KSRM College of Engineering (Autonomous)

Kadapa-516003

DEPARTMENT OF ECE

UG R18 VI Semester Syllabus

VI Semester

S. No.	Subject Code	Subject	Category	L	T	P	IM	EM	Credits
1	1804601	Embedded Systems	EC	3	0	0	30	70	3
2	1804602	Digital Communication	EC	3	0	0	30	70	3
3	1804603	Microwave Engineering	EC	3	0	0	30	70	3
4	1804604	**Open Elective I**	OE	3	0	0	30	70	3
5	1804605	**Professional Elective I**	ECEL	3	0	0	30	70	3
6	1804606	Analog and digital communication Lab	EC	0	0	3	50	50	1.5
7	1804607	Digital Signal Processing Lab	EC	0	0	3	50	50	1.5
8	1824608	Micro Wave &Optical Communication Lab	EC	0	0	4	50	50	2
9	1899609	Organizational Behaviour	MC	3	0	0	30		0
10	1804610	Internship	PR				100		2
		Total:							22

Electronics & Communication Engineering -- Tracks and Courses

S. No.	Track Title / Specialization	Pre-Requisite - I	Pre-Requisite - II	Professional Elective - I	Professional Elective – II	Professional Elective - III	Professional Elective - IV
1	**Communication Systems**	Signals & Systems	Analog & Digital Communications	Fiber Optic Communication	Information Theory & Coding	Radar and Satellite Communication	CMC
2	**Embedded systems**	Digital system Design	Microprocessors & Microcontrollers	Data structures and Algorithms	Real Time Operating Systems	Computer System Architecture	SoC Architecture
3	**Signal Processing**	Signas & Systems	Digital Signal Processing	Digital Signal Processors & Architectures	Scientific Computing	Digital Image & Video processing	Speech Processing
4	**VLSI Design**	Digital system Design	Integrated Circuits & Applications	Analog IC Design	CMOS Design	Digital IC Design	Low Power VLSI Design
5	**RF & Microwave Engineering**	Electromagnetic Theory	Antennas & Wave Propagation	Introduction to MEMS	Electromagnetic Interference & Compatibility	Cognitive Radio	RF System Design

Course Title	Embedded Systems				B. Tech. ECE VI Sem			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1804601	EC	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:

- The main objective of the course is to get students familiar with the typical problems and constraints that arise when designing and developing embedded systems
- The course will also introduce theoretical and practical solutions to these typical problems that the students are expected to master and be able to apply to realistic case studies.

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

CO 1	Understand the fundamental concepts of a embedded system.
CO 2	Get broad exposure to and understand various applications of embedded system in industry, medicine, and defence.
CO 3	Learn the embedded design models
CO 4	Learn the various case studies of embedded system like smart card, adaptive cruise control, mobile phone software.

UNIT I

Introduction: Embedded systems overview, Design challenge, Processor technology, IC technology, Design technology. RT-Level combinational logic, Sequential logic (RT-Level), Custom single purpose processor design (RT-Level), optimizing custom single purpose processors.

UNIT II

General Purpose Processors: Basic architecture, Operation, Programmer's View, Development environment, Application specific Instruction Set processors (ASIPs).

UNIT III

State Machine and Concurrent Process models: Introduction, Models Vs Languages, Finite State Machine with Data path model (FSMD), Using State Machines, Program State Machine (PSM),Concurrent Process Model, Concurrent Processes, Communication among processors, Synchronization among processes, Implementation, Data flow model, Real-time Systems.

UNIT IV

Design Technology: Introduction, Automation-The parallel evolution of complication and synthesis, Logic, RT, Behavioral synthesis, System synthesis and hardware/software codesign,

Verification of hardware/software co-simulation, Reuse of intellectual property cores.

UNIT V

Embedded RTOS Concepts: Architecture of the Kernel, Tasks and Task Scheduler, interrupt service routines, Semaphores, Mutex, Mail boxes, Message Queues, Event Registers, Pipes, Signals.

Text Books:

1. Embedded Systems Design - A Unified Hardware/Software introduction by Frank Vahid, Tony D. Givargis, John Wiley & Sons. Inc.2002.
2. Embedded / Real-Time Systems: Concepts, Design and Programming Black Book by Dr. K.V.K.K. Prasad, Dreamtech Publications.

