Scheme of Instruction and Syllabi
of
Choice Based Credit System (CBCS) of

BE / B.TECH V AND VI SEMESTERS
OF
FOUR YEAR DEGREE COURSE
IN
ELECTRONICS & COMMUNICATION ENGINEERING

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(TM)
(An Autonomous Institution)
Affiliated to OU; All U.G. and 5 P.G. Programmes (Civil, CSE, ECE, Mech. & EEE)
Accredited by NBA; Accredited by NAAC - 'A' Grade (UGC); ISO Certified 9001:2015
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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

Choice Based Credit System (with effect from 2018-19)

B.E (Electronics and Communication Engineering)

SEMESTER – V

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16ECC 18	Digital Communication	4	-	3	30	70	4
2	16ECC 19	Integrated Circuits and Applications	4	-	3	30	70	4
3	16ECC 20	Microprocessors and Microcontrollers	4	-	3	30	70	4
4	16ECC 21	Control Systems	3	-	3	30	70	3
5		Elective-I	3	-	3	30	70	3
PRACTICALS								
6	16ECC 22	Digital Communication Lab	-	3	3	25	50	2
7	16ECC 23	Integrated Circuits and Applications Lab	-	3	3	25	50	2
8	16ECC 24	Microprocessors and Microcontrollers Lab	-	3	3	25	50	2
TOTAL			**18**	**9**	**-**	**225**	**500**	**24**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

	Elective-I
16ECE01	Computer Organization and Architecture
16ECE02	Engineering Material Science
16EEE04	Electrical Technology
16EEE13	Industrial Electronics

16ECC18

DIGITAL COMMUNICATION

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To make the student learn the different techniques involved in digital transmission of analog signals.
2. To give the student an understanding of the various concepts of information theory and source coding schemes.
3. To make the student know about the need for error control coding.
4. To facilitate the student to understand various methods of generating and detecting different types of error correcting codes.
5. To enable the student to interpret the performance of digital modulation schemes.
6. To make the student learn various spread spectrumtechniques.

Course Outcomes:

Upon completing this course, students will be able to:

1. Understand the concept of pulse digital modulation schemes and compare their performance.
2. Interpret the concept of information theory and apply source coding schemes.
3. Demonstrate various error control schemes.
4. Develop the encoding and decoding techniques to detect and correct the errors.
5. Evaluate the performance of digital modulation schemes with probability of error.
6. Identify and apply spread spectrum modulation techniques.

UNIT-I

Digital Transmission of Analog Signals: Elements of a digital communication system, Uniform quantization, PCM system, Bandwidth requirement of PCM system, Noise in PCM Systems, Non- uniform quantization, TDM-PCM system. Differential quantization, Differential PCM system, Delta Modulation, Noise in DM system, ADM. Comparison of PCM ,DPCM,DM and DM schemes.

UNIT-II

Information Theory: Uncertainty, Information and Entropy, Source coding: Source coding theorem, Shannon – Fano algorithm and Huffman coding. Discrete memoryless channels, Types of channels, cascaded channels, mutual information, Channel capacity, Information rate and Information capacity, Rate distortion theory.

UNIT-III

Error Control Coding: Need for error control coding, Types of transmission errors. Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, minimum distance of a block code, error detecting capabilities and error correcting, Standard array and syndrome decoding.
Binary cyclic codes (BCC): description of cyclic codes, encoding, decoding and error correction of cyclic codes using shift registers, Convolution codes: description, encoding, decoding: Exhaustive search method and sequentialdecoding.

UNIT-IV

Digital Carrier Modulation Schemes: Optimum receiver for Binary Digital Modulation Schemes, Binary ASK, PSK, DPSK, FSK signaling schemes and their error probabilities. Introduction to MSK, Comparison of Digital Modulation Schemes. Introduction to M-ary Signaling Schemes, M-ary coherent PSK, QPSK, Synchronization methods.

UNIT –V

Spread-Spectrum Modulation: Need for spreading a code, generation and properties of PN sequence. Direct Sequence Spread Spectrum, Frequency Hopping spread spectrum systems and their applications.
Synchronization in Spread Spectrum Modulation: Acquisition and Tracking of Frequency Hopping spread spectrum and Direct Sequence Spread Spectrum systems.

Text Books:

1. Sam Shanmugham.K., "Digital and Analog Communication Systems," Wiley, 2012.
2. Simon Haykin, "Communication Systems," 4/e, Wiley India, 2011.
3. Herbert Taub, Donald L. Shilling &GoutamSaha, "Principles of Communication Systems," 4/e, Tata McGraw-Hill Education 2013.

Suggested Readings:

1. John Proakis, MassoudSalehi,"Digital Communications" 5/e , McGraw-Hill Higher Education, 2007.
2. R.P. Singh, S.D. Sapre, "Communication Systems", 2/e, Tata McGraw-Hill Education, 2008.

16ECC19

INTEGRATED CIRCUITS AND APPLICATIONS

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To learn the concept of Op-Amp and its characteristics.
2. To impart the linear and nonlinear applications of operational amplifier.
3. To impart the theory and applications of 555 IC Timer, IC regulator and PLL.
4. To introduce the concepts of Data converters.
5. To analyze combinational and sequential circuits with ICs.
6. To introduce the concepts of memories, PLDs.

Course Outcomes:

Student will be able to:

1. Understand the basic construction, characteristics and parameters of Op-Amp.
2. Analyze the linear and nonlinear applications of Op-Amp.
3. Understand the concepts of IC555 timer, IC723 regulator and PLL.
4. Classify and describe the characteristics of different logic families
5. Design the Combinational and Sequential circuits with ICs.
6. Understand the concepts of memories, design of PLD's.

UNIT – I

Introduction to ICs: Integrated circuits classification, Integrated circuit package types, pin identification and temperature ranges.

Operational Amplifier: Op-Amp block diagram, ideal Op-Amp Characteristics, Op-Amp parameters: Input offset voltage, Output offset voltage, input offset and bias currents, Slew rate, CMRR and PSRR.

UNIT – II

Op-Amp Applications : Inverting and Non-inverting amplifiers with ideal and non-ideal Op-amps, Voltage Follower, Difference Amplifier, Summing Amplifier, ideal and practical Integrator and differentiator, Voltage to Current and Current to Voltage converters, Sample and Hold circuit. Comparator, Schmitt Trigger with and without reference voltage, Triangular waveform generator.

UNIT – III

555 Timer: Functional diagram. Modes of operation: Monostable, Astablemultivibrators, applications of 555 Timer.

Regulators: Analysis and design of regulators using IC 723.

PLL: Operation, lock range, Capture range, PLL applications: Frequency multiplier and frequency translator.

Data Converters: Specifications, DAC- Weighted Resistor, R-2R Ladder, ADC-Parallel / Comparator, Successive Approximation and Dual Slope.

UNIT – IV

Logic families: Digital IC characteristics. TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs. Comparison of TTL and CMOS logic families.

Combinational Circuits: Design using TTL-74XX or CMOS 40XX series: Decoders, drivers for LED, Encoder, priority encoder, Multiplexer and their applications, Demultiplexer, Digital comparator, Parallel and serial binary adder, Subtractor circuits using 2's complement. Carry look-ahead adder, BCD adder.

UNIT – V

Sequential Circuits: Design using TTL-74XX or CMOS 40XX series: Synchronous and Asynchronous counters, Cascading of BCD counters, applications of counters, Shift register and applications.

Memories: Memory Terminology, ROM, RAM types, Architectures, operation and applications, Expanding word size and capacity, Introduction to PLD's, PAL and PLA.

Text Books:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4/e, PHI, 2010.
2. Ronald J. Tocci, Neal S. Widmer& Gregory L.Moss, "Digital Systems: Principles and Applications." PHI, 10/e, 2011.

Suggested Reading:

1. K.R.Botkar, "Integrated Circuits," 10/e, Khanna Publishers, 2010.
2. Roy Chowdhury D, Jain S.B, "Linear Integrated Circuits,"4/e, New Age International Publishers, 2010.
3. Jain R.P., "Modern Digital Electornics."4/e, TMH, 2011.

16ECC20

MICROPROCESSORS AND MICROCONTROLLERS

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the architecture and instruction set of 8086 microprocessor.
2. To familiarize the assembly language programming of 8086.
3. To understand the difference between assembler, emulator and debugger.
4. To understand the 8051 microcontroller concepts and applications of microcontrollers.
5. To familiarize programming aspects of 8051 both in assembly and C language.
6. To interface various peripherals to 8051 microcontroller.

Course Outcomes:

Students will be able to:

1. Understand the architecture of 8086 microprocessor and 8051 microcontroller.
2. Write an assembly language program for different applications by using instruction set of 8086 microprocessor.
3. Understand different programmable peripheral devices for a given application.
4. Distinguish between Microprocessor and Microcontroller based systems.
5. Identify and explain the operations of peripherals, typically used with interfacing microprocessors / microcontrollers.
6. Develop the microcontroller based programs for various applications.

UNIT – I

Microprocessors: Introduction to Microprocessor, 8086/8088 Architecture, pin description, Physical Memory Organization, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings, Addressing modes, Instruction formats, Instruction set of 8086.

UNIT – II

Assembly language programming using 8086: Assembler directives and operators, Programs using data transfer, arithmetic, logical, branching and ASCII instructions. String processing, Stack, Interrupt Structure, Procedures and Macros, Introduction to assemblers and debugging tools. Brief overview of x86 series microprocessors.

UNIT – III

Interfacing with 8086: Semiconductor memory interfacing, Dynamic RAM interfacing, Interfacing I/O ports, PPI 8255, Modes of operation of 8255.

Special purpose programmable devices: Programmable interval timers (8253/8254), DMA controller (8257), Serial and parallel data transmission formats, Programmable communication interface (8251) USART, Programmable interrupt controller (8259).

UNIT – IV

Microcontrollers: Microprocessors vs Microcontrollers, Internal architecture of 8051 and its pin configuration, Memory organization. Addressing modes and bit addressable features. 8051 instruction set: Data transfer, arithmetic, logical and branching groups. Interrupt and I/O port structures and their operations. Basic assembly language programming with 8051.Introduction to 8051 programming in C language.

UNIT – V

8051 on-chip peripherals and their programming: Timer programming in assembly and C, serial port programming in assembly and C, Interrupt programming in assembly and C.

Interfacing with 8051: 8051 interfacing to external memory, Expansion of I/O ports - Interfacing with the PPI 8255.Interfacing ADC, 7 segment display, LCD module and Stepper motor with 8051.

Text Books:

1. Ray A.K and Bhurchandhi K.M, "Advanced microprocessor and peripherals", 3rd edition, TMH 2012.
2. Ayala K.J,"The 8051 Microcontroller Architecture, programming and Application", Penram International, 2007.
3. Mazidi M.A, Mazidi J.G and Rolin D Mckinlay, "The 8051 Microcontroller and Embedded systems using Assembly and C", 2nd edition, Pearson education 2007.

Suggested Readings:

1. Douglas V Hall, "Microprocessors and Interfacing Programming and Hardware", revised 2nd edition, THM 2007.
2. Ajay V. Deshmukh, "Microcontrollers – theory and applications", Tata McGraw-Hill Companies – 2011.

16ECC21

CONTROL SYSTEMS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce various control systems and their equivalent mathematical models, block diagrams and signal flow graphs.
2. To familiarize with the time response analysis of different systems.
3. To introduce the system analysis using Routh-Hurwitz and root locus techniques.
4. To illustrate various frequency domain techniques for the system analysis.
5. To familiarize compensators and controllers of a control system.
6. To introduce the state space analysis of a system.

Course Outcomes:

After completion of this course, a student will be able to:

1. Find the transfer function of a system represented by a block diagram and signal flow graph.
2. Evaluate the time domain specifications and steady state error of a system.
3. Analyze the stability of a system.
4. Analyze the system in frequency domain.
5. Compare various controllers and compensators.
6. Apply State Space Concept to analyze and design a control system.

UNIT-I

Control System Fundamentals: Classification of control systems, Open and Closed Loop control systems, Block diagram reduction and signal flow graphs, Mathematical modeling of a Mechanical system and conversion into electrical System.

UNIT-II

Time Response Analysis: Transfer function and Impulse Response, Types of Inputs, Transient Response of first and second order system with different inputs, Time domain Specifications. Types of Systems, static error coefficients, error series, PD, PI and PID controllers.

UNIT-III

Stability Analysis: Routh-Hurwitz criteria for stability. Root Locus Techniques, Analysis of typical systems using root locus techniques, Effect of location of roots on system response.

UNIT-IV

Frequency Response Analysis: Frequency domain specifications,Bode plot, Principle of Argument, Nyquist plot and stability criterion, Gain and Phase Margins from the Bode and Nyquist diagrams.
Lead and Lag compensators.

UNIT-V

State Space Analysis: Concept of State, State Variable, State vector and State space. State space representations of linear time invariant systems, State transition matrix, Solution of state equation, Controllability, Observability and Design of control systems using state variable feedback.

Text Book:

1. I.J.Nagrath and M.Gopal, "Control Systems Engineering", New Age International Publishers, 5/e 2012.
2. Benjamin C. Kuo, "Automatic Control Systems", 7/e, PHI, 2010.

Suggested Reading:

1. K. Ogata, "Modern Control Engineering", EEE, 5/e, PHI, 2003.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11/e Pearson 2008.
3. GopalMadan, "Digital control engineering", 1/e, New age publishers, 2008.

16ECE01

COMPUTER ORGANIZATION AND ARCHITECTURE

(Elective-I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To design and understanding of the different basic components of a computer system.
2. To understand fixed and floating point arithmetic algorithms.
3. To understand Instruction set, Instruction codes and Assembly Language.
4. To design and synthesize new and better computer architectures.
5. To understand input/output mechanisms.
6. To understand various parts of system memory hierarchy.

Course Outcomes:

At the end of the course, the student will be able to:

1. Discuss the basic structure and organization of computer system.
2. Apply fixed and floating point arithmetic algorithms.
3. Explain Instruction cycle, register transfer and micro operations.
4. Discuss about RISC/CISC architectures, pipeline and vector processing.
5. Explain Input/output organization.
6. Discuss about Memory organization and Management.

Unit - I

Data Representation and Computer Arithmetic: Introduction to Computer Organization and architecture, Fixed point representation of numbers, Digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non restoring algorithms, Floating point representation with IEEE standards.

Unit - II

Basic Computer Organization and Design: Instruction codes, stored program organization, Computer registers and common bus system, Computer instructions: Timing and Control, Instruction cycle, Fetch and Decode, Register reference instructions, Memory reference instructions, I/O and Interrupt: Configuration, Instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, Address sequencing, Micro instruction format.

Unit - III

Central Processing Unit: Introduction, General register organization, Stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, CISC and RISC: Features and Comparison,Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Basics of Vector processing and Array Processors.

Unit - IV

Input-Output Organization: Peripheral devices, I/O interface: I/O Bus and interface modules, I/O versus Memory Bus, Isolated versus memory mapped I/O, Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer, Modes of Transfer: Programmed I/O, Interrupt initiated I/O, Priority interrupt: Daisy chaining, Parallel Priority interrupt, Input- Output Processor: CPU-IOP communication, I/O channel.

Unit - V

Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory, mapping functions: direct, associate and set associate. Virtual memory: address mapping using pages, Page replacement, Memory management hardware: Segmented Page mapping, Memory protection.

Text Books:

1. MorisMano.M.,"Computer System Architecture," 3/e, Pearson Education, 2017.
2. Hamachar, VranesicZyonks, safeazak, "Computer Organization," 5/e, McGraw Hill, 2007.

Suggested Reading:

1. William Stallings, "Computer Organization and Architecture: Designing for performance," 7/e, Pearson Education, 2006.
2. John P.Hayes, "Computer Architecture and Organization," 3/e,TMH, 1998.

16ECE02

ENGINEERING MATERIAL SCIENCE

(Elective-I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

The course aims to give the students

1. To provide Introduction about different materials and their structural properties.
2. To understand behavior of magnetic materials.
3. To give knowledge about resistors, conducting and super conducting materials.
4. To understand characterization techniques to study the properties of nanomaterials.
5. To discuss the applications of different nanomaterial in chemical and biological fields.
6. To have knowledge of nanomaterials applicable in other fields.

Course Outcomes:

After completion of course the student will be able to

1. Classify the materials based on structural properties.
2. Analyze magnetic materials in terms of magnetic moments and domain structures.
3. Compare and contrast Resistors, conductors and super conductors.
4. Apply various characterization techniques to study the properties of nanomaterials.
5. Choose appropriate nanomaterials for chemical and biological applications.
6. Identify various nanomaterials for engineering and industrial applications.

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Unit – I Introduction

Material Science and Engineering, Classification of Engineering Materials, Levels of Structures, Structure – Property Relationships in materials.

Unit – II Magnetic Materials

Terminology and Classification, Magnetic Moments due to Electronic spin, Ferromagnetism and Related phenomena, Domain Structure, The Hysteresis loop, Soft Magnetic materials, Hard Magnetic materials.

Unit – III Conductors and Resistors

The Resistivity Range, Free Electron Theory, Conduction by Free Electrons, Conductor and Resistor Materials, Superconducting Materials.

Unit - IV: Introduction to Nanomaterials

Introduction to Nanomaterials, Structural characterization: XRD, SEM, TEM, Electronic Spectroscopy, Electrical Conductivity, Physical properties of Nanomaterials, Optical properties of Nanomaterials

Unit –V: Application of Nanomaterials

Molecular Electronics and Nanoelectronics, Nanobots, Biological Applications of Nanoparticles, Catalysis by Gold Nanoparticles, Band Gap Engineered Quantum Devices, Nanomechanics, Carbon Nanotube Emitters, Photo Electrochemical Cells, Photonic Crystals and Plasmon Waveguides.

Text Books:

1. V. Raghavan, “Materials Science and Engineering: A First Course”, 6th Edition, Prentice Hall, 2015.
2. G. Schmidt, “Nanoparticles: From theory to applications”, Wiley Weinheim 2004.
3. Guozhongcao, “Nano Structures and Nano materials”, Imperial college press.(eBook)

Reference Books:

1. W.F Smith, Principles of material science and engineering, McGraw Hill, New York (1994).
2. L.H. Van Vlack - Elements of Materials Science & Engineering – Addison-Wesley Publishing Company, New York.

16EE E04

ELECTRICAL TECHNOLOGY
(Elective-I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE6	30 Marks
Credits	3

Course Objectives:

1. To know the fundamentals of DC Generators and DC motors
2. To study AC generators & Transformers
3. To understand the concepts of poly phase systems.
4. To know the concepts of 1 ϕ & 3 ϕ Induction motors.
5. To understand fundamentals of Power system.
6. To understand basics of NCES

Course Outcomes:

Students will be able to:

1. Know the fundamentals of DC Generators and DC motors
2. Study AC generators & Transformers
3. Understand the concepts of poly phase systems.
4. Know the concepts of 1 ϕ & 3 ϕ Induction motors.
5. Understand fundamentals of Power system.
6. Know the difference between CES & NCES

UNIT-I

D.C. Generators: Constructional details, Simple lap & wave windings, Methods of excitation, Induced EMF, Basic ideas of armature reaction and commutation, Characteristics of shunt, series and compound generators and their applications.

DC Motors: Significance of back EMF, Torque developed in motors, three point starter, Characteristics of shunt, series and compound motors, Speed control of DC motors.

UNIT-II

Poly Phase System: Advantages of three phase system, Star and delta connections, Relationship between line and phase quantities, Measurement of power by Two Wattmeter method.

A.C. Generators: Construction, EMF equation, Armature reaction, Synchronous impedance, Regulation.

UNIT-III

Transformers: Single Phase transformer, Construction, Working principle, EMF equation, Ideal transformer, Phasor diagram under no load and loaded conditions, OC and SC tests on transformer, Efficiency and regulation.

UNIT-IV

Induction Motors: Construction, Production of rotating magnetic field, Slip, Slip-torque characteristics, Starting methods of Induction motors.

Single Phase Induction Motors: Construction, Theory of operation, Characteristics of shaded pole, Split phase and capacitor motors, Applications.

UNIT-V

Power Systems: Basic ideas of thermal, hydro, nuclear and non-conventional generating systems and layout, Block diagram of power systems, advantages of non conventional generation systems.

Text Books:

1. H. Cotton, Electrical Technology, CBS Publishers and distributors, 7th Edition, 2005.
2. V.K.Mehta, Principles of Electrical Engineering, S. Chand and Co, 2nd Edition, 2004.
3. M.L.Soni, PV Gupta, VS Bhatnagar, A course in Electrical Power, DhanpatRai and Sons, 4th Edition, 2008.

Suggested Reading:

1. P.V. Prasad, S. Siva Nagaraju, Electrical Engineering: Concepts & Applications, Cengage Learning, 1st Edition, 2012
2. B.L.Theraja, Electrical Technology Vol.I and Vol.II, S.Chand and Co, 23rd Edition.
3. M.S.Naidu, Kamakshaiah, Electrical Technology, TMH Publications,1st Edition,2007

16EEE13

INDUSTRIAL ELECTRONICS

(Elective-I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objective:

1. To introduce the characteristics of various power semiconductor switches and their applications.
2. To know the importance of protection, triggering and commutation techniques of SCR.
3. To make acquainted with the operating principles of AC-DC, DC-DC, AC-AC and DC-AC converters.
4. To understand various voltage control techniques in power converters.
5. To comprehend quadrant operation of various power converters.
6. To recognize various application of power converters.

Course Outcomes:

Student will be able to:

1. Analyze basic operation of various power semiconductor devices and to compare their characteristics.
2. Design protection circuit and control circuits for SCR.
3. Analyze the operation principles of different AC-DC, DC-DC, AC-AC, and DC-AC converters.
4. Identify different voltage control strategies in different converters.
5. Be acquainted with different quadrant operation of power converters.
6. know the practical application of power electronic converters.

UNIT-I

Power Diodes and Transistors: Power diode, characteristics, Recovery characteristics, Types of power diodes, General purpose diodes, Fast recovery diodes, their applications, Power MOSFET and IGBT.

UNIT-II

Silicon Controlled Rectifier (SCR): SCR-Static characteristics, Two transistor analogy, Protection of SCRs, Dynamic characteristics, SCR trigger circuits-R, RC and UJT triggering circuits, turn-off methods of SCR, GTO- SCR, Comparison between SCR and GTO-SCR.

UNIT-III

Phase controlled converters: Study of Single-phase half wave and full wave controlled rectifiers with R, RL, RLE loads, significance of free wheeling diode, Dual converters - circulating and non circulating current modes.

DC-DC Converters: Principles of Step-down, Step-up, Step UP/Down choppers, Time ratiocontrol and current limit control, Types of choppers Type- A, B, C, D and E.

UNIT-IV

AC-AC Converters:

Principle of operation of Single phase Cyclo-converters and their applications. Single-phase AC Voltage Controllers with R and RL loads.

Inverters: Principle of operation of Single-phase Inverters, Voltage control methods, Singlepulse width modulation, multiple pulse width modulation, Sinusoidal pulse width modulation.

UNIT-V

Industrial Applications:

Overview of Switched mode power supplies, Online and offline UPS (block diagrams), Thyristor controlled reactors, switched capacitor networks, Emergency light control, automatic water level control, resistance heating, induction and dielectric heating.

Text Books:

1. Singh.M.D and Khanchandani.K.B, Power Electronics, Tata McGraw Hill, 2nd Edition, 2006.
2. Rashid.M.H. Power Electronics Circuits Devices and Applications. Prentice Hall of India, 2003.
3. Bimbra.P.S, Power Electronics, Third Edition, Khanna Publishers, 2013.

Suggested Reading:

1. Mohan, Undeland, Robbins, Power Electronics, John Wiley, 1996.
2. P.C.Sen, Power Electronics, Tata Mc-Graw Hill, 1st Edition, 2001.
3. G. K. Mithal, "Industrial Electronics", Khanna Publishers, Delhi, 2000.

16EC C22

DIGITAL COMMUNICATION LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Carry out experiments on various pulse digital modulation techniques.
2. Perform different line coding techniques.
3. Conduct the experiment to identify errors in cyclic codes
4. Work on convolutional encoder and decoder for controlling the errors.
5. Execute experiments on digital carrier modulation techniques.
6. Study the characteristics of MODEM.

Course outcomes:

Upon completing this course, students will be able to:

1. Experiment with various pulse digital modulation techniques.
2. Examine different line coding techniques.
3. To detect and correct errors in cyclic codes.
4. Assess the errors in convolutional encoder and decoder.
5. Demonstrate digital carrier modulation techniques experimentally.
6. Know the importance of MODEM characteristics.

List of Experiments

1. PCM generation and detection.
2. Data formats / Line coding.
3. Linear Delta Modulation and demodulation.
4. Adaptive Delta Modulation and demodulation.
5. Error detection and correction in cyclic codes.
6. Convolutional encoder and decoder.
7. ASK generation and detection.
8. FSK generation and detection.
9. BPSK generation and detection.
10. QPSK generation and detection.
11. Minimum Shift Keying generation and detection.
12. MODEM characteristics.

Reference Book:

1. Department Laboratory Manual.

Sample Mini Projects:

1. Develop a code for different digital modulation schemes and verify through simulation.
2. Design different Line coding schemes using logic Gates

16ECC23

INTEGRATED CIRCUITS AND APPLICATIONS LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Tolearn the configurations and parameters of the 741 Op-Amp.
2. To explain the circuits of linear and nonlinear applications of Op-Amp
3. To know the concepts of IC555 timer, IC723 and data converters.
4. To know the various characteristics of TTL and CMOS gates.
5. To learn combinational and Sequential circuits using digital ICS.
6. To know the difference between linear and digital ICs.

Course Outcomes: Students will be able to

1. Analyze the configurations, parameters of Op-Amp (IC741).
2. Demonstrate the circuits of Op-Amp for various applications.
3. Analyze and design the circuits using IC555 timer, IC723 and data converters.
4. Analyze the characteristics of TTL and CMOS gates
5. Analyze and design various combinational circuits using digital ICs.
6. Analyze and design various sequential circuits using digital ICs.

Lab Experiments

Part-A: **Linear IC Experiments**

1. Voltage Follower, Inverting and Non Inverting Amplifiers using Op-Amp.
2. Measurement of Op-Amp parameters
3. Arithmetic Circuits using Op-Amp
4. Waveform generation using Op-Amp.
5. Astable, Monostable multi vibrators using IC555Timer.
6. Low and High Voltage Regulators using IC723.
7. D to A Converter using R-2R ladder.

Part-B: Digital IC Experiments

1. Measurement of various characteristic parameters of TTL and CMOS gates.
2. Logic function Implementations using Decoders.
3. Logic function Implementations usingMultiplexers
4. Binary adder and subtractor, BCD adders using ICs.
5. Design of Synchronous, Asynchronous up/down counters.
6. Shift registers and ring counter using ICs.
7. Interfacing counters with 7-segment LED display units.

General Note: At least 6 experiments from eachpart.
Reference Book: Laboratory Manual.

Mini Project cum Design Exercise(s):
To realize and design a Mini project using either linear or digital or combination of linear and digital IC's

Sample Mini Projects:

a) Design and implementation of a Digital clock.
b) Design and implementation of a Security Monitoringsystem.
c) Design and implementation of Binary Multiplier
d) Design and implementation of a Water level indicator using 555 IC
e) Design and implementation of FSK Modulator using 555 IC

ECC24

MICROPROCESSOR AND MICROCONTROLLER LAB

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To develop and understand the assembly language programming concepts of 8086 Microprocessor.
2. To understand the difference between assembler, emulator and debugger.
3. To Interface different programmable controllers to 8086 microprocessor.
4. To Interface a microcontroller to external input/output devices and perform its programming.
5. To develop and understand the embedded C programming concepts of 8051 microcontroller.
6. To control the operation of various peripherals by using 8051 microcontrollers.

Course Outcomes:

Students will be able to:

1. Write the 8086 assembly language programs on arithmetic, logical operations and DOS function calls.
2. Know about different assemblers available for programming 8086 microprocessor.
3. Understand the advantage of various debugging tools available to program 8086 microprocessor.
4. Write and test embedded C programming on interfacing modules with 8051.
5. Learn the hardware and software interaction and integration.
6. Design and develop the 8051 based embedded systems for various applications.

I. List of Experiments

1. Study and use of 8086 microprocessor trainer kit and simple programs under different addressing modes.
2. Multiplication and division programs.
3. Single byte, multi byte binary and BCD addition, subtraction.
4. Code conversion.
5. Sorting and string search.

6. Interfacing traffic signal controller using 8086.
7. Familiarity and use of 8051 microcontroller trainer kit and simple programs under different addressing modes.
8. Timer and counter operations and programming using 8051.
9. Interfacing applications using LED, switch, relay and buzzer
10. Interfacing ADC using 8051.
11. Generation of waveforms using DAC by interfacing it with 8051.
12. Program to control stepper motor using 8051.
13. Interfacing 7-segment display using 8051.
14. Interfacing LCD using 8051.

II. Mini Project cum Design Exercise(s):

Design and realize a mini project on 8086/ 8051 based interfacing for a given specification.

(Ex: Interfacing hex keypad to 8086 through keyboard and display controller (8279), Interfacing Elevator, Interfacing Real time clock etc.)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Choice Based Credit System (with effect from 2017-18)
B.E (Electronics and Communication Engineering)

SEMESTER – VI

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16ECC25	Embedded System Design	3	-	3	30	70	3
2	16ECC26	Digital Signal Processing	4	-	3	30	70	4
3	16ECC27	Microwave Engineering	3	-	3	30	70	3
4	16ECC28	Wireless Mobile Communication	3	-	3	30	70	3
5		Elective-II	3	-	3	30	70	3
6		Elective-III	3	-	3	30	70	3
PRACTICALS								
7	16ECC29	Embedded System Design Lab	-	3	3	25	50	2
8	16ECC30	Digital Signal Processing Lab	-	3	3	25	50	2
9	16ECC31	Microwave Engineering Lab	-	3	3	25	50	2
TOTAL			**19**	**9**	**-**	**255**	**570**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Elective-II		Elective-III	
16ECE03	Analog and Mixed Signal Design	16ITE25	Java Programming
16ECE04	Coding Theory and Techniques	16ITE26	Python Programming
16ITE27	Data Structures	16ECE05	CPLD and FPGA Architectures
16MTE03	Numerical methods for Scientific and Engineering Computation	16ECE06	Digital Control systems
		16ECE07	Optical Fiber Communication

16ECC25

EMBEDDED SYSTEM DESIGN

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To learn the fundamentals of the embedded system design.
2. To provide in depth understanding - ARM processor fundamentals and instruction set.
3. To learn architecture details of ARM 7 microcontrollers.
4. To interface various I/O devices to ARM 7 microcontroller.
5. To understand embedded system design environment.
6. To analyze various embedded applications and debugging tools.

Course Outcomes:

Students will be able to:

1. Know the fundamentals of the embedded system design.
2. Understand the ARM architecture and its instruction set.
3. Analyze various features of ARM7 microcontroller.
4. Able to interface various I/O devices to ARM 7 microcontroller.
5. Understand the Embedded system design cycle
6. Develop and Debug various embedded system applications.

UNIT – I

Introduction to Embedded systems: Embedded systems vs General computing systems, Classifications, Applications areas, Processor embedded into a system, Processor selection for embedded system, Embedded hardware units and devices in a system, Design metrics and Challenges in embedded system design. ARM design philosophy.

UNIT – II

ARM Processor Fundamentals: Register organization, Program Status Register, Pipeline, Introduction to exceptions.

ARM Instruction set: Data processing instructions, Branch instructions, Load-Store instructions, Software interrupt instruction, Program Status Register instructions, Loading constants, and Conditional executions. Introduction to THUMB instructions: Differences between Thumb and ARM modes, Register usage.Introduction to ARM C Programming.

UNIT – III

ARM 7 Microcontroller (LPC2148)**:** Salient features of LPC 2148, Pin description of 2148, Architectural Overview. **ARM 7**(LPC2148) **Peripherals:** Description of General Purpose Input/Output (GPIO) ports, Pin control Block. Features, Pin description, Register description and operation of PLL, Timers, PWM, Interfacing: LED, Relay, Buzzer, LCD, DAC, DC motor. Communication protocols: Brief overview on I2C, SPI, and CAN.

UNIT – IV

Embedded System Design Cycle: Embedded system design and co-design issues in system development process, Design cycle in the development phase for an embedded systems. Embedded software development tools: Host and Target machines, Linker/Locators for embedded software, Embedded software into the target system.

UNIT – V

Debugging tools and Applications: Integration and testing of embedded hardware, Testing methods, Debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, Simulator, Emulator and In-Circuit Emulator, IDE, RTOS services, VxWorks features. Case Studies: Embedded system design for automatic vending machines and digital camera.

Text Books:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design," 3/e, Tata McGraw Hill Education, 2015.
2. Andrew N.SLOSS, DomonicSymes, Chris Wright "ARM System Developers Guide- Designing and optimizing system software" ELSEVIER 1st Edition, 2004.
3. Steve Furber "ARM System On Chip Architecture" 2/e Pearson education, 2000.

Suggested Readings:

1. David E.Simon, "An Embedded software primer", Pearson Education,2004.
2. ARM 7 (LPC 214x) user manual from Philips semiconductors

16ECC26

DIGITAL SIGNAL PROCESSING

Instruction	4 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. Discrete-time signals in the frequency domain using DTFT and DFT.
2. Implementation of the FFT algorithms and its applications.
3. Design digital IIR and FIR filters for the given specifications.
4. The basics of Multirate digital signal processing and its applications
5. DSP processor architecture for the efficient implementation of DSP applications.
6. Decimator and interpolator on DSP Processor.

Course Outcomes:

Students will be able to:

1. Understand the concept of DTFT and DFT for signal processing applications.
2. Implement linear filtering using FFT.
3. Design and implement FIR and IIR filters for the given specifications.
4. Interpret the concepts of Multirate digital signal processing and its applications.
5. Demonstrate the design of digital filters using DSP Processor.
6. Examine the functionality of decimator and Interpolator on DSP Processor.

UNIT-I

Discrete Fourier Transform: Overview of Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Properties of DFT, Efficient computation of DFT-Fast Fourier Transform (FFT) algorithms: Radix-2 FFT algorithms – Decimation in Time, Decimation in Frequency algorithms, Inplace computation, bit reversal algorithm. Use of FFT algorithms in linear filtering.

UNIT-II

FIR Filter Design: Amplitude and Phase responses of FIR filters – Linear phase FIR filters – Windowing technique for design of FIR filters – Rectangular, Bartlet, Hamming, Blackman, and Kaiser Windows. Realization of digital filters-Direct form-I and II, cascade and parallel forms of IIR filters, Realization of linear phase FIR filter, Finite word length effects.

UNIT-III

IIR Filter Design: Butterworth and Chebyshev approximation, IIR digital filter design techniques- Impulse Invariant transformation, Bilinear transform techniques, Digital Butterworth and Chebyshev filters, Spectral transformation techniques. Comparison between FIR and IIR filters.

UNIT- IV

Multirate Digital Signal Processing: Introduction -Decimation by a Factor -D, Interpolation by a Factor -I, Sampling Rate Conversion by a Rational Factor -I/D. Implementation of Sampling Rate Conversion, Multistage implementation of Sampling Rate Conversion, polyphase decomposition, Noble Identities, Application of Multirate Signal Processing.

UNIT-V

DSP Processors: Introduction, Difference between DSP and General Purpose Processor architectures, need for DSP processors. General purpose DSP processor-TMS320C67XX processor, architecture, functional units, pipelining, registers, linear and circular addressing modes, instruction set.

Text Books:

1. Alan V. Oppenheim & Ronald W. Schafer, “Digital Signal Processing,” PHI, 2/e, 2010.
2. John G. Proakis&Dimtris G. Manolakis, “Digital Signal Processing Principles, Algorithms and Application,” PHI, 4/e, 2012.
3. RulphChassaing, “Digital Signal Processing and Applications with the C6713 and C6416 DSK”, John wiley& sons, 2005.

Suggested Reading:

1. Sanjit K Mitra,”Digital Signal Processing, A computer based approach”, TMH, 3/e, 2011.
2. TarunkumarRawat, “Digital Signal Processing”, First edition, Oxford, 2015.
3. Avtar Singh & S. Srinivasan, “Digital Signal Processing Implementation using DSP microprocessors”, Thomson Brooks, 2/e, 2004.

16ECC27

MICROWAVE ENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
redits	3

Course Objectives:

1. To understand importance of microwaves and their applications.
2. To analyze and solve wave equations for both guided waves and waveguides.
3. To learn scattering parameters which are used to characterize microwave network.
4. To understand the principle and operation of microwave sources.
5. To know various microwave solid state devices and their characteristics.
6. To understand microwave power measurement techniques.

Course Outcomes:

Students will be able to:

1. Apply the wave equations and their solutions to analyze the waves between parallel planes and waveguides.
2. Determine the scattering matrix for various microwave components.
3. Analyze the interaction of electron beam, RF field for various microwave sources.
4. Know the characteristics of IMPATT and TRAPATT diodes.
5. Understand the microwave power measurement techniques.
6. Gain the knowledge on microwave applications.

UNIT – I

Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves.

Guided Waves: Waves between parallel planes. TE and TM waves. Characteristics of TE and TM waves,TEM waves. Velocity of propagation, Wave impedance, Attenuation in parallel plane guides.

UNIT - II

Rectangular Waveguides: Rectangular waveguides, TM and TE waves, Impossibility of TEM wave in waveguides. Power transmission and Power Losses. Wave Impedance, Attenuation factor and Quality factor of rectangular waveguides.

Circular Waveguides: Solutions of wave equations in cylindrical coordinates, Characteristics of TM and TE modes.

Microwave Cavities - Rectangular and Circular cavity resonators, Quality factor and applications of cavity resonator.

UNIT - III

Microwave Circuits and Components: Concept of microwave hybrid circuit, Introduction to scattering parameters. Properties and S-parameters of reciprocal components- E and H Plane Tees, Magic Tee, Directional Coupler. Properties of Waveguide Corners, Twists and Bends.Hybrid ring.

Waveguide Attenuators - Different types, Resistive Card and Rotary Vane attenuator;

Waveguide Phase Shifters - Different types, Dielectric and Rotary Vane phase shifter.

Non reciprocal components: Ferrites – Composition and Faraday rotation; Ferrite components - Isolators, Gyrators and Circulators. S-parameters of Isolator and Circulator.

UNIT- IV

Microwave Tubes: Limitations of conventional tubes at microwave frequencies. Microwave tubes-O type and M type classifications.

O-type tubes: Two Cavity Klystron, Velocity modulation process, Bunching process. Output Power and Beam loading. Multi cavity Klystron Amplifiers. Reflex Klystron-Velocity Modulation, power output and efficiency, Electronic Admittance.

Helix TWT: Slow wave structures, Principle of operation and applications of helix TWT (qualitative treatment only).

M-type tubes: Introduction, Magnetron Oscillators, different types, ð-mode of operation, frequency pushing and pulling effects and their remedies. Cross field amplifier and BWO.

UNIT – V

Microwave Solid State Devices: Introduction, Transfer Electronic Devices- Gunn diode, RWH theory-Differential negative resistance and two valley model theory. Gunn oscillation modes.Applications of PIN and Varactor diode.

Avalanche Transit time devices: Introduction, IMPATT and TRAPATT diode – physical structure, negative resistance, power output and efficiency (qualitative treatment only).

Measurement of Power: Measurements of low, medium and high microwave power. Basic principles of Reflectometer.

Text Books:

1. E. C. Jordan & Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", 2/e, Pearson Education, 2006.
2. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.

Suggested Reading:

1. Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Annapurna Das and Sisir K Das "Microwave Engineering" 1/e, 2000, Tata McGraw-Hill.
3. Herbert J.Reich, John G.Skalnik, Philip F. Ordung, Herbert L. Krauss," Microwave Principles", East-West Pvt. Ltd. Madras.

16ECC28

WIRELESS MOBILE COMMUNICATION

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To make the student understand the wireless communication systems and features of 4G mobile standards and their comparison with 1G, 2G, 2.5G and 3G technologies.
2. To give the student an understanding of Cellular system for Mobile.
3. To enable the student to understand the Mobile radio propagation models.
4. To provide the student with an understanding of small scale fading and diversity reception.
5. To make the student to learn the salient features of various multiple access systems.
6. To make the student to learn concepts of GSM, IS-95 CDMA and OFDM

Course outcomes:

Student will be able to:

1. Compare the technology trends changing from generation to generation.
2. Design a Cellular system for Mobile communications using frequency reuse for maximum coverage,
   less interference and optimum capacity.
3. Apply the large scale path-loss and analyze small scale fading.
4. Choose an appropriate Propagation model for either Outdoor or Indoor cellular communication.
5. Categorize various multiple access techniques according to the complexity, installation cost, speed of transmission, channel properties.
6. Analyze the system specifications of either GSM or CDMA based Mobile Communication Systems and OFDM.

UNIT - I

Wireless Communication Systems: Bluetooth, Trends in Radio and Personal Communications, Comparison of 1G, 2G, 2.5G and 3G technologies. UMTS system architecture and Radio Interface; Features of 4G, WLAN.

UNIT – II

Cellular Concept -System Design Fundamentals : Frequency reuse, channel assignment strategies, Handoff process, factors influencing handoffs, types of handoffs, Interference and system capacity, Cross talk, Enhancing capacity and cell coverage, Trunked radio system, grade of service as per Erlang's B system.

UNIT – III

Mobile Radio Propagation models: Introduction to Radio Wave Propagation, Free space propagation model, three basic propagation mechanisms, ground reflection, Diffraction practical link budget design using path loss models, Outdoor propagation models: Longley Rice model and Okumura model. Indoor propagation models, partition losses. Small scale multipath propagation: Parameters of mobile multipath channels, types of small scale fading. Diversity reception methods.

UNIT – IV

Multiple Access Techniques: Need and concept of multiple access techniques, FDMA, TDMA, SSMA, CDMA, FHMA, SDMA. OFDM in wireless communication systems. Applications of multiple access techniques.

UNIT – V

Wireless systems: GSM: Services and Features, System architecture, Radio Sub system, Channel Types, Frame structure and Signal processing. CDMA Technologies: Digital Cellular standard IS-95 Forward Channel, Reverse Channel. Introduction to CDMA 2000.

Text Books:

1. Theodore.S. Rappaport, "Wireless Communications: Principles and Practice", 2/e, Pearson Education, 2010
2. T.L.Singhal "Wireless Communication Systems", 1/e, TMH Publications, 2010.

Suggested Reading:

1. William.C.Y.Lee, "Mobile Cellular Telecommunications: Analog and Digital Systems", 2/e, Mc-Graw Hill, 2011.
2. Kernilo, Feher, "Wireless Digital Communications", PHI, 2002.

16ECE03

ANALOG AND MIXED SIGNAL DESIGN

(Elective-II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. The concepts of MOS Devices.
2. Characteristic behavior of MOS amplifier in various configurations
3. Different types of Current mirrors and differential amplifiers using MOSFET.
4. Analysis of Two-stage Op-Amp amplifier
5. The analysis of switched capacitors, sample and hold circuits and stability of Op-Amp.
6. To analyze different types of data converters.

Course Outcomes:

Students will able to:

1. Recall the elementary concepts of MOS device, MOS amplifiers and Op-Amp
2. Classify and relate the performance of different types of MOS Amplifiers, Current Mirrors, Op-Amps and data converters
3. To Model MOS device under different cases
4. Examine different MOS amplifier configurations, Op-Amp, Data converters, will be able to distinguish different types of Op- Amp configurations and their performance parameters.
5. Choose the best configuration for the specifications Slew rate, conversion speed.
6. Design, develop and improve the performance of the data converters and Op-Amp.

UNIT 1: MOS amplifiers

Introduction to analog design, Basics of MOS device: general consideration, MOS VI Characteristics, Second order effects, MOS small signal model, Signal stage amplifier: common source amplifier, Source follower, common gate stage.

UNIT 2: Current mirrors & Op-Amp

Simple current mirrors, cascade current mirror (gain , output resistance), Bipolar current mirrors, High out impedance current mirrors: cascode gain stage, Wilson current mirror, Source degenerated current mirrors, MOS amplifiers using CM as load, Differential pairs with current mirror loads (MOS and bipolar) Operational amplifiers, Basic two stage MOS Operational amplifier–Characteristic parameters, two stage MOS Op-Amp with Cascodes

UNIT 3: Two Stage Op-Amp

MOS Telescopic-cascode Op-Amp, MOS Folded cascode op-amp, Fully differential folded cascode op-amp Current feedback op-amps, Op-Amp Stability and frequency compensation of Op-Amps, Phase margin and noise in Op-Amps, Comparators: Op-Amp Based Comparators.

UNIT 4: Switched Capacitors

Basic building blocks, basic operation and analysis, Inverting and Non-inverting integrators, signal flow diagrams.

Sample and Hold circuits - Performance Requirements, MOS Sample and Hold basics, Clock feed through problems

UNIT 5: D/A andA/DConverters

D/A converters: Specifications, Decoder based converter, Binary-scaled converters, Thermometer code converters, Current mode converters.

Nyquist rate A/D Converters: Integrated converters – successive approximation converters, Nyquist rate A/D Converters: Integrated converters – successive approximation converters.

Text books:

1. BehzadRazavi, Design of Analog CMOS Integrated Circuits, Tata McGrah Hill. 2002
2. David Johns, Ken Martin, Analog Integrated Circuit Design, John Wiley & sons. 2004

Suggested Reading:

1. Paul.R. Gray & Robert G. Major, Analysis and Design of Analog Integrated Circuits, John Wiley & sons. 2004
2. Jacob Baker.R.et.al., CMOS Circuit Design, IEEE Press, Prentice Hall, India, 2000.

16ECE04

CODING THEORY AND TECHNIQUES

(Elective-II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Mathematical models of various channels and basic notions of error control coding.
2. Implementation of channel coding techniques in digital communications.
3. Fundamentals of abstract algebra, finite fields and its extension.
4. Mathematical structure and algorithms for RS codes.
5. Concepts of interleaving and complete analysis of Convolutional codes.
6. Modern capacity approaching codes like Turbo codes and its encoding and decoding strategies.

Course Outcomes:

Student will be able to:

1. Understand the theory and principles of information theory and channel Coding.
2. Design and analyze the encoding and decoding circuits for Block codes.
3. Apply the principles of abstract algebra, finite fields and its extension to design related codes.
4. Develop and execute encoding and decoding algorithms associated with RS codes.
5. Demonstrate the ability to select and design simple convolutional codes.
6. Analyze modern capacity approaching codes like Turbo codes.

UNIT-I

Coded digital communication systems: Introduction, Channel models, Discrete Memory less channel, Binary Symmetric channel, Binary Symmetric Erasure Channel, Burst Channel, Types of Codes, Types of errors, Error control Strategies; channel coding Theorem, Channel coding gain.

UNIT II

Linear Block codes: Introduction, encoding, Syndrome computation and error detection, Standard array decoding, Maximum likelihood decoding, Encoder and Syndrome Generator implementations of systematic codes, Error-detecting and correcting capabilities, Hamming codes, Hamming bound.

Cyclic codes: Description, encoding and Syndrome computation and error detection, Encoder and Syndrome generator implementations of systematic and unsystematic codes, Generator and Parity check matrices.

UNIT III

Galois Fields: Fields, Binary arithmetic, Construction of Galois Fields GF (2^m) from GF (2), Basic properties of Galois Fields,

RS codes: Introduction, encoding and decoding using Berlekamp-Massey algorithm.

UNIT IV

Convolution codes: Introduction, Encoding, State diagram, Code Tree, Code Trellis diagram, Decoding: Maximum- Likelihood decoding, soft decision and hard decision decoding, Viterbi algorithm.

UNIT V

Turbo codes: Concatenation, Types of Concatenation, interleaving, types of interleavers, Turbo codes: Introduction, encoding and decoding using BCJR Algorithm.

Text books:

1. Shulin and Daniel J. Costello, Jr. "Error Control Coding," 2/e, Pearson, 2011.
2. L.H.Charles LEE, "Error control block codes for Communication Engineers", Artech, 2000, 1st edition.
3. Man Young Ree, "Error-Correcting Coding Theory", Mc-Graw-Hill publishing company, 1989,1st edition.

Suggested reading:

1. Bernard Sklar, "Digital Communications: Fundamentals and Applications - Prentice Hall, 2001.
2. K Sam Shanmugum, "Digital and Analog Communication Systems", Wiley, 2012.

16ITE27

DATA STRUCTURES
(Elective-II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To familiarise with different linear and nonlinear data structures.
2. To present the concepts of time and space complexity
3. To discuss applications of various data structures.
4. To develop a base for advanced computer science study.

Course Outcomes:
Student will be able to:
1. Understand basic data structures arrays and linked lists
2. Analyse time complexity of algorithms
3. Understand the basic operations of Stacks and Queues
4. Implement basic operations on data structures
5. Understand applications of binary trees and graphs
6. Understand various kinds of searching and sorting techniques

UNIT-I

Introduction to Data Structures and Algorithms: Elementary data structure organisation, classification of data structures, operations on data structures, Abstract Data Type, Algorithms, Different approaches to designing an algorithm, Control structures used in algorithms, Time and Space Complexity, Big O Notation, Omega Notation (Ω), Theta Notation (Θ)

UNIT-II

Arrays: Introduction, Declaration of Arrays, Accessing the Elements of an Array, Storing Values in Arrays, Operations on Arrays, **Linked Lists:** Introduction, Singly Linked Lists, Circular Linked Lists, Doubly Linked Lists, Applications of Linked Lists

UNIT-III

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on a Stack, Linked Representation of Stacks, Operations on a Linked Stack, Applications of Stacks, **Queues:** Introduction to Queues, Array Representation of Queues, Linked Representation of Queues, Types of Queues, Applications of Queues

UNIT-IV

Trees: Introduction, Types of Trees, Creating a Binary Tree from a General Tree, Traversing a Binary Tree, Applications of Trees, **Efficient Binary Trees:** Binary Search Trees, Operations on Binary Search Trees

UNIT-V

Graphs: Introduction, Graph Terminology, Directed Graphs, Bi-connected Components, Representation of Graphs, Graph Traversal Algorithms **Introduction to Searching:** Linear Search, Binary Search, Introduction to Sorting, Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Radix Sort, Heap Sort, Shell Sort, Tree Sort, Comparison of Sorting Algorithms

Text Books:

1. ReemaThareja, “Data Structures Using C”, Second Edition, Oxford Higher Education, 2014
2. Horowitz Ellis, SahniSartaj& Anderson-Freed Susan, “Fundamentals of Data Structures in C”, Orient BlackSwan, 2008

Suggested Reading:

1. NarasimhaKarumanchi, “Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles”, CareerMonk Publications, 2016.
2. NarasimhaKarumanchi, “Coding Interview Questions”, 3rd Edition, CareerMonk Publications, 2016
3. Yashavant P. Kanetkar, “Data Structure Through C”, BPB Publications, 2003.

Web Resources:

1. NPTEL Videos Introduction to data structures and algorithms - http://nptel.ac.in/courses/106102064/1
2. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
3. https://visualgo.net/en

16MTE03

NUMERICAL METHODS FOR SCIENTIFIC AND ENGINEERING COMPUTATIONS

(Elective-II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To Solve the simultaneous equations using Decomposition method and also find the roots of the non-linear equations.
2. To Compute the solution using Numerical differentiation and also integration for finding the intermediate values for the set of observations.
3. To Identify the solution for the initial value problem and boundary value problem using numerical differential equations.
4. To Estimate the best values of the parameters using Least square approximation for the fitting of equations.
5. To Solve the set of equations and also compute the inverse of the matrix using different types of matrix methods.
6. To Analyze the engineering applications and also finding the best solution.

Course outcomes:

Student will be able to:

1. Solve and also identify the rate of convergence of non-linear equations for computing the roots.
2. Analyze the solution and also estimate the integration for the set of observations of the polynomial.
3. Know the solution of initial value problem and boundary value problem with the help of Numerical differential equations.
4. Understand and also estimate the parameters of growth curve using Least square approximation.
5. Use the different Matrix methods for finding the inverse of the given set of equations.
6. Achieve the outcome of the problems using different numerical methods.

UNIT-I:

Solution of Non-linear equations: Errors, rate of convergence, methods for finding the solution for transcendental equations-regulafalsi method, secant method, Newton-Raphson method.

Solution for simultaneous equations: Iterative methods-LU decomposition method, partition method..

UNIT-II

Numerical differentiation: operators, forward interpolation and backward interpolation. Newton's interpolation formula, Lagrange's interpolation formula, first and second order differentiation of equal intervals.

Numerical integration: Newton-Cotes Integration, Gaussian Integration, Romberg Integration.

UNIT-III

Numerical solution for differential equations: Initial value problem-single step method, multistep method, Euler's method, modified Euler's method, RungeKutta (R-K 3rd order, 4th order) methods. Adams-Bashforth method.

UNIT-IV

Curve fitting: Principle of least square approximation-fitting of straight line, quadratic polynomials, growth curves (exponential curve, power curve).

UNIT-V

Eigen values and Eigen vectors: Power method, inverse power method, Householder's method.

Text Books:

1. M.K.Jain, S.R.K.Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", Sixth Edition, 2012,New Age International Publishers
2. Dr.B.S.Grewal, "Numerical Methods in Engineering & Sciences with programs in C & C++", Tenth Edition, 2014, Khanna Publishers.

Suggested Reading:

1. V.K.Singh, "Numerical and Statistical Methods in Computer",2005, Paragon International Publishers
2. RadhaKantaSarkar, "Numerical Methods for Science and Engineering", 2004, Eswar Press

16ITE25

JAVA PROGRAMMING

(Elective-III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the fundamentals of Java language which includes defining classes, invoking methods, inheritance, polymorphism, exception handling etc.
2. To solve real world problems by creating Java applications using sound OOP practices, standard class libraries and APIs.
3. To introduce event driven Graphical User Interface (GUI) programming and usage of standard class libraries.

Course Outcomes:

1. Achieve proficiency in object-oriented concepts and also learns to incorporate the same into the Java programming language.
2. Create Java application programs using sound OOP practices e.g. Inheritance, interfaces and proper program structuring by using packages, access control specifiers.
3. Understand and Implement the concepts of Exception Handling and Multithreading in java.
4. Develop the ability to solve real-world problems through software development in high-level programming language using Large APIs of Java as well as the Java standard class library.
5. Understand File, Streams, Input and Output Handling in java.
6. Create graphical user interfaces in java as well as apply the knowledge of Event Handling.

UNIT-I

Evolution of java: Java's Magic: The Bytecode, The Java Buzzwords Objects, **Overview of Java:** Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

UNIT-II

Inheritance, Packages and Interfaces: Inheritance basics, using super keyword**,** Method overriding, Dynamic method dispatch , Abstract classes, using final with inheritance , Introduction to Object class,

Packages: Defining, Creating and Accessing a Package, importing packages,

Interfaces : Defining and implementing interfaces, Nested Interfaces.

Strings Handling: String Constructors, Length, Operations, String Comparison, Searching for strings, Difference between String &StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives.

UNIT-III

Exception Handling in Java: Exception handling fundamentals, Exception types**,** Usage of try, catch, throw, throws and finally clauses, writing your own exception classes.

Multithreading in Java: The java Thread Model, How to create threads, Thread class in java, Thread priorities, Thread synchronization.

Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

UNIT-IV

Collections Framework: Overview of Collection Framework, Commonly used Collection classes – ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, Collection Interfaces –Collection, List, Set, SortedSet, Accessing a collection via an Iteration,Storing user-defined classes in collections, Map Interfaces and Classes, Using a comparator. Legacy classes – Vector, Hashtable, The Enumeration interface.

Input/Output : How to read user input (from keyboard) using scanner class, Stream classes, InputStream, OutputStream, FileInputStream, FileOutputStream, Reader and Writer, FileReader, FileWriter cl asses. File class.

UNIT-V

GUI Design & Event Handling: Component, Container, window, Frame classes. Working with Frame windowGUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling button click events, Adapter classes.Writing GUI Based applications.**Database Handling in Java**: Java Database Connectivity (JDBC)

Text Books:

1. Herbert Schildt: "Java: The Complete Reference", 8th Edition, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell: "Core Java, Volume I—Fundamentals", 8th edition, Prentice Hall, 2008.

Suggested Reading:

1. SachinMalhotra&SaurabhChoudhary: "Programming in Java", 2nd Edition, Oxford University Press, 2014.
2. C. Thomas Wu, "An introduction to Object-oriented programming with Java", 4th edition, Tata McGraw-Hill Publishing company Ltd., 2010.
3. K. Arnold and J. Gosling, "The JAVA programming language", 3rdedition, Pearson Education, 2000.

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

16ITE26

PYTHON PROGRAMMING

(Elective-III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course is introduced to

1. Introduce the fundamentals of Python programming.
2. Learn how to use lists, tuples, and dictionaries in Python programs.
3. Learn how to read and write files in Python.
4. Impart usage of exception handling for error handling.
5. Familiarize python visualization.

Course Outcomes:

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

1. Understand basic data structures of python.
2. Perform operations on strings.
3. Understand the concepts of file I/O.
4. Understand exception handling in Python.
5. Plot data using appropriate Python visualization libraries.
6. Develop basic Python applications.

Prerequisites: Programming and Problem Solving (16CSC01), Programming Laboratory (16CSC02)

Unit-I

Introduction to Python Programming: Using Python, The IDLE Programming Environment, Input and Output Processing, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, More About Data Output: New line, Item Separator, Escape Characters, Formatting parameters.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.

Unit-II

Repetition Structures: Introduction, while loop, for loop, Sentinels, Input Validation Loops, Nested Loops.

Functions: Introduction, Defining and Calling a Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions Generating Random Numbers, Writing Our Own Value-Returning Functions, The math Module, Random Module, Time Module and Storing Functions in Modules.

Unit-III

Lists and Tuples: Sequences, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples.

Strings: Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings.

Unit-IV

Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

Python File Input-Output: Opening and closing file, various types of file modes, reading and writing to files, manipulating directories

Unit-V

Exception Handling: What is exception, various keywords to handle exception such try, catch, except, else, finally, raise.

Regular Expressions: Concept of regular expression, various types of regular expressions, using match function

Introduction to plotting in Python – Basic Plots- Line and Scatter Plot, Histograms and plotting data contained in files.

Text Books:

1. Tony Gaddis, "Starting Out With Python", 3rd edition, Pearson, 2015.
2. Charles Dierbach, "Introduction to Computer Science using Python", Wiley, 2013.

Suggested Reading:

1. Kenneth A. Lambert, "Fundamentals of Python", Delmar Cengage Learning, 2013.
2. James Payne, "Beginning Python using Python 2.6 and Python 3", wrox programmer to programmer, 2010.
3. Paul Gries, "Practical Programming: An Introduction to Computer Science using Python", 3rd edition, 2016.
4. Clinton W. Brownley, "Foundations for Analytics with Python", 1st edition, O'Rielly Media, 2016.

Web Resources:

1. https://www.python.org/
2. https://www.coursera.org/learn/python
3. https://learnpythonthehardway.org/book/
4. https://www.coursera.org/specializations/python

16ECE05

CPLD AND FPGA ARCHITECTURES

(Elective-III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Familiarization and implementation of various programmable Logic devices.
2. To study various Complex Programmable Logic Devices Architectures.
3. To understand the different programming technologies.
4. To study Field programmable gate arrays and realization techniques.
5. To design different case studies with Actel FPGAs.
6. To study the design tools and ASICs.

Course Outcomes:

Students will be able to:

1. Understand the concept of programmable logic devices and differences between these devices.
2. Analyze various CPLD architectures and their programming technologies.
3. Analyze various FPGA architectures and their programming technologies.
4. Implement various logic functions on PLDs, CPLDs and FPGAs.
5. Understand the concepts of placement and routing and classifying ASICs.
6. Demonstrate VLSI tool flow for CPLDs and FPGAs.

UNIT I

Review of Logic Design: Implementation of logic functions with multiplexers. **Programmable Logic Devices**: Architectures of PROM, PLA and PAL. Implementation of MSI circuits using Programmable Logic Devices.

UNIT II

Complex Programmable Logic Devices: Introduction to CPLD Architecture of CPLD. Logic Block, I/O Block, Interconnect matrix and features of Altera max 7000 series, AMD Mach 4 and Xilinx XC-9500 CPLD.

UNIT III

Xilinx FPGAs: Introduction to FPGA, FPGA Programming Technologies. Architecture, Logic Blocks, I/O Block, Routing Architecture and features of Xilinx XC-4000, SPARTAN-II ,Virtex-II and salient features of VirtexIII to VII devices.

UNIT IV

Altera FPGAs: Logic Block, I/O Block, Routing Architecture and features of Altera's Flex 10000 series FPGA. Anti-Fuse Programmed FPGAs: Introduction, Architecture of Actel's Act1, Act2, and Act3 FPGAs. Designing Adders, Accumulators and Counters with the ACT devices.

UNIT V

Digital Design Flow: Digital design tools for FPGAs. Digital design flow for CPLDs and FPGAs. Importance of Placement and Routing, Introduction to ASICs: Semi-Custom and Full-Custom ASICs.

Text books:

1. S. Trimberger, Edr, "Field Programmable Gate Array Technology", Springer Pub., 2011.
2. Ronald J . Tocci, Neal S. Widmer, Gregory L. Moss "Digital Systems", 10/e, Pearson academic press 2011.
3. P.K.Chan& S. Mourad, "Digital Design Using Field Programmable Gate Array", PHI, 1994.

Suggested Reading:

1. S. Brown, R.J.Francis, J.Rose, Z.G.Vranesic, "Field programmable gate array", BSP, 2007.
2. Manuals from Xilinx, Altera, AMD, Actel.

16ECE06

DIGITAL CONTROL SYSTEMS

(Elective-III)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce digital control system architecture and their transfer functions.
2. To illustrate stability analysis in Z-plane.
3. To introduce modern control theory using State Space Analysis.
4. To familiarize with the Time and Frequency domain response of digital control systems.
5. To familiarize the students with different compensators and Controllers of digital control systems.
6. To illustrate the procedure of digital controller design using Pole Placement.

Course Outcomes:

After completion of this course, a student will be able to

1. Evaluate the transfer function of a discrete data control system.
2. Test the stability of digital control systems.
3. Analyze a system using state variable concepts.
4. Analyze a system using time and frequency domain approaches.
5. Compare various digital controllers and compensators.
6. Design the digital control system using pole placement.

UNIT-I

Elements of Digital Control System: Introduction, digital control system architecture, Transfer function of a discrete data control system,advantages and disadvantages, Sample and Hold Systems.

UNIT-II

Stability Analysis: Mapping between the S-Plane and the Z-Plane — Primary strips and Complementary Strips — Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury's stability test — Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

UNIT — III

State Space Analysis: State Space Representation of discrete time systems, solving discrete time state space equations, State transition matrix and its Properties, Methods for Computation of State Transition Matrix, Pulse Transfer Function Matrix, Discretization of continuous time state - space equations. Concepts of Controllability and Observability, Tests for controllability and Observability.Duality between Controllability and Observability.

UNIT-IV

Design of Discrete Time Control System : Transient and Steady State response Analysis, Design based on Root locus Methods, Design based on the frequency response method- Bilinear Transformation and Design procedure in the ù -plane, Bode diagrams, Lead, Lag and Lead-Lag compensators and digital PID controllers.

UNIT-V

Pole Placement and Observer Design: Design of state feedback controller via pole placement - Necessary and sufficient conditions, Ackerman's formula. State Observers - Full order state observer, Error Dynamics and Design of Prediction observers.

Text Books:

1. K. Ogata, "Discrete-Time Control Systems", PHI, 2nd Edition, 2012.
2. M.Gopal, "Digital Control and State Variable Methods", TMH, 3rd Edition,2009.

Suggested Reading:

1. B.C. Kuo, "Digital Control Systems" , Oxford University Press, 2nd Edition, 2003.
2. V. I. George, C. P. Kurian, "Digital Control Systems", Cengage Learning, 1st Edition, 2012.

16ECE07

OPTICAL FIBER COMMUNICATION

(Elective-III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
2. To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
3. To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes.
4. To learn the Power Launching and coupling, Lensing schemes.
5. To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.
6. To learn the advances in optical systems such as WDM and Local Area Networks.

Course Outcomes:

Student will be able to:

1. Outline the Optical fiber communication and classify fiber modes configurations and structures.
2. Analyze the channel impairments like losses and dispersion.
3. Identify the various Optical sources and apply their principle.
4. Evaluate the Power Launching and coupling, Lensing schemes
5. Distinguish the fiber optical receivers such as PIN APD diodes and examine the noise performance in photo detectors.
6. Examine the Digital Transmission Systems and demonstrate the advances in optical systems.

UNIT – I

Overview of Optical Fiber Communications: Evolution of fiber optic system, advantages, disadvantages and applications of optical fiber communication, Elements of Optical Fiber Transmission link, Basic Optical laws and definitions

Optical Fiber Modes and Configurations: Overview of Modes and Key concepts, Linearly Polarized Modes, Single Mode Fibers and Graded Index fiber structure.

UNIT – II

Signal Degradations in Optical Fibers: Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-Information Capacity determination, Group Delay, Material Dispersion, Waveguide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in Guided Index fibers, Design Optimization of Single Mode fibers-Refractive Index profile and cut-off wavelength.

UNIT – III

Optical Sources: Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency, LED power, Modulation of LED, laser Diodes, External Quantum efficiency, Resonant frequencies, Laser Diodes, Temperature effects, Power Launching and coupling, Lensing schemes, Fiber-to-Fiber joints, Fiber splicing.

UNIT – IV

Photo Detectors: PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation, Error Sources, Receiver Configuration, Probability of Error, Quantum Limit.

UNIT – V

Digital Transmission Systems: Point-to-Point link system considerations -Link Power budget, Rise - time budget, Noise Effects on System Performance.
Advances in Optical Systems: WDM, Local Area Networks.

Text books:

1. Gerd Keiser, "Optical Fiber Communication", 5th edition, TMH, 2013.
2. John M Senior, "Optical Communication, Principles and Practice", 3rd edition, PHI, 2010.

Suggested Reading:

1. Joseph C Palais, "Fiber optic communication", 5th Edition, PHI, 2005
2. Le Nguyen Binh, "Digital Optical Communications," First Indian Reprint (Taylor & Francis), Yesdee Publications 2013.
3. John Gower, "Optical Communication System", 2nd edition, PHI, 2001.

16ECC29

EMBEDDED SYSTEM DESIGN LAB

Instruction	3 Hours per week
Semester end Examination Duration	3 Hours
Semester end Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To develop and understand the ARM7 C programming
2. To understand the usage of Integrated Development Environment (Keil)
3. To interface ARM7 to various input/output devices
4. To develop the programs using serial communication protocols
5. To process the analog signals using ARM7
6. To control the operation of various peripherals using ARM7 microcontroller

Course Outcomes:

Students will be able to:

1. Develop the ARM7 C programs using arithmetic, logical and branch operations
2. Understand the usage of various debugging tools available to program ARM7
3. Program ARM7 to interface various input/output modules
4. Know about the data transfer using serial communication protocols.
5. Analyze the hardware and software interaction and integration.
6. Design and develop the ARM 7 based embedded systems for various applications

List of Experiments

I. Basic ARM 7 Programming using instruction set

1. Study and use of ARM 7 Microcontroller trainer and Keil IDE
2. Programs using data manipulation and arithmetic instructions
3. Programs using logical and branch instructions
4. Sorting and String operations

II. ARM7 C programming:

5. LEDs and Switches interfacing
6. Relay and Buzzer interfacing
7. LCD interfacing
8. DAC interfacing

9. ADC interfacing
10. DC Motor interfacing
11. 7-Segment display interfacing
12. Temperature sensor interfacing through SPI

III. RTOS programming:

13. Introduction to RTOS (VxWorks) and its basic functions.
14. RTOS Timerprogramming (VxWorks).
15. RTOS Task functionprogramming (VxWorks).

Sample Mini Projects:

Design and realize a mini project on ARM7/ARM9 for given specification.

i. UART Interfacing
ii. I2C interfacing for serial communication Application.

16ECC30

DIGITAL SIGNAL PROCESSING LAB

Instruction	3 Hours per week
Semester end Examination Duration	3 Hours
Semester end Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. Design of digital filters using MATLAB.
2. FFT algorithm using MATLAB.
3. Multirate signal processing using MATLAB.
4. Spectral analysis of noisy signals using MATLAB.
5. Implementation of digital filters on DSP Processor.
6. Generate LTI system response on DSP Processor.

Course Outcomes:

Students will be able to:

1. Design and analyze the digital filters using MATLAB.
2. Implement FFT algorithms for linear filtering and correlation using MATLAB.
3. Experiment with multirate techniques using MATLAB.
4. Perform spectral analysis of noisy signal using welch's method.
5. Design and Implement the digital filters on DSP processor.
6. Obtain response of a LTI system to a ramp/step input on DSP processor.

List of Experiments

(A) Experiments on signal processing using MATLAB.

1. Basic matrix operations and Generation of test signals.
2. Linear Convolution , circular convolution and Correlation
3. Discrete Fourier Transform(DFT) and Fast Fourier Transform(FFT)
4. FIR filter design using different windows
5. IIR filter design: Butter worth, Chebyshev type 1 and 2: LPF, HPF, BPF & BSF filter.
6. Spectral Analysis of noisy signal using Welch's method.
7. Interpolation and Decimation.
8. Multistage filter.

(B) Experiments on DSK and CCS

1. Study of procedure to work in real- time.
2. Solutions of difference equations.
3. Linear Convolution.

4. Implementation of FIR filter.
5. Implementation of second order IIR filters.
6. Decimation and Interpolation.

Note:

1. Minimum of 6 from Part A and 4 from Part B is mandatory.
2. For Part "A", MATLAB with different toolboxes like Signal Processing, Signal Processing block set, and SIMULINK/ MATHEMATICA/ any popular software can be used.

References:

1. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing using MATLAB", 4/e, Cengage learning, 2011.
2. B. Venkataramani and M. Bhaskar,"Digital Signal Processor architecture, programming and application", 6/e, TMH, 2006.

Sample Mini Projects:

1. Design the best IIR band pass filter to meet the given specifications:

   Pass band cut off frequencies: [500 600] Hz
   Stop band cut off frequencies: [525 675] Hz
   Pass band ripple: d" 2dB
   Stop band attenuation: e" 60dB
   Phase response: Approximately linear in pass band

   Consider Butterworth, Chebyshev, Elliptic and Bessel filters

2. Design the best low pass filter to meet the given specifications:

   Pass band cut off frequency: 1K Hz
   Stop band cut off frequency: 3K Hz
   Pass band ripple: d" 2dB
   Stop band attenuation: e" 80dB
   Group Dealy: d" 5ms
   Phase response: Approximately linear in pass band

   Consider FIR and Elliptic filters.

3. Design a three stage multirate filter to meet the given specifications:

   Pass band cut off frequency: 450 Hz
   Stop band cut off frequency: 500 Hz
   Pass band ripple: d" 3dB
   Stop band attenuation: e" 40dB
   Sampling frequency: 40 KHz

   Compare with single stage filter.
4. Consider a clean speech signal of length 5000 samples and compute the Power Spectrum. Now add 0dB random noise. Compute the power spectrum using Welch and Eigen value Estimation method and also compare with the original spectrum.

16ECC31

MICROWAVE ENGINEERING LAB

Instruction	3 Hours per week
Semester end Examination Duration	3 Hours
Semester end Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To understand the characteristics of Reflex Klystron Oscillator (RKO) and Gunn Oscillator.
2. To learn frequency measurement techniques using cavity wave meters.
3. To determine VSWR for various loads using slotted section.
4. To calculate power ratios at ports of various microwave components.
5. To learn measurement of impedance for various microwave loads.
6. To plot the radiation pattern for an antenna.

Course Outcomes:

Students will be able to:

1. Know the characteristics of RKO and Gunn Oscillator.
2. Understand the relation between guide wavelength, free space wavelength and cut off wavelength.
3. Measure VSWR for various loads at microwave frequencies.
4. Estimate the microwave power ratios at various ports of microwave components.
5. Calculate unknown impedance of various microwave loads.
6. Understand the measurement of radiation patterns.

List of Experiments

1. Characteristics of Reflex Klystron Oscillator- To find the mode numbers and efficiencies of different modes.
2. Characteristics of Gunn diode and Gunn diode oscillator.
3. Measurement of frequency and Guide wavelength: Verification of the relation between guide wavelength, free space wavelength and cut-off wavelength.
4. Measurement of VSWR for the given loads.
5. Measurement of impedance for horn antenna, matched load, slide screw tuner etc.
6. Characteristics of Directional coupler.
7. Characteristics of E-plane, H-plane and Magic Tee.

8. Characteristics of Circulator.
9. Radiation pattern of horn antenna.
10. Study of various antennas like dipoles, loops, Yagi antenna, log periodic antenna and their radiation pattern.

Sample Mini Projects:

1. To design microwave components such as: Directional couplers, circulators and Hybrid junctions using Simulation software.
2. To design antenna arrays such as: Binomial, Chebyshev, using Simulation software.

References:

1. Department Laboratory Manual.
2. G.S. Raghu Vamsi, "Basic microwave techniques and Laboratory manual", 2nd Edition, New age international publishers, 2009.