Electrotherapy Equipment: Short-wave Diathermy machine, Microwave diathermy Machines, Ultrasonic therapy unit, Electro-diagnostic/Therapeutic instruments, Pain relief through electrical Stimulation.	

Course Outcomes: :

Students will be able to	
1	Design, simulate, build and debug complex combinational and sequential digital circuits based on an abstract functional specification
2	The capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology
3	An understanding of biology and physiology.
4	The ability to make measurements on and interpret data from living systems.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Handbook of Biomedical Instrumentation, Khandpur	2010
2	Medical Instrumentation: Application and Design, J.G.Webster, Houghton Mifin.	1991
3	Biomedical Instrumentation and Measurements, Leslie Cromwell, Fred J. Weibell.	2004
4	Introduction to Biomedical Equipment Technology, Joseph J.Carr, John M.Brown.	2001

Course Name	**:**	**ELECTRONIC WASTE MANAGEMENT**
Course Code	**:**	**ECN 534**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

Course objectives: This subject introduces the concept of E-waste, properties of different materials used in manufacturing of electrical and electronics products and different methods used to dispose all these materials like landfill, burning, concept of recycling and E-waste management methods.

Lecture wise breakup	No. of Lectures

1	**INTRODUCTION:** Introduction to E-waste, classification of E-waste, legislative influences on electronic recycling, WEEE and ROHS directive, treatment options for WEEE, material composition of WEEE, health and safety implication	**6**
2	**MATERIALS USED IN MANUFACTURING ELECTRICAL AND ELECTRONIC PRODUCTS:** Overview, ROHS directive and prescribed materials – lead, brominated flame retardants, soldering and move to lead free assembly, printed circuit board materials, encapsulant of electronic components, indium tin oxide and LCD screens, polymeric materials in enclosures, casing and panels, material composition of mobile phones, computers, televisions, washing machines and other electronic components, useful components and hazardous components in electronic waste.	**8**
3	**DUMPING, BURNING AND LANDFILL:** Introduction, landfills, pollutions from landfill, landfill site construction, burning, incineration, thermal processing, current practices in India, case studies and projects.	09
4	**INTEGRATED APPROACH TO ELECTRONIC WASTE RECYCLING:** Separation and sorting, treatment, emerging technologies like separation, thermal treatment, sensing technologies, plastics to liquid fuels, sorting, crushing, automated disassembly, design for recycling and inverse manufacturing. Design methodology and resource efficiency, environmentally sound treatment technology for E-waste, eco-design guidelines for manufacturing, case studies and project.	**11**
5	**ELECTRONIC WASTE MANAGEMENT:** Methods for electronic waste management, national and international efforts, corporate social responsibility, extended producer responsibility(EPR), current practices in India, case studies and project.	**08**

Course Outcomes:

Students will be able to	
1	Implement different E-waste management methods.
2	Understand aspects and issues related to recycling of E waste
3	Understand the dumping, burning, incineration (combustion) and land disposal of E waste.

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	E-waste implications, regulations and management in India and current global best practices by rakeshJohri (2008), TERI publishing.	2008

2	E-Waste: Managing the digital dump yard by VishakaMunshi, ICFAI.	2008

Course Name	**:**	**MOBILE COMMUNICATIONS AND FADING**
Course Code	**:**	**ECN 535**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

The student would be able to understand the basics of mobile communication and realize the problems encountered in day today life encouraging him to find solutions hence with.