Reference Books:

1. Introduction to embedded systems - by Raj Kamal, TMH, 2002.
2. An Embedded Software primer, David E.Simon, 1st edition, Addison Wesley professional, 2007.

Course Title	Digital Communication				B. Tech. ECE VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1804602	**EC**	**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:

- Introduce the fundamentals of digital communication systems.
- To understand the analysis of digital communications system and fundamentals of channel coding.

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

CO 1	Understand various baseband digital transmission systems
CO 2	Analyze the different pulse digital modulation techniques.
CO 3	Evaluate channel capacity for distortion less data transmission and coding for data compression.
CO 4	Comprehend the different band pass digital transmission systems.
CO 5	Analyze and design error control techniques.

UNIT-I

Pulse-Digital Modulation: Review of sampling theorem, PCM system and its bandwidth requirement, Noise in PCM Systems, Quantization noise and SNR, Differential PCM, Delta modulation and Noise in delta modulation, Adaptive delta modulation, TDM, Asynchronous TDM, Comparison of TDM & FDM.

UNIT-II

Base band data transmission: Introduction, Matched filter, Inter-symbol Interference, Nyquist's Criterion for distortion less binary data, Correlative Level coding-Duobinary signaling, Modified Duobinary signaling, Partial response signaling, M-ary signaling scheme, Binary Vs M – ary, Equalization schemes, Eye diagrams.

UNIT-III

Band Pass Data Transmission: Model of band-pass data transmission systems, Gram-Schmidt Orthogonal Procedure, Geometric representation of signals, coherent detection of signals in the presence of noise, correlation receiver, matched filter receiver, Digital modulation schemes- ASK, FSK (coherent & Non Coherent), PSK, DPSK, Comparison of digital modulation schemes, M-ary signaling schemes- QPSK, 8/16PSK, and QAM.

UNIT-IV

Information theory: Introduction, Unit of information, Entropy, Rate of Information, Joint and conditional entropy, mutual information, channel models and channel capacity, Shannon's theorem-Continuous Channel, Channel capacity of a Gaussian channel (Shannon- Hartley theorem), Bandwidth vs S/N trade-off, source encoding of discrete memory less source- Shannon- Fano coding, Huffman coding.

UNIT-V

Error control coding: Linear block codes, matrix description, Hamming codes, Decoding, Binary cyclic codes, Algebraic structure, Encoding using shift register, syndrome calculation, Burst and random error correcting codes- Convolutional codes, code tree diagram, state diagram, trellis diagram Encoders and decoding algorithms.

Text Books:

1. Simon Haykin, "Communication Systems", 2nd & 4th Edition, Wiley Estern
2. Sam Shanmugam,, K "Analog & Digital Communication Systems", John Willey & Sons
3. R.P. Singh & S.D. Sapre, "Communication Systems, Analog & Digital", Tata McGraw-Hill

Reference Books:

1. B.P. Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press, 2nd Edition, 1996
2.Taub, H & Schilling D.L.", Principles of Communication System, McGraw Hill, 3rd Edition, 2009.
3. Bernard Sklar, "Digital Communications", Prentice-Hall PTR, 2nd Edition, 2001.

<table>
<tr><td colspan="2">Course Title</td><td colspan="5">Microwave Engineering</td><td colspan="3">B. Tech. ECE VI Sem</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">1804603</td><td rowspan="2">EC</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exams</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>--</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration: 2Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives:
• To impart Knowledge about various microwave components, microwave junctions, microwave tubes and microwave signal characteristic measurements.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to</td></tr>
<tr><td>CO 1</td><td colspan="8">Use Wave guide and Microwave components for various applications.</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze various micro Wave Oscillators and Amplifiers.</td></tr>
<tr><td>CO 3</td><td colspan="8">Describe fabrication of striplines and MICs & microwave bench setup for various microwave measurements.</td></tr>
<tr><td>CO 4</td><td colspan="8">Determine S – parameters of various microwave devices .</td></tr>
<tr><td>CO 5</td><td colspan="8">Compute microwave signal parameters, power output and efficiency of microwave active devices..</td></tr>
</table>

UNIT-I

Waveguides: Introduction to microwave frequencies and band, Rectangular wave guides, Excitation of wave guides. Wave equations, rectangular and circular waveguides for TE and TM modes, Cutoff frequency and wave length, Group and phase velocity, Wave impedance, Guide attenuation, Rectangular and cylindrical resonators, Q of the cavity resonators.

Microwave Components: Microwave hybrid circuits-S-parameters of two port network, Attenuators, Phase shifters, Wave guide Tees and their S-matrices, Bends, Corners and twists. Two hole Directional coupler and its S-matrix, Ferrites-composition and characteristics, Faraday rotation, Gyrator, Isolators and circulators, S-matrix of circulator and isolator.

UNIT-II

Microwave tubes-I: Limitations and losses of conventional tubes at microwave frequencies. Microwave tubes-O type and M type classifications. O type tubes: Two cavity klystron-structure,

Reentrant cavities, Velocity modulation process and Applegate diagram, Bunching process and small signal theory-Expressions for output power and efficiency. Reflex Klystron – structure, Velocity Modulation, Applegate diagram, Mathematical theory of bunching, Output power, efficiency, Oscillating modes and output characteristics, Effect of repeller Voltage on output Power, Illustrative Problems.

UNIT-III

Helix TWTS: Significance, Types and characteristics of slow wave structures; Structure of TWT and amplification process, Suppression of oscillations, gain considerations.
M -Type Tubes: Introduction, Magnetrons, Different types, Cylindrical magnetron-Hull cutoff and Hartree conditions, Modes of resonance and PI-mode operation, Separation of PI-mode, Output characteristics, Illustrative Problems.

UNIT-IV

Microwave Solid State Devices: Classification , applications, Tunnel diode, Gunn diode-principles, RWH theory, Characteristics, Basic modes of operation - Gunn oscillation modes, IMPATT diode, PIN diode, Varactor diode, Crystal diode, Schottky Barrier diode, Parametric amplifier.

UNIT-V

Microwave Measurements: Measurement of frequency, Power, VSWR, Impedance, Reflection coefficient, Attenuation constant, S-parameters and Q of a cavity Resonator.
Microwave ICs: Striplines and micro striplines, Advantages of MICs, Hybrid MICs, Monolithic MICs- advantages, materials and fabrication,

Text Books:

1. Samuel Y Liao, "Microwave devices and circuits", Prentice Hall, 1999.
2. M. Kulkarni, "Microwave and Radar Engineering", Umesh Publications, 1998.
3. Annapoorna Das and Sisir K. Das, "Microwave Engineering", Tata McGraw-Hill, 2000.

Reference Books:

1. Herbert J. Reich, J. G. Skalnik, P. F. Ordung and H. L. Krauss, "Microwave principles," CBS publishers and distributors, New Delhi, 2004.
2. R. E. Collin, "Foundations for microwave engineering," IEEE press, John Wiley, 2nd Edition, 2002.
3. Om. P. Gandhi, "Microwave Engineering and Applications," Pergamon, 1981.

Course Title	Fiber Optic Communication Open Elective I					B. Tech. ECE VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1804604	**EC**	**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 functionality of each of the components of fiber optic communication system
- To understand the properties and principles of different types of optical fibers, and losses that occur in fibers.
- To understand the working and principle of optical sources (LED and LASER) and power launching schemes.
- To analyze the operation of various optical detectors (PIN & APD) and optical receiver.
- To understand the design of optical systems, WDM and Measurements

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

CO 1	**Identify** the structures of Optical fibers based on modes, refractive index and fiber materials.
CO 2	**Analyze** the different kind of losses in fibers and optical fiber link design parameters.
CO 3	**Categorize** the types of optical sources and optical detectors on the basis of physical construction and principle of operation.
CO 4	**Explain** the necessity for using splices, couplers and connectors in energy transmission.
CO 5	**Discuss** WDM concepts, Optical Amplifiers, Optical System design and Measurements.

UNIT-I

Introduction and Optical fiber waveguides: Historical Development, The General System, Advantages of Optical Fiber Communications, Ray Theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew Rays, Cylindrical Fiber – Modes, V Number, Mode coupling, Step Index fibers, Graded Index Fibers Single mode fibers - Cut off wavelength, Mode Field Diameter, Effective Refractive Index.

UNIT-II

Fiber Materials - Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers, Mechanical Properties of Fibers, Fiber Optic Cables. **Transmission Characteristics of optical fibers** -Attenuation, Material Absorption Losses in Silica Glass Fibers, Linear Scattering Losses,

Fiber Bend Loss, Dispersion, Chromatic dispersion, Intermodal dispersion, Overall fiber dispersion, Polarization – Fiber Birefringence, Polarization Mode Dispersion.

UNIT-III

Optical Sources: Light Emitting Diodes (LEDs) - LED Structures, Light Source Materials, Quantum efficiency and LED Power, Modulation of LED. **LASER Diodes**- Laser Diode Modes and Threshold Conditions, Laser Diode Rate Equations, External Quantum Efficiencies, Resonant Frequencies. **Photo Detectors: Physical principles of photo diodes**- The PIN and Avalanche photo diode (APD), detector response time, structures for InGaAs APDs, temperature effect on avalanche gain, comparisons of photo detectors.

UNIT-IV

Power launching and Coupling-Source to Fiber Power Launching – Source output pattern, power coupling calculation, power launching versus wavelength, Equilibrium Numerical Aperture, **Lensing schemes for Coupling Improvement** -non imaging microsphere, Laser diode to fiber coupling, LED coupling to single mode fibers. **Fiber-to-fiber Joints** – Mechanical misalignments, Fiber related losses, Fiber end face preparation, **Fiber Splicing** – Splicing techniques, splicing single mode fibers, **Optical Fiber Connectors** – Connector types, Single mode fiber connectors- Connector return losses, **Passive components** – The 2 x 2 fiber coupler, Star couplers

UNIT-V

Optical receiver operation: Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, **Optical system design** - Point to point links, system considerations, Link Power budget, Rise time budget, Transmission distance, **Operational principles of WDM** - Types, Fiber grating filters. **Measurements** – Optical Time domain Reflectometer (OTDR). Attenuation Measurements, dispersion Measurements, EYE Patterns.

Text Books:

1. Gerdkeiser, "Optical fiber communications", McGraw Hill International Edition, 4th Edition, 2010.
2. John M. Senior , "Optical fiber communications", PHI, 3rd Edition, 2010.

Reference Books:

1. Max Ming-Kang Liu, "Principles and Applications of Optical Communications", TMH, 2010.
2. S. C. Gupta, "Text book on optical fiber communication and its applications", PHI, 2005.
3. Satish Kumar, " Fundamentals of Optical Fiber communications", , PHI, 2009.
4. DjaferKmynbaev Lowell L. Scheiner, "Fiberoptic communications Technology", Pearson Education pte. Ltd.

Course Title	Data structures and Algorithms Open Elective I				B. Tech. ECE VI Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1804604	**EC**	**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 develop skills and analyze linear and non linear data structures.
- To understand basic concepts about linked lists, stacks, queues.
- To study algorithms as they apply to trees and graphs.
- To study in detail about sorting, searching and hashing.

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

CO 1	Understand the variety of abstract data types and data structures.
CO 2	Analyze data structures such as linked list, Stacks and Queues.
CO 3	Apply and analyze tree traversal algorithms and graph traversal algorithms.
CO 4	Organize data in order using various sorting algorithms.
CO 5	Ability to understand the concept of hashing, B-Trees and B+-Trees.

UNIT-I

Introduction: Data structures, Primitive & Non Primitive data structures, Linear & Non Linear data structures, Linear Lists: Definition, Arrays: Definition, Linked Lists: Single Linked List- Definition, Insertion and Deletion operations, Doubly Linked List- Definition, Insertion and Deletion operations.

UNIT-II

Stacks: Definition, Array & Linked representations, Operations, Applications, Queues: Definition, Array & Linked representations, Operations, Circular Queues & Dequeues .

UNIT-III

Trees: Basic terminology, Binary Trees- Definition, Properties, Representation, Complete and Full Binary Tree, Tree Traversal Algorithm: In order, Preorder and Postorder, Priority Queues: Definition, Heaps, Leftist Trees, Binary Search Tree(BST): Definition, Operations & Implementations, BST with Duplicates, Indexed BST.

UNIT-IV

Balanced Search Trees: AVL, Red-Black & Splay Trees, Graphs: Terminology, Representations, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS), Minimum Spanning Tree.

UNIT-V

Sorting: Selection, Insertion, Bubble, Heap, Searching: Sequential & Binary Search. Hashing: Introduction, Hash Table representation, Hash Functions , Collisions: Introduction, Separate Chaining, Open Addressing , B-Trees, Operations on B-Trees, B+-Trees.

Text books:

1. An Introduction to Data Structures with applications, Jean Paul Trembley and Paul G. Sorenson, McGraw Hill.

2. Fundamentals of Data Structures in C, Horowitz, Sahni, Anderson Freed, Universities press.

3. Data Structures using C++, Varsha H.Patil, Oxford University Press.

Reference books:

1. Data Structures, Algorithms and Applications in C++, Ananda Rao Akepogu and Radhika Raju Palagiri, Pearson Education.

2. Data Structures and Algorithms in C++, S.Sahni, University Press (India) Private Limited, Second Edition.

3. Data Structures, Seymour Lipschutz, Schaum's Outlines, McGraw Hill.

Course Title	Digital Signal Processors & Architectures Open Elective I				B. Tech. ECE VI Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1804604	**EC**	**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 and analyze DSP algorithms & architectures

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

CO 1	Understand Aspects of architectures.
CO 2	Understand Memory mapped accelerators
CO 3	Analyze DSP algorithms.
CO 4	Map the algorithms to architectures

Unit-I

DSP System Models: Introduction- Review of digital logic, Timing and Power in digital circuits, Quality metrics and bounds - Implementation Costs and Metrics, Architecture cost components, Examples of Architectures, Multi-objective Optimization.

Number representation- Scientific notation and Floating point

FIR and IIR Implementation: FIR filter, Serial FIR filter architectures, Simple programmable architecture, Block diagrams and SFGs, Dataflow Graphs, Iteration period, FIR filter iteration period, IIR filter iteration period, Computation Model.

Unit-II

Dedicated hardware and transforms – Implementation, Constraint analysis for IPB computation, Motivational examples for IPB, General IPB computation, Sample period calculation, Parallel architecture, Odd-even register reuse, Power consumption, Pipelining, Pipelining FIR filter, Time-invariant systems, Valid pipelining examples, Feed forward cutsets, Balanced pipeline, Retiming basic concept, Example and uses of retiming

Resource sharing: adder example, Changing iteration period, Hardware assumptions and constraint analysis, Mathematical formulation, Examples with formulation, Example: Biquad filter, Hardware architecture, Review biquad folding sets, Complete biquad hardware,

Unit-III

Scheduling: Obtaining a folding schedule, ASAP schedule, Utilization Efficiency, ALAP schedule, Iteration period bound and scheduling, Retiming for scheduling, Blocked schedules, Overlapped

schedules, mproved blocked schedule, Allocation, Binding and Scheduling, Heuristic approaches to scheduling, Mathematical formulation, ILP formulation, List scheduling, Hardware model, Force Directed Scheduling.

Unit-IV

Programmable Sytems: Software Compilation, Optimization Examples, Loop optimizations, Software pipelining, FFT Optimization, CPUs and FPGAs, FFT on FPGA board, Understanding ELF files

Unit-V

Memory and Communication Systems: On-chip communication basics, Many-to-Many communication, AXI bus handshaking, HW accelerator for FPGA, DMA and arbitration, Network-on-chip basics, NoC - topologies and metrics, NoC– routing, NoC - switching and flow control,
Specialized Architectures: Systolic Arrays – Background, CORDIC algorithm, Parallel implementation of FIR filters, Unfolding Transformation, Look ahead Transformation, Introduction to GPUs and Matrix multiplication

Text Books:

1. KK Parhi, "VLSI Digital Signal Processing Systems: Design and Implementation", Wiley, NY, 1999.
2. Lars Wanhammar, Academic Press, 1999.

Reference Books:

1. Peter Pirsch, "Architectures for Digital Signal Processing", 2nd edition, John Weily, 2007
2. B. Venkataramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications", 2 Edition, TMH, 2004.
3. Jervis, "Digital Signal Processing- A practical approach", 4th edition, Pearson Education,2004.

Course Title	Analog IC Design Open Elective I					B. Tech. ECE VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1804604	**EC**	**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 concepts of Analog MOS devices and current mirror circuits
- To Analyze the stability and frequency compensation techniques of Op-Amp Circuits

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

CO 1	Understand the concepts of Analog MOS devices and current mirror circuits
CO 2	Design different configuration of Amplifiers and feedback circuits
CO 3	Describe the characteristics of frequency response of the amplifier and its noise.
CO 4	Analyze the stability and frequency compensation techniques of Op-Amp Circuits
CO5	Construct switched capacitor circuits and PLLs

Unit-I

Introduction to Analog IC Design and Current Mirrors: Concepts of Analog Design – General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors- Active current mirrors- Large and Small signal analysis- Common mode properties.

Unit-II

Amplifiers and Feedback: Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage. Single ended and differential operation- Basic Differential pair- Common mode response- Differential pair with MOS loads- Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies- Effect of loading- Effect of feedback on Noise.

Unit-III

Frequency Response of Amplifiers and Noise: General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth.

Unit-IV

Operational Amplifier Stability and Frequency Compensation: General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps- General consideration of stability and frequency compensation- Multi pole system- Phase margin- Frequency compensation- Compensation of two stage op Amps- Other compensation techniques.

Unit-V

Switched Capacitor Circuits and PLLs: General Considerations- Sampling switches- Switched Capacitor Amplifiers-Switched Capacitor Integrator-Switched Capacitor Common mode feedback. Phase Locked Loops-Simple PLL-Charge pump PLLs-Non ideal Effects in PLLs-Delay locked loops- its Applications.

TEXT BOOK:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuits‖, Tata McGraw Hill, 2001, 33rd re-print, 2016.

REFERENCES:

1. Phillip Allen and Douglas Holmberg, CMOS Analog Circuit Design‖ Second Edition, Oxford University Press, 2004.
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009
3. Grebene, Bipolar and MOS Analog Integrated circuit design‖, John Wiley & sons, Inc., 2003

Course Title	Introduction to MEMS Open Elective I					B. Tech. ECE VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1804604	**EC**	**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:

- Introduction to MEMS and micro fabrication
- To study the essential material properties
- To study various sensing and transduction technique
- To know various fabrication and machining process of MEMS
- To know about the polymer and optical MEMS

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

CO 1	Familiarized with the important concepts applicable to MEMS, their fabrication.
CO 2	Analysis and testing of MEMS.
CO 3	Apply the MEMS for different applications.

UNIT-I

INTRODUCTION TO MEMS AND MICROFABRICATION: History of MEMS Development, Characteristics of MEMS-miniaturization - Micro electronics integration - Mass fabrication with precision. Micro fabrication - Microelectronics fabrication process- Silicon based MEMS processes- new material and fabrication processing- points of consideration for processing.

UNIT-II

ELECTRICAL AND MECHANICAL PROPERTIES OF MEMS MATERIALS: Conductivity of semiconductors, crystal plane and orientation, stress and stain – definition – relationship between tensile stress and stain- mechanical properties of silicon and thin films, Flexural beam bending analysis under single loading condition- Types of beam- deflection of beam-longitudinal stain under pure bending- spring constant, torsional deflection, intrinsic stress, resonance and quality factor.

UNIT-III

SENSING AND ACTUATION: Electrostatic sensing and actuation-parallel plate capacitor – Application-Inertial, pressure and tactile sensor- parallel plate actuator- comb drive. Thermal sensing and Actuations-thermal sensors-Actuators- Applications- Inertial, Flow and Infrared sensors. Piezoresistive sensors- piezoresistive sensor material- stress in flexural cantilever and membrane- Application-Inertial, pressure, flow and tactile sensor.

PIEZOELECTRIC SENSING AND ACTUATION: piezoelectric material properties-quartz-PZT-PVDF –ZnO- Application-Inertial, Acoustic, tactile, flow-surface elastic waves. Magnetic actuation- Micro magnetic actuation principle- deposition of magnetic materials-Design and fabrication of magnetic coil.

UNIT-IV

BULK AND SURFACE MICROMACHINING: Anisotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), Isotropic wet etching, Basic surface micromachining process- structural and sacrificial material, stiction and antistiction methods, Foundry process.

UNIT-V

POLYMER AND OPTICAL MEMS: Polymers in MEMS- polymide-SU-8 liquid crystal polymer(LCP)-PDMS-PMMA-Parylene- Flurocorbon, Application-Acceleration, pressure, flow and tactile sensors. Optical MEMS-passive MEMS optical components-lenses-mirrors-Actuation for active optical MEMS.

Text books:

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
2. Julian W.Gardner, Vijay K Varadhan, "Microsensors, MEMS and Smart devices", John Wiley & sons, 2001.

References:

1. Gaberiel M.Rebiz, "RF MEMS Theory,Design and Technology", John Wiley & Sons,2003.
2. Charles P.Poole, Frank J.Owens, "Introduction to nanotechnology" John Wiley & sons, 2003.

Course Title	Analog and digital communication Lab				B. Tech. ECE VI Sem			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1804606	EC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		-	-	3	1.5	50	50	100
					End Exam Duration: 3Hrs			

Course Objectives:

- Design and generation of AM,PM, FM,ASK,PSK, QPSK communication techniques.
- Usage of Communications test equipment.

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

CO 1	Use the knowledge of Amplitude, Frequency and Pulse Modulation Systems in developing analog Communication systems
CO 2	Use the knowledge of TDM, PCM, Delta Modulation, FSK, PSK, DPSK,QPSK in developing Digital Communication systems
CO 3	Perform measurements like Sensitivity, Selectivity and Fidelity of Communication subsystems and systems
CO 4	Use test equipment to test various communication systems they develop
CO5	Use the knowledge of Amplitude, Frequency and Pulse Modulation Systems in developing analog Communication systems

Part- A: Analog Communication Lab:

1. Amplitude modulation and demodulation.
2. Frequency modulation and demodulation.
3. Characteristics of Mixer.
4. Pre-emphasis & de-emphasis.
5. Pulse Amplitude Modulation and demodulation.
6. Pulse Width Modulation and demodulation.
7. Pulse Position Modulation and demodulation.
8. Radio Receiver measurements – Sensitivity, Selectivity, & Fidelity.

Part- B: Digital Communication Lab:

1. Sampling Theorem – verification.
2. Time division multiplexing.
3. Pulse Code Modulation.

4. Delta modulation.
5. Frequency shift keying - Modulation and Demodulation.
6. Phase shift keying - Modulation and Demodulation.
7. Differential phase shift keying - Modulation and Demodulation.
8. QPSK - Modulation and Demodulation

Course Title	Digital Signal Processing Lab					B. Tech. ECE VI Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1804607	**EC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		-	--	3	1.5	50	50	100
						End Exam Duration: 3Hrs		

Course Objectives:

- To become familiar with MATLAB fundamentals
- To write MATLAB programme for basic DSP operations
- To understand the uses of TMS320C6748 processors
- To write C language code for basic DSP operations and executed using TMS processors

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

CO 1	Analyze discrete/digital signals using mat lab and the basic operations of signal processing.
CO 2	Obtain the spectral parameters of windowing functions.
CO 3	Design FIR and IIR filters for desired specifications
CO 4	Design and implement DSP algorithms in software using a computer language such as C with TMS320C6748 floating point processor.

List of Experiments: (Minimum of 5 experiments are to be conducted from each part)

Software Experiments (PART – A)

1. Generation and display of fundamental discrete-time sequences.
2. Finding Power and (or) Energy of a given discrete-time sequence.
3. Convolution of two discrete-time sequences with and without built in command.
4. Correlation between two discrete-time sequences with and without built in command.
5. DFT of a given signal with and without built in command.
6. Design of FIR filter using windowing technique.
7. Design of IIR filters using Impulse invariance or bilinear transformation.
8. Design of analog filters.

Using DSP Processor kits (Floating point) and Code Composure Studio (CCS) (PART – B)

1. Introduction to DSP Processors.
2. Generation of fundamental signals and plot the same as a waveform showing all the specifications.

3. Finding Power and (or) Energy of a given signal.
4. Convolution of two discrete-time sequences.
5. Correlation between two discrete-time sequences
6. DFT of a given signal
7. Design of FIR filter using windowing technique and verify the frequency response of the filter.
8. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
9. Design of analog filters.

Equipment/Software Required:

1. Licensed MATLAB software with required tool boxes for 30 users.
2. DSP floating Processor Kits with Code Composure Studio (8 nos.)
3. Function generators
4. CROs
5. Regulated Power Supplies

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).