VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE
(VJTI)
MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)

Curriculum
(Scheme of Instruction & Evaluation and Course contents)

For
Four Year Undergraduate Programme Leading to
Bachelor of Technology (B.Tech.) Degree
in
Electronics Engineering

Implemented from the batch admitted in Academic Year 2014-15

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Bachelor of Technology (B. Tech.)
in

106 Electronics Engineering

B. Tech (Electronics Engineering) SEMESTER VII								
Scheme of Instruction				Scheme of Evaluation				
S. No.	**Course Code**	**Course Title**	**L-T-P (Hours/week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.	EC4001S	Microwave and Optical Communication	3-1-0=4	4	10	30	60	3
2.	EC4002T	Data Communication and Networking	3-0-0=3	3	10	30	60	3
	EC4002P	Data Communication and Networking Lab	0-0-2=2	1	100% CIE			
3.	EC4003T	Embedded Systems	3-0-0=3	3	10	30	60	3
	EC4003P	Embedded Systems Lab	0-0-2=2	1	100% CIE			3
4.		Elective-II	4-0-0=4	4	10	30	60	
		Elective-II Lab	0-0-2=2	1				3
5.		Open Elective	4-0-0=4	4	10	30	60	
6.	EC4901D	Project I	0-0-4=4	2	100% CIE			3
7.	EC4004A	Information Technology Act	3	3 units	100% CIE			
		Total	**31**	**23**				

B. Tech (Electronics Engineering) SEMESTER VII: *OPEN ELECTIVE*

S. No.	Course Code	Course Title
1.	EC4601S	Signal Processing and Applications

B. Tech (Electronics Engineering) SEMESTER VIII								
Scheme of Instruction				Scheme of Evaluation				
S. No.	**Course Code**	**Course Title**	**L-T-P (Hours/week)**	**Credits**	**TA**	**IST**	**ESE**	**ESE hours**
1.	EC4011T	Wireless Communication	3-0-0=3	3	10	30	60	3
	EC4011P	Wireless Communication Lab	0-0-2=2	1	100% CIE			
2.	EC4012T	Basics of VLSI	3-1-0=4	4	10	30	60	3
	EC4012P	Basics of VLSI Lab	0-0-2=2	1				
3.	EC4013T	Advanced	3-0-0=3	3	10	30	60	3
	EC4013P	Advanced Digital Signal Processing Lab	0-0-2=2	1	100% CIE			3
4.		Elective-III	3-0-0=3	3	10	30	60	
		Elective-III Lab	0-0-2=2	1	100% CIE			3
5.		Elective-IV	4-0-0=4	4	10	30	60	
6.	EC4902D	Project II	0-0-8=8	4	*			3
		Total	**31**	**25**				

*Abbreviations: **L**: Lecture, **T**: Tutorial, **P**: Practical, **TA**: Teacher Assessment / Term work Assessment, **IST**: In Semester Tests (comprise of average of two In semester tests),**ESE**: End Semester Written Examination, **CIE**: Continuous In-semester Evaluation*

B. Tech (Electronics Engineering)
Elective Groups

T Y B. Tech (Electronics Engineering) SEMESTER VI: Elective – I

S. No.	Course Code	Course Title
1.		Image and Video Processing
		Image and Video Processing Lab
2.		Neural network and Fuzzy Logic
		Neural network and Fuzzy Logic Lab
3.		Audio, Video and Image Compression
		Audio, Video and Image Compression Lab
4.		Virtual Instrumentation
		Virtual Instrumentation Lab

B. Tech (Electronics Engineering) SEMESTER VII: Elective – II

S. No.	Course Code	Course Title
1.	EC4101T	Biomedical Instrumentation
	EC4101P	Biomedical Instrumentation Lab
2.	EC4102T	Error Correcting Codes
	EC4102P	Error Correcting Codes Lab
3.	EC4103T	Speech Processing
	EC4103P	Speech Processing Lab

B. Tech (Electronics Engineering) SEMESTER VIII: Elective – III

S. No.	Course Code	Course Title
1.	EC4111T	Process Control Instrumentation
	EC4111P	Process Control Instrumentation Lab
2.	EC4112T	Microcomputer System Design
.	EC4112P	Microcomputer System Design Lab
3.	EC4113T	DSP Processors
	EC4113P	DSP Processors Lab

B. Tech (Electronics Engineering) SEMESTER VIII: Elective – IV

S. No.	Course Code	Course Title
1.	EC4115S	Satellite Communication
2.	EC4116S	Mechatronics
3.	EC4117S	Next Generation Networks
4.	EC4118S	Wireless Sensor Network
5.	EC4119S	E-Security

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4001S**
Course Title	**MICROWAVE AND OPTICAL COMMUNICATION**
Prerequisite	Electromagnetics and Fields, Principles Of Communication

COURSE OUTCOMES

After completion of the course, students should be able to

- Design various matching circuits and describe various waveguide devices.
- Analyze and distinguish modal propagation in metallic and dielectric waveguides.
- Describe the working principle of various microwave and optical sources and detectors.
- Quantify the various power losses and dispersion mechanism in optical fibers and transmission lines.

COURSE CONTENTS

Module 1	**Transmission Lines**
	Introduction, Lumped Element Model of Transmission Lines, Telegraphers equation, propagation constant, Characteristic Impedance, Reflection Coefficient , VSWR and Impedance Transformation relation in a Transmission Line, Power Relations in Transmission Line,
Module 2	**Smith Chart**
	Graphical Representation of Transmission Line on Smith Chart, Impedance and Admittance Chart, Quarter Wave Transformer, Single and Double Stub Matching
Module 3	**Waveguides**
	Modal Propagation, TE,TM and TEM Waves, Wave Propagation in Parallel Plate, Rectangular and Circular Waveguide
Module 4	**Microwave Active and Passive Devices**
	Waveguide Devices : magic tee, e plane tee, h plane tee, circulator, coupler Active Devices (Solid State) (Only Qualitative Analysis): Gunn Diode, Tunnel Diode, IMPATT Diode Active Devices (Vacuum Tube) (Only Qualitative Analysis): Klystron, Reflex Klystron, Magnetron, TWT
Module 5	**Optical Fiber Technology**
	Light Propagation in Optical Fiber, Types of Fiber based on refractive index profile and mode transmission
Module 6	**Transmission Characteristics of Optical Fiber**
	Attenuation, absorption, bending losses and dispersion in optical fibers, OTDR
Module 7	**Optical Fiber Sources and Detectors**
	Working principle and characteristics of LED, LASER, PIN and APD.
TEXT BOOKS:	
1	R. K. Shevgaonkar, Electromagnetic Waves, Tata McGraw-Hill,2005

2	David Pozar, Microwave Engineering, Wiley,2011
Additional Reading:	
1	S.Liao, Microwave Devices and Circuits, Pearson Publication,3rd Edition 2003
2	Gerd Keiser, Optical Fiber Communication, McGrawHill Publication,2008

Program Name	B.Tech. (Electronics Engineering), SEMESTER - VII
Course Code	EC4002T
Course Title	DATA COMMUNICATION AND NETWORKING
Prerequisite	Principles Of Communication

COURSE OUTCOMES

After completion of the course, students should be able to

- Describe the layered network architecture.
- Distinguish different networking components and their respective roles in a communication system.
- Explain the various routing protocols and algorithms
- Analyze the features and operation of various network protocols

COURSE CONTENTS

Module 1	**Data Communication:**
	Components, Direction of Data flow, Networks, Types of connections, Topologies (Bus, Star, Ring, Mesh). Transmission Media – Twisted-Pair Cable, Coaxial Cable, Fibre Optics, Line Coding. Physical layer standards Basics of Message switching, Packet switching, Circuit switching and cell switching. Introduction to LAN, MAN, WAN.
Module 2	**Protocols And Standards:**
	Standards – ISO/OSI reference model, Overview of TCP/IP architecture, TCP/IP model, Structured cabling and specification: Standard CAT5, 5E-RS232 Interfacing Standard.
Module 3	**Data Link Layer:**
	Link-layer and its services, IEEE 802 standards, Medium Access Control (MAC), Logical Link Control (LLC) and Link layer addressing. Local area networks and IEEE 802.11 wireless LANs, multiple-access protocols. Random access, efficiency of pure and slotted ALOHA, CSMA, CSMA/CD (IEEE 802.3), and CSMA/CA (IEEE 802.11n). Flow Control and Error control: Stop and wait, Go back N ARQ, Selective Repeat ARQ. HDLC and Introduction to VLAN.
Module 4	**Network and Transport Layer:**
	IP Addressing (IPv-4) methods, Sub-netting, Routing Network as a Graph, Distance Vector and Link State algorithms, Datagram Forwarding in IP. Distance Vector: Routing Information Protocol (RIP), Link State: Open Shortest Path Find (OSPF). Address Translation: Address Resolution Protocol (ARP). Host Configuration: Dynamic Host Configuration Protocol (DHCP).

	Error Reporting: Internet Control Message Protocol (ICMP). Global Internet - subnetting, classless routing, IPv6, Mobile IP. Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Port number, Flow control and congestion control, Connection establishment and teardown, Quality of services (QoS).
Module 5	**Application Layer:**
	Domain Name Space (DNS) – Services provided, DNS records and messages server. Simple Mail Transfer Protocol (SMTP) – Architecture and Services, Message format, Pretty good privacy technique. Hyper Text Transfer Protocol (HTTP) – Connections and Architecture. Message format, Web catching, World Wide Web (WWW) – Client Server Architecture-Browser settings, Telnet.
Module 6	**Networking Devices:**
	Internetworking device- hub, repeater, bridge- spanning tree algorithm, switch, router Interfaces and connectors. **Performance factors** – Throughput, Bandwidth and Latency, High speed networks, Application performance needs.
TEXT BOOKS:	
1.	Behrouz. A. Forouzan, "*Data Communication and Networking*", Tata McGraw Hill.2007
2.	Wlliam Stallings, "*Wireless Communication and Networks*", Prentice Hall, 2nd edition, 2005.
3.	Leon Garcia, Widjaja, "*Communication Networks*", Tata McGraw Hill.2004
Additional Reading:	
1.	Larry L. Peterson, Bruce S. Davie, "*Computer networks*", 4th Edition, Elsevier.2007
2.	Jean Walrand & PravinVaraiya, "*High Performance Communication Networks*", Elsevier.2014
3.	Curt M. White, "*Data Communication and Computer Network*" 6-th Edition, 2008.

Program Name	**B.Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4002P**
Course Title	**DATA COMMUNICATION AND NETWORKING LAB**
Prerequisite	Principles Of Communication

COURSE OUTCOMES

After completion of the course, students should be able to

- Describe the layered network architecture.
- Identify and distinguish different networking components and their respective roles in a communication system.
- Implement various routing protocols and algorithms
- Implement various network protocols

COURSE CONTENTS

Module 1	**Framing Sequence:** Bit stuffing and character stuffing **Error Detecting Code:** Cyclic Redundancy Check
Module 2	**Transmission Flow Control and Error Control Protocol** • Stop and wait protocol • Go Back N Protocol • Selective Repeat Protocol
Module 3	Implementation of Routing Protocol • Distance Vector Algorithm(Djitras Algorithm) • Link State algorithms(Bellman Ford Algorithm)
	-
Module 4	**Local Area Network** Compare and contrast different CSMA/CD algorithms • Non-persistence • 1-persistence • P-persistence
Module 5	**Configure a Network** for • Static Routing. • Distance Vector Routing protocol- RIP. • Link State Vector Routing protocol- OSPF.
Module 6	To understand the working of "Connection Establishment" in TCP

Module 7	Configure Virtual Local Area Network (VLAN) on switches.
Module 8	**Wireless Local Area Network**. -Compare the working of the different data transmission methods in WLAN:Basic access and RTS/CTS mechanism. -To study how the loss, utilization and transmission time of a WLAN (IEEE 802.11b) network varies as the distance between access point and wireless nodes are varied.
Text Books:	
1.	Behrouz. A. Forouzan, "*Data Communication and Networking*", Tata McGraw Hill, 2010
2	Wllliam Stallings, "*Wireless Communication and Networks*", Prentice Hall, 2nd edition, 2005.
3	Leon Garcia, Widjaja, "*Communication Networks*", Tata McGraw Hill.2004

Programme Name	**B.Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4003T**
Course Title	**EMBEDDED SYSTEMS**
Prerequisite	Microprocessors And Controllers

COURSE OUTCOMES

After completion of the course, students should be able to

- Describe the hardware and software architecture of embedded system.
- Identify the necessary communication Interface for the embedded system.
- Organize the complete embedded system development project.
- Design and develop the small-scale embedded system.

COURSE CONTENTS

Module I	**Introduction to Embedded system**
	Introduction To Embedded Systems, Definition Of Embedded System, Embedded Systems Vs General Computing Systems, History Of Embedded Systems, Classification, Major Application Areas, Purpose Of Embedded Systems, Characteristics And Quality Attributes Of Embedded Systems. Embedded Processor Requirements, Features, Types, RISC Processors, Harvard Architecture, Super Harvard Architecture, Selection Of Processors & Microcontrollers.
Module II	**Architecture of Embedded System**
	Hardware Architecture: 8051, Arm, Memory, Clock Circuitry, Watchdog Timer, Chip Select, I/O Devices, Debug Port, Communication Interfaces, Power Supply Unit. Software Architecture: Services Provided By OS, Architecture Of Embedded OS, Categories Of Embedded OS, Application Software, Communication Software, Development And Testing Tools.
Module III	**Communication Interfaces**
	Need For Communication Interfaces, OSI Reference Model, Basic Of Networks, Network Topology, RS232/UART,RS422/RS485, USB, Infrared, Ethernet, IEEE 802.11, Bluetooth, SPI, I2C, CAN, Wifi, Flex Ray, LIN Bus, Zigbee.
Module IV	**Embedded Software**
	Software Developments Tools, Cross Platform Development, Programming Languages Like Embedded C, Embedded C++ And J2ME , Device Drivers, Debuggers, Profilers, Code Optimization, Overview Of RTOS, Architecture Of Kernel, Task & Task Scheduler, ISR, Semaphore, Mutex, Mailbox, Message Queues, Event Registers, Pipes, Signals, Timers, Memory Management, Priority Inversion Problem.
Module V	**Embedded System Development & Testing**

	Different Embedded System Development Models, Requirement Engineering, Design Tradeoff, Co-Design, Hardware Design, Software Design, Implementation, Integration & Testing, Packaging, Configuration Management, Managing Embedded System Development Projects, Embedded System Fiascos.
Module VI	**Design Examples & Case Studies of Embedded System**
	Digital Thermometer, Navigation Systems, Smart Card, RF Tag
Text Books:	
1.	Raj Kamal "Embedded system" Tata McGraw Hill.2003
2.	Prasad "Embedded Real time systems" Dream tech Wiley Publication.2003
Additional Reading:	
1.	David Simon, "An embedded Software Primer" Pearson Publication, 1999
2.	Frank Vahid, "Embedded system- A unified Hardware Software Introduction" John Wiley and Sons.2002

Programme Name	**B.Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4003P**
Course Title	**EMBEDDED SYSTEM LAB**
Prerequisite	**Microprocessors And Controllers**

COURSE OUTCOMES

After completion of the course, students should be able to

- Design and implement programs on 8051 microcontroller and its derivatives
- Connect sensors and implement programs using them
- Using RTOS in embedded projects
- Design build and test an embedded product

COURSE CONTENTS

Module 1	**Embedded Software Development Tools**
	Keil µ vision 4 and 5 project management, Study How to create Embedded Project, Compile and Test Project for 8051 it's Derivative, Testing of 8051 based project on Target Board, Programming of Flash Memory, use Debugger. Flowcode, Arduino open source software and hardware platform.
Module 2	**Embedded Hardware Development Board**
	Programming 8051 and Arduino UNO
Module 3	**Embedded sensors and peripheral modules**
	Test several sensors and peripherals modules with 8051 and Arduino UNO boards.
Module 4	**Deployment of embedded system**
	Deployment of software into hardware and testing hardware, software and hardware with software and measure design parameters.
Module 5	**RTOS**
	Study of Various Commands of RTOS like RTX51 tiny. Free RTOS, RTLinux and programming and develop multitasking software applications.
Module 6	**Embedded system design and implementation**
	Design, build and test embedded product for various embedded applications using development systems and open source platforms.
Module 7	**System on chip design**
	Design, build and test hardwired embedded system using FPGA Design, build and test medium scale embedded system using Xilinx ZYNQ.
Text Books:	
1.	Raj Kamal "Embedded system" Tata McGraw Hill,2003.
2.	Prasad "Embedded Real time systems" Dream tech Wiley Publication.2003
Additional Reading:	
1.	Mazidi "8051 microcontroller and embedded system" Pearson,2005

2.	Cornel Amariei, Arduino Development Cookbook, Packet publishing
3.	Pete Cockerell “ARM assembly language programming”
4.	Rahul Dubey, “Introduction to embedded system design using FPGA” Springer, 2013

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4004A**
Course Title	**INFORMATION TECHNOLOGY ACT**
Prerequisite	**Nil**

COURSE OUTCOMES

After completion of the course, students should be able to

- Abide according to the cyber world and cyber law in general
- Explain about the various facets of cyber crimes
- Solve problems arising out of online transactions and provoke them to find solutions
- Clarify the Intellectual Property issues in the cyber space and the growth and development of the law in this regard
- Distinguish the regulation of cyber space at national and international level

COURSE CONTENTS

Module 1	**Concept of Information Technology and Cyber Space**
	Interface of Technology and Law, Jurisdiction in Cyber Space and Jurisdiction in traditional sense, Internet Jurisdiction, Indian Context of Jurisdiction, Enforcement agencies, International position of Internet Jurisdiction, -Cases in Cyber Jurisdiction
Module 2	**Information Technology Act, 2000**
	Aims and Objects, Overview of the Act, Jurisdiction, Electronic Governance, Legal Recognition of Electronic Records and Electronic Evidence, Digital Signature Certificates, Securing Electronic records and secure digital signatures, Duties of Subscribers, Role of Certifying Authorities, Regulators under the Act, The Cyber Regulations Appellate Tribunal, Internet Service Providers and their Liability, Powers of Police under the Act, Impact of the Act on other Laws
Module 3	**E-Commerce**
	UNCITRAL Model, Legal aspects of E-Commerce, Digital Signatures, Technical and Legal issues, E-Commerce, Trends and Prospects, E-taxation, E-banking, online publishing and online credit card payment, Employment Contracts, Contractor Agreements, Sales, Re-Seller and Distributor Agreements, Non-Disclosure Agreements, Shrink Wrap Contract, Source Code, Escrow Agreements etc.
Module 4	**Cyber Law and IPRs**
	Understanding Copy Right in Information Technology, Software, Copyrights vs Patents debate, Authorship and Assignment Issues, Copyright in Internet, Multimedia and Copyright issues, Software Piracy,

	Patents, Understanding Patents, European Position on Computer related Patents, Legal position of U.S. on Computer related Patents, Indian Position on Computer related Patents, Trademarks, Trademarks in Internet, Domain name registration, Domain Name Disputes & WIPO, Databases in Information Technology, Protection of databases, Position in USA, EU and India
Module 5	**Cyber Crimes**
	Meaning of Cyber Crimes, Different Kinds of Cyber-crimes, Cyber-crimes under IPC, Cr.P.C and Indian Evidence Law, Cyber-crimes under the Information Technology Act-2000, Cyber-crimes under International Law, Hacking, Cyber Stalking, Denial of service Attack, Virus Dissemination, Software Piracy, Internet Relay Chat (IRC) Crime, Credit Card Fraud, Net Extortion, Phishing etc, Cyber Terrorism, Violation of Privacy on Internet, Data Protection and Privacy
TEXT BOOKS:	
1.	Kamlesh N. & Murali D.Tiwari (Ed), IT and Indian Legal System, Macmillan India Ltd, New Delhi,2002
Additional Reading:	
1.	K. L. James, The Internet: A User's Guide, Prentice Hall of India, New Delhi, 2003
2.	Chris Reed, Internet Law-Text and Materials, Universal Law Publishing Co., 2nd Edition, 2005,
3.	Vakul Sharma, Hand book of Cyber Laws, Macmillan India Ltd, New Delhi
4.	S.V.Joga Rao, Computer Contract & IT Laws (in 2 Volumes), Prolific Law Publications, New Delhi, 2005

ELECTIVE II

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC410T**
Course Title	**BIOMEDICAL INSTRUMENTATION**
Prerequisite	Instrumentation Systems

COURSE OUTCOMES

After completion of the course, students should be able to

- To integrate the information about generation of biopotentials
- Apply electronic engineering principles for data acquisition and measurement of biopotentials
- Analyze the working and design aspects of the instruments used in medical field.
- Evaluate the necessity of prosthetic devices and develop block schematic

COURSE CONTENTS

Module 1	**Fundamentals of Medical Instrumentation**
	Anatomy and Physiology, Physiological Systems of the Body, Problems in measuring the Physiological variables, Components of Medical Instrument.
Module 2	**Bioelectric Signals and Electrodes, Transducers**
	Origin of Bioelectric signals, Resting and Action Potentials, Depolarization and Repolarization, Propagation of Action Potentials. Electrode Theory, Recording Electrodes, Silver-Silver Chloride Electrodes, Microelectrodes. Transducer Principle, Classification of Transducers, various Transducers for the measurement of Physiological Events, Amplifiers and Signal Processing.
Module 3	**The Cardiovascular System and Measurements**
	The Heart and Cardiovascular System: Heart Sounds and their measurements with Phonocardiograph, Stethoscope etc., Phonocardiogram. Blood Flow: Characteristics of Blood Flow, Measurement of Blood flow and Cardiac output with Magnetic Blood Flow meter, Ultrasonic Blood Flow Meter & Radio Graphic Method. Blood Pressure: Measurement of Blood Pressure with Indirect and Direct methods, Sphygmomanometry, Programmed Electrosphygmomanometry, Digital Blood Pressure meter, Impedance Plethysmography.
Module 4	**Generation & Recording of Bio Electrical Activities**
	Electrocardiogram: ECG Electrode Placement- "Bipolar Limb Lead Configuration by Einthoven, Unipolar Limb Leads(Wilson leads),Augmented Unipolar Limb Leads, Precordial and Marriott Leads", ECG Recorders. Electromyogram: EMG System, Electrodes used and their placement, Latency, Applications. Electro Encephalogram: EEG Electrodes and their placement-'Anterior-Posterior' and 'Lateral' measurements, Recording Modes of EEG, Applications of EEG. ElectroRetinogram: Human Eye System, ERG Recording techniques,

	Standards of ERG, Applications of ERG. ElectroOculogram: EOG basics, Recording methods, patient preparation, Arden Index, Diagnostic Utility of EOG
Module 5	**Measurements in the Respiratory System**
	Introduction, Physiology of the Respiratory System, Lung Volumes/Capacities, Instrumentation for measuring the Mechanics of Breathing- Kymograph, Spiro meter etc.
Module 6	**Prosthesis**
	Introduction, Types of Prosthetic Devices, Application and working principle of various prosthetic devices eg.Myoelectric Control System for paralyzed arm, Audiometry and Hearing Aids. Dialysis: Introduction, Function of the Kidneys, Artificial Kidney, Dialyzers, Membranes for Dialysis, Haemodialysis, Peritoneal Dialysis.
Module 7	**Therapeutic Equipment**
	Introduction, High Frequency Heat Therapy, Short-wave Diathermy, Microwave Diathermy, Ultrasonic Therapy Unit., Endoscopy, Gastroscope, Bronchoscope, Sigmoidoscope, Laproscope, Pacemakers and Defibrillators.
Module 8	**Medical Imaging Systems**
	Introduction, X-ray Machines and Digital Radiography, Computed Tomography, CT Scanners, Ultrasonic Imaging Systems, MRI & PET Scan, Thermal Imaging Systems
Module 9	**Bio Telemetry and Telemedicine**
	Introduction to Biotelemetry, The Components of a Biotelemetry System, Implantable Units, Single-Channel/Multi-Channel/Multi-Patient Telemetry Systems, Application of Telemetry in Patient Care, Telemedicine.
Module 10	**Patient Care and Monitoring**
	The elements of Intensive-Care Monitoring, Patient-Monitoring Equipment – Different types, The Organization of Hospital for Patient-Care Monitoring.
Module 11	**Patient Safety**
	Physiological effects of Electric Current, Shock Hazards and Leakage Currents, precautions to minimize Electric Shock Hazards and Leakage Current, Methods of Accident Prevention, Safety codes for electro medical equipment
Text Books:	
1.	"Handbook of Biomedical Instrumentation" by R.S.Khandpur, Third Edition 2014, Tata McGraw Hill Education Private Limited
2	"Biomedical Instrumentation and Measurements" by Leslie Cromwell, Fred J. Weibell & Erich A. Pfeiffer, Second Edition (2011), Prentice Hall of India publication
Additional Reading:	
1	"Introduction to Biomedical Equipment Technology" by Joseph J. Carr and John M. Brown, Fourth Edition(2011), Pearson Education
2	"Biophysical measurements" by Strong P., Second Edition, Measurement Concepts publication

3	“Principles of applied biomedical instrumentation” by Leslie Alexander Geddes, L. E. Baker, Third Edition, Wiley publication
4	“Medical Instrumentation Application and Design” by John G. Webster, Third Edition (2011), Wiley publication
5	“Medical Electronics” by G. E. Donovan, published by Butterworth & Co.
6	“Biomedical Instruments: Theory and Design” by Walter Welkowitz, Sid Deutsch & Metin Akay, Second Edition, Academic Press

Programme Name	**B.Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4101P**
Course Title	**BIOMEDICAL INSTRUMENTATION LAB**
Prerequisite	Instrumentation Systems

COURSE OUTCOMES

After completion of the course, students should be able to

1. Analyze the salient traits of medical instruments.
2. Apply electronic engineering principles to design signal conditioning systems for biopotentials.
3. Demonstrate the experimentation related to medical instruments.
4. Develop software for biopotentials processing.

COURSE CONTENTS

Module 1	Analyze the salient traits of the following medical instruments and demonstrate the related experimentation :- ECG System
Module 2	BP Monitor
Module 3	Heart Rate Monitor
Module 4	Respiration Rate Monitor
Module 5	EMG System
Module 6	EEG System
Module 7	Phonocardiograph System
Module 8	Design and demonstration of ECG amplifier system
Module 9	Design and demonstration of signal conditioning system for biopotentials
Module 10	Develop algorithms for biopotentials processing (using MATLAB/ LabVIEW, etc)
Text Books:	
1.	"Handbook of Biomedical Instrumentation" by R.S.Khandpur, Third Edition 2014, Tata McGraw Hill Education Private Limited
2	"Biomedical Instrumentation and Measurements" by Leslie Cromwell, Fred J. Weibell & Erich A. Pfeiffer, Second Edition (2011), Prentice Hall of India publication
Additional Reading:	
1	"Introduction to Biomedical Equipment Technology" by Joseph J. Carr and John M. Brown, Fourth Edition(2011), Pearson Education
2	"Biophysical measurements" by Strong P., Second Edition, Measurement Concepts publication
3	"Principles of applied biomedical instrumentation" by Leslie Alexander Geddes, L. E. Baker, Third Edition, Wiley publication
4	"Medical Instrumentation Application and Design" by John G. Webster, Third Edition (2011), Wiley publication

5	“Medical Electronics” by G. E. Donovan, published by Butterworth & Co.
6	“Biomedical Instruments: Theory and Design” by Walter Welkowitz, Sid Deutsch & Metin Akay, Second Edition, Academic Press

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4102T**
Course Title	**ERROR CORRECTING CODES**
Prerequisite	Digital Communication Systems

COURSE OUTCOMES

After completion of the course, students should be able to

- Compare various concepts and evaluate numerical problems in various concepts of linear algebra
- Describe qualitatively and solve numericals on cyclic and BCH codes
- Solve numericals on convolution, LDPC and trellis codes
- Describe various concepts of space time coding

Module 1	**Linear Abstract Algebra and Finite Fields**
	Groups, Fields, Rings, Vector spaces, subspaces, Galois field, Extension fields, Primitive element, primitive polynomial, GCD of polynomial, LCM of polynomial, minimal polynomial, factorization of (X^n-1) over a Galois field, construction of generator polynomial & parity check polynomial primitive n^{th} root of unity.
Module 2	**Cyclic Codes**
	Properties, Various methods of generation and detection of cyclic codes, error detecting capability, cyclic Hamming code and Golay code.
Module 3	**Binary and Non-Binary BCH codes**
	Binary primitive BCH codes, decoding, iterative algorithm for finding the error location polynomial, error location numbers and error correction, implementation of error correction. Q-ary linear block codes, primitive BCH codes, RS codes, decoding of BCH and RS codes.
Module 4	**Convolutional Codes**
	Encoder and decoder, structural properties, optimum decoding of Convolutional codes, Viterbi, soft output Viterbi BCGR algorithm. **Turbo coding**- encoding and decoding.
Module 5	**Low Density Parity Check Codes**
	Encoding and detection, sum-product algorithm, simplification of sum product algorithm

Module 6	**Trellis coded Modulation**
	Background on Signal constellation, construction and detection
Module 7	**Space-Time Coding**
	Fading channels and Space-Time codes, Rayleigh channel and MIMO channel, space-time block codes, space-time trellis codes.
Text Books:	
1.	Shu Lin, Daniel J.Costello, "Error Control Coding", 2nd Edition, Pearson, Reprint 2012.
Additional Reading:	
1.	Jorge Castineira Moreira, Patrick Guy Farrell, "Essentials of Error Control Coding", 1st Edition, Wiley, Reprint 2013.
2.	Todd K. Moon, "Error Correction Coding: Mathematical Methods and Algorithms", 1st Edition, Wiley, Reprint 2013.
3.	Stephen B. Wicker, "Error control systems for Digital communication & storage".

Programme Name	**B.Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4102P**
Course Title	**ERROR CORRECTING CODES LAB**
Prerequisite	Digital Communication Systems

COURSE OUTCOMES

After completion of the course, students should be able to

- Use the various codes for encoding the data.
- Design a code with greater compression ratio and with minimum error and high signal to noise ratio.
- Design and implement hardware using FPGA

COURSE CONTENTS

Module 1	Study and implementation of M-ary digital modulation techniques
Module 2	Study of Matlab/Scilab for Error Correcting Codes tool box
Module 3	Construct generator matrix and parity-check matrix for code
Module 4	Implement Encoder for various codes
Module 5	Implement Decoder for various codes
Module 6	Calculate BER and FER
Module 7	Implement digital communication system with error correcting code using Matlab Simulink Model
Module 8	Implement Hardware for channel encoding and channel decoding using FPGA
Text Books:	
1.	Shu Lin, Daniel J.Costello, "Error Control Coding", 2nd Edition, Pearson, Reprint 2012.
Additional Reading:	
1	Todd K. Moon, "Error Correction Coding: Mathematical Methods and Algorithms", 1st Edition, Wiley, Reprint 2013.
2	Stephen B. Wicker, "Error control systems for Digital communication & storage".

Programme Name	**B.Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4103T**
Course Title	**SPEECH PROCESSING**
Prerequisite	Digital Signal Processing

COURSE OUTCOMES

After completion of the course, students should be able to

- Analyze the speech signal and to identify the different parameters of speech signal like voiced/unvoiced, vowel/consonant, types of articulation etc.
- Compare various time and frequency domain techniques used in speech processing.
- Develop various speech models using various features vectors like LPC, Cepstrum, MFCC etc.
- Develop simple speech processing applications like Speech Recognition, Speaker Recognition, Speech Coding

COURSE CONTENTS

Module 1	**Speech production and perception**
	Speech production mechanism, Auditory System and Hearing Mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis.
Module 2	**Time domain methods for speech processing**
	Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation.
Module3	**Frequency domain methods for speech processing**
	Short time Fourier analysis, filter bank analysis, spectrographic analysis, Format extraction, pitch extraction, Analysis - synthesis systems, Auditory models.
Module 4	**Linear predictive coding of speech**
	Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains.
Module5	**Speech signal analysis**
	Cepstral analysis of speech, Mel frequency cepstral coefficients (MFCC), format and pitch estimation.
Module6	**Application of speech processing**
	Speech Synthesis, Speech Coding, Speech and Speaker recognition and verification. Vector quantization, Hidden Markov modeling for isolated word and continuous speech recognition.

Text Books:	
1.	Lawrence Rabiner and Ronals Schafer, "Theory and Applications of Digital Speech Processing", Prentice Hall, 2011
2	T.F. Quatieri, Discrete-Time Speech Signal Processing, Prentice Hall 2002.
3	L.T. Rabiner and R. Schafer, Digital Processing of Speech Signals, Prentice Hall, 1978.
Additional Reading::	
1	Douglas O"Shaughnessy, Speech Communciations: Human and Machine, Universities Press, 2001.
2	J.L Flanagan : Speech Analysis Synthesis and Perception - SprengerVertag,
3	I.H.Witten :Principles of Computer Speech , Academic press.
4.	Digital Audio Signal Processing, Second Edition, UdoZolzer, A John Wiley& sons Ltd. Publications
5.	Applications of Digital Signal Processing to Audio and Acoustics Mark Kahrs, Karlheinz Brandenburg, KLUWER ACADEMIC PUBLISHERS NEW YORK, BOSTON, DORDRECHT, LONDON, MOSCOW

Programme Name	**B.Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4103P**
Course Title	**SPEECH PROCESSING LAB**
Prerequisite	Digital Signal Processing

COURSE OUTCOMES

After completion of the course, students should be able to

- Analyze the speech signal and to identify the different parameters of speech signal like voiced/unvoiced, vowel/consonant, types of articulation etc.
- Develop various speech models using various features vectors like LPC, Cepstrum, MFCC etc.
- Develop simple speech processing applications like Speech Recognition, Speaker Recognition, Speech Coding

COURSE CONTENTS

Module 1	Three experiments in time domain operations like Zero crossing detector, Energy Estimation, Autocorrelation etc by recording speech signal
Module 2	Study of spectrogram for various combination of speech syllables
Module3	Three experiments on Frequency domain methods for speech processing pitch extraction formant extraction etc.
Module 4	Experiments on simple some applications of speech
Text Books:	
1.	Lawrence Rabiner and Ronals Schafer, "Theory and Applications of Digital Speech Processing", Prentice Hall, 2011
2	T.F. Quatieri, Discrete-Time Speech Signal Processing, Prentice Hall 2002.
3	L.T. Rabiner and R. Schafer, Digital Processing of Speech Signals, Prentice Hall, 1978.
Additional Reading::	
1	Douglas O"Shaughnessy, Speech Communications: Human and Machine, Universities Press, 2001.
2	J.L Flanagan : Speech Analysis Synthesis and Perception – Springer Vertag,2010
3	I.H.Witten : Principles of Computer Speech , Academic press, 2011.
4.	Digital Audio Signal Processing, UdoZolzer, A John Wiley& sons Ltd. Publications, Second Edition,
5.	Applications of Digital Signal Processing to Audio and Acoustics Mark Kahrs, Karlheinz Brandenburg, Kluwer Academic Publishers New York, 2013

SEM-VIII

Programme Name	**B.Tech (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4011T**
Course Title	**WIRELESS COMMUNICATION**
Prerequisite	Basics of Communication and Digital Communication

COURSE OUTCOMES:

After completion of the course, students should be able to

- Describe various fundamental concepts of mobile communication.
- Characterize different indoor and outdoor propagation models related to losses and different types of fading.
- Explain CDMA concepts and architecture, frame structure, system capacity, services provided.
- Compare and contrast the 2.5G, 3G and 4G technologies evolution with their characteristics and limitations.

COURSE CONTENTS

Module 1	**Fundamentals of Mobile Communication**
	Introduction to wire1ess communication. Frequency Division Multiple access, Time Division Multiple access, Spread Spectrum Multiple access, Space Division Multiple access, and OFDM. Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, trunking and grade of service, improving the capacity of cellular systems and related design problems.
Module 2	**Mobile Radio Propagation**
	Study of indoor and outdoor propagation models. Small scale fading and multi-path Small-scale multi-path propagation, parameter of multi-path channels, types of small scale fading, Raleigh and Ricean distribution.
Module 3	**Evolution of 1G-2G Technologies**
	AMPS, GSM Network architecture, signaling protocol architecture, identifiers, channels, introduction frame structure, speech coder RPE-LTP, authentication and security, call procedure, handoff procedure, services and features. **GSM evolution in GPRS and EDGE:** Architecture and services offered. **CDMA-1:** Frequency and channel specifications of forward and reverse CDMA channel, packet and frame formats, mobility and radio resource management.
Module 4	**3G Technology**
	IMT-2000/UMTS: Network architecture, air Interface specification, forward and reverse channels in W-CDMA and CDMA 2000, spreading and modulation. Cell search and synchronization, establishing a connection, hand off and power control in 3G system.
Module 5	**3GPP LTE 4G**

	Introduction and system overview. Frequency bands and spectrum ,network structure, and protocol structure Frame slots and symbols, modulation, coding, multiple antenna techniques **Logical and Physical Channels:** Mapping of data on to logical sub-channels physical layer procedures, establishing a connection, retransmission and reliability, power control. 4G Introduction and vision. Multi antenna Technologies: MIMO; software defined radio. Adaptive multiple antenna techniques, radio resource management, QOS requirements. Introduction to 5G
	TEXT BOOKS:
1	Rappaport,T.S., "Wireless communications", Second Edition, Pearson Education, 2010
2	Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006
3	Vijay Garg , "Wireless Communications and networking", First Edition, Elsevier 2007.
	ADDITIONAL READING:
1	Young Kyun Kim and Ramjee Prasad, "*4 G Roadmap and Emerging Communication Technologies*", Artech house.2006
2	Raj Pandya, "*Mobile And Personal Communications Systems And Services*", Prentice hall.2000
3	Upena Dalal, " Wireless Communication", Oxford University Press, 2009
4	C.Y Lee , "*Mobile Communication*", Wiley.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VII**
Course Code	**EC4011P**
Course Title	**WIRELESS COMMUNICATION LAB**
Prerequisite	Basics of Communication and Digital Communication

COURSE OUTCOMES:

After completion of the course, students should be able to

- Implement indoor and outdoor propagation path loss models
- Implement GSM signals for radio resource allocation
- Generate and receive spread spectrum signals for CDMA
- Compare and contrast the 2.5G, 3G and 4G technologies evolution with their characteristics and limitations.

COURSE CONTENTS

Module 1	**Wireless Path loss - Study of Propagation Path loss Models: Indoor & Outdoor**
	Free Space Propagation – Path Loss Model. Multipath Fading in Cellular Mobile Communication. Link Budget Equation for Satellite Communication. Carrier to Noise Ratio in Satellite Communication. Outdoor Propagation – Okumura Model. Outdoor Propagation – Hata Model.
Module 2	**GSM Technology**
	Study of the Tx IQ/Rx IQ signals. Performance of SIM Detection. GSM Data services & capability. Radio Resource Allocations and Scheduling in Cellular Mobile .Communication.
Module 3	**CDMA Technology**
	Generation of Direct sequence spread spectrum (DS-SS) Reception of Direct sequence spread spectrum (DS-SS). Generation of frequency hoped spread spectrum (FH-SS). Reception of frequency hoped spread spectrum (FH-SS). Generation of Hadamard Codes.
Module 4	**Design and Implementation**
	Equalizer.
	Rake receiver
	TEXT BOOKS:
1.	Iti Saha Misra, “Wireless Communications and Network”, McGraw Hill Education Pvt. Ltd.2009.
2	T.S. Rappaport, “Wireless Communication, principles & practice”, Prentice Hall of India.

	ADDITIONAL READING::
1	GSM Manual
2	CDMA Manual

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4012T**
Course Title	**BASICS OF VLSI**
Prerequisite	Electronic Circuit Analysis and Design I & II, Integrated Circuits and Applications

COURSE OUTCOMES:

After completion of the course, students should be able to

- Describe basic VLSI design flow, hierarchy, styles and design quality parameters.
- Explain semiconductor grade silicon production, CMOS fabrication process and should be able to draw and describe layout.
- Describe MOSFET structure, operation, characteristics, physical effects and scaling and should be able to calculate vital parameters related to MOSFET.
- Analyze and design various MOSFET circuits using different MOSFET based topologies (especially CMOS topology) functionally as well as for different parameter (delay, power, noise) constraints.
- Analyze and design functional units such as adders, multipliers, RAMs etc.

COURSE CONTENTS

Module 1	**Introduction**
	Moore's law; VLSI Design flow; design hierarchy; concepts of regularity, modularity and locality; VLSI design styles; design quality.
Module 2	**Fabrication and Layout of CMOS Integrated Circuits**
	Semiconductor grade silicon production; CMOS fabrication process – photolithography, diffusion, ion-implantation, CMOS process flow, isolation – LOCOS and STI; modern CMOS process trends such as lightly doped drain, copper interconnects, low-k and high-k dielectrics, three dimensional IC; layout, layout design rules, CMOS inverter layout design; latchup and latchup prevention techniques.
Module 3	**Physics and Modeling of MOSFETs**
	Energy band diagram view of MOS system under external bias; MOSFET structure and operation; first order V-I characteristics of MOSFET; channel length modulation; substrate bias effect; MOSFET modeling – drain-source resistance, MOSFET capacitance, junction leakage currents; MOSFET scaling; Short channel effects such as classical short channel effect, reverse short channel effect, mobility degradation, velocity saturation, hot carrier effect, DIBL, subthreshold leakage; Narrow channel effect; Current equations for velocity saturated MOSFETs.
Module 4	**CMOS inverter: Analysis and Design**

	VTC of ideal inverter; noise margin; CMOS digital logic inverter – different regions of operation, calculation of critical voltage points on VTC; CMOS inverter switching characteristics; design of CMOS inverter; power dissipation in CMOS inverter; comparison of various MOSFET based inverter topologies with CMOS inverter; ratioed and ratioless designs.
Module 5	**Static Logic Circuits**
	CMOS based gates such as NAND, NOR, XOR, XNOR and complex logic circuits; transistor sizing for gates; adder, SR latch and D latch circuits; CMOS SRAM cell; Schmitt trigger and tri-state output circuits; implementation of logic gates using other MOSFET based topologies such as pseudo nMOS etc.
Module 6	**Transmission Gate & Dynamic Logic Circuits**
	nMOS and pMOS pass transistors; CMOS transmission gate; clock feedthrough, charge leakage, charge sharing; bootstrapping; dynamic CMOS logic; high performance dynamic CMOS circuits such as domino CMOS logic, NORA and TSPC CMOS logic; DRAM cell.
	TEXT BOOKS:
1	Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits-Analysis and Design, 3rd edition, McGraw Hill
2	Jan M. Rabaey, Anantha Chandrakasan & Borivoje NIkolic, Digital Integrated Circuits-A Design Perspective, 2nd edition, PHI
3	David A Hodges, Horace G Jackson & Resve A Saleh, Analysis and Design of Digital Integrated Circuits in deep submicron technology, 3rd edition, McGraw Hill
	ADDITIONAL READING:
1	Neil H E Weste & Kamran Eshragian, Principles of CMOS VLSI Deisgn- A systems perspective, Addison- Wesley
2	John P. Uyemura, CMOS Logic Circuit Design, Springer International Edition
3	Adel S. Sedra & Kenneth C. Smith, Microelectronic Circuits, 5th edition, Oxford University Press
4	S. M. Sze, VLSI Technology, 2nd edition, Bell Laboratories.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4012P**
Course Title	**BASICS OF VLSI LAB**
Prerequisite	Electronic Circuit Analysis and Design I & II, Integrated Circuits and Applications

COURSE OUTCOMES

After completion of the course, students should be able to

- Simulate MOSFET based digital circuits.
- Simulate fabrication process.
- Describe the hardware of digital circuits in HDL.
- Program an FPGA using a HDL.

COURSE CONTENTS

Module 1.	To plot MOSFET I-V Characteristics.
Module 2.	To plot CMOS inverter VTC.
Module 3.	To plot CMOS Inverter Switching Characteristics.
Module 4.	To study pMOS, nMOS and CMOS Transmission Gate Characteristics.
Module 5.	To implement simple circuits using Domino logic.
Module 6.	To design Schematic and Layout of CMOS complex gates, adders, latches etc.
Module 7.	To simulate entire process of CMOS Fabrication.
Module 8.	Hardware description of combinational logic circuits such as – Full adder b. Multiplexer c. Decoder
Module 9.	To write the HDL code for – D Flip Flop b. J-K Flip Flop c. T Flip Flop
Module 10.	To write the HDL code for a given synchronous sequential counter.
Module 11.	To write the HDL code for a given FSM.
Module 12.	To write the HDL code for a given ALU.
Module 13.	To implement 16X8 bit memory using HDL.
Module 14.	To implement a digital circuit HDL code on an FPGA.
Additional Reading:	
1.	Douglas L Perry, VHDL programming by example, 4th edition, McGraw Hill
2.	Jayaram Bhaskar, VHDL Primer, Prentice Hall
3.	Zainalabedin Navabi, Verilog Digital system Design, 2nd edition, McGraw Hill

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4013T**
Course Title	**Advanced Digital Signal Processing**
Prerequisite	Signals And Systems, Digital Signal Processing

COURSE OUTCOME

After completion of the course, students should be able to

- Compare the spectrum of analog signal with digital signal sampled at different frequencies
- Analyze signal by splitting into different levels to obtain better frequency resolution. Also reconstruction with the required information for specific applications.
- Model the random processes as MA, AR and ARMA.
- Apply wavelet analysis to signal and image processing applications.

COURSE CONTENTS

Module 1	**Digital spectrum**
	Revision of DTFT, FFT: DIT-FFT, DIF-FFT, Sampling, Comparison of analog and digital spectrum with different sampling frequency, aliasing
Module 2	**Multirate Digital Signal Processing**
	Decimation, Interpolation, multi stage interpolators and decimators, Analysis and Synthesis of digital signal using Decimation and interpolation, Filter design and implementation, Application of multirate signal processing
Module 3	**Discrete Time Random Process**
	Definitions and representation of random process, parametric and non parametric spectral estimations; estimation of auto correlation and power density spectrum. Filtering random process Non parametric techniques like: periodogram, modified periodogram Barlett, Welch & Blackman-Tuckey, approach
Module 4	**Discrete Time Random Process Modeling**
	Parametric Techniques: Yule Walker Method and Power spectrum method for modeling: Autoregressive (AR), Moving Average (MA) and Autoregressive Moving average (ARMA) Linear Predictive coding: Minimizing mean square error
Module 5	**Wavelets**
	Review Fourier transform, Short-time Fourier transform, Introduce time frequency resolution, orthogonality and orthonormality

	Continuous time wavelet transform, Discrete wavelet transform Analysis using Harr scaling and wavelet functions, refinement relations, Analysis and synthesis refinement equations Tiling of the time-frequency plane and wavepacket analysis
Text Books:	
1.	J. G. Proakies, D.G. Manolakis, and D. Sharma, "Digital Time Signal Processing: principles, algorithms, and applications," Pearson Education, 2006.
2.	S.M. Hayes, Modern Spectral Estimation, Prentice hall, 1988.
3.	R. M. Rao, and A.S. Bopardikar, "Wavelet Transforms," Pearson Education, 2001.
Additional Reading::	
1.	DaFatta, D. J., Lucas, J. G., and Hodgkiss, W. S. "Digital Signal Processing: A system design approach," Wiley publications, 1988.
2.	C. S. Burrus, R. A. Gopinath, and H. Guo,."Introduction to Wavelets and Wavelets Transforms," Prentice Hall, 1998.
3.	Ambardar, A., "Analog and Digital Signal Processing," Thomason Learning, 1999
4.	Ifeachor, E. C., and Jervis, B. W., "Discrete Time Signal Processing: principles, algorithms, and applications," Addison Wesley, 1993.

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Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4013P**
Course Title	**Advanced Digital Signal Processing Lab**
Prerequisite	Signals And Systems, Digital Signal Processing

COURSE OUTCOME

After completion of the course, students should be able to

- Compare the spectrum of analog signal with digital signal sampled at different frequencies
- Analyze signal by splitting into different levels to obtain better frequency resolution.
- Model the random processes.
- Apply wavelet analysis to signal and image processing applications.

COURSE CONTENT

Module 1	Comparison of different band limited analog spectrum into digital spectrum with different sampling frequency.
Module 2	FFT: DIT-FFT, DIF-FFT, experiments and verification of properties
Module 3	Decimators and Interpolators
Module 4	Multi stage Interpolators and Decimators
Module 5	Linear Predicative Coding
Module 6	Spectral Estimation and Power Density Spectrum
Module 7	Non parametric techniques like: periodogram, modified periodogram Barlett, Welch & Blackman-Tuckey, approach
Module 8	Short-time Fourier transform, Wavelets
Text Books	
1.	J. G. Proakies, D.G. Manolakis, and D. Sharma, "*Digital Time Signal Processing: principles,algorithms, and applications,"* Pearson Education, 2006.
2.	S.M. Kay, Modern Spectral Estimation, Prentice hall, 1988.
3.	R. M. Rao, and A.S. Bopardikar, "*Wavelet Transforms,"* Pearson Education, 2001.
Additional Reading:	
1.	DaFatta, D. J., Lucas, J. G., and Hodgkiss, W. S. "*Digital Signal Processing: A system design approach*," Wiley publications, 1988.
2.	C. S. Burrus, R. A. Gopinath, and H. Guo,."*Introduction to Wavelets and Wavelets Transforms*,"PrenticeHall, 1998.
3.	Ambardar, A., "*Analog and Digital Signal Processing*," Thomason Learning, 1999

4.	Ifeachor, E. C., and Jervis, B. W., "*Discrete Time Signal Processing: principles, algorithms, d applications*," Addison Wesley, 1993.

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ELECTIVE III

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4111T**
Course Title	**ELECTIVE III – PROCESS CONTROL INSTRUMENTATION**
Prerequisite	Instrumentation Systems

COURSE OUTCOME

After completion of the course, students should be able to

- Describe various fundamentals of process control
- Analyze various measurement methods for physical parameters
- Explain the working and analyze the characteristics of various controllers and valves
- Design data acquisition systems and program using PLC

COURSE CONTENTS

Module 1	Introduction to Process Control, Feedback Control, Types of Processes, Performance Characteristics of measuring systems.
Module 2	Measurement methods of different process parameters like pressure, force, torque, velocity, acceleration (Review).
Module 3	Fluid flow measurement methods – Measurement of fluid density, viscosity, specific gravity, pH, humidity and liquid level.
Module 4	Controllers – Modes of control like ON/OFF, proportional, derivative, integral, PD, PI and PID controllers. Selection of a proper control mode for a given process, Pneumatic control mechanisms, electronic controllers, Electronic and Pneumatic signal transmission.
Module 5	Control valves like globe, pinch, butterfly ball valve etc., characteristics of valves, cavitation and flashing, selection of control valves for a process, valve sequencing.
Module 6	Introduction to PLC, PLC ladder logic, drawing of ladder diagrams, Programming of PLC.
Module 7	Generalized data acquisition and data distribution systems, Multichannel DAS, Data Logger
TEXT BOOKS:	
1.	Anderson N. A., Instrumentation for Process Measurement and Control, Third edition, Chilton Company, 1980
2.	Johnson C., Process Control Instrumentation Technology, Fourth edition, Prentice Hall of India, 2001
ADDITIONAL READING::	
1.	Dunning Gary, Introduction to Programmable Logic Controllers, Delmar – Thomson Learning, 2001.

2.	Patranabis D, Principles of Process Control, Tata McGraw Hill, Second edition, 2001.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4111T**
Course Title	**ELECTIVE III – PROCESS CONTROL INSTRUMENTATION LAB**
Prerequisite	Instrumentation Systems

COURSE OUTCOME

After completion of the course, students should be able to

- Evaluate measurement techniques of different process parameters
- Setup experiments to measure fluid flow parameters
- Explain the working and analyze the characteristics of various controllers and valves
- Design data acquisition systems and program using PLC

COURSE CONTENTS

Module 1	Measurement of Performance Characteristics of measuring systems.
Module 2	Few experiments on different measurement methods of different process parameters like pressure, force, torque, velocity, acceleration (Review).
Module 3	Experiments on Fluid flow measurement methods for parameters like fluid density, viscosity, specific gravity, pH, humidity and liquid level.
Module 4	Design of Controllers with different Modes like ON/OFF, proportional, derivative, integral, PD, PI and PID controllers.
Module 5	Few experiments on programming PLC
TEXT BOOKS:	
1.	Anderson N. A., Instrumentation for Process Measurement and Control, Third edition, Chilton Company, 1980
2.	Johnson C., Process Control Instrumentation Technology, Fourth edition, Prentice Hall of India, 2001
REFERENCE BOOKS:	
1.	Dunning Gary, Introduction to Programmable Logic Controllers, Delmar – Thomson Learning, 2001.
2.	Patranabis D, Principles of Process Control, Tata McGraw Hill, Second edition, 2001.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4112T**
Course Title	**ELECTIVE III – MICROCOMPUTER SYSTEM DESIGN**
Prerequisite	**Microprocessor Systems**

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Describe the architecture of Pentium processor
- Illustrate cache structures implemented in Pentium processor
- Implement PCI bus for computer systems
- Interpret USB data and control transfers

COURSE CONTENTS

Module 1	**The Pentium Processor**
	Functional units of Pentium processor. Overview of cache operation and cache types. Pentium cache overview. Pentium signals interface. Address bus, data bus, misaligned transfers, Communications with 8, 16, 32 and 64 Bit devices, bus control signals, bus master signals, System test and initialization. System management tools. Reliability and error reporting. Code cache and Instruction pipeline. Introduction to the pre-fetcher, Instruction branch prediction, code cache organization and operation, the floating point pipeline. The data cache and burst bus cycles. Introduction to internal data cache, structure of internal data cache, and the bus cycle state machine, anatomy of write hit and miss, inquire cycles. Bus cycle overview, burst cycles, single transfer bus cycle - pipelined and non-pipelined, special cycles. Interrupt acknowledge bus cycle, bus cycle state machine, bus and bus state transition.
Module 2	**PCI Bus**
	Local Bus concept. Introduction to PCI Bus operation; Introduction to Reflected wave switching; PCI Bus functional signal groups. PCI Bus Arbitration, Arbiter, Arbitration algorithms, hidden bus arbitration, example of arbitration between two masters, bus access latency, PCI read and write transfers, PCI I/O addressing, Interrupt acknowledge. Interrupt routing, Interrupt chaining.
Module 3	**Peripheral Bus Interfaces**
	The SATA interface, timing specifications, SATA protocol, Model of an SATA Disk Drive.
Module 4	**Universal Serial Bus (USB)**
	Introduction to USB,PC requirements, Bus topology, understanding the host and the peripheral, the development process. USB transfer basics, Elements of a transfer, successful transfers. Transfer types, Control transfer, Bulk transfer, Interrupt transfer, Isochronous transfer, time critical transfers. USB versions
	TEXT BOOKS:

1	Don Anderson et al, Pentium Processor System Architecture, Addison-Wesley Professional; second edition, 1995
2	Tom Shanley et al, PCI System Architecture,. Addison-Wesley Professional; fourth edition, 1999
3	Don Anderson, SATA storage Technology, Serial ATA, Mindshare Press, 2007
	Jan Axelson, USB complete, Penram Publication, fourth edition, 2011

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4112P**
Course Title	**ELECTIVE III – MICROCOMPUTER SYSTEM DESIGN LAB**
Prerequisite	**Microprocessor Systems**

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Design and implement assembly language programs for Pentium microprocessors
- Design and implement programs for data transfer on SATA bus
- Design and implement programs for data transfer on USB

COURSE CONTENTS

1. Any five programs on cache operations, superscalar architecture of Pentium, branch prediction logic.
2. Any three programs on SATA data transfer techniques
3. Any three programs on USB data transfers

Text Books

1. Don Anderson et al, Pentium Processor System Architecture, Addison-Wesley Professional; second edition, 1995
2. Don Anderson, SATA Storage Technology: Serial ATA, Mindshare Press, 2007
3. Jan Axelson, USB Complete, Penram Publication, fourth edition, 2011

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4113T**
Course Title	**ELECTIVE III – DSP Processors**
Prerequisite	Digital Signal Processing and Microprocessor Systems

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Compare and contrast programmable DSP characteristics
- Describe architecture and use instruction set of TMS320C5X DSP processor
- Describe architecture and use instruction set of TMS320C6X processor
- Describe architecture and use instruction set of ADSP processors
- Describe architecture and use instruction set of TMS320C54X processors

COURSE CONTENTS

Module 1	**FUNDAMENTALS OF PROGRAMMABLE DSPs**
	Introduction to DSP Processors: Differences between DSP and other µp architectures, their comparison and need for special ASPs, RISC & CISC CPUs. Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in PDSPs , Multiple access memory , Multi-port memory , VLIW architecture-Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.
Module 2	TMS320C5X PROCESSOR
	Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals
Module 3	TMS320C6X PROCESSOR
	Architecture of the C6x Processor - Instruction Set - DSP Development System: Introduction – DSP Starter Kit Support Tools- Code Composer Studio - Support Files - Programming Examples to Test the DSK Tools – Application Programs for processing real time signals
Module 4	ADSP PROCESSORS
	Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

Module 5	ADVANCED PROCESSORS
	Architecture of TMS320C54X: Pipe line operation, Code Composer studio – Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.
Text Books:	
1.	B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2.	Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012
Additional Reading:	
1.	User guides Texas Instrumentation, Analog Devices, Motorola.
2.	Rulph Chassaing, Digital Signal Processing and Applications with the C6713 and C6416 DSK, John Wiley & sons, Inc., 2005

Programme Name	**B.Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4113P**
Course Title	**ELECTIVE III – DSP PROCESSOR LAB**
Prerequisite	Digital Signal Processing and Microprocessor Systems

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Compare and contrast programmable DSP characteristics
- Design and implement programs using TMS320C5X PROCESSOR
- Design and implement programs using TMS320C6X PROCESSOR
- Design and implement programs using ADSP PROCESSORS

Module 1	Design and implement programs using programmable DSPS
Module 2	Design and implement programs using TMS320C5X PROCESSOR
Module 3	Design and implement programs using TMS320C6X PROCESSOR
Module 4	Design and implement programs using ADSP PROCESSORS
Module 5	Design and implement programs using TMS320C54X and TMS320C6X

Text Books:	
1.	B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2.	Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012
Additional Reading:	
1.	User guides Texas Instrumentation, Analog Devices, Motorola.
2.	Rulph Chassaing, Digital Signal Processing and Applications with the C6713 and C6416 DSK,A JOHN WILEY & SONS, INC., PUBLICATION, 2005

ELECTIVE IV

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4115S**
Course Title	**SATELLITE COMMUNICATION**
Prerequisite	Basics of Communication, Digital Communication

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Design and implement simple programs using various satellite technology, satellite subsystems, for different types of satellite missions and areas of application of satellite technology.
- Analyze the orbits and trajectories of satellites.
- Describe the Satellite Launch procedures and various in-orbit operations
- Analyze multiple access techniques in Satellite Communication and distinguish tradeoff in satellite link design related aspects.

COURSE CONTENTS

Module 1	**Introduction to Satellites and their Applications**
	Ever-expanding Application Spectrum , What is a Satellite?, History of the Evolution of Satellites, Evolution of Launch Vehicles, Future Trends
Module 2	**Satellite Orbits and Trajectories**
	Definition of an Orbit and a Trajectory, Orbiting Satellites – Basic Principles, Orbital Parameters, Injection Velocity and Resulting Satellite Trajectories, Types of Satellite Orbits
Module 3	**Satellite Launch and In-orbit Operations**
	Acquiring the Desired Orbit, Launch Sequence, Orbital Perturbations, Satellite Stabilization, Orbital Effects on Satellite's Performance, Eclipses, Look Angles of a Satellite, Earth Coverage and Ground Tracks
Module 4	**Satellite Hardware**
	Satellite Subsystems, Mechanical Structure, Propulsion Subsystem, Thermal Control Subsystem, Power Supply Subsystem, Attitude and Orbit Control, Tracking, Telemetry and Command Subsystem, Payload, Antenna Subsystem, Space Qualification and Equipment Reliability
Module 5	**Multiple Access Techniques**
	Introduction to Multiple Access Techniques, Frequency Division Multiple Access (FDMA), Single Channel Per Carrier (SCPC) Systems, Multiple Channels Per Carrier (MCPC) Systems, Time Division Multiple Access (TDMA), TDMA Frame Structure, TDMA Burst Structure, Computing Unique Word Detection Probability, TDMA Frame Efficiency, Control and Coordination of Traffic, Frame Acquisition and Synchronization, FDMA vs. TDMA, Code Division Multiple Access (CDMA), Space Domain Multiple Access (SDMA)

Module 6	**Satellite Link Design**
	Transmission Equation, Satellite Link Parameters, Frequency Considerations, Propagation Considerations, Techniques to Counter Propagation Effects, Noise Considerations, Interference-related Problems, Antenna Gain-to-Noise Temperature (G/T) Ratio, Link Design
Text Books:	
1.	*Satellite Technology- Principles And Applications*,3rd edition, 2014 by Anil K. MainiVarsha Agrawal. John Wiley & Sons Ltd,
2	*Satellite Communications*, 3rd edition 2001 by Dennis Roddy. McGraw-Hill
3	*Introduction to Satellite communication*, 3rd edition 2008 by Bruce R Elbert. Artech House.
4	*Satellite communication* 2009 by Dharma Raj Cheruku. I K International Publishing House Pvt Ltd New Delhi
Additional Reading::	
1	*Satellite Communication* 2012 by Joseph N Pelton, Springer
2	*Satellite Communication Engineering* 2013, by Michael Olorunfunmi Kolawole. CRC press

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4116S**
Course Title	**ELECTIVE-IV MECHATRONICS**
Prerequisite	Control Systems

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Apply various modeling techniques to design mechatronics systems.
- Model and simulate physical systems.
- Apply the concepts of automation and controls, electric drives, instrumentation, to aid in the design, characterization, analysis, and troubleshooting of mechatronics systems.
- Use advanced principles of sensors, transducers and actuators to aid in the design, characterization, analysis, and troubleshooting of mechatronics systems.

COURSE CONTENTS

Module 1	**Introduction to Mechatronics:**
	Mechatronics key elements, Mechatronics design process, approaches in Mechatronics
Module 2	**Modeling and Simulation of Physical System**
	Simulation and Block Diagrams, Analogies and Impedance Diagrams, Electrical Systems, Mechanical Translation Systems, Mechanical rotational System, Electromechanical Coupling, Fluid Systems
Module3	**Sensors and Transducers**
	Introduction to Sensors and Transducers, Sensors for Motion and Position Measurement, Force, Torque, and Tactile Sensors, Flow Sensors , Temperature - Sensing Devices , Ultrasonic Sensors, Range sensors, Active Vibration Control Using Magnetostrictive Transducers, Fiber Optic Devices in Mechatronics.
Module4	**Actuating Devices:**
	Direct Current Motor, Permanent Magnet Stepper Motor, Fluid Power Actuation, Fluid Power Design Elements, Piezoelectric Actuators
Module5	**Hardware Components for Mechatronics**
	Transducer Signal Conditioning and Devices for Data Conversion, Programmable Controllers
Module6	**Signals, Systems, and Controls:**
	Introduction to Signals, Systems, and Controls, System Representation, Linearization of Nonlinear Systems, Time delays, Measures of System Performance, Root Locus and Bode Plots.

Module7	**Real - Time Interfacing:**
	Introduction, Elements of a Data Acquisition and Control System, Overview of the I/O Process, Installation of the I/O Card and Software, Installation of the Application Software, Examples of interfacing.
Module 8	**Closed Loop Controllers**
	Continuous and discrete processes, control modes, two step mode, proportional mode, derivative control, integral control, PID controller, Digital controllers, Control system performance, Controller tuning, Velocity Control and Adaptive control.
Module 9	**Advanced Applications in Mechatronics**
	Sensors for Condition Monitoring , Mechatronic Control in Automated Manufacturing, Artificial Intelligence in Mechatronics , Fuzzy Logic Applications in Mechatronics , Fuzzy Logic Applications in Mechatronics, Microsensors in Mechatronics.
TEXT BOOKS:	
1.	Devdas Shetty and Richard A. Kolk, Mechatronics System Design, Thomson Asia Pvt. Ltd., Second Reprint,2001
2.	W. Bolton, Mechatronics, Pearson Education Asia, Third Indian Reprint 2001
ADDITIONAL READING::	
1.	David G. Alciatore and Michael B. Histand, Introduction to Mechatronics and Measurement Systems, TataMcGraw Hill, Second Edition, 2003

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4117S**
Course Title	**ELECTIVE-IV NEXT GENERATION NETWORKS**
Prerequisite	Digital Communication, and Data Communication

COURSE OUTCOMES

After successful completion of this course, students should be able to

- State the technical features and design considerations of the next generation mobile networks.
- Compare the carious IMS Services
- Describe the common technologies used in the core, distribution and access layers.
- Design a network with good capacity and efficiency.

COURSE CONTENTS

Module 1	**Introduction**
	Evolution of public mobile services - motivations for IP based services, Wireless IP network Architecture – 3GPP packet data network architecture, Introduction to next generation networks -Changes, Opportunities and Challenges, Technologies, Networks, and Services, Next Generation Society, future Trends.
Module 2	**IMS and Convergent Management**
	IMS Architecture - IMS services, QoS Control and Authentication, Network and Service management for NGN, IMS advantages, Next Generation OSS Architecture - standards important to OSS architecture, Information framework, OSS interaction with IMS, NGN OSS function/ information view reference model, DMTF CIM.
Module3	**MPLS AND VPN**
	Technology overview –MPLS &QoS, MPLS services and components – layer 2 VPN, layer 2 Internet working, VPN services, signaling, layer 3 VPN – Technology overview, Remote Access and IPsec integration with MPLS VPN.
Module4	**Multicast**
	MPLS Multicast VPN overview – Applications, examples, IPv6 and MPLS - Technology overview, Future of MPLS – Integrating IP and optical networks, Future layer 3 services, future layer 2 services.
Module5	**NGN Management** Network Management and Provisioning – Configuration, Accounting, performance, security, case study for MPLS, Future enhancements – Adaptive self-healing networks.

	TEXT BOOKS:
1	Thomas Plavyk, “Next generation Telecommunication Networks, Services and Management”, Wiley& IEEE Press Publications, 2002.
2	Neill Wilkinson, “Next Generation Network Services”, John Wiley Publications, 2002.
	ADDITIONAL READING::
1	Monique J. Morrow, “Next Generation Networks”, CISCO Press, 2007.
2	Robert Wood, “MPLS and Next Generation Networks: Foundations for NGN and EnterpriseVirtualization", CISCO Press, 2006.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4118S**
Course Title	**ELECTIVE-IV WIRELESS SENSOR NETWORKS**
Prerequisite	Wireless Communication, Data Communication

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Describe the concepts, network architectures and applications of ad hoc and wireless sensor networks.
- Analyze the protocol design issues of ad hoc and sensor networks.
- Explain the concepts of communication, MAC, routing protocols and also study about the naming and addressing in WSN.
- Describe routing protocols for ad hoc and wireless sensor networks with respect to some protocol design issues.

COURSE CONTENTS

Module 1	**Overview Of Wireless Sensor Networks**
	Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, Advantages of sensor networks- energy advantage, detection advantage, Sensor network applications- Habitat Monitoring, Tracking chemical plumes- Smart transportation.
Module 2	**Architectures**
	Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.
Module 3	**Networking Sensors**
	Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts- S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.
Module 4	**Infrastructure Establishment**
	Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.
Module 5	**Sensor Network Platforms And Tools**
	Sensor Node Hardware- Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.
TEXT BOOKS:	

1.	Holger Karl & Andreas Willig, "*Protocols And Architectures for Wireless Sensor Networks*", John Wiley, 2005.
2.	Feng Zhao & Leonidas J. Guibas, "*Wireless Sensor Networks- An Information Processing Approach*", Elsevier, 2007.
ADDITIONAL READING::	
1.	Kazem Sohraby, Daniel Minoli, & Taieb Znati, "*Wireless Sensor Networks- Technology, Protocols, And Applications*", John Wiley, 2007.
2.	Anna Hac, "*Wireless Sensor Network Designs*", John Wiley, 2003.
3.	K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325—349.
4.	Philip Levis, "*TinyOS Programming*".
5.	Anna Ha´c, "*Wireless Sensor Network Designs*", John Wiley & Sons Ltd.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - VIII**
Course Code	**EC4119S**
Course Title	**E-Security**
Prerequisite	**Data Communication, Computer Networks**

COURSE OUTCOMES

After successful completion of this course, students should be able to

- Apply concepts of E-security.
- Explain the different aspects of management and security of the networking.
- Implement standards for integrity, authentication and key management.
- Design firewalls for different applications.

COURSE CONTENTS

Module 1	**INTRODUCTION ON SECURITY**
	Security Goals, Types of Attacks: Passive attack, active attack, attacks on confidentiality, attacks on Integrity and availability, Security services and mechanisms, Techniques: Cryptography, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers- Steganography- Revision on Mathematics for Cryptography.
Module 2	**SYMMETRIC & ASYMMETRIC KEY ALGORITHMS**
	Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, principle of asymmetric key algorithms, RSA Cryptosystem.
Module 3	**INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT**
	Message Integrity, Hash functions: SHA 512, Whirlpool, Digital signatures: Digital signature Standards, Authentication: Entity Authentication: Biometrics, Key management Techniques.
Module 4	**NETWORK SECURITY, FIREWALLS AND WEB SECURITY**
	Introduction on Firewalls, Types of Firewalls, Firewall Configuration and Limitation of Firewall, IP Security Overview, IP security Architecture, Authentication Header, Security payload, Security associations, Key Management, E-mail security: PGP, MIME,S/MIME, Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature.
Module 5	**WIRELESS NETWORK SECURITY**
	Security Attack issues specific to Wireless systems: Worm hole, Tunnelling, DoS, WEP for Wi Finetwork, Security for Broadband networks: Secure Ad hoc Network, Secure Sensor Networks
Text Books:	

1.	Behrouz A. Forouzan," Cryptography and Network security" Tata McGraw-Hill, 2008.
2.	William Stallings,"Cryptography and Network security: Principles and Practice", 2nd Edition, Prentice Hall of India, New Delhi, 2002.
3.	Atul Kahate," Cryptography and Network security", 2nd Edition, Tata McGraw-Hill, 2008.
Additional Reading::	
1.	H. Yang et al., "Security in Mobile Ad Hoc Networks: Challenges and Solution", IEEE Wireless Communications, Feb. 2004.
2.	Lidong Zhou et al."Securing Ad Hoc Networks", IEEE Network Magazine, vol. 13, no. 6, pp.24-30, December 1999.
3.	"Security of Wireless Ad Hoc Networks", http://www.cs.umd.edu/~aram/wireless/survey.pdf
4.	David Boel et.al (Jan 2008), "Securing Wireless Sensor Networks – Security Architecture Journal of networks", Vol. 3. No. 1. pp. 65 -76.
5.	Perrig, A., Stankovic, J., Wagner, D. (2004), "Security in Wireless Sensor Networks", Communications of the ACM, 47(6), 53-57.