R15 Schema & Syllabus for V & VI Semesters

Department of ECE

K.S.R.M. College of Engineering (Autonomous)

Kadapa

(w.e.f. 2017-18 I Semester)

Schema for V Semester

S. No.	Subject Code	Subject	SC	L	T	P	IM	EM	CR
1	1504501	Microprocessors & Interfacing	PJ	4	0	0	30	70	3
2	1504502	Linear IC Applications	PJ	4	0	0	30	70	3
3	1504503	Digital Communications	PJ	4	0	0	30	70	3
4	1504504	Antenna and Wave Propagation	PJ	4	0	0	30	70	3
5	1515505	Computer Organization	PN	4	0	0	30	70	3
6	1504506	Digital IC Applications	PJ	4	0	0	30	70	3
7	1504507	IC Applications Lab	PJ	0	0	3	50	50	2
8	1504508	Communication Engineering Lab	PJ	0	0	3	50	50	2
		Total					280	520	22

Schema for VI Semester

S. No.	Subject Code	Subject	SC	L	T	P	IM	EM	CR
1	1525601	Managerial Economics & Financial Analysis	HS	4	0	0	30	70	3
2	1504602	Digital Signal Processing	PJ	4	0	0	30	70	3
3	1504603	Microwave Engineering	PJ	4	0	0	30	70	3
4	1512604	Control Systems	PN	4	0	0	30	70	3
5	1504605	Microcontrollers and Applications	PJ	4	0	0	30	70	3
6	 1515606 1515607 1515608	**Elective-I** 1. Data structures 2. Computer Networks 3. Database Management Systems	PN	4	0	0	30	70	3
7	1504609	Microprocessors & Microcontrollers Lab	PJ	0	0	3	50	50	2
8	1504610	Digital Signal Processing Lab	PJ	0	0	3	50	50	2
		Total					280	520	22

V Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504501	**PJ**	**Microprocessors & Interfacing**	**4**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

- To become familiar with 8085 & 8086 Microprocessor Architecture, Instructions, Operating Modes and Programming.
- To use 8086 microprocessor for various applications.
- To study various peripherals for microprocessor based systems.

Learning Outcomes:

- This course describes the Architecture and instruction set of 8085 Microprocessors and.
- This course describes the Architecture and instruction set of 8086 Microprocessors
- Students get the ability to write programs and execute using 8086 Microprocessor.
- They know about data transfer schemes and Interface the 8086 Microprocessor to the outside world
- Design and develop Microprocessor based Systems for various applications

UNIT I

Introduction to 8085 Microprocessor: Development of microprocessors, 8085 Microprocessor - Architecture, Organization, Instruction set, Addressing modes, Basic Timing Diagrams, Interrupts and Simple Programs.

UNIT II

Introduction to 8086 Microprocessor: 8086 Microprocessor - Architecture, Organization, Instruction set, Addressing modes, Interrupt system. Pin diagram, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings.

UNIT III

Assembly Language Programming: Assembler directives, Assembly language programs (8086) with Assembler directives for addition, subtraction, multiplication, division etc., sorting and searching, bit manipulation, look-up tables, string manipulations, Macros and Delay subroutines, Debugging.

UNIT IV

Data transfer schemes and Peripheral Interfacing: Synchronous, Asynchronous, Interrupt driven and DMA type schemes, 8255 PPI and its interfacing, Programmable Communication Interface (8251 USART) and its interfacing, Programmable Interval Timer (8254) and its interfacing, Programmable interrupt controller (8259) and its interfacing, Programmable DMA controller (8257) and its interfacing.

UNIT V

Memory and I/O Interfacing to 8086: Address decoding techniques, Interfacing Static RAM and ROM chips, ADC and DAC Interfacing.

Case studies: Traffic light controller, Stepper motor control, Data acquisition, Temperature measurement and control.

Text Books:

1. Ramesh S. Gaonkar, “Microprocessor architecture, programming and its applications with 8085”, Penram Interantional Publications, 4th Edition.
2. A. K. Ray and K.M. Bhurchandi, "Advanced Microprocessors and Peripherals", TMH.

Reference Books:

1. Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware", 2nd Edition, Tata McGraw-Hill.
2. Barry B. Brey, “The Intel Microprocessors-Architecture, Programming and Interfacing”, 8th Edition, PHI.
3. Y. Liu and Glenn A. Gibson, “Microcomputer Systems: 8086/8088 Family Architecture, Programming and Design”, 2nd Edition, PHI.

V Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504502	**PJ**	**Linear IC Applications**	**4**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

- To introduce Operational Amplifiers (Op-Amps)
- To give the concepts of design and analysis related to Op-Amp Applications as
    - Timers
    - Phase Locked Loops (PLLs)
    - Waveform Generators
    - Analog Filters
    - Data Converters

Learning Outcomes:

- Apply Op-Amps in various IC applications
- Use the knowledge of DC and AC characteristics of Op-Amps in the design and simulation of analog systems and subsystems
- Apply Multivibrator Circuits using Op-Amps and 555 Timers and study the applications of Phase Locked Loops in Communication Systems
- Design and analyze Data Converters and Active Analog Filter circuits in the development of Instrumentation and Control Systems

UNIT-I

Differential amplifiers: Definition, DC and AC analysis of Dual input-Balanced output Differential Amplifier, Properties of other three differential amplifier configurations, Transfer characteristics of Differential Amplifier, Level Translator.

Operational Amplifiers: Ideal op-amp Characteristics, Internal circuit of Op-Amp, Block diagram of Commercial IC Op-Amp, FET input op-amp, DC and AC characteristics of Op-Amp, Frequency Compensation.

UNIT-II

Basic Op-Amp Applications: Ideal Inverting and Non-Inverting Amplifiers, Voltage Follower, Summer, Subtractor, Differentiator - Ideal Differentiator, Practical Differentiator, Integrator - Ideal Integrator, Practical Integrator, Instrumentation amplifier, DC and AC Amplifiers, V to I and I to V converters, Precision rectifiers, Sample and Hold Circuit.

UNIT-III

Comparators and waveform generators: Principle of Comparator, Schmitt Trigger, Astable Multivibrator, Monostable Multivibrators, Triangular Wave Generator.

Active Filters: Introduction to Analog Active Filters, Design and analysis of First Order Low Pass Filter and First Order High Pass Filter, Design and analysis of Second order Low pass Filter and Second Order High Pass Filter, Qualitative treatment of Band pass Filters and Band Reject Filters.

UNIT-IV

Sinusoidal Oscillators: Criterion for Oscillations, RC Phase Shift Oscillator, Wien Bridge Oscillator.

555 Timers: Functional block diagram and Pin diagram of 555 Timer, 555 Timer in Monostable Mode, 555 Timer in Astable Mode

Phase Locked Loops (PLLs): Basic principle of PLL, Components used in PLL, IC PLL (565), PLL applications.

UNIT-V

Digital to Analog Converters (DACs): Introduction, Basic DAC Technique, Weighted Resistor DAC, R-2R Ladder DAC, Inverted R-2R DAC, IC 1408 DAC, DAC Specifications

Analog to Digital Converters (ADCs): Functional Diagram of ADC, 'Direct type' vs 'Integrating type' ADCs, Parallel Comparator (Flash) ADC, Successive Approximation AD, Dual Slope ADC, ADC Specifications.

Text Books:

1. D. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", 2nd Edition, New Age, 2003
2. Ramakant A. Gayakward, "Op-amps and Linear Integrated Circuits", 4th Edition, Pearson Education, 2003
3. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013

Reference Books:

1. James M. Fiore, "Opamps & Linear Integrated Circuits Concepts & Applications", Cengage, 2010.
2. Thomas L. Floyd and David M. Buchla, "Fundamentals of Analog Circuits", Pearson, 2013.
3. Jacob Millman and Christos C. Halkias, "Integrated Electronics - Analog and Digital Circuits and Systems", Tata McGraw-Hill, 2003
4. Robert F. Coughlin, Fredrick F. Driscoll, "Op-amp and Linear ICs", PHI Learning, 6th Edition, 2012.

V Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504503	PJ	Digital Communications	4	0	0	30	70	3

Course Objectives:

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

Learning Outcomes:

- Analyze the different pulse digital modulation techniques
- Understand various baseband digital transmission systems
- Comprehend the different band pass digital transmission systems
- Analyze and design error control techniques

UNIT-I

Wave form coders: Review of sampling theorem, PCM system, Quantization noise, Companding, B.W. requirements of PCM, Differential PCM, Delta modulation, Adaptive delta modulation, Noises in PCM & Delta Modulation, TDM, Asynchronous TDM, Comparison of TDM & FDM.

UNIT-II

Base band data transmission: Characterization of band-limited channels, Design of band-limited signals for no inter symbol interference (ISI), The Nyquist criterion, Design of band limited signals with controlled ISI, Partial response signals, Transmitting & receiving filters for optimum performance, M-ary signaling scheme, Binary Vs M – ary, Equalization schemes, Eye diagrams.

UNIT-III

Digital Communication system and Information theory: Model of a digital communication system, Unit of information, Entropy, mutual information, channel models and channel capacity, Shannon's theorem-Shannon-Hartley theorem, Bandwidth, S/N trade-off, source encoding of discrete memory less source, shannon- Fano coding, Huffman coding, coding efficiency.

UNIT-IV

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

UNIT-V