SYLLABUS OF B.E. III YEAR

OF

FOUR YEAR DEGREE COURSE

IN

ELECTRONICS & COMMUNICATON ENGINEERING

Academic Year 2015-16

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)

Hyderabad – 500 075

SCHEME OF INSTRUCTION AND EXAMINATION
3/4 B.E.
ELECTRONICS & COMMUNICATON ENGINEERING

SEMESTER – I

S.No.	Syllabus Ref. No.	Subject	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L	T/D/P		Univ. Exam	Sessionals	
THEORY								
1	EC 311	Linear Integrated Circuits	4	-	3	75	25	3
2	EC 312	Digital Integrated Circuits	4	-	3	75	25	3
3	EC 313	Computer Organization and Microprocessors	4	-	3	75	25	3
4	EC 314	Control Systems Engineering	4	-	3	75	25	3
5	EC 315	Digital Communication	4	-	3	75	25	3
6	CE 444	Human Values and Professional Ethics (Mandatory course)	2*	-	2	50	-	-
PRACTICALS								
7	EC 316	Integrated Circuits Lab	-	3	3	50	25	2
8	EC 317	Microprocessor and Interfacing Lab	-	3	3	50	25	2
9	EC 318	Digital Communication Lab	-	3	3	50	25	2
		Total	**22**	**9**	**-**	**575**	**200**	**21**

L: Lecture, T: Tutorial, D: Drawing, P: Practical
*: 21 periods per Semester

EC 311

LINEAR INTEGRATED CIRCUITS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To learn the basic building blocks of linear integrated circuits.
2. To study the applications of Operational Amplifiers.
3. To learn the theory and applications of active filters, PLL, 555 timers, ADC and DAC.

Course Outcomes:

1. Understand the building blocks of Op-Amp.
2. Implement the applications of Operational Amplifiers.
3. Analyze and Design of active filters, PLL, 555 Timers, ADC and DAC

Unit – I

Differential Amplifiers: Classification, DC and AC analysis of single/dual input balanced and unbalanced output configurations using BJTs and MOSFETs.

Operational Amplifier: Op-Amp block diagram, ideal Op-Amp Characteristics, Op-Amp and its features, Measurement of Op-Amp parameters: Input and Output offset voltages and currents, Slew rate, CMRR, PSRR. Frequency response and compensation techniques.

Unit – II

Op-Amp Applications I: 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, Instrumentation amplifier, Sample and Hold circuit, Log and Antilog amplifiers, Analog multiplier and divider, Precision rectifiers.

Unit – III

Op-Amp Applications II: Comparator, Schmitt Trigger with and without reference voltage, Astable Multivibrator, Monostable Multivibrator, Triangular waveform generator.

Active Filters: Introduction, Analysis of Butterworth first order, second order lowpass and highpass filters, Band-pass filters, Band-stop filters, Notch filter, All-pass filter.

Unit – IV

555 Timer: Introduction and its functional diagram. Modes of operation: Monostable, Astable multivibrators, applications of 555 Timer.

Function Generator: Analysis and Design of Function Generator using IC 8038.
Voltage Controlled Oscillator: Operation and applications using IC 566.
Phase Locked Loops: Introduction, Principles, Block diagram and Description of IC 565, Applications of PLL: frequency multiplication and frequency synthesis.

Unit – V

Regulators: Introduction, Analysis and design of regulators using 78XX and 723 monolithic ICs, Current limiting and Current foldback techniques using IC 723.
Data Converters: Introduction, specifications, DAC- Weighted Resistor, R-2R Ladder, ADC- Parallel Comparator, Successive Approximation and Dual Slope.

Text Books:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits," 4/e, PHI, 2010.
2. Roy Chowdhury D, Jain S.B.," Linear Integrated Circuits,"4/e, New Age International Publishers, 2010.

Suggested Reading:

1. K.R.Botkar, "Integrated Circuits," 10/e, Khanna Publishers, 2010.
2. David A.Bell, 'Op-Amp & Linear ICs', Oxford, 2013.
3. Sedra and Smith, "Micro Electronic Circuits", 6/e, Oxford University Press, 2009.

EC 312

DIGITAL INTEGRATED CICUITS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To study the characteristics and operations of Bipolar and MOS logic families.
2. To analyze the operations and implementation of various combinational and sequential logic circuits using IC's.
3. To study the architecture and operation of different programmable devices.

Course Outcomes:

1. Understand the characteristics and operation of Bipolar and MOS logic families.
2. Design and implementation of various combinational and sequential logic circuits using IC's.
3. Understand the architecture and operation of different programmable devices.

Unit-I: Bipolar Logic Families

Integrated circuits classification, Integrated circuit package types, pin identification and temperature ranges, IC characteristics. TTL logic family, TTL series, TTL output configurations: open collector, Totem pole, Tri state logic. ECL logic family.

Unit-II: MOS Logic families

MOS logic family (PMOS and NMOS), CMOS logic family and its series characteristics, CMOS transmission gate (bilateral switch) and its applications, CMOS open drain and high impedance outputs. Dynamic MOS logic family, dynamic MOS inverter, dynamic MOS NAND and NOR gates. Comparison of various logic families. Interfacing of logic families: CMOS driving TTL, TTL driving CMOS, ECL driving TTL and TTL driving ECL.

Unit-III: Combinational Circuits

Design using TTL-74XX and CMOS 40XX series: Decoders, drivers for LED and LCD display, Encoder, priority encoder, Multiplexer and their applications, Demultiplexer, Parity generator and Checker circuit, Digital comparator, Parallel and serial binary adder, Subtractor circuits using 2's complement. Carry look-ahead adder, Decimal adder, Decimal Subtractor using 10's complement, Binary Multiplier.

Unit-IV: Sequential circuits

Flip-flops and their conversions. Design of Synchronous and Asynchronous counters, Cascading of BCD counters, applications of counters, Shift register and applications with 74XX and CMOS 40XX series of IC Counters. Sequence generation, Sequence detection.

Unit-V: Memories

ROM, RAM types, Architectures, operation and applications, Flash memory, Expanding word size and capacity, Introduction to PLD's, Architecture of PAL, PLA with operation, Introduction to CPLD and FPGA architectures.

Textbooks:

1. Ronald J. Tocci, Neal S. Widmer & Gregory L.Moss, "Digital Systems: Principles and Applications." PHI, 10/e, 2009.
2. Charles H Roth and Larry L Kinney, "Fundamentals of Logic Design" 7th edition, Cengage Publication, 2014.

Suggested Reading:

1. Jain R.P., "Modern Digital Electornics."4/e, TMH, 2011.
2. Sonde, B.S. "Introduction to system Design using IC's" Wiley, 2/e, 1994.

EC 313

COMPUTER ORGANIZATION AND MICROPROCESSORS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To learn the concepts of computer arithmetic operations, computer instructions and its memory organization
2. To examine the 8086 and 8088 microprocessors in terms of hardware/software and functions of signals generated/accepted.
3. To understand the 8086/8088 architecture and its programming.
4. Explore how to interface the memory and I/O devices to 8086 microprocessor.

Course Outcomes:

1. Mathematically represent and analyze the computer arithmetic operations.
2. Write an assembly language programming for different applications.
3. Design an 8086 based microcomputer by interfacing memory and I/O devices.

Unit- I

Data representation and Computer arithmetic: Introduction to computer systems, organization and architecture, evolution and computer generations; 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.

Basic Computer organization: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle; Program interrupt, Interrupt cycle.

Unit-II

Central Processing Unit: General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. Characteristics of CISC and RISC.

Memory organization: Memory hierarchy, Primary memory, Auxiliary memory, Cache memory: mapping functions, Virtual memory: address mapping using paging and Segmentation.

Unit–III

8086/8088 Microprocessor: Architecture and Pin diagram of 8086/8088 microprocessor, Register organization, Memory organization, Instruction set, Minimum and Maximum mode operations, 8086 control signal interfacing under minimum mode system, control signal interfacing under maximum mode

using multiprocessing systems. Addressing modes, Interrupt structure. Brief overview of x86 series microprocessors.

Unit–IV

8086 Assembly Language programming: Assembler directives and operators, programs using data transfer, arithmetic, logical, branching and ASCII instructions. String processing, Procedures, Macros and stack, Basic programs using DOS functions. Introduction to assemblers and debugging tools.

Unit–V

8086 Interfacing: Memory interfacing using standard RAM, EPROM IC Chips, 8255 PPI, 8253/8254 programmable interval timers, 8257 DMA controller, 8279 Keyboard and display controller interfacing and 8251 programmable communication interface. Serial and parallel data transmission formats, USART interfacing.

Text Books:

1. Morris Mano M. "Computer System Architecture" , 3/e, Pearson Education, 2005.
2. Ray A.K. and Bhurchandi, K.M., "Advanced Microprocessor and peripherals", 2/e TMH –2007.
3. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro, Pentium II, III, IV", Pearson Education, 2006.

Suggested Reading:

1. William Stallings, "Computer Organization and Architecture Designing for performance" 7/e, Pearson Education, 2006.
2. Douglas V Hall, "Microprocessors and interfacing, Programming and Hardware", 2/e, TMH, 2006.

EC 314

CONTROL SYSTEMS ENGINEERING

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To acquire the basic concepts of automatic control systems
2. To learn the basics of control systems representations/modeling
3. To learn stability analysis in time and frequency domains.

Course Outcomes:

1. Represent the mathematical model of a system and analyze the stability of the system.
2. Determine the response of different systems to a step input. Analyze the system in frequency domain.
3. Understand the discrete data control systems and modern control systems

Unit I

Control System Fundamentals and Components: Classification of control systems, Open and closed loop systems, Control system components; Error sensing devices - potentiometers, synchros, AC & DC servo motors, Mathematical modeling of mechanical systems and their conversion into electrical systems. Block diagram reduction and signal flow graphs.

Unit II

Time response: Transfer function and Impulse response, Types of inputs, Transient response of second order system for step input, Time domain specifications. Types of systems, static error coefficients, error series, Routh - Hurwitz criterion for stability. Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response.

Unit III

Frequency response plots: Bode plots, frequency domain specifications. Gain margin and Phase Margin. Principle of Argument, Nyquist plot and stability criterion.
Compensation: Cascade and feedback compensation using Bode plots. Phase lag, lead, lag-lead compensators. PID controller.

Unit IV

Discrete Data Control Systems: Digital control system, advantages and disadvantages, digital control system architecture, Discrete transfer function, Sampled data system, Transfer function of sample data systems and Stability of discrete data systems.

Unit V

State Space Representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix and solution of state equations, Controllability and Observability, Design of digital control systems using state space concepts.

Text Book:

1. I.J .Nagrath & 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. Gopal Madan, "Digital Control Engineering" 1/e, New age publishers, 2008.

EC 315

DIGITAL COMMUNICATION

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To learn various digital pulse modulation and digital carrier modulation techniques.
2. To learn the different source coding and channel coding schemes.
3. To learn the need for spreading a code and various spread spectrum techniques.

Course Outcomes:

1. Understand the knowledge of digital pulse modulation and digital carrier modulation techniques.
2. Analyze the different source coding and channel coding schemes.
3. Understand various spread spectrum 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. Introduction to linear prediction theory, Differential quantization, Differential PCM system, Delta Modulation, Noise in DM system, ADM. Comparison of PCM and DM systems.

Unit-II

Information Theory: Uncertainty, Information and Entropy. Source coding: Shannon – Fano algorithm and Huffman coding. Discrete memoryless channels, Probability relations in a channel, priori and posteriori entropies, 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 sequential decoding.

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. M-ary Signaling Schemes, M-ary coherent PSK(QPSK only). 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. Syncronization in Spread Spectrum Modulation.

Text Books:

1. Simon Haykin, "Communication Systems," 4/e, Wiley India, 2011.
2. Sam Shanmugham.K., "Digital and Analog Communication Systems," Wiley, 1979.

Suggested Reading:

1. Herbert Taub, Donald L. Shilling & Goutam Saha, " Principles of Communication Systems," 4/e, Tata McGraw-Hill Education 2013.
2. R.P. Singh, S.D. Sapre, "Communication Systems", 2/e, Tata McGraw-Hill Education, 2008.

EC 316

INTEGRATED CIRCUITS LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To measure the characteristics of Op Amp and implementing the arithmetic circuits, filters, oscillators using Op Amp.
2. To analyze the operation and implementation of circuits using IC 566, IC 723, IC 555.
3. To Design and Implementation of Combinational and Sequential Circuits.

Course Outcomes:

1. Measure the characteristics of Op-Amp and implement the arithmetic circuits, filters, oscillators using Op Amp.
2. Analyze the operation and implement of circuits using IC 566, IC 723, IC 555
3. Design and Implement of Combinational and Sequential Circuits.

Lab Experiments

Part-A

1. Measurement of Op-Amp parameters.
2. Voltage Follower, Inverting and Non Inverting Amplifiers using Op-Amp.
3. Arithmetic Circuits: Summer, Subtractor, Integrator and Differentiator using Op-Amp.
4. Active filters: LP, HP and BP using Op-Amp.
5. Astable, Monostable multi vibrators using Op-Amp.
6. Triangle and Square wave generators using Op-Amp.
7. Voltage Controlled Oscillator Using IC 566.
8. Low and High Voltage Regulators using IC 723.
9. Astable, Monostable multi vibrators using IC 555 Timer.

Part-B

1. Measurement of propagation delay, fan-out, Noise margin and transfer Characteristics of TTL and CMOS IC gates.
2. (a) Design of code converters using logic gates.
   (b) Parity generator and checker circuits.
3. Logic function Implementations using Multiplexers

4. Arithmetic Circuits: Binary adder and subtractor, BCD adders using IC's.
5. Flip-Flop operations and conversions using gates and ICs
6. Design of Synchronous, Asynchronous up/down counters.
7. Shift registers and ring counter using ICs.
8. Interfacing counters with 7-segment LED display units.

General Note:

1. At least 5 experiments from each part.
2. At least 3 or 4 experimetns should be carried out using SPICE tools.

Reference Book: Laboratory Manual.

Mini Project cum Design Exercise(s):

To realize and design mini project using either linear or digital or combination of linear and digital IC's (giving specifications for each project).

a) Design a crystal oscillator for the given specifications frequency= 1 KHZ, Amplitude=1 Vpp, duty cycle=50%.
b) Design a universal shift register using JKFF.
c) Construct an electronic harmonium using 555 Timer that performs server rhythemic sounds.
d) Design of Digital clock.
e) Design of Security Monitoring system

CE 444 **HUMAN VALUES AND PROFESSIONAL ETHICS**

Instructions	: 21 Periods per semester (7*3)
Duration of University Examination	: 2 Hours
University Examination	: 50 Marks
Sessional	: Nil
Credits	: Nil

Course Objectives:

1. To develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. To enable the students understand the values, the need for value adoption and prepare them meet the challenges
3. To enable the students develop the potential to adopt values, develop a good character and personality and lead a happy life
4. To motivate the students practice the values in life and contribute for the society around them and for the development of the institutions /organisation around they are in.
5. To make the students understand the professional ethics and their applications to engineering profession

Course Outcomes

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions / organisations they work in.
5. Students shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-1 Concepts and Classification of Values –Need and challenges for value Adoption

Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values –Espoused and Applied Values – Value judgement based on Culture – Value judgement based on Tradition – Interdependence of Values

Need for value education – Findings of Commissions and Committees - Corruption and illegal practices – Science and Technology without values- Exploitation of nature – Increasing use of violence and intoxicants – Lack of education in values – Implications of education in values – Vision for a better India

Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges

UNIT – 2: Personal Development and Values in Life Personal Development: Enlightened self-interest – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity – The quest for Character – Tests of Character – The key to good character

Values in Life: Building an ethical policy – Integrating values in everyday life – Archaic Social Values – Parenting practices – Critical Thinking - Analyzing and Prioritizing values – Practicing Yoga and Meditation

UNIT – 3: Practicing Values for the development of Society

Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Environmental awareness – Working for the Sustainable development of the society

Values in Education system: Present Scenario- Engineering education –Current trends- Need for quality improvement- Adoption of value education – Principles of Integrity-Institutional Development.

UNIT – 4: Basic Concepts of Professional Ethics

Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Professional and Professionalism, Ethical role of a professional Basic ethical principles, Some basic ethical theories, use of ethical theories.

Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities

UNIT-5: **Ethics in engineering profession**

Engineering profession-Technology and Society-Engineering as Social Experimentation-Engineering ethics-Ethical obligations of Engineering Professionals-Role of Engineers-Engineers as Managers-Professional responsibilities of Engineers- Engineers Responsibility for Safety- A few Case Studies on Risk management

Conflicts of Interest- Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking

Text Books:

1. Subramanian R., " Professional Ethics " , Oxford University Press , 2013
2. Nagarajan R.S., " A Text Book on Human Values and Professional Ethics " New Age Publications , 2007
3. Dinesh Babu S., " Professional Ethics and Human Values " , Laxmi Publications , 2007

Reference Books:

4. SantoshAjmera and Nanda Kishore Reddy " Ethics , Integrity and Aptitude " ,McGrawhill Education Private Limited , 2014
5. GovindaRajan M., Natarajan S., Senthil Kumar V.S." Professional Ethics and Human Values " Prentice Hall India Private Limited ,2012
6. Course Material for Post Graduate Diploma In "Value Education & Spirituality " Prepared by Annamalai University in Collaboration with Brahma Kumaris , 2010

EC 317

MICROPROCESSOR AND INTERFACING LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

To Develop and understand the Assembly language programming concepts of 8086 Microprocessor.

Course Outcomes:

1. Write the 8086 assembly language programs on arithmetic, logical operations and DOS function calls.
2. Interface memory and I/O devices with 8086 microprocessor.
3. Design and develop the 8086 based microcomputer system for various applications.

Lab Experiments

1. Programs using Arithmetic operations, Branching Operations.
2. Logical operations and string operations.
3. Multiplication and division for signed/unsigned data.
4. Single byte, multi byte binary and BCD addition and subtraction.
5. Code conversions.
6. String Searching and Sorting.
7. Using DOS function calls.
8. Interfacing traffic signal control using 8086.
9. Generation of waveforms using DAC interface.
10. Interfacing stepper motor control using 8086.
11. Interfacing 7 -segment LED (Common Cathode/Common Anode) displays.
12. Generation of waveforms and gating applications using 8253/8254 timers.
13. Real time clock using 8086.
14. Interfacing Elevator simulator control using 8086.

Mini Project cum Design Exercise(s).

To design and realize a mini project using 8086 microprocessor and interface modules.

Suggested Reading:

1. Walter A. Triebel, Avtar Singh "The 8088 and 8086 Microprocessors: Lab Manual" PHI 2nd Edition 2000

EC 318

DIGITAL COMMUNICATION LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To carry out experiments on various pulse digital modulation and digital carrier modulation techniques.
2. To verify the Line coding techniques.
3. To verify the error control coding schemes.

Course Outcomes:

1. Analyze the pulse digital modulation and digital carrier modulation schemes through experiments.
2. Analyze the Line coding techniques.
3. Measure the error controlling schemes.

List of Experiments:

1. PCM generation and detection.
2. Error control coding.
3. Data formats / Line coding.
4. Linear Delta Modulation and demodulation.
5. Adaptive Delta Modulation and demodulation.
6. ASK generation and detection.
7. FSK generation and detection.
8. BPSK generation and detection.
9. QPSK generation and detection.
10. Minimum Shift Keying generation and detection.
11. Modem characteristics.
12. Wavelength division multiplexing and demulitiplexing.

General Note: At least 10 experiments are to be conducted.

Reference Book: Laboratory Manual.

Mini Project:

1. Develop a code for different digital modulation schemes and verify through simulation.
2. Design different Line coding schemes using logic Gates.
3. Study and design the multiplexing techniques.

SCHEME OF INSTRUCTION AND EXAMINATION
3/4 B.E.
ELECTRONICS & COMMUNICATON ENGINEERING

SEMESTER – II

S.No.	Syllabus Ref. No.	Subject	Scheme of Instruction		Scheme of Examination			
			Periods per week		Duration in Hours	Maximum Marks		Credits
			L	T/D/P		Univ. Exam	Sessionals	
THEORY								
1	EC 321	Microcontrollers and Applications	4	-	3	75	25	3
2	EC 322	Microwave Engineering	4	-	3	75	25	3
3	EC 323	Digital Signal Processing	4	-	3	75	25	3
4	EC 324	Mobile Cellular Communications	4	-	3	75	25	3
5	___	Elective-I	4	-	3	75	25	3
PRACTICALS								
6	EC 326	Microcontroller Lab	-	3	3	50	25	2
7	EC 327	Microwave Lab	-	3	3	50	25	2
8	EC 328	Digital Signal Processing Lab	-	3	3	50	25	2
Total			**20**	**9**	**-**	**525**	**200**	**21**

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

S.No.	CODE	ELECTIVE – I
1	EC 351	Coding Theory and Techniques
2	EC 352	Optical Fiber Communication
3	EC 353	CPLD and FPGA Architectures
4	EC 354	Analog and Mixed IC Design
5	EC 355	System Automation and control

EC 321

MICROCONTROLLERS AND APPLICATIONS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To understand the 8051 and ARM Microcontroller architecture and instruction set.
2. To acquire the knowledge of interfacing memory and I/O devices.
3. To learn the 8051and ARM based embedded applications.

Course Outcomes: Students will be able:

1. Write an assembly language programming and Embedded C programming for different applications.
2. Interface memory and I/O devices to 8051/ARM.
3. Design a Microcontroller based embedded system for various applications.

UNIT-I

8051 Microcontroller: Introduction to Microcontroller, Overview of 8051 family, Internal Architecture of 8051, PSW, Pin description, I/O Ports, Memory organization and expansion. 8051 Instruction set: Addressing modes and Bit addressable features, Data transfer, Arithmetic, Logical, Program branching and bit manipulation instructions.

UNIT-II

8051 Programming: Introduction to 8051 programming development tools, basic programming using instruction set, Introduction to 8051 C Programming, SFRs, 8051 Timer Programming in Assembly and C, 8051 Serial port Programming in Assembly and C, 8051 Interrupt Programming in Assembly and C.

UNIT-III

8051 Interfacing: 8051/8031 interfacing to external memory(RAM, ROM), 8255(PPI) interfacing, LCD and Keyboard Interfacing, Digital to Analog converter, Analog to Digital converter and sensor interfacing, Relay and PWM, DC Motor interfacing, Stepper Motor interfacing.

UNIT-IV

ARM: ARM Design Philosophy, ARM Processor families, Architecture-revisions, Registers, Current Program Status Register, pipeline, exception, interrupts and the vector table; core extensions, introduction to ARM instruction set.

UNIT-V

Applications of Microcontrollers: Design and development of the applications in the area of communications (GSM module, GPS, Zigbee), Keil IDE features and RTOS with 8051 in the area of automotive applications.

Suggested Reading:

1. Mazidi M.A, Mazidi JG, & Rolin D. Mckinlay, "*The 8051 Microcontroller & Embedded Systems using Assembly and C* ", 2/e, Pearson Education, 2007.
2. Andrew N.Sloss, Domonic Symes, Chris Wright "*ARM System Developers Guide Designing and optimizing system software*" Elsevier 1st Edition 2004.

References:

1. Ayala, K.J., "*The 8051 Microcontroller Architecture, Programming and Applications*", Penram International, 2007.
2. Rajkamal, "*Microcontrollers Architecture, Programming Interfacing and system Design*", Pearson Education 2007.
3. Steve Furber., "*ARM System-on-Chip Architecture*" 2nd Edition Addison-Wesley, 2000.

EC 322

MICROWAVE ENGINEERING

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To prepare students to understand basic principle of microwave and its applications.
2. To prepare students to understand different microwave components and analyzing different type of junctions used in microwave engineering.
3. To teach the students about various microwave solid state devices and their characteristics.

Course Outcomes:

1. Students will be able to calculate cut off frequency, identify possible modes and obtain mode characteristics of Reflex Klystron and Gunn oscillator.
2. The students would be able to understand the principles of operation of waveguide, gyrator, isolator attenuator etc. and obtain scattering matrix for various junctions like E-plane, H plane, Circulator, Direction Coupler.
3. Students will know the basics of microwave solid state devices such as Gunn diode and Avalanche Devices such as IMPATT, TRAPATT diodes and efficiently use them in microwave engineering applications.

UNIT - I

Guided Waves: Propagation of TE, TM and TEM waves between parallel planes. Velocity of propagation, wave impedance, attenuation in parallel plane guides.

UNIT - II

Waveguides: TE and TM waves in rectangular and circular waveguides, Wave Impedance, Characteristic Wave Impedance, Attenuation and Q of waveguides. Cavity resonators, resonant frequency and Q, Applications of cavity resonator.

UNIT - III

Microwave Circuits and Components: Concept of Microwave circuit, Normalized voltage and current, Introduction to scattering parameters and their properties, S parameters for reciprocal and Non-reciprocal components- Magic Tee, Directional coupler, E and H Plane Tees and their properties, Attenuators, Phase Shifters, Isolators and circulators.

UNIT- IV

Microwave Tubes: High frequency limitations of conventional tubes, Bunching and velocity modulation, mathematical theory of bunching, principles and operation of two cavity, multi cavity and

Reflex Klystron. Theory of crossed field interaction; Principles and operation of magnetrons and crossed field amplifiers, TWT and BWO.

UNIT – V

Microwave Solid State Devices: Principles of operation, characteristics and applications of Varactor, PIN diode, GUNN diode and IMPATT diode. Elements of strip lines, microstrip lines, slot lines and fin–lines.

Microwave measurements: Microwave bench set up to obtain characterstics of RKO and Gunn oscillator, VSWR measurement, Impedence measurement, measurment of coupling coefficent and direcvity of directionnal couplers, Measurement of radiation patterns and gain for horn antenna.

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 R. E. Collins, "Foundations for Microwave Engineering", 2/e, Wiley India Pvt. Ltd., 2012.

3. Sushrut Das, "Microwave Engineering" 1/e, oxford press, 2014.

EC 323

DIGITAL SIGNAL PROCESSING

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To design digital IIR and FIR filters for the given specifications.
2. To learn the basics of Multirate digital signal processing and its applications
3. To learn the DSP processor architecture for the efficient implementation of digital filters.

Course Outcomes:

1. Design and implement FIR and IIR filters for the given specifications.
2. Understand the concepts of Multirate digital signal processing and its applications.
3. Implement the filters using DSP Processors.

Unit-I

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 and Correlation.

Unit-II

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

Unit-III

IIR Filter Design: Butterworth and Chebychev approximation, IIR digital filter design techniques-Impulse Invariant transformation, Bilinear transformation techniques, Butterworth and Chebychey 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, Sampling Rate Conversion by an arbitrary factor, Applications of Multirate Signal Processing.

Unit-V

DSP Processors: Introduction, Differences between DSP and General Purpose Processor architectures, need for DSP processors. General purpose DSP processors: TMS 320C54XX processor, architecture, 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, 2007.
3. Avtar Singh & S. Srinivasan, "Digital Signal Processing Implementation using DSP microprocessors", Thomson Brooks, 2/e, 2004.

Suggested Reading:

1. Chi- Tsong Chen, "Digital Signal Processing Spectral Computation and filter Design", Oxford, 2/e, 2007.
2. Tarunkumar Rawat, "Digital Signal Processing", First edition, Oxford, 2015.

EC 324

MOBILE CELLULAR COMMUNICATIONS

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course objectives:

1. To understand the concept and implementation of frequency reuse and Handoff techniques and to analyze interference and capacity enhancement.
2. To appreciate the factors influencing outdoor and indoor propagation systems and to analyze various multiple access protocols based on their merits and demerits.
3. To visualize the system architectures and implementation of GSM and CDMA based mobile communication systems.

Course outcomes:

1. Design a Cellular layout for Mobile communications using frequency reuse for maximum coverage, less interference and optimum capacity.
2. Chose an appropriate Propagation model for either Outdoor or Indoor cellular communication and to identify the salient features protocols pertaining to various multiple access systems.
3. Analyze the system specifications of either GSM or CDMA based Mobile Communication systems and how they have been changing from generation to generation.

UNIT - I

Basic Cellular system and its operation: frequency reuse, channel assignment strategies, Handoff process, factors influencing handoffs, handoffs in different Generations, Interference and system capacity, Cross talk, Enhancing capacity and cell coverage, Trunked radio system, grade of service as per Erlang's B system.

UNIT – II

Propagation models: Free space propagation model, three basic propagation mechanisms, practical link budget design using path loss models, outdoor propagation models: Durkin's model and indoor propagation model, partition losses. Small scale multipath propagation, Parameters of mobile multipath channels, Diversity reception, types of small scale fading.

UNIT – III

Multiple Access Techniques: FDMA, TDMA, SSMA, FHMA, CDMA, SDMA.

UNIT – IV

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

UNIT – V

Technology Trends & Specifications : WLAN, Bluetooth, PAN, introduction to OFDM in Wireless communication Trends in Radio and Personal Communications, UMTS system architecture and Radio Interface, Comparison of 1G, 2G, 2.5G and 3G technology, Features of 4G,

Text Books:

1. Theodore.S. Rappaport, "Wireless Communications: Principles and Practice", 2/e, Pearson Education, 2010
2. William. C.Y.Lee, "Mobile Communication Engineering", 2/e , Mc-Graw Hill, 2011.
3. T.L.Singal "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. Dharma Prakash, Quing-an-Zeng, Agarwal, "Introduction to Wireless & Mobile Systems", Cengaje Publications, 3rd edition, 2012.

EC 326

MICROCONTROLLER LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

To develop and understand the assembly and embedded C programming concepts of 8051 Microcontroller

Course Outcomes:

1. Write and test the assembly language programs on arithmetic and logical operations.
2. Write and test embedded C programming on interfacing modules
3. Design and develop the 8051 based embedded systems for various applications

I. List of Experiments

1.2.3. Familiarity and use of 8051 Microcontroller trainer - Instruction set for simple program (using 4 to 15 lines of instruction Code) for data transfer, manipulation, Arithmetic perations, Branching operations, logical operations and testing of "byte/bit patterns" in a given data.

4. Timer and Counter operations & Programming using 8051.
5. Interfacing 8051 with DAC to generate the waveforms
6. Interfacing traffic signal control using 8051.
7. Program to control stepper motor using 8051.
8. LEDs and Switches interfacing with 8051 programming in C.
9. Relay and Buzzer interfacing with 8051 programming in C.
10. LCD interfacing with 8051 programming in C.
11. ADC interfacing with 8051 programming in C.
12. DC Motor interfacing with 8051 programming in C.
13. 7-Segment display interfacing with 8051 programming in C.
14. Elevator simulator interfacing with 8051 programming in C.
15. RTC interfacing with 8051 programming in C

Mini Project cum Design Exercise(s).

To design and realize a mini project using 8051/ARM and interfacing modules.

Suggested Reading:

1. Myke Predko - Programming and Customizing the 8051 Microcontroller, TMH, 2005.

EC 327

MICROWAVE LAB

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. The student would understand the characteristics of RKO and Gunn oscillator.
2. Measurement of frequency and wavelengths would be learnt by the student.
3. VSWR various TEES would be understood by the student.
4. Radiation pattern would be learnt by the student for horn antenna.

Course Outcomes:

After undergoing the course, the student would be able to

1. Analyze the characteristics of RKO and Gunn oscillator are drawn and studied by the student.
2. Measure the frequency and guided wavelength are found and measured by the student.
3. Estimate the VSWR for various loads and S-Matrix for various microwave devices.
4. Obtain the horn antenna radiation pattern.

LIST OF EXPERIMENTS

1. Characteristics of Reflex Klystron oscillator, finding the mode numbers and efficiencies of different modes.
2. Characteristics of Gunn diode oscillator, Power Output Vs Frequency, Power Output Vs Bias Voltage.
3. Measurement of frequency and Guide wavelength calculation:
   i. Verification of the relation between Guide wavelength, free space wavelength and cutoff wavelength of X- band rectangular waveguide.
   ii. Verification of the straight line relation between $(1/\lambda_g)^2$ and $(1/\lambda_0)^2$ and finding the dimension of the guide.
4. Measurement of low and high VSWRs: VSWR of different components like matched terminals, capacitive and inductive windows, slide screw tuner for different heights of the tuning posts etc.
5. Measurement of impedance for horn antenna, Matched load and slide screw tuner.
6. To find the S-parameters of Directional coupler.
7. To find the S-parameters of Tees: E plane, H plane and Magic Tee.
8. To find the S-parameters of Circulator.
9. Measurement of radiation patterns for basic microwave antennas like horn and parabolic reflectors in E-plane and H-plane. Also to finding the gain, bandwidth and beamwidth these antennas.

10. Study of various antennas like dipoles, loops, Yagi antenna, log periodic antenna and their radiation pattern.

Mini Project:

i. To design microwave components such as: Directional couplers, circulators and Hybrid junctions using Simulation software.

ii. To design antenna arrays such as: Binomial, Chebyshev, using Simulation software.

EC 328

DIGITAL SIGNAL PROCESSING LAB

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. Design the IIR and FIR filters using matlab.
2. Design multistage decimator using matlab.
3. Study the operation and performs of TMS320C6713 floating point processor.

Course Outcomes:

1. Design and implement digital filters using matlab.
2. Design and implement mutlirate techniques using matlab.
3. Implement digital filters using TMS320C6713 floating point processor.

(A) Experiments on signal processing using MATLAB.

1. Basic matrix operations and Generation of test signals.
2. Linear Convolution, circular convolution and Correlation.
3. DFT and FFT algorithm.
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. Familiarity with CCS and DSK kit.
2. Response of a LTI system to a ramp/step input.
3. Linear Convolution.
4. Discrete Fourier Transform (DFT).
5. Implementation of FIR filter.
6. Implementation of second order IIR filters.

Note:

1. Minimum of 6 from Part A and 4 from Part B is mandatory.
2. For section "A", MATLAB with toolboxes like Signal Processing, FDA or LAB VIEW software can be used.

Reference Book:

1. Vinay K.Ingle and John G. Proakis, "Digital Signal Processing using MAT LAB ", 4/e, Cengage learning, 2011.
2. B.Venkataramani and M. Bhaskar, "Digital Signal Processor Architecture, Programming and Application", sixth edition, TMH, 2006.

EC 351

CODING THEORY AND TECHNIQUES

(ELECTIVE – I)

Instruction	4 Periods/week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. To study the importance of channel coding techniques in digital communications.
2. To learn the mathematical structure and algorithms for RS and turbo codes.

Course Learning Outcomes:

1. Understand the theory and principles of channel Coding and techniques.
2. Analyze the performance of RS and turbo codes.

Unit-I

Coding for Reliable Digital Transmission and Storage: Introduction, Types of codes, Types of errors, Channels models, Modulation and coding, channel coding Theorem, Channel coding gain.

Unit II

Linear Block codes: Introduction, encoding, syndrome decoding, error-detecting and correcting capabilities, Maximum likelihood decoding.

Cyclic codes: Description, encoding and syndrome decoding.

Unit III

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

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

Unit IV

Convolution codes: Introduction, Encoding, State diagram, 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 (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.

Suggested readings:

1. Simon Haykin, “Communication Systems”, 4/e, Wiley, 2000.
2. K Sam Shanmugum, “Digital and Analog Communication Systems”, Wiley, 2005.

EC 352

OPTICAL FIBER COMMUNICATION

(ELECTIVE – I)

Instruction	4 Periods/week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Learn concepts of propagation through optical fiber, Losses and dispersion thorugh optical fiber.
2. Understand operating principles of light sources and detecters used in optical transmitters and Receivers.
3. Design an optical link in view of loss and dispersion.

Course Outcomes:

1. To analyze the propagation thourgh optical fiber for different modes and understand different sources of loss and dispersion.
2. To study optical transmitters and receivers.
3. To design an optical fiber link based on power budget and time budgets.

UNIT – I

Elements of Optical Fiber Systems: Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations, Mode theory of Circular Waveguides, Overview of Modes and Key concepts, Linearly Polarized Modes, Single Mode Fibers and Graded Index fiber structure.

UNIT – II

Losses and Dispersion: - 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, Mode Coupling, Design Optimization of Single Mode fibers-Refractive Index profile and cut-off wavelength.

UNIT – III

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

UNIT – IV

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

UNIT – V

Link design considerations: Point-to-Point link -Link Power budget, Rise - time budget, Noise Effects on System Performance, Operational Principles of WDM, Erbium-doped Amplifiers.

Text Books:

1. Gourd Keiser, "Optical Fiber Communication" TMH, 4/e, 2000.
2. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.

Suggested Readings:

1. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
2. Binh, “Digital Optical Communications”, First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.

EC 353

CPLD & FPGA ARCHITECTURES

(ELECTIVE – I)

Instruction	4 Periods/week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Familiarization of various complex programmable Logic devices of different families.
2. To study Field programmable gate arrays and realization techniques.
3. To study different case studies using one hot design methods and studying System level Design

Course Outcomes:

1. Implementation of various logic circuits on PLDs, CPLDs and FPGAs.
2. Analyze different FSM techniques like petrinets.

UNIT I

Programmable logic: ROM ,PROM ,PLA,PAL,SPLD, CPLD and FPGA, Features, Architectures, Programming, Applications and Implementation of MSI circuits using Programmable logic Devices.

UNIT II

CPLD's: Complex Programmable Logic Devices, logic block, I/O block, interconnect matrix, logic blocks and features of Altera flex logic 10000 series CPLD's , max 7000 series CPLD's, AT & T – ORCA's (Optimized Reconfigurable Cell Array), Cypres flash 370 device technology, Lattice pLSI's 3000series.

UNIT III

FPGAs: Field Programmable Gate Arrays – Logic blocks, routing architecture, Logic cells and features of commercially available FPGA's- XILINX XC4000, Virtexii FPGA's, XILINX SPARTAN II, Alteras Act1, Act2, Act3 FPGA's, Actel FPGA's, AMD FPGA.

UNIT IV

Finite State Machines (FSM): Top Down Design, State Transition Table , State assignments for FPGAs, Realization of state machine charts using PAL, FSM Architectures: Architectures Centered around non registered PLDs, Design of state machines centered around shift registers, One_Hot state machine, Petrinets for state machines-Basic concepts and properties, Finite State Machine-Case study.

UNIT V

System Level Design: Controller, data path designing, Functional partition, Digital front end digital design tools for FPGAs & ASICs, System level design using mentor graphics EDA tool (FPGA Advantage), Design flow using CPLDs and FPGAs.

Suggested Reading:

1. S. Trimberger, Edr, "Field Programmable Gate Array Technology", Kluwer Academic Pub., 1994.
2. Richard F.Tinder, "Engineering Digital Design", 2/e, Academic press
3. Charles H. Roth, "Fundamentals of logic design", 4/e, Jaico Publishing House.

References:

1. P.K.Chan & S. Mourad, "Digital Design Using Field Programmable Gate Array", PHI, 1994.
2. S. Brown, R.J.Francis, J.Rose, Z.G.Vranesic, "Field programmable gate array", BSP, 2007.
3. Manuals from Xilinx, Altera, AMD, Actel.

EC 354

Analog and Mixed IC Design

(Elective - I)

Instruction	4 Periods/week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Familiarization of current mirrors and their application in the design of Operational Amplifiers.
2. To study the various design issues of Op-Amps and their different architectures.
3. To study different types of data converter circuits.

Course Outcomes:

1. Able to gain the knowledge about various issues of Op-Amp design
2. Understand various other Op-Amp architectures
3. Students will be able to realize an A/D or D/A converter using current mirrors circuits.

UNIT I

Basic MOS Devices and Current Mirrors:

MOS Structure, I/V characteristics, MOS device models, Second Order Effects, Advanced MOS Modeling.

Simple CMOS current mirror, Common source amplifier, Source follower, Common gate stage, Source degenerated current mirror, High output impedance current mirrors, Cascode gain stage, Bipolar current mirrors, Bipolar gain stage, Frequency response of amplifiers.

UNIT II

Design of Op-Amp and its Frequency Response:

MOS Differential pair and gain stage, bi-polar differential pair and gain stage.

Operational Amplifiers: Two stage Op-Amps, Feedback and Op-amp Compensation, Common Mode Feedback, Input range limitation, Slew-rate, Power supply rejection, Multipole systems, Phase margin, Frequency compensation.

Advanced current mirrors, Folded Cascade Opamp, Current Mirror Opamp, Fully Differential Opamp, Current Feedback Opamp.

UNIT III

Design of Comparator and Switched Capacitor Circuits:

Use of Opamp for a Comparator, Charge Injection Error, Latched Comparators, CMOS Comparator and Bipolar Comparator.

Basic building blocks of switched capacitor, Basic Operation and Analysis, First order, Bi-quad, Charge Injection, Switched Capacitor Gain Circuit, Correlated Double Sampling Techniques, Other Switched Capacitor Circuits.

UNIT IV

S/H Circuits and Data Converters:

Sample and hold circuits: Performance and basics of sample and hold circuit, examples of CMOS, Bi-Polar sample and hold Circuits.

Converters: Ideal D/A converters, Ideal A/D converters, Quantization Noise, Signed codes, Performance limitations.

Nyquist Rate D/A Converters: Decoder based Converters, Binary scaled Converters, Thermometer code Converter -realization of converters using current mirrors.

UNIT V

Nyquist Rate A/D Data converters:

A/D Converters: Integrating Converter, Successive Approximation Converter, Cyclic A/D, Flash Converter, Two step A/D Converter, Interpolating A/D, Folding and Pipe-Lined, Time Interleaved Converters-realization of converters using current mirrors.

Text Books:

1. D.A John & Ken Martin, "Analog Integrated Circuit Design". John Wiley Publications, Reprint 2011.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata-McGraw Hill Publications,2002.

Suggested Reading:

1.Philip E. Allen & Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 2002

EC 355

SYSTEM AUTOMATION AND CONTROL

(Elective - I)

Instruction	4 Periods/week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks
Credits	3

Course objectives:

1. To learn the various sensors and transducers.
2. To study the data acquisition and signal conditioning modules.
3. To learn the concepts of motion control systems and robotics.

Course Outcomes:

1. Understand the various sensors and transducers.
2. Implement the data acquisition and signal conditioning modules.
3. Understand the concepts of motion control systems and robotics.

UNIT – I

Introduction to sensors and transducers: displacement, position, and proximity, velocity and motion, force, fluid pressure, liquid flow, liquid level, temperature, light. Selection of sensor.

UNIT – II

Data acquisition and Signal conditioning: various signal conditioning modules. Use of data acquisition. Fundamentals of Analog to digital conversion, sampling, amplifying, filtering, noise reduction. Criteria to choose suitable data acquisition equipment.

UNIT – III

Introduction to systems: Measurement and control. Basic system models. Mathematical models. Mechanical system building blocks, Electrical system building blocks, Fluid system building blocks and Thermal system building blocks. Engineering systems: Rotational – translational, Electromechanical, hydraulic-mechanical.

UNIT – IV

Dynamic responses of systems, system transfer functions, frequency response, closed loop controllers. Microcontroller basics, architecture, hardware interfacing, programming a microcontroller.
Programmable logic controllers: basic structure, input/output processing, programming, selection of a PLC.

UNIT – V

Motion control and robotics: concepts of motion control system and real world applications. Components of a motion control system. Motion controller, Motors and mechanical elements, move types, Motor amplifiers and drives. Feed back devices and motion input/output.

Suggested Reading:

1. W. Bolton, "Mechatronics: Electronic control systems in mechanical and electrical Engineering", 3/e, Pearson Education, 2008.
2. Robert A. Witte, "Electronic Test Instruments: Analog and Digital Measurements", 2/e, Pearson Education, 2002.
3. Dan Necsulescu, "Mechatronics", 1/e, Pearson Education, 2002.
4. De Silva, " Mechatronics", First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications