Course Title	MICROWAVE & OPTICAL COMMUNICATIONS LAB				B. Tech. ECE VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1824608	**EC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		--	--	4	2	50	50	100
						End Exam Duration: 3Hrs		

Course Objectives:

- To provide knowledge on various types of waveguides.
- To find the S-matrix of different Junctions and to obtain Gun Diode and RKO characteristics.
- To find numerical aperture and bending losses of given optical fiber.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	**Analyze** the characteristics of different microwave sources.
CO 2	**Measure** the parameters of wave guide and microwave junctions.
CO 3	**Examine** the characteristics of optical fiber and sources.
CO 4	**Verify** the characteristics of microwave antennas

Part – A (Any 7 Experiments):

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation Measurement.
4. Directional Coupler Characteristics.
5. VSWR Measurement.
6. Impedance Measurement.
7. Waveguide parameters measurement.
8. Scattering parameters of Directional Coupler.
9. Scattering parameters of Magic Tee.

Part – B (Any 5 Experiments):

1. Characterization of LED.
2. Characterization of Laser Diode.
3. Intensity modulation of Laser output through an optical fiber.
4. Measurement of Data rate for Digital Optical link.
5. Measurement of NA.
6. Measurement of losses for Analog Optical link.
7. Radiation Pattern Measurement of Antennas (at least two antennas).

Course Title	INTERNET OF THINGS (IOT)				B. Tech. ECE VII Sem		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
1804701	**EC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- This course imparts knowledge on, introduction to IoT, its complete architecture & internet Protocols involved enabling IoT communication over the network.
- The course also offers an introduction to IoT platforms, end devices, networks and cloud services.
- Using case analysis, assignments, Labs & projects students will acquire skills necessary to identify building blocks of an IoT application.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand IoT architecture, internet & network topologies and Different Cloud storage services.
CO 2	Apply appropriate hardware and software tools for IoT applications.
CO 3	Analyze TCP/IP protocol, various Programming Concepts.
CO 4	Compare cloud storage services, various libraries, addressing modes and IoT devices.
CO 5	Design a basic systems using IoT for various applications.

UNIT-I:

Introduction & Overview of Internet of things: Introduction to The Internet of things today, Vision of internet of things, An IoT architecture outline, Functional blocks of IoT, industrial IoT, Challenges in IOT,Hardware and Software tools required for IoT application development.

Case Study: SimpleLink ™ Wi-Fi ® Enabled Electronic Smart Lock.

UNIT-II:

Internet/Web and Networking Basics: Introduction to internet & network topologies,TCP/IP protocol, TCP/IP Layers and their relative Protocols, IP addressing(IPV4), IP Address Classification & Subnet, Local IP, Gateway IP and DNS,TCP & UDP Communication, Overview of MAC Address, Energia, WiFi Library API's .

Case Study: Connected microcontrollers essential to automation in buildings

UNIT-III:

MSP 432 processor: MSP 432 processorfeatures, Architecture, its Booster Packs, Development Environment, Libraries, Fundamental Programming Concepts**,** TM4C123G Launchpad, Sensor hub Booster pack, CC3220 SF Launchpad.

UNIT-IV

Cloud Communication in IOT: IOTdevice to cloud storage communication Model, need of Cloud services in IOT, Different Cloud storage services, Cloud Data processing and frame format, Introduction to clouds like Temboo, Blynk, Pubnub etc.

Case Study: Advances in bio-inspired sensing help people lead healthier lives.

UNIT-V:

IOT Platform and Application development: IoT applications in home, infrastructures, Healthcare, Transport, buildings, security, Industries, and other IoT electronic equipment, Adapting IPV6 for IOT Requirement(overview).

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", 2014. ISBN: 978-0996025515.
2. Boris Adryan, Dominik Obermaier, Paul Fremantle, "The Technical Foundations of IoT", Artech Houser Publishers, 2017.
3. Michael Margolis, "Arduino Cookbook", O"Reilly, 2011.
4. Marco Schwartz, "Internet of Things with ESP8266", Packt Publishing, 2016

Reference Books:

1. Jan Axelson by Embedded Ethernet And Internet Complete (Designing and Programming Small Devices for Networking)
2. Jean-Philippe Vasseur,Adam Dunkels, Morgan Kuffmann. "Interconnecting Smart Objects with IP"
3. Samuel greengard by " internet of things"Pearson 2nd edition
4. David E. Simon, An Embedded Software Primer- Pearson Ed. 2005

Course Title	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION				B. Tech. ECE VII Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1804702	**EC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- The presentation of fundamental measurement concepts and measurement methodologies including the description of basic instruments that are the technological implementation of general methodologies.
- Understanding about the transducers and to help the students analyze various signals using CRO.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define the performance characteristics of an instrument.
CO 2	Understand the principle of analog, digital voltmeters and wave analyzers.
CO 3	Explain different types of oscilloscopes.
CO 4	Use AC and DC bridges for relevant parameter measurement.
CO 5	Apply the complete knowledge of various electronic transducers to measure the physical Quantities in the field of science and technology.

UNIT I

Performance characteristics of Instruments: Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error.

Analog Instruments: Transistor Voltmeter, Micro Voltmeter (Chopper type) – DC Differential voltmeter – AC voltmeters – Multi meter -wave analyzers (AF & RF) – Harmonic distortion analyzer- Spectrum analyzer-Applications.

UNIT II

Bridges: Wheat stone bridge, Kelvin Bridge, Measurement of inductance- Maxwell's bridge, Anderson Bridge. Measurement of capacitance-Schearing Bridge, Wien Bridge Errors and precautions in using bridges- Q meter and measurement methods

UNIT III

Cathode Ray Oscilloscopes: Motion of electron in electronic field and in magnetic field-Block diagram of CRO, CRT, Electrostatic deflection sensitivity – Vertical and Horizontal deflection systems – Principle of operation of dual beam, dual trace, sampling and storage CRO's.

UNIT IV

Digital Instruments: Digital Voltmeters (Ramp, Dual slope, stair case, successive approximation types) Digital multi meter, Universal counter, Digital tachometer, Digital Phase meter.

UNIT V

Transducers: Active & passive transducers, Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples,

Thermistors, Sensistors. Measurement of physical parameters force, pressure, velocity, humidity, moisture, speed, proximity and displacement. Data acquisition systems.

Text Books:

1. H.S. Kalsi, Electronic instrumentation, second edition - Tata McGraw Hill, 2004.
2. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques –PHI, 5th Edition, 2002.
3. A.K. Sawhney, "A Course In Electrical And Electronic Measurements And Instrumentation", DhanpatRai Publications, 2012.
4. Golding, E.W. and Widdis, F.C., Electrical Measurements and Measuring Instruments, A.H.Wheeler and Co, 5th Edition, 2011.

References:

1. David A. Bell, Electronic Instrumentation & Measurements - PHI (OUP), 2nd Edition, 2003.
2. Robert A.Witte, Electronic Test Instruments, Analog and Digital Measurements - Pearson Education, 2nd Ed., 2004.
3. K. Lal Kishore,Electronic Measurements & Instrumentations, Pearson Education – 2005.
4. Ernest.O.Doebelin and Dhanesh.N.Manik, Doebelin's Measurement Systems, McGraw Hill Education, 6th Edition, 2011.

Course Title	INFORMATION THEORY AND CODING				B. Tech. ECE VII Sem		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
1804703	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To know various information measures.
- To understand various information channels.
- To explain different source code algorithms.
- To familiarize quantization and transform coding.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand various information measures
CO 2	Describe various information channels.
CO 3	Use different source code algorithms.
CO 4	Analyze quantization and transform coding.

UNIT-I

Information Theory: Introduction to Information Theory and Coding, Definition of Information Measure and Entropy, Extension of An Information Source and Markov Source, Adjoint of An Information Source, Joint and Conditional Information Measure, Properties of Joint and Conditional Information Measures and A Morkov Source Properties of Joint and Conditional Information measures and a Markov source.

UNIT-II

Source Coding: Source coding theorem, Prefix Codes, Kraft McMillan Inequality property, Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding.

UNIT-III

Information Channels I: Introduction to Information Channels, Equivocation and Mutual Information, Properties of Different Information Channels, Reduction of Information Channels, Properties of Mutual Information and Introduction to Channel Capacity, Calculation of Channel Capacity for Different Information Channels, Shannon's Second Theorem.

UNIT-IV

Information Channels II: Error Free Communication Over Noisy Channel, Error Free Communication Over A Binary Symmetric Channel and Introduction to Continuous Sources and Channels, Differential Entropy and Evaluation of Mutual Information for Continuous Sources and Channels, Channel Capacity of A Band Limited Continuous Channel

UNIT-V

Quantization: Introduction to Quantization, Lloyd-Max Quantizer, Companded Quantization, Variable Length Coding and Problem Solving in Quantizer Design, Vector Quantization, Transform Coding-Idea of Transform Coding, Choosing the weights of basis vector, forward transform, Energy preserving, Optimal bit allocation .

Text books:

1. T. M. Cover, J. A, Thomas, "Elements of information theory," Wiely Interscience, 2 nd Edition, 2006
2. R. W. Hamming, "Coding and information theory," Prentice Hall Inc., 1980.
3. S. Keshav, An Engineering Approach to Computer Networks, 2nd Edition, Pearson Education.
4. Kurose James F, Keith W, Computer Networking A Top-Down Approach –6th Edition, Pearson

Reference Books:

1. Bose, "Information Theory, Coding and Cryptography", Mc graw hill Education
2. S. Gravano, "Introduction to Error Control Codes", OUP Oxford (24 May 2001)
3. Robert B. Ash, "Information Theory", Dover Publications (November 1, 1990)
4. Todd k Moon, "Error Correction Coding: Mathematical Methods and Algorithms", Wiley, 2005.

Course Title	REAL TIME OPERATING SYSTEMS				B. Tech. ECE VII Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1804704	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

The objective of this course is to

- Develop an understanding of various Real Time systems Application
- Obtain a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
- Get in-depth in designing and developing a real operational system

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Explain the fundamentals of interaction of OS with a computer and user computation
CO 2	Understand the fundamental concepts of creating and OS controlling devices
CO 3	Describe the programming logic of modelling process based on the OS features
CO 4	Develop the concepts of inter-process communications
CO 5	Design application development of RTOS.

UNIT-I:

INTRODUCTION: Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multithreading concepts, Processes, Threads, Scheduling.

UNIT-II:

BASICS OF REAL-TIME CONCEPTS: Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel.

UNIT-III:

PROCESS MANAGEMENT: Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals.

UNIT-IV

INTER-PROCESS COMMUNICATION: Messages, Buffers, mailboxes, queues, semaphores, deadlock, priority inversion, PIPES MEMORY MANAGEMENT:- Process stack management, run-time buffer size, swapping, overlays, block/page management, replacement algorithms, real-time garbage collection.

UNIT-V:

CASE STUDIES: Case study Linux POSIX system, RTLinux / RTAI, Windows system, Vxworks, uItron Kernel Design Issues: structure, process states, data structures, inter-task communication mechanism, Linux Scheduling.

Text Books:

1. Jane W. S. Liu, Real Time Systems, – Pearson Education Publication.
2. J. J Labrosse, "MicroC/OS-II: The Real –Time Kernel", Newnes, 2002.
3. Peter Marwedel,Embedded System Design, Springer.
4. Marilyn Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.

Reference Books:

1. W. Richard Stevens, "Advanced Programming in the UNIX® Environment", 2nd Edition, Pearson Education India, 2011.
2. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wley& Sons, 2004
3. Doug Abbott, "Linux for Embedded and Real-Time Applications", Newnes, 2nd Edition, 2011.
4. Frank Vahid, Tony D. Givargis, Embedded System Design – A Unified Hardware/Software Introduction- John Wiley, 2002.

Course Title	SCIENTIFIC COMPUTING USING MATLAB				B. Tech. ECE Vll Sem		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
1804705	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To make students familiar with the concepts of programming and the get them accustomed with high-level languages like Matlab, Mathematica, etc.
- To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems
- To provide an overview of numerical and symbolic integration, differential equations and simulation.
- To provide an overview of initial value problems, two point boundary value problems, optimization and eigen value problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand various commands in MATLABS and algebraic equations using MATLAB
CO 2	Explain the programs for curve fitting and roots of equations
CO 3	Develop the programs for Numerical Differentiation and integration.
CO 4	List the various methods for initial value problem and two point boundary value problem
CO 5	Solve optimization and Eigen value problems

UNIT-I

Introduction to MATLAB: Introduction to MATLAB, Data Types and Variables, Arrays, Cells, Strings, Operators, Flow Control, Loops, Functions, Input/Output, Array Manipulation, Plotting.

Systems of Linear Algebraic Equations: Introduction, Gauss Elimination Method, LU Decomposition Methods, Symmetric and Banded Coefficient Matrices, Pivoting, Matrix Inversion, Iterative Methods-Gauss–Seidel Method, Conjugate Gradient Method.

UNIT -II

Interpolation and Curve Fitting: Introduction, Polynomial Interpolation-Lagrange's Method, Newton's Method, Neville's Method, Limitations of Polynomial Interpolation, Interpolation with Cubic Spline, Least-Squares Fit.

Roots of Equations: Introduction, Incremental Search Method, Method of Bisection, Brent's Method, Newton–Raphson Method, Systems of Equations, Zeros of Polynomials.

UNIT- III

Numerical Differentiation: Introduction, Finite Difference Approximations, Richardson Extrapolation, Derivatives by Interpolation.

Numerical Integration: Introduction, Newton–Cotes Formulas, Romberg Integration, Gaussian Integration, Multiple Integrals.

UNIT -IV

Initial Value Problems: Introduction, Taylor Series Method, Runge–Kutta Methods, Stability and Stiffness, Adaptive Runge–Kutta Method, Bulirsch–Stoer Method.

Two-Point Boundary Value Problems: Introduction, Shooting Method, Finite Difference Method.

UNIT -V

Symmetric Matrix Eigenvalue Problems: Introduction, Jacobi Method, Inverse Power and Power Methods, Householder Reduction to Tridiagonal Form, Eigenvalues of Symmetric Tridiagonal Matrices.

Introduction to Optimization : Introduction, Minimization Along a Line, Conjugate Gradient Methods.

Text Books:

1. Jaan Kiusalaas, "NUMERICAL METHODS IN ENGINEERING WITH MATLAB", Cambridge university press, 2005.
2. Stephen J. Chapman, "MATLAB Programming for Engineers", Thomson learning, 4th Edition.
3. Rajkumar bansal "Matlab and its applications in engineering"Pearson 2nd edition.
4. Ram.n.patel,Ankush Mittal "Programming in Matlab" Pearson 2nd edition.

Reference Books:

1. Ian Gladwell, Warren Ferguson Jr., James G. Nagy, "Introduction to Scientific Computing Using MATLAB", Lulu Publishing, 2011.
2. Alfio Quarteroni,Fausto Saleri, Paola Gervasio, "Scientific Computing with MATLAB and Octave", Springer International Publishing, 4 th edition, 2014.
3. Vasilios N. Katsikis "A Fundamental Tool for "Scientific Computing and Engineering Applications".
4. Gerald & Wheatley, "Applied Numerical Analysis" Pearson 7th Edition, 2003

Course Title	CMOS DESIGN					B. Tech. ECE VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1804706	PE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To provide rigorous foundation in MOS and CMOS digital circuits
- To train the students in transistor budgets, clock speeds and the growing challenges of power consumption and productivity

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Analyze the CMOS circuit and its use
CO 2	Estimate the circuit Performance
CO 3	Design Various CMOS logic design circuits
CO 4	Understand the design of a systems and its methods
CO 5	Design various subsystems

UNIT-I:

INTRODUCTION TO CMOS CIRCUITS

MOS Transistors, MOS Transistors switches, CMOS logic circuit and System representations, MOS Transistor theory – Introduction MOS device design equation, the complementary CMOS inverter – DC characteristics, Static Load MOS inverters, The differential inverter, The transmission gate, The Tri state inverter, Bipolar Devices**.**

UNIT-II:

CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION

Introduction, Resistance estimation, Capacitance estimation, Inductance estimation, Switching characteristics of CMOS gate Transistor, Sizing, Power Dissipation, Sizing Routing conductors, Charge sharing, Design Margining, Reliability.

UNIT-III:

CMOS CIRCUIT AND LOGIC DESIGN

CMOs Logic Gate design, Basic Physical Design of simple gate, CMOS Logic structures clocking strategies, i/o Structures, Low Power Design.

UNIT-IV

SYSTEMS DESIGN AND DESIGN METHOD

Design Strategies CMOS chip Design options, Design Methods, Design Capture Tools, Design Verification Tools, Design Economics, and Data Sheets. CMOS Testing – Manufacturing Test Principles, Design Strategies for Test, Chip level Test Techniques, System Level Test Techniques, and Layout Design for Improved Testability.