Lecture wise breakup	**No. of Lectures**

1	**INTRODUCTION** Introduction to Wireless Communications Systems and applications , Need of mobility , Development and differences between current standards, WLL, WLAN, Bluetooth and personal area networks (PANs) 802.11b (Wi-Fi Networks)	**04**
2	**WIRELESS TRANSMISSION** Frequencies for radio transmission, cellular concept, signal propagation effects, Mobile communication channel models. Interference, improving capacity in cellular systems	**06**
3	**FADING, DIVERSITY AND EQUALISATION** Small scale Multipath Propagation, Parameters of mobile multipath channels, Types of small scale fading, Rayleigh and Rician fading distribution, Training a generic adaptive equalizer, Linear , Nonlinear and algorithms for adaptive equalization, Diversity techniques, RAKE Receiver. Interleaving, Block, Convolutional and turbo codes.	08
4	**MULTIPLE ACCESS TECHNIQUES** FDMA, TDMA, SSMA, Spectral efficiency of multiple access systems.	**06**
5	**WIRELESS NETWORKING** Mobile IP, Mobility and internet module, Assumptions and requirements, entities and terminology, IP packet delivery, registration, Tunelling, Optimisation, IPv6 protocol, Indirect TCP, Snooping TCP, Mobile TCP, Transmission, Transaction oriented TCP.	**06**

6	**TELECOMMUNICATION SYSTEMS** GSM, Mobile Services, Architecture, frame structure, Signal Processing in GSM.	07
7	**EMERGING TECHNOLOGY** Ultra wideband (UWB), Multiband OFDM, Broadband wireless access (BWA), UMTS	05

Course Outcomes:

Students will be able to	
1	Design wireless networks
2	Develops an ability to apply knowledge of engineering to design of cell geometry.
3	Understand the importance of Multiple Access techniques, voice coding techniques and mobility management in GSM network.
4	update themselves with recent technology and happenings in the field of Mobile technology

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Wireless Communications-Principles and Practice, Theodore S. Rappaport	2002
2	Wireless Digital Communications, Dr.KamiloFeher	2nd Edition
3	Wireless Communications and Networks, William Stallings	Latest edition
4	Mobile Communications, JochenSciller	Latest edition

Course Name	**:**	**ADVANCED COMPUTER ARCHITECTURE**
Course Code	**:**	**ECN 536**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

The students after attending this course will be able to understand the functioning of microcontrollers. The importance of architecture of device and the programming shall help the students use the devices. The role of support chips and their functioning in a programmable system will become clear.

Lecture wise breakup	**No. of Lectures**

1	**OVERVIEW OF VON NEUMANN ARCHITECTURE:** Instruction set architecture; The Arithmetic and Logic Unit, The Control Unit,	**08**

	Memory and I/O devices and their interfacing to the CPU; Measuring and reporting performance; CISC and RISC processors.	
2	**PIPELINING:** Basic concepts of pipelining, data hazards, control hazards, and structural hazards; Techniques for overcoming or reducing the effects of various hazards.	**06**
3	**HIERARCHICAL MEMORY TECHNOLOGY**: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.	06
4	**INSTRUCTION-LEVEL PARALLELISM:** Concepts of instruction-level parallelism (ILP), Techniques for increasing ILP; Superscalar, superpipelined and VLIW processor architectures; Vector and symbolic processors; Case studies of contemporary microprocessors	**08**
5	**MULTIPROCESSOR ARCHITECTURE:** Taxonomy of parallel architectures; Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks; Distributed shared-memory architecture, Cluster computers.	**08**
6	**NON VON NEUMANN ARCHITECTURES:** Data flow Computers, Reduction computer architectures, Systolic Architectures.	06

Course Outcomes:

Students will be able to	
1	Understand the advanced concepts of computer architecture and RISC and CISC architectural characteristics.
2	Investigating modern design structures of Pipelined and Multiprocessors systems.
3	understand the memory organization and instruction level pipelining including the case studies

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1	Computer Organization and Architecture: Designing for performance, W. Stallings, 4th Ed. PHI, 1996.	1996
2	Computer Architecture: A Quantitative Approach, J. H. Hennessy and D. A. Patterson, 2nd Ed., Morgan Kaufmann, 1996.	1996
3	Advanced Computer Architecture: Parallelism, Scalability and Programmability, Kai Hwang, McGraw-Hill Inc, 1993.	1993
4	Parallel Computer Architecture: A Hardware/Software Approach, D. E. Culler, J. Pal Singh, and A. Gupta, HarcourtAsiaPte Ltd., 1999.	1999

Course Name	**:**	**TELECOMMUNICATION SYSTEM**
Course Code	**:**	**ECN 537**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

This subject covers the concepts of modern and advance topics of communication like:

- Personal area networks like: Bluetooth, Zigbee
- WI-FI, Wimax, Ad-hoc networks.
- Human area network.
- Cognitive Radio Network.
- Optical wireless network.

Lecture wise breakup	**No. of Lectures**

1	Review of wireless communication, wireless media, satellite communication, wireless standards, propagation techniques, wireless generation – 2g, 3g, 4g protocols, open and proprietary standards.	03
2	TRAI (telecom regulatory authority of India), its role and scope, TERM/DOT, WPC.	02
3	Wi-Fi, wi-max, ad-hoc network, and standards.	02
4	Bluetooth, zigbee, ultra wide band communication.	06
5	Broadband (wired and wireless)	03
6	Cable, DTH and IP-TV.	05
7	Optical wireless communication	02
8	Global positioning system (GPS)	02
9	Telecom infrastructure and telecom security, IPV-4 and IPV-6.	03
10	Cognitive radio communication	04
11	Human area networks.	02
12	Simulating telecom networks, case study referred simulation	04
13.	Project/case study of the telecom status in India.	04

Course Outcomes:

Students will be able to gain	
1	Knowledge of commercial communication systems
2	Knowledge of software tools for modeling and simulation of telecommunication systems
3	Ability in the design of communication networks, wireless transmission systems, radar and remote sensing sensors
4	Ability in the design of electronic circuits for the radio front end of a trasmit/receive equipment
5	Ability to apply telecommunication systems engineering techniques taking account of industrial and commercial constraints – project management.

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1.	An Introduction to Wireless Technology, Gary S. Rogers and John Edwards, Pearson Education	2003
2	Bluetooth Revealed, Brent A. Miller and ChatschikBisdikian, Pearson Education.	2000

Course Name	**:**	**MICROCONTROLLER AND EMBEDDED PROCESSORS**
Course Code	**:**	**ECN 538**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

The students after attending this course will be able to understand the functioning of microcontrollers and microprocessors. The importance of architecture of device and the programming shall help the students use the devices. The role of support chips and their functioning in a programmable system will become clear.

Lecture wise breakup	No. of Lectures
1	**PIC MICROCONTROLLER** Introduction to PIC18F family of microcontroller, CPU, Architecture, pin configuration, pipelining ,memory organization, registers, addressing modes Instruction set, Assembly language programming, subroutines , timers, Interrupts, I/O ports, serial port, ADC, PWM	**12**
2	**PERIPHERAL OF PIC MICROCONTROLLER** Timers – Interrupts, I/O ports- I^2C bus-A/D converter-UART- CCP modules -ADC, DAC and Sensor Interfacing –Flash and EEPROM memories, Interfacing with LED, Switches, LCD, Key pad with examples	**10**
3	**ARM PROCESSORS** ARM Architecture, CPU, Registers, memory organization, Buses, Interrupts, , Addressing modes, GPIO, timers, Interfacing of LCD	**10**
4	**FUNDAMENTALS OF EMBEDDED SYSTEMS** Real time systems, Multitasking system, Thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock.	**10**

Course Outcomes:

Students will be able to	
1	Understand the architecture and programming of contemporary microcontroller and microprocessor like PIC, ARM etc.
2	Interface peripheral devices with these microcontrollers

3	Use microcontrollers, microprocessors architecture knowledge to design Embedded System.

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1.	PIC Microcontroller & Embedded Systems-using assembly and C for PIC 18 by Muhammand Ali Mazidi, R.D Mckinlay & Danny Causey, Pearson Education	2008
2	Microcomputer Engineering by Gene H. Miller, Pearson Education	2003
3	Fundamentals of Embedded software by Danial W. Lewis, PHI	2000
4	Embedded Microcontroller by Todd D. Mortan, Pearson Education	2000

REFERENCES:

Course Name	**:**	**DIGITAL IMAGE PROCESSING**
Course Code	**:**	**ECN 539**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

The students after attending this course will be able to understand advanced topics like:

- Spatial domain filtering.
- Filtering in frequency domain using hotelling transform, Fourier transform and discrete cosine transform.
- Image restoration and fusion.
- Image compression techniques.
- Image Segmentation.

Lecture wise breakup	No. of Lectures

1	**INTRODUCTION:** Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Perspective Projection, Spatial Domain Filtering, sampling and quantization.	02
2	**SPATIAL DOMAIN FILTERING:** Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian	04
3	**FILTERING IN THE FREQUENCY DOMAIN:** Hotelling Transform, Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering	05

4	**IMAGE RESTORATION AND FUSION:** Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Restoration from projections	05
5	**IMAGE COMPRESSION:** Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Huffman Coding, Arithmetic Coding, Golomb Coding, LZW coding, Transform Coding, Sub-image size selection, blocking artifacts, DCT implementation using FFT, Run length coding, FAX compression (CCITT Group-3 and Group-4), Symbol-based coding, JBIG-2, Bit-plane encoding, Bit-allocation, Zonal Coding, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding, Motion Compensation	06
6	**WAVELET BASED IMAGE COMPRESSION:** Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT),Continuous Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding, Digital Image Watermarking.	04
7	**MORPHOLOGICAL IMAGE PROCESSING:** Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.	05
8	**IMAGE SEGMENTATION:** Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation	05
9	**FEATURE ESTIMATION:** Morphological Operations, Edge Detection, Edges in multichannel images, Texture Analysis, Optical flow based motion estimation, Reflectance based shape recovery, Depth from focus, Stereo matching and depth estimation.	06

Course Outcomes:

Students will be able to	
1	Understand basic concepts of digital image processing.
2	Apply principles and techniques of digital image processing using MATLAB
3	Analyze and implement image processing algorithms.
4	Gain hands-on experience in using software tools for processing digital images

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1.	Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education.	2007
2	Fundamentals of Digital Image Processing By Anil K Jain.	2005

Course Name	**:**	**OPTOELECTRONICS AND COMMUNICATION**
Course Code	**:**	**ECN 540**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

The students after attending this course will be able to understand advanced topics like:

- Optic fiber material and their properties.
- Optical transmitter and receiver design.
- Lightwave communication system design
- Optical instrumentation
- Components of fiber optic networks
- Fiber losses and their compensation

Lecture wise breakup	No. of Lectures

1	**FIBER OPTIC GUIDES** Basic Optical laws and definitions, Optical fiber modes and configurations, mode theory for circular waveguides, Single mode fibers, graded index fiber structure, fiber materials, Glass fibers, active glass fibers, plastic optical fibers, Photonic crystal fibers, Fiber manufacturing, design issues, fabrication methods, cables and connectors	08
2	**FIBER LOSSES AND DISPERSION** Intrinsic and extrinsic losses, dispersion in single mode fibers, dispersion induced limitations, Polarization mode dispersion, speciality fiber, Dispersion shifted and Dispersion flattened fibers, few mode fibers, dispersion management, nonlinear effects, stimulated Raman scattering, Stimulated Brillouin scattering, Self phase modulation, cross phase modulation, four wave mixing	07
3	**OPTICAL TRANSMITTERS AND RECEIVERS** LED, power current characteristics, spectrum, modulation response and structures, semiconductor lasers, Optical gain, feedback and laser threshold, laser structures, control of longitudinal modes, laser characteristics and transmitter design, Photodetectors, Receiver design and performance	08
4	**LIGHT WAVE SYSTEM** System architecture, sources of power penalty, Multichannel systems: WDM	07

	lightwave systems, WDM components, TDM, Subcarrier multiplexing, Soliton based communication, loss managed solitons and dispersion managed solitons	
5	**COMPONENTS OF FIBER OPTIC NETWORKS** Transceivers for fiber optic networks, Semiconductor optical amplifiers and its applications, Erbium doped fiber amplifiers, Raman fiber amplifiers, hybrid amplifiers, Thulium doped fiber amplifiers, Neodymium doped fiber amplifiers, Ytterbium doped fiber amplifiers, passive components, switches and functional modules of fiber optic networks	08
6	**OPTICAL INSTRUMENTATION:** Introduction to test and measuring instruments, optoelectronic circuits: OTDR, optical Spectrum Analyzer, Fiber Optic sensors: fiber optic and radiation sensors, their noise and error analysis, application in physical sensors.	04

Course Outcomes:

Students will be able to	
1	Understand the basic and applied concepts of optical fiber material and their properties, optical transmitter and receiver design.
2	Understand the design aspects of lightwave communication system, various losses and their compensation. Wavelength division multiplexing, optical instrumentation, optical amplifier, dispersion compensation techniques.
3	Explain the various functional modules of fiber optic networks.
4	Do various experiments, simulate and analyze the designed systems using these concepts. Students will analyze and design various types of optical communication systems.

Suggested Books:

Sr. No.	**Name of Book/ Authors/ Publisher**	**Year of Publication/ Reprint**
1.	G.P. Aggarwal, "Fiber optic Communication systems, John Wiley and sons.	Latest Edition
2	Mynbaev, "Fiber- optics communication Technology", Pearson Education India.	Latest Edition
3	Keiser, "Optical fibre communication", Tata McGraw Hill	2009
4	John M Senior, "Optical fiber communication", Pearson India	Latest Edition

Course Name	**:**	**ADVANCED TECHNIQUES FOR SIGNAL RECEPTION**
Course Code	**:**	**ECN 541**
Credits	**:**	**3**
L T P	**:**	**3-0-0**

Total No. of Lectures – 42

Course Objectives:

The students after attending this course will be able to understand advanced topics like:

- Blind multi-user detection
- Group blind multi-user detection
- Space time multi-user detection
- Turbo multi-user detection

Lecture wise breakup	No. of Lectures

1	**BLIND MULTIUSER DETECTION:** Linear receivers for synchronous CDMA, blind multiuser detection, direct methods, subspace methods, performance of blind multiuser detectors, subspace tracking algorithms, blind multiuser detection in multipath channels.	07
2	**GROUP BLIND MULTIUSER DETECTION:** Group blind multiuser detection, synchronous CDMA, performance, nonlinear group blind multiuser detection for CDMA, group blind multiuser detection in multipath channels.	07
3	**ROBUST MULTIUSER DTECTION IN NON GAUSSIAN CHANNELS:** Multiuser detection via robust regression, asymptotic performance of robust multiuser detection, and implementation of robust multiuser detectors, robust multiuser detection based on local likelihood search, extension to multipath channels, detection in stable noise.	07
4	**SPACE TIME MULTIUSER DETECTION:** Adaptive array processing in TDMA systems, optimum space time multiuser detection, linear space time multiuser detection, adaptive space time multiuser detection in synchronous CDMA, adaptive space time multiuser detection in multipath CDMA.	07
5	**TURBO MULTIUSER DETECTION:** Turbo multiuser detection for synchronous CDMA, turbo multiuser detection with unknown interference, turbo multiuser detection in CDMA with multipath fading, turbo multiuser detection in CDMA with turbo coding, turbo multiuser detection in CDMA with turbo coding.	07
6	**NARROWBAND INTERFERENCE SUPPRESSION:** Linear predictive techniques, nonlinear predictive techniques, code aided techniques, performance comparison of NBI suppression techniques, near far resistance to both NBI and MAI by linear MMSE (min mean square error) detector, adaptive linear MMSE NBI suppression, and maximum likelihood code aided methods.	07

Course Outcomes:

Students will be able to	
1	Understand basic and applied concepts of Blind multi-user detection
2	Understand basic and applied concepts of Group blind multi-user detection
3	Understand basic and applied concepts of Space time multi-user detection
4	Understand basic and applied concepts of Turbo multi-user detection

Suggested Books:

Sr. No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1.	Wireless Communication Systems: Advanced Techniques For Signal Reception By Xiaodong Wang, H. Vincent Poor, Pearson 1st Edition	2006
2	Smart Antennas For Wireless Communication: Is 95 And Third Generation Cdma Application Pearson.	1999
3	Space -Time Wireless Channels – Durgin, Pearsons.	Latest edition

COURSE CODE	**:**	**ELECTRONICS LAB I**
COURSE CODE	**:**	**ECN 542**
L T P	**:**	**0 0 3**
CREDIT	**:**	**2**

Course Objectives: By the end of this course, the students should be able to

1. Design wired and wireless ad-hoc networks
2. Identify the architecture of GSM and explain its functioning.
3. Design and demonstrate the link budget in a satellite communication system.

	List of experiments:	Number of turns:
1	To design of various network topologies like ring, star and mesh etc. and calculate their parameters.	1
2	Design a fully connected and self healing network and find their parameters	1
3	To study GSM Architecture along with functionality of hardware	1
4	To understand Network topology and implementation	1
5	To study and estimate Call flow (Voice and data)	1
6	To comprehend regarding Intra Circle Roaming (ICR) functionality	1
7	To estimate, calculate and design Link Budget etc.	1
8	To measure the baseband analog signal parameters in a wireless link.	1
9	To study the phenomenon of linear and circular polarization of antennas.	1
10	To measure the propagation delay, C/N ratio and bit error rate of a signal in a sitcom link.	1
11	To setup a RS-232 wireless communication link using RS-232 ports.	1

12	To design the various combinational and sequential digital circuits using VHDL and simulate them.	1

Course Outcome:

Students will be able to	
1	Design, implement and analyze wired and wireless networks.
2	Analyze satellite communication system and derive the link budget.
3	Evaluate the functionality of GSM architecture and demonstrate its implementation.

Course code	**: ELECTRONICS LAB II**
Course code	**: ECN 543**
L T P	**: 0 0 3**
Credit	**: 2**

Course Objectives:

By the end of this course, the students should be able to

1) To understand the operation of the various modules/components of a Fiber optic Communication system
2) Use modern hardware and software tools to design and analyze optical communication systems.
3) Describe the various live technologies like FTTH,GSM,CDMA and enhance their technical knowledge
4) To program, simulate and test the PIC 18 and ARM processor based circuits and to interface sensors.
5) To program various devices using FLOWCODE, MPLAB and KIEL.

	List of experiments:	**Number of turns:**
1	Characterization of DFB Lasers, Optical Add Drop Multiplexer and 4 channel DWDM devices.	1
2	Analysis of 4 channel DWDM system.	1
3	Computer aided design of optical communication systems including advanced modulation formats, DWDM/CWDM system using optical amplifiers, FTTH/PON, OCDMA, Dispersion compensation etc. and do investigations in terms of BER, eye diagrams, electrical spectrum	2
4	Design and simulation of multimode optical communication	1

	system for Gigabit Ethernet, PONs, Free Space optics.	
5	To design and analyze the different 2 D and 3D optical waveguides, couplers, bent waveguides, splitters etc. and study their mode profiles	2
6	To study and estimate Handover facilities, Handover Success rate	1
7	To study optimization strategies to improve grade of service.	1
8	To calculate and estimate EMF radiations	1
9	To calculate and estimate loss in leaky cable	1
10	To estimate various types of interferences	1
11	To conduct the experiments based on LED, 7 segment display, LCD, Graphical LCD, keypad and motor driver interface using Flow code.	1
12	To program and simulate PIC microcontroller based experiments using flowcode, MPLAB.	1
13	To program and simulate ARM processor based experiments using Flowcode and keil software.	1

Course Outcome:

Students will be able to	
1	Evaluate systems and perform fiber-optic communication system engineering calculations
2	Design and analyze the optical communication systems using hardware and software tools available in the lab.
3	Demonstrate the various live technologies like FTTH,GSM,CDMA and identify its performance parameters.
4	Design embedded system using different processors and interface various peripherals and sensors.
5	Analyze a given embedded system design and to evaluate its performance.