UNIT-V:

CMOS SUB SYSTEM DESIGN 1

Data path operations – Addition/Subtraction party generators, Comparators. Zero/one Detectors, Binary Counters, ALU's, Multiplication shifters, Memory Elements, Control FSM, Control Logic Implementation**.**

Text Books:

1. N.H.E.Weste&D. Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson, 2011.
2. J.Rabey& B. Nikolic, "Digital Integrated circuits", 2 ndEdition,Pearson, 2003.1
3.Douglas A. Pucknell& Kamran Eshraghian, Basic VLSI Design, PHI 3rd Edition (original Edition – 1994).
4. Kamran Eshraghian, EshraghianDougles and A. Pucknell, Essentials of VLSI circuits and systems,PHI, 2005 Edition

Reference Books:

1. P.E.Allen&D.R. Holberg, "CMOS Analog Circuit Design", 3rd Edition, Oxford University Press, 2011.
2. R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", 3rd Edition, Wiley, 2010
3. John M. Rabaey, Digital Integrated Circuits, PHI, EEE, 1997.
4.Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits - Analysis and Design, McGraw-Hill, Fourth Edition, 2014.

Course Title	ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY				B. Tech. ECE VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1804707	PE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To acquire knowledge of non linearloads.
- To acquire knowledge of different converter circuits used in powersystems
- To walk around the various applications and stability analysis in powersystems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand EMC regulation and methods of eliminating interferences.
CO 2	Explain about the methods of grounding of cable shield.
CO 3	Understand the concept of filtering and shielding.
CO 4	Explain about the types of digital circuit noises.
CO 5	Learning about electrostatic discharge and standards.

UNIT-I

INTRODUCTION: Sources of EMI, Conducted and radiated interference- Characteristics - Designing for electromagnetic compatibility (EMC)- EMC regulation- typical noise path- use of network theory- methods of eliminating interference.

UNIT-II

METHOD OF HARDENING: Cabling –capacitive coupling- inductive coupling- shielding to prevent magnetic radiation- shield transfer impedance, Grounding – safety grounds – signal grounds- single point and multipoint ground systems- hybrid grounds- functional ground layout –grounding of cable shields- ground loops-guard shields.

UNIT-III

BALANCING, FILTERING AND SHIELDING : Power supply decouples- decoupling filters- amplifier filtering –high frequency filtering shielding – near and far fields- shielding effectiveness- absorption and reflection loss, Shielding with magnetic material- conductive gaskets, windows and coatings- grounding of shields.

UNIT-IV

DIGITAL CIRCUIT NOISE AND LAYOUT: Frequency versus time domain- analog versus digital circuits- digital logic noise- internal noise sources- digital circuit ground noise –power distribution-noise voltage objectives- measuring noise voltages-unused inputs-logic families.

UNIT-V

ELECTROSTATIC DISCHARGE,STANDARDS AND LABORATORY TECHNIQUES:
Static Generation- human body model- static discharges-ED protection in equipment design- ESD versus EMC, Industrial and Government standards – FCC requirements – CISPR recommendations-Laboratory techniques- Measurement methods for field strength-EMI.

TEXT BOOKS:

1. Henry W.Ott, "Noise reduction techniques in electronic systems", John Wiley & Sons,1989.
2. Bernhard Keiser, "Principles of Electro-magnetic Compatibility", Artech House, Inc. (685 canton street, Norwood, MA 020062 USA)1987.
3. Matthew N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed., 2008.
4. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics," TMH, 7th ed., 2006

REFERENCE BOOKS:

1. Bridges,J.E Milleta J.and Ricketts.L.W.,"EMP Radiation and Protective techniques", John Wiley and sons, USA1976.
2. John D. Krauss, "Electromagnetic", McGraw- Hill publications, 3rd ed., 1988.
3. John D. Ryder, "Networks, Lines, and Fields," PHI publications, Second Edition, 2012.
4. Schaum's out – lines, "Electromagnetics,", Tata McGraw-Hill publications, Second Edition, 2006.

Course Title	RADAR AND SATELLITE COMMUNICATION				B. Tech. ECE Vll Sem		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
1804708	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- The goal of the course is to introduce students to the fundamentals of radar and satellite communication.
- To provide an understanding of the basic concepts, operation, and modern radar systems.
- To familiarize with basic concepts related to satellite Communication. Understand Sub-Systems of Satellites and Launches.
- To know about the parameters affecting the Satellite System Performance.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand about radar technology.
CO 2	Explain different types of radar.
CO 3	Develop the communication satellite mechanics.
CO 4	Compare Earth station technology and Satellite spacecraft.
CO 5	Analyze and evaluate various parameters to design the power budget for satellite links

UNIT-I

Introduction to Radar: Introduction to radar, Radar block diagram and operation, Radar frequencies, Applications of radar, Radar range equation, Prediction of range performance, Minimum detectable signal, Receiver noise, Probability density function, SNR, Integration of radar pulses, Radar cross-section of targets, PRF and range ambiguities,

UNIT -II

Radar Technology: Doppler Effect, CW radar, FM CW radar, Multiple frequency CW radar. MTI radar- Delay line canceller, Range gated doppler filters, Blind speeds, Staggered PRF, Tracking radar-sequential lobing, conical scan, Monopulse: amplitude comparison and phase comparison methods, Radar displays.

UNIT- III

Orbital aspects of Satellite Communication: Introduction to geo-synchronous and geo-stationary satellites, Kepler's laws, Locating the satellite with respect to the earth, Sub-satellite point, Look angles, Mechanics of launching a synchronous satellite, Orbital effects, Indian scenario in communication satellites

UNIT -IV

Spacecraft and Earth station: Satellite subsystems- Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Spacecraft antennas, and multiple access techniques, comparison of FDMA, TDMA, and CDMA. Earth station equipments, tracking systems

UNIT -V

Satellite link design: Introduction to satellite link design, basic transmission theory, system noise temperature and G/T ratio, design of downlink and uplink, design of satellite links for specified C/N

Text Books:

1. Merrill I.Skolnik, "Introduction to Radar Systems", 2nd edition-TMH 1980.
2. Pratt, John Wiley, "Satellite communications",3rd edition.
3. Robert M.Gagliardi, - satellite communication systems, CBS Publications
4. M. Kulkarni, Microwave and Radar Engineering, Umesh Publications, 1998

Reference Books:

1. Dennis Roddy, "Satellite Communications", 2nd Edition, 1996,
2. M Richharia "Satellite Communication System", CBS Publications
3. K. K Sharma "Introduction to Radar Systems", 3rd edition.
4. Mark A. Richards, James A. Scheer, William A. Holm, Principles of Modern Radar: Basic Principles –Yesdee, 2013

Course Title	COMPUTER SYSTEM ARCHITECTURE				B. Tech. ECE VII Sem		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
1804709	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To learn about the evolution of computer architecture and its performance measuring parameters.
- To provide knowledge about instruction sets of different processors.
- To teach multiprocessors system interconnections.
- To know the instruction pipeline designs.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand different parallel computer models
CO 2	Describe the advanced processor technologies
CO 3	Interpret memory hierarchy and mechanisms for enforcing cache coherence
CO 4	Compare different multiprocessor system interconnecting mechanisms
CO 5	Analyze different pipelining techniques

UNIT-I:

Introduction: Parallel computer models – Evolution of Computer Architecture, System Attributes to performance, Amdahl's law for a fixed workload. Multiprocessors and Multicomputers, Multi-vector and SIMD computers, Architectural development tracks, Conditions of parallelism.

UNIT-II:

Processors and memory hierarchy: Advanced processor technology- Design Space of processors, Instruction Set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar and vector processors, Memory hierarchy technology.

UNIT-III:

Multiprocessors system interconnects: Hierarchical bus systems, Cross bar switch and multi-port memory, Multistage and combining networks. Cache Coherence and Synchronization Mechanisms, Cache Coherence Problem, Snoopy Bus Protocol, Directory Based Protocol, Hardware Synchronization Problem

UNIT-IV

Message Passing Mechanisms: Message Routing schemes, Flow control Strategies, Multicast Routing Algorithms. Pipelining and Superscalar techniques – Linear Pipeline processors and Nonlinear pipeline processors

UNIT-V:

Instruction pipeline design: Arithmetic pipeline deign - Super Scalar Pipeline Design.Multithreaded and data flow architectures - Latency hiding techniques, Principles of multithreading - Multithreading Issues and Solutions, Multiple context Processors, Fine-grainMulticomputer- Fine-grain Parallelism. Dataflow and hybrid architecture

Text Books:

1. K. Hwang and Naresh Jotwani, Advanced Computer Architecture, Parallelism, Scalability, Programmability, TMH, 2010.
2. H P Hayes, "Computer Architecture and Organization", McGraw Hill, 1978.
3. K. Hwang & Briggs , "Computer Architecture and Parallel Processing", McGraw Hill International, 1986
4. M J Flynn, "Computer Architecture: Pipelined and Parallel Processor Design", Narosa Publishing House, 2012.

References:

1. M Sasikumar, D Shikkare and P Raviprakash, "Introduction to Parallel Processing", PHI, 2014.
2. P M Kogge, "The Architecture of Pipelined Computer", McGraw Hill, 1981.
3. P V S Rao , Computer System Architecture, PHI, 2009.
4. Patterson D. A. and Hennessy J. L., Morgan Kaufmann ,,Computer Organization and Design:The Hardware/Software Interface", Morgan Kaufmann Pub, 4/e, 2010.

Course Title	DIGITAL IMAGE AND VIDEO PROCESSING				B. Tech. ECE VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1804710	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To study the image fundamentals and transforms necessary for image processing
- To learn the concepts of filtering in spatial and frequency domain
- To study different image compression techniques
- To understand image segmentation algorithms and Object recognition.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define various image and video processing parameters
CO 2	Explain image filtering, segmentation, restoration and compression
CO 3	Compare different Color models, enhancement techniques, motion estimation and image restoration techniques
CO 4	Apply the concepts of image and video processing techniques in various applications.
CO 5	Analyze mathematical operations, coding, filtering and motion estimation methods in image and video processing.

UNIT-I:

Introduction: Fundamentals of Image Processing: Digital image fundamentals, Applications of image processing, Image Sampling and Quantization, relationship between pixels. Relationship between pixels - neighbours of a pixel, Adjacency, Connectivity, Regions and boundaries, distance measures, Mathematical tools in digital image processing – Array versus matrix operations, Linear and Nonlinear Operations, Arithmetic operations, geometrical spatial transformations and image registration.
Color Images,Color models–RGB, CMYK, HSI;

UNIT-II:

Image Enhancement: Spatial domain methods: Point processing, Histogram processing, Fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters.

Frequency domain methods: Basics of filtering in frequency domain, General approach for operating in the linear transform domain, 2-D DFT and Properties, image smoothing, image sharpening, Homomorphic filtering, LOG filters.

UNIT-III:

Image Compression: Redundancies in images, Fidelity criteria, Image compression models, Error free compression – Variable length coding, Huffman coding, Arithmetic coding, LZW coding, Bit-plane coding, loss less and lossy predictive coding, Discrete cosine Transform, Transform coding, Image Compression standards.

UNIT-IV

Image Restoration: Degradation model, Noise models, Restoration in the presence of noise only – spatial filtering, Periodic noise reduction by frequency domain filtering, Linear position-Invariant degradation, Inverse filtering, least mean square (Wiener) filters, Constrained Least Squares filtering.

Image Segmentation: Point, Line and Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation – Region growing, Region splitting and merging.

UNIT-V

Video Processing: Definition of video signal, Analog and digital video, Spatial and temporal sampling, Video formats, Frame types, Video subsampling, Video compression, Motion estimation algorithms – Gradient techniques, Pel – recursive techniques, Block Matching Techniques, Search algorithms for Block Matching in motion estimation – Full search algorithm, Three step search algorithm.

Text Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008.
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004.
3. Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing, Tata McGraw Hill Education, 2011.
4. Somka,Hlavac Boyle,"Digital image Processing and computer vision"Cengage learning (Indian edition,2008)

Reference Books:

1. Scotte Umbaugh, Digital Image Processing and Analysis - Human and Computer Vision Application with CVIP Tools –2nd Ed, CRC Press, 2011.
2. M. Tekalp , Digital Video Processing – Prentice Hall International
3. Ed. Al Bovik ,"Handbook of Image and Video Processing", 2nd Edition, Academic Press, 2000.
4. Vipula Singh, Digital Image Processing with MATLAB and LabView, Elsevier.

Course Title	DIGITAL IC DESIGN					B. Tech. ECE VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1804711	PE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives

- To understand the basics of MOS Design.
- To understand the basics of Combinational MOS Logic Circuits and the basics of Sequential MOS Logic Circuits.
- To understand concepts of different interconnection techniques.
- To describe concepts of Semiconductor memories and RAM array Organization.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basics of MOS Design
CO 2	Understand the basics of Combinational MOS Logic Circuits and the basics of Sequential MOS Logic Circuits
CO 3	Analyze concepts digital integrated circuits and its applications
CO 4	Understand concepts of different interconnection techniques
CO 5	Describe concepts of Semiconductor memories and RAM array Organization

UNIT-I:

MOS Design: Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT-II:

Combinational MOS Logic Circuits: MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates, AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates, Multiplers.

UNIT-III:

Sequential MOS Logic Circuits: Behaviour of bi stable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

UNIT-IV:

Dynamic Logic Circuits: Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits. Interconnect:Capacitive Parasitics, Resistive Parasitics, InductiveParasitics, Advanced Interconncet Techniques, clock distribution networks , clock delays, clock skew and Jitter.

UNIT-V:

Flash Memory, RAM array organization. Semiconductor Memories: Memory Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory-NOR flash and NAND flash.

Text Books:

1. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Ed., PHI.
2. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.
3. Modern VLSI Design-Wayne Wolf, fourth edition, copyrights 2009.
4. J.Rabey& B. Nikolic, "Digital Integrated circuits", 2 ndEdition,Pearson, 2003

Reference Books:

1. P.E.Allen&D.R. Holberg, "CMOS Analog Circuit Design", 3rd Edition, Oxford University Press, 2011.
2. R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", 3rd Edition, Wiley, 2010
3. John M. Rabaey, Digital Integrated Circuits, PHI, EEE, 1997.
4. Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits - Analysis and Design, McGraw-Hill, Fourth Edition, 2014.

Course Title	COGNITIVE RADIO				B. Tech. ECE VII Sem			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1804712	PE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- Providehighlyreliablecommunicationswheneverandwhereverneededandtoutilizetheradios pectrumefficientlybyintelligently exploiting licensed spectrum.
- Toobtainusefulinformationabouttheirsurroundingenvironmentwiththeprimaryusersandthe appearanceof spectrum holes.
- To maximize probability of detection, throughput and false alarm and to minimize sensing time.
- To find the optimal path from the source of data to its destination and to improve the throughput and QOS metrics.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basics of SDR and how it evolves from Software Defined Radio to Cognitive Radio.
CO 2	Interpret the basics of various spectrum sensing techniques and Algorithms
CO 3	Recognize the concepts of cooperative spectrum sensing and handoff process
CO 4	Understand the functions of MAC layer and Network layer and its various protocols
CO 5	Interpret the basics of security management and the various attacks &its counter measures.

UNIT I

Introduction to Cognitive Radio

Introduction –Software Defined Radio: Architecture–Digital Signal Processor and SDR Baseband architecture – Reconfigurable Wireless Communication Systems – Digital Radio Processing –Cognitive Radio: Cognitive radio Framework – Functions – Paradigms of Cognitive Radio

UNIT II

Spectrum Sensing

Introduction –Spectrum Sensing – Multiband Spectrum Sensing – Sensing Techniques – Other algorithms– Comparison – Performance Measure & Design Trade-Offs : Receiver operating characteristics – Throughput Performance measure –Fundamental limits and trade-offs.

UNIT III

Cooperative Spectrum Acquisition

Basics of cooperative spectrum sensing–Examples of spectrum acquisition techniques – cooperative transmission techniques – sensing strategies– Acquisition in the Presence of Interference: Chase- combining HARQ –Regenerative cooperative Diversity– spectrum overlay– spectrum handoff

UNIT IV

MAC Protocols and Network Layer Design

Functionality of MAC protocol in spectrum access –classification –Interframe spacing and MAC challenges– QOS – Spectrum sharing in CRAHN –CRAHN models – CSMA/CA based MAC protocols for CRAHN – Routing in CRN– Centralized and Distributed protocols – Geographical Protocol

UNIT V

Trusted Cognitive Radio Networks

Trust for CRN :Fundamentals – Models – Effects of Trust Management –Security properties in CRN –Route Disruption attacks –Jamming attacks –PU Emulation attacks

TextBooks

1. Mohamed Ibnkahla, "Cooperative Cognitive RadioNetworks: The completeSpectrum Cycle,"Iedition.
2. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer, 2009
3. Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge, 2009
4. Linda E. Doyle," Essentials of Cognitive Radio", Cambridge, 2009

References

1. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009
2. Alexander Maziar Nekovee, Thomas Hou, "Cognitive Radio Communications and Networks," 2010, Elsevier
3. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.
4. Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.

Course Title	WIRELESS COMMUNICATION				B. Tech. ECE VIII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1804802	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	0	0	2	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To understand the design of a Wireless Communication system Concepts.
- To understand Broadband Wireless Channel Modeling, fundamentals of UWB.
- To study the various digital signaling techniques and Cellular mobile communication.
- To understand the concepts of OFDM and MIMO.
- To understand the multiple Access techniques and architecture for different Wireless Systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand 3G/4G Standards, Diversity, Cellular Communication. OFDM, MIMO OFDM.
CO 2	Apply basic principles to compute BER, Codes for CDMA and channel capacity.
CO 3	Analyze the characteristics of various Wireless Communication channels, Various channel models,
CO 4	Compare various channel characteristics, Multiple access schemes, various receivers and 3G/4G standards.
CO 5	Design Channel models, Receivers and MIMO Diversity

UNIT-I

Wireless Communications and Diversity: Introduction to 3G/4G Standards, Wireless Channel and Fading, Rayleigh Fading and BER of Wired Communication, BER for Wireless Communication, Introduction to Diversity, Multi-antenna Maximal Ratio Combiner, BER with Diversity, Spatial Diversity and Diversity Order,

UNIT-II

Broadband Wireless Channel Modeling: Wireless Channel and Delay Spread, Coherence Bandwidth of the Wireless Channel, ISI and Doppler in Wireless Communications.

UWB (Ultra wide Band): UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit-Error Rate Performance of UWB.

UNIT-III

Cellular Communication: Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes - Call Setup, Handover etc., Telegraphic Theory.

CDMA: Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization.

UNIT-IV

OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues.

MIMO: Introduction to MIMO, MIMO Channel Capacity, SVD and Eigen modes of the, MIMO Channel , MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT, MIMO OFDM.

UNIT-V

3G and 4G Wireless Standards- GSM, GPRS, WCDMA, LTE, WiMAX

Text Books:

1. Aditya K. Jagannatham, "Principles of Modern Wireless Communication Systems", Publisher McGraw Hill..
2. William C. Y. Lee, "Mobile Communications Engineering", Mc Graw Hill Publications
3. Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London, 1997.
4. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.

References:

1. Theodore Rapp port, " Wireless Communications: Principles and Practice", Prentice Hall.
2. Ezio Biglieri, "MIMO Wireless Communications", Cambridge University Press.
3. David Tse and Pramod Viswanath, " Fundamentals of Wireless Communications", Publisher Cambridge University Press.
4. Andrea Goldsmith, "Wireless Communications", Cambridge University Press.

Course Title	SOC ARCHITECTURE				B. Tech. ECE VIII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1804803	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	0	--	2	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

The students will be able to

- Understand the components of system, hardware and software.
- Know the basic concepts of processor architecture and instructions.
- Describe external and internal memory of SOC & Bus models.
- Understand SOC customization and reconfiguration technologies.
- Explain SOC design approach.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Memorize the system architecture, components of system hardware and software.
CO 2	Know the basic concepts of processor architecture and instructions and delays
CO 3	Describe memory & bus models of SOC.
CO 4	Know SOC customization and reconfiguration technologies.
CO 5	Apply the knowledge of SOC design in real time applications.

UNIT-I:

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, an approach for SOC Design, System Architecture and Complexity.

UNIT-II:

Processors: Introduction , Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT-III:

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation , SOC Memory System, Models of Simple Processor – memory interaction.

Interconnect: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses , Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time.

UNIT-IV

SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance Specific design, Customizable Soft Processor, Reconfiguration – overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT-V:

Application Studies / Case Studies: SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

Text Books:

1. Hubert Kaeslin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication", Cambridge University Press, 2008.
2. B. Al Hashimi, "System on chip-Next generation electronics", The IET, 2006
3. Rochit Rajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center,2000
4. P Mishra and N Dutt, "Processor Description Languages", Morgan Kaufmann, 2008

References:

1. Michael J. Flynn and Wayne Luk, "Computer System Design: System-on-Chip". Wiley,2011
2. Richard S. Sandige, "Modern Digital Design", MGH, International Editions, 1990
3. Charles H. Roth, "Fundamentals of Logic Design", 5th Edition. Cengage Learning, 2010.
4. B. Al Hashimi, "System on chip-Next generation electronics", The IET, 2006

Course Title	SPEECH PROCESSING				B. Tech. ECE VIII Sem		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
1804804	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	0	--	2	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To study the basic principles of speech production and modelling
- To study the time domain and frequency domain processing of speech.
- To compute the LPC coefficients for speech modelling
- To study the concepts of speech recognition, speaker verification and identification system.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define speech parameters such as pitch, formant, silence, etc.
CO 2	Describe Speech Production Mechanism, feature extraction techniques in time and frequency domain
CO 3	Apply LPC coefficients for Pitch, Formant detection and extraction of coefficients in speech and speaker identification and verification
CO 4	Analyze and determine feature extraction parameters in time and frequency domain

UNIT-I:

Fundamentals of Digital Speech Processing: Fundamentals of Digital Speech Processing: Process of speech production – Mechanisms of speech production, Acoustic phonetics, the acoustic theory of speech production – Sound propagation, Effects of losses in the vocal tract, Effects of radiation at the lips. Vocal tract transfer functions for vowels, the effect of nasal coupling, Excitation of sounds in the vocal tract, Models based upon the acoustic theory, Digital models for speech signal – Vocal tract, Radiation, Excitation, The complete model

UNIT-II:

Time Domain Methods for Speech Processing: Time Domain Methods for Speech Processing: Time dependent processing of speech, Short time energy and Average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using energy and zero crossings, Pitch period estimation using a parallel processing approach, The short time auto correlation function, The short time average magnitude difference equation, Pitch period estimation using autocorrelation function

UNIT-III:

Frequency Domain Methods for Speech Processing: Short time Fourier analysis, Definitions and properties, Design of digital filter banks, Fiter bank design using using IIR filters, Filter bank design using FIR filters, Implementation of the filter bank summation method using the fast Fourier transform, Pitch Detection.

UNIT-IV:

Linear predictive Coding (LPC) for Speech: Basic principles of linear predictive analysis, Computation of the gain for the model, Solution of the LPC equations- Cholesky decomposition solution for the covariance method. Durbins recursive solution for the autocorrelation equations, Comparison between the methods of solution of the LPC analysis equations, Frequency domain interpretation of Linear predictive analysis.

UNIT-V:

Voice response systems – General considerations in the design of voice response system, A multiple output digital voice response system, Speech synthesis by concatenation of formant coded words, typical applications of computer voice response systems,

Speaker recognition systems – speaker verification systems, speaker identification systems, Speech recognition systems – Isolated digit recognition system, Continuous digit recognition system, LPC distance measures.

Text Books:

1. L.R. Rabiner and S. W. Schafer, Digital Processing of Speech Signals, Pearson Education.
2. Douglas O' Shaughnessy, Speech Communications: Human & Machine, 2nd Ed., Wiley-IEEE Press.
3. Lawrence Rabiner and Biing-Hwang Juang, ―Fundamentals of Speech Recognition‖, Pearson Education, 2003.
4. Daniel Jurafsky and James H Martin, ―Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition‖, Pearson Education, 2002.

Reference Books:

1. 1. Thomas F. Quatieri, Discrete Time Speech Signal Processing: Principles and Practice, 1st Ed., Pearson Education.
2. Ben Gold & Nelson Morgan, Speech and Audio Signal Processing: Processing and Perception of Speech and Music , 1st Ed., Wiley.
3. T. Dutoit, F. Marqués, L.R. Rabiner, Applied signal processing: a MATLAB-based Proof of Concept, Springer
4. Douglas O'Shaughnessy, "Speech Communications: Human & Machine," 2nd Ed., IEEE Press.

Course Title	LOW POWER VLSI DESIGN				B. Tech. ECE VIII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
1804805	PE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	0	--	2	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To study the concepts of device behavior and modeling
- To study the concepts of low voltage, low power logic circuits.
- To identify the power dissipation mechanisms in various MOS logic styles
- To familiarize suitable techniques to reduce power dissipation, power optimization and power estimation.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand leakage sources and reduction techniques.
CO 2	Characterize and model power consumption & understand the basic analysis methods.
CO 3	Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.

UNIT-I:

Technology & Circuit Design Levels: Sources of power dissipation in digital ICs, degree of freedom, recurring themes in low-power, emerging low power approaches, dynamic dissipation in CMOS, effects of Vdd & Vt on speed, constraints on Vt reduction, transistor sizing & optimal gate oxide thickness, impact of technology scaling, technology innovations.

UNIT-II:

Low Power Circuit Techniques: Power consumption in circuits, flip-flops & latches, high capacitance nodes, energy recovery, reversible pipelines, high performance approaches.

UNIT-III:

Low Power Clock Distribution: Power dissipation in clock distribution, single driverVersus distributed buffers, buffers & device sizing under process variations, zero skew Vs.Tolerable skew, chip & package co-design of clock network.

UNIT-IV

Logic Synthesis for Low Power estimation techniques: Power minimization techniques, low power arithmetic components- circuit design styles, adders, multipliers.

UNIT-V:

Low Power Memory Design: Sources & reduction of power dissipation in memory subsystem, sources of power dissipation in DRAM & SRAM, low power DRAM circuits, low power SRAM circuits.

Text Books:

1. P. Rashinkar, Paterson and L. Singh, “Low Power Design Methodologies”, KluwerAcademic, 2002
2. Kaushik Roy, Sharat Prasad, “Low power CMOS VLSI circuit design”, John WileysonsInc.,2000.
3. J.B.Kulo and J.H Lou, “Low voltage CMOS VLSI Circuits”, Wiley, 1999.
4. Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits –Analysis and Design, TMH,2011.

References:

1. A. P. Chandrasekaran and R. W. Broadersen, “Low power digital CMOS design”, Kluwer,1995
2. Gary Yeap, “Practical low power digital VLSI design”, Kluwer, 1998.
3. Kiat-Seng Yeo, Kaushik Roy, “Low-Voltage, Low-Power VLSI Subsystems”, TMH Professional Engineering.
4. Ming-BO Lin, “Introduction to VLSI Systems: A Logic, Circuit and System Perspective” CRC Press,2011

Course Title	RF SYSTEM DESIGN				B. Tech. ECE VllI Sem		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
1804806	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	0	--	2	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To learn the importance and issues in the design of RF
- To design RF filter and RF amplifier
- To study about the characteristics of oscillators, mixers, PLL, wireless synthesizers and detector

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand different RF Components such as Passive components, Microstrip Transmission Line.
CO 2	Design RF Amplifiers-High gain, Low gain Minimum Noise Amplifiers.
CO 3	Design of RF Oscillators.
CO 4	Design of RF Converters, Mixers.
CO 5	Design of Matching networks for RF Circuits.

UNIT-I

RF systems: basic architectures, Transmission media and reflections, Maximum power transfer, Passive RLC Networks - Parallel RLC tank, Q, Series RLC networks, matching, Pi match, T match, Passive IC Components, Interconnects and skin Effect, Resistors, capacitors, Inductors

UNIT -II

Review of MOS devices: Distributed Systems- transmission lines, reflection coefficient, The wave equation, examples, Lossy transmission lines, Smith charts – plotting gammaTime Domain Methods for Speech Processing: Time domain parameters of speech, methods for extracting the parameters: Zero crossings, Auto-correlation function, pitch estimation. Analysis and Synthesis of Pole-Zero Speech Models

UNIT- III

High Frequency Amplifier Design: Bandwidth estimation using open-circuit time constants, Bandwidth estimation using short-circuit time constants, Rise time, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers, Cascaded amplifiers. Noise- Thermal noise, flicker noise review, Noise figure, LNA Design - Intrinsic MOS noise Parametes, Power match versus noise match, Large signal performance, design examples & Multiplier based mixers. Mixer Design – Sub sampling mixers.

UNIT -IV

RF Power Amplifiers: Class A, AB, B, C Amplifiers, Class D, E, F amplifiers, RF Power amplifier design examples. Voltage controlled oscillators – Resonators, Negative resistance Oscillators.

UNIT –V

Phase locked Loop: Linearized PLL models, Phase detectors, charge Pumps, Loop filters, PLL design Examples. Frequency synthesis and oscillators - Frequency division, integer-N synthesis, Fractional frequency synthesis. Phase noise - General considerations, Circuit examples. Radio architectures - GSM radio architectures, CDMA, UMTS radio architectures

Text Books:

1. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2004.
2. Behzad Razavi, "RF Microelectronics", Prentice Hall, 1997.
3. Reinhold Ludwig, Pavel Bsetchko, "RF Circuit Design — Theory and Applications," Pearson Education India, 2000.
4. Devendra K.Misra, "Radio Frequency and Microwave Communication Circuits," Analysis and Design, Wiley Student Edition, John Wiley & Sons, Inc.

Reference Books:

1. Ellinger, Frank, **"**Radio Frequency Integrated Circuits and Technologies", Springer, 2008.
2. Matthew M. Radmanesh, "Radio Frequency and Microwave Electronics," PEI.
3. Cam Nguyen, "Radio-Frequency Integrated-Circuit Engineering",John Wiley & Sons, 2015.
4. Christopher Bowick, Cheryl Aljuni and John Biyler, "RF Circuit Design," Elsevier Science, 2008.

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Open Electives

S. No.	Subject code	Subject	L	T	P	IM	EM	Credits
1	18OE401	Overview of Microcontrollers	3	0	0	30	70	3
2	18OE402	Industrial electronics	3	0	0	30	70	3
3	18OE403	Introduction to VLSI	3	0	0	30	70	3
4	18OE404	Principles of Communication Systems	3	0	0	30	70	3
5	18OE405	Electronic Instrumentation and measurements	3	0	0	30	70	3
6	18OE406	Introduction to IOT	3	0	0	30	70	3
7	18OE407	Nano Electronics	3	0	0	30	70	3
8	18OE408	Fundamentals of RADAR Engineering.	3	0	0	30	70	3

Course Title	OVERVIEW OF MICROCONTROLLERS				B. Tech. ECE VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
18OE401	**OE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To become familiar with 8051, MSP 430, PIC and ARM controllers.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	**Understand** the types of Microcontrollers.
CO 2	**Define** various components and list out various features of microcontrollers.
CO 3	**Describe** the various blocks of 8051, MSP 430, PIC and ARM microcontrollers

UNIT I

Introduction: Microcontrollers, Vonneumann Vs Harvard, CISC vs RISC, Types of Microcontrollers, Examples of Microcontrollers, Selection of a microcontroller, Microcontroller resources, Applications.

UNIT II

The 8051 Architecture: Introduction, architecture of 8051, pin diagram, internal RAM memory organization, Special Function Registers, external memory interfacing-ROM & RAM, stack, timers and interrupts.

UNIT III

MSP 430 Microcontroller: The Outside View—Pin-Out, The Inside View—Functional Block Diagram, Memory, Central Processing Unit, Memory-Mapped Input and Output, Clock Generator, Exceptions: Interrupts and Resets.

UNIT IV

PIC Microcontrollers: Overview and Features, Architecture Details of PIC 16C6X/7X, I/O Ports, Interrupts, Timer, ADC, Features of 16F8XX series.

UNIT V

ARM Architecture: RISC Design philosophy, ARM Design philosophy, Registers, Program Status Register, Instruction pipeline, Interrupts and vector table.

Text Books:

1. Raj Kamal, "Microcontrollers- Architecture, Programming, Interfacing and System Design"- Second Edition, Pearson, 2012.
2. John H Davis, "MSP 430 Microcontroller Basics", Newnes publishers, 2008.
3. Andrew N.Sloss, Dominic Symes, Chris Wright "ARM System Developer's Guide-Designing and Optimizing system software", Elsevier, 2008.
4. Ajay V Deshmukh, "Microcontrollers: Theory and Applications", TMH, 2005.

Reference Books:

1. Mazidi Muhammad Ali, Mazidi Janice Gillespie &McKinlayRolin D, The 8051Microcontroller and Embedded Systems, 2nd Edition, Pearson Education, 2008.
2. Design with PIC Microcontrollers – John B. Peatman, Pearson Education, 2005.
3. PIC User MANUAL
4. ARM User MANUAL.

Course Title	INDUSTRIAL ELECTRONICS				B. Tech. ECE VI Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
18OE402	OE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To understand working of semiconductor devices.
- To gain the knowledge of AC to DC, AC to AC and DC to DC converters.

Course Outcomes :Upon successful completion of the course, students will be able to

CO 1	**Understand** the basics of Power Electronics.
CO 2	**Learn** the details of power semiconductor switches (Construction, Characteristics and operation)
CO 3	**Understand** the working of various types of converters.
CO 4	**Learn** how to analyze the converters and design the components of them, under various load types.
CO 5	**Learn** about the control of various converters

UNIT-I

Power Semiconductor devices: Constructional features, Operating Principle, Characteristics and specification of power semiconductor diode, Power Bipolar Junction transistor (BJT), Thyristors and Triacs, Gate Turn off Thyristors (GTO), Metal oxide semiconductor field effect transistor (MOSFET), Insulate Gate Bipolar transistor (IGBT), Hard and soft switching of Power semiconductors.

UNIT-II

AC to DC Convertors: Single Phase uncontrolled rectifier, Single Phase fully controlled rectifier, single phase half controlled bridge rectifier, Operation and analysis of three phase fully controlled bridge converter, Operation and analysis of three phase half controlled converter, Effect of source Inductance on the performance of AC to DC converters, Power factor improvement, Harmonic reduction, filter.

UNIT-III

DC to DC Converters: Types of basic DC-DC converters, Analysis of Buck converter (DC-DC) circuit, Commutation of thyristor based circuits, Introduction to switched mode power supply (SMPS) circuits, Fly-back type switched mode power supply, Forward type switched mode power supply, Design of transformer for switched mode power supply circuits.

UNIT-IV

AC to AC Voltage converter: Three phase AC regulators, Phase angle control in Traic based single Phase AC regulators, Introduction to cyclo converters, three phases to single phase cyclo converters, three phase to three phase cyclo converters, Control circuit for three phase to three phase converter.

UNIT-V

Introduction to voltage source Inverters, Analysis of 1-Phase square wave voltage source Inverter, 3-Phase voltage source with square wave output. 3-phase pulse width modulated inverter. Sine PWM and its realization, current source Inverter, Load commutated current source inverter.

Text Books:

1. M. D. Singh and K. B. Khanchandani," Power Electronics".
2. Ned Mohan, Tore M. Undeland, and William P. Robbins,"Power Electronics: Converters, Applications And Design, Media Enhanced (With CD)".
3. John G. Kassakian, Martin F. Schlecht, and George C. Verghese,"Principles Of Power Electronics".
4. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc,1991

Reference Books:

1. G. K. Mithal, Maneesha Gupta, "Industrial and Power Electronics", Khanna Publishers,1987.
2. George M. Chute, R. D. Chute, "Electronics in Industry", McGraw-Hill School Pub Co, 5th Edition,
3. A.Anand Kumar, "Pulse and Digital Circuits", PHI, 2005
4. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education

Course Title	INTRODUCTION TO VLSI				B. Tech. ECE VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
18OE403	OE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To introduce the concepts of IC fabrication technologies.
- To understand scaling techniques of CMOS devices and their effects.
- To study the methods to design the basic Gate level designs and draws their corresponding Layouts.
- To provide basic idea of Subsystem design, PLDs and CMOS testing.

Course Outcomes :Upon successful completion of the course, students will be able to

CO 1	**Understand** the operation of a MOS transistor down to the physical level.
CO 2	**Implement** various logic gates and circuits using MOS transistors.
CO 3	**Analyze** PLD and FPGA families for logic design.
CO 4	**Analyze** various CMOS testing schemes.

UNIT-I

Introduction to VLSI: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies- Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation.

UNIT-II

Basic Electrical Properties: Basic Electrical Properties of MOS Circuits: Ids Vs Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit, Pass transistor, NMOS Inverter, CMOS Inverter analysis and Bi-CMOS Inverters.

UNIT-III

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2μ CMOS Design rules for wires, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT-IV

Subsystem Design: Basic circuit concepts: Sheet resistance, area capacitance and delay calculation,Subsystem Design, Shifters, Adders, ALUs, Multipliers, High Density Memory Elements.

UNIT-V

Semiconductor IC Design and CMOS testing: PLAs, FPGAs, CPLDs, Standard Cells, ach. CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Layout Design for improved Testability.

Text Books:

1. Kamran Eshraghian, EshraghianDougles and A. Pucknell, Essentials of VLSI circuits and systems,PHI, 2005 Edition.
2. Weste and Eshraghian, Principles of CMOS VLSI Design, Pearson Education, 1999.

3. Douglas A. Pucknell& Kamran Eshraghian, Basic VLSI Design, PHI 3rd Edition (original Edition – 1994).
4. Neil H.E. Weste, David Harris, Ayan Banerjee, CMOS VLSI Design- A Circuits and Systems Perspective, 3rd Edition, Pearson Education.

Reference Books:

1. John .P. Uyemura, Introduction to VLSI Circuits and Systems, JohnWiley, 2003.
2. John M. Rabaey, Digital Integrated Circuits, PHI, EEE, 1997.
3. Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits - Analysis and Design, McGraw-Hill, Fourth Edition, 2014.
4. Wayne Wolf, Pearson Education, Modern VLSI Design, 3rd Edition, 1997.
   S.M. SZE, VLSI Technology, 2nd Edition, TMH, 2003.

Course Title	PRINCIPLES OF COMMUNICATION SYSTEMS				B. Tech. ECE VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
18OE404	**OE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To understand the Basics of Telecommunication Engineering.
- To introduce the Elements of Telecommunication systems.
- To provide Knowledge about various communication systems

Course Outcomes :Upon successful completion of the course, students will be able to

CO 1	**Understand** the fundamental concepts of Telecommunication Engineering.
CO 2	**Understand** use of different modulation techniques used in Analog and Digital Communication
CO 3	**Understand** different Telecommunication systems like Satellite communication, Optical Fiber communication, Wireless communication, Mobile communication etc. and its applications.
CO 4	**Compare** and contrast advantages and limitations of various Telecommunication systems.

UNIT I

Basics of Telecommunication Engineering:

Definition of Telecommunication, Examples of telecommunications and evolution, various types of telecommunication systems such as telephone network, Radio broadcasting system, Computer networks, Internet.

UNIT I

Basic Elements of Telecommunication systems:

General Block schematic of communication system, Communication channels, Analog versus digital communication systems, Need of modulation, Types of analog modulation such as AM and FM, Types of digital modulation such as Pulse code modulation, delta modulation, Continuous wave modulation such as ASK, FSK, PSK.

UNIT III

Introduction to Optical Fiber Communication:

Use of optical fiber in communication, Principle and working of OFC system, Block diagram, Types of optical fibers, various elements required in designing OFC system, Applications such as long distance transmission links, Computer communication networks.

UNIT IV

Introduction to Satellite Communication:

Use of satellite in telecommunications, Launching of Satellite from earth station, Types of satellite orbits, Classification of satellite according to applications, Satellite communication link block diagram.

UNIT V

Some concepts in Wireless communications:

Wireless Standards: Overview of 2G and 3G, 4G cellular standards, Multiple access schemes-FDMA, TDMA, CDMA and OFDM, Modulation schemes- BPSK, QPSK. GSM, Wi-Fi & Wi-Max, Bluetooth, Recent Trends/Developments.

Text Books:

1) Simon Haykin,"Communication Systems", 4th Edition, John WileyPublication.
2) George Kenndey, " Electronics Communication systems", 4thEdition
3) John G. Proakis," Digital Communication", Tata McGrawHill
4) T . Prat, C.W. Bostian," Satellite Communication", WileyPublication

Reference Books:

1. S. Rappaport," Wireless communication – Principles and Practice", PearsonEducation.
2. John M. Senior,"Optical Fiber Communication Principles and Practice", PearsonEducation.
3. Taub and Schilling, "Principles of communication Systems", Mc Grace Hill, ISE,1971.
4. Dennis Roddy and John Coolen, "Electronic communications" Prentice-Hall of India Private Limited, 1981.

Course Title	ELECTRONIC INSTRUMENTATION AND MEASUREMENTS				B. Tech. ECE VII Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
18OE405	**OE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To study Performance characteristics of Instruments.
- To understand the principles in Analog and Digital Instruments.
- To understand the working of CROs, Transducers and bridges.

Course Outcomes :Upon successful completion of the course, students will be able to

CO 1	**Understand** the performance characteristics of an instrument.
CO 2	**Understand** the principle of analog, digital voltmeters and wave analyzers
CO 3	**Explain** different types of oscilloscopes
CO 4	**Use** AC and DC bridges for relevant parameter measurement.
CO 5	**Apply** the complete knowledge of various electronic transducers to measure the physical Quantities in the field of science and technology

UNIT I

Performance characteristics of Instruments : Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics- speed of response, Fidelity, Lag and Dynamic error.

Analog Instruments: Transistor Voltmeter, Micro Voltmeter (Chopper type) – DC Differential voltmeter – AC voltmeters – Multi meter -wave analyzers (AF & RF) – Harmonic distortion analyzer- Spectrum analyzer.

UNIT II

Digital Instruments: Digital Voltmeters (Ramp, Dual slope, stair case, successive approximation types) Digital multi meter, Universal counter, Digital tachometer, Digital Phase meter.

UNIT III

Cathode Ray Oscilloscopes: Motion of electron in electronic field and in magnetic field- Block diagram of CRO, CRT, Electrostatic deflection sensitivity – Vertical and Horizontal deflection systems – Principle of operation of dual beam, dual trace, sampling and storage CRO's- Measurements with CRO (Voltage, Current, time, frequency, Phase angle, lissajous figures).

UNIT IV

Bridges: Wheat stone bridge, Kelvin Bridge, Measurement of inductance- Maxwell's bridge, Anderson Bridge. Measurement of capacitance-Schearing Bridge, Wien Bridge Errors and precautions in using bridges- Q meter and measurement methods.

UNIT V

Transducers: Active & passive transducers**,** Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors. Measurement of physical parameters force, pressure, velocity, humidity, moisture, speed, proximity and displacement.Data acquisition systems.

Text Books:

1. H.S. Kalsi, Electronic instrumentation, second edition - Tata McGraw Hill, 2004.
2. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques –PHI, 5th Edition, 2002.
3. A.K. Sawhney, "A Course In Electrical And Electronic Measurements And Instrumentation", DhanpatRai Publications, 2012.
4. Golding, E.W. and Widdis, F.C., Electrical Measurements and Measuring Instruments, A.H.Wheeler and Co, 5th Edition, 2011.

References:

1. David A. Bell, Electronic Instrumentation & Measurements - PHI (OUP), 2nd Edition, 2003.
2. Robert A.Witte, Electronic Test Instruments, Analog and Digital Measurements - Pearson Education, 2nd Ed., 2004.
3. K. Lal Kishore,Electronic Measurements & Instrumentations, Pearson Education – 2005.
4. Ernest.O.Doebelin and Dhanesh.N.Manik, Doebelin's Measurement Systems, McGraw Hill Education, 6th Edition, 2011.

Course Title	INTRODUCTION TO IOT				B. Tech. ECE VII Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
18OE406	OE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To understand the basics of IOT.
- To study the Programming Using Arduino.
- To provide the knowledge about sensors and transducers.

Course Outcomes :Upon successful completion of the course, students will be able to

CO 1	**Understand** about IoT, its Architecture and its Applications, basic electronics used in IoT & its role.
CO 2	**Develop** applications with C using Arduino IDE.
CO 3	**Analyze** about sensors and actuators.
CO 4	**Design** IoT in real time applications using today's internet & wireless technologies.

UNIT I

INTRODUCTION: Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications Applications of IoT – Industrial IoT – Security in IoT.

UNIT II

BASIC ELECTRONICS FOR IoT: Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.

UNIT III

PROGRAMMING USING ARDUINO: Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.

UNIT IV

SENSORS AND ACTUATORS: Analog and Digital Sensors – Interfacing temperature sensor, ultrasound sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.

UNIT V

SENSOR DATA IN INTERNET: Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (ThingSpeak).

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-On Approach”, 2014. ISBN: 978-0996025515.
2. Boris Adryan, Dominik Obermaier, Paul Fremantle, “The Technical Foundations of IoT”, Artech Houser Publishers, 2017.
3. Michael Margolis, “Arduino Cookbook”, O‟Reilly, 2011.
4.. Marco Schwartz, “Internet of Things with ESP8266”, Packt Publishing, 2016

Reference Books:

1. Jan Axelson by Embedded Ethernet And Internet Complete (Designing and Programming Small Devices for Networking)
2. Jean-Philippe Vasseur,Adam Dunkels, Morgan Kuffmann. “Interconnecting Smart Objects with IP”
3. Samuel greengard by “ internet of things”
4. David E. Simon, An Embedded Software Primer- Pearson Ed. 2005

Course Title	NANO ELECTRONICS				B. Tech. ECE VIII Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
18OE407	OE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To understand the principles of tunneling, lithography and scaling of physical systems.
- To provide the knowledge about MEMS and NEMS

Course Outcomes :Upon successful completion of the course, students will be able to

CO 1	**Understand** the divers electronic and device fabrication.
CO 2	**Demonstrate** the applications of FET and MOSFET
CO 3	**Describe** lithography.
CO 4	**Analyze** MEMS and NEMS

UNIT-I

Tunnel junction and applications of tunneling, Tunneling Through a Potential Barrier, Metal—Insulator, Metal-Semiconductor, and Metal-Insulator-Metal Junctions, Coulomb Blockade, Tunnel Junctions, Tunnel Junction Excited by a Current Source. Spintronics and Foundations of nano-photonics.

UNIT-II

Field Emission, Gate—Oxide Tunneling and Hot Electron Effects in nano MOSFETs, Theory of Scanning Tunneling Microscope, Double Barrier Tunneling and the Resonant Tunneling Diode.

UNIT-III

Introduction to lithography- Contact, proximity printing and Projection Printing, Resolution Enhancement techniques, overlay-accuracies, Mask-Error enhancement factor (MEEF), Positive and negative photoresists, Electron Lithography, Projection Printing, Direct writing, Electron resists. Lithography based on Surface Instabilities: Wetting, De-wetting, Adhesion, Limitations, Resolution and Achievable / line widths etc. Lift off process, Bulk Micro machining.

UNIT-IV

Introduction to MEMS and NEMS, working principles, as micro sensors (acoustic wave sensor, biomedical and biosensor, chemical sensor, optical sensor, capacitive sensor, pressure sensor and thermal sensor), micro actuation (thermal actuation, piezoelectric actuation and electrostatic actuation–micro gripers, motors, valves, pumps, accelerometers, fluidics and capillary electrophoresis, active and passive micro fluidic devices, Piezoresistivity, Piezoelectricity and thermoelectricity, MEMS/NEMS design, processing, Oxidation, Sputter deposition, Evaporation, Chemical vapor deposition etc.

UNIT-V

Introduction – Scaling of physical systems – Geometric scaling & Electrical system scaling. The Single-Electron Transistor: The Single- Electron Transistor Single-Electron Transistor Logic, Other SET and FET Structures, Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs,Coulomb Blockade in a Nanocapacitor, Molecular SETs and Molecular Electronics.

Text Book:

1. Stephen D. Sentaria, "Microsystem Design", Kluwer, Academic Press
2. George W Hanson, "Fundmentlas of nano electronics," Pearson publications ,India, 2008
3. T. Fukada & W.Mens, "Micro Mechanical system Principle & Technology", Elsevier, 1998.
4. NicolaeLobontiu and Ephrahim Garcia Kluwer, "Mechanics of micro electro mechanical systems," Academic Publishers – Boston

Reference Books:

1. WR Fahrner, "Nano Terchnology and Nano Electronics – Materials, devices and measurementTechniques",Springer.
2. T.Pradeep, "Nano: The Essentials – Understanding Nano Scinece and Nanotechnology", Tata Mc.Graw Hill.
3. W. Goddard, D. Brenner, S. Lyshevski, G.J.Iafrate, "Handbook of Nanoscience, Engineering and Technology," CRC Press (2000)
4. Shunri Odo and David Feny, "Silicon Nanoelectronics"CRC Press, Taylor & Francis Group
5. Karl Goser, Peter Glosekotter, Jan Dienstuhl, "Nanoelectronics and Nanosystems – From Transistor to Molecular and Quantum Devices".

Course Title	FUNDAMENTALS OF RADAR ENGINEERING				B. Tech. ECE VIII Sem		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
18OE408	**OE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To gain the knowledge about radar subsystems, their performance and key functions.
- To provide the in depth knowledge and issues related various tracking radars.

Course Outcomes :Upon successful completion of the course, students will be able to

CO 1	**Understand** the essential principles of operation of radar systems.
CO 2	**Describe** the various Radar components
CO 3	**Analyze** different Radar systems
CO 4	**Analyze** the different Tracking methods

UNIT-I

Fundamentals: Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Radar block diagram and operation, Radar frequencies, Applications of Radar, simple form of radar range equation. Integration of Radar pulses, Radar cross-Section of targets, PRF.

UNIT-II

Radar components: RF amplifier, TWT, CFA, Modulators, Mixers-Conversion loss, Noise figure, Types of Mixers, Duplexers-Branch type, Balanced and Solid state Duplexers, Displays-CRT displays, A, B, C, E-scopes, PPI, RHI.

UNIT-III

Radar systems: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, FMCW radar, multiple frequency C.W radar.

UNIT-IV

MTI and Pulse Doppler radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance. Non-coherent MTI, MTI versus Pulse Doppler radar.

UNIT-V

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers.

Text Books:

1. Merrill I.Skolnik, “Introduction to Radar Systems”, 2nd Edition, TMH 1980.
2. N.S. Nagaraja, “Elements of electronic navigation, 2nd Edition, TMH 1996.
3. Byron Edde, “Radar Pnnciples, Technology. Applications,” Pearson Education, 2004.
4. Peebles. Jr., P.Z..“Radar Principles,” Wiley. New York, 1998.

References

1. Mark A. Rkhards, James A. Scheer, William A. HoIm., “Principles of Modem Radar: Basic Principles,” Yesdee, 2013
2.Merrill I. Skolnik,“Radar Handbook”3rd Ed., McGraw Hill Education, 2008.
3. Paul A Lynn, “Radar Systems,” Macmillan International Higher Education, 1987
4. Hamesh Meikle, “Modern Radar Systems,” Artech House, 2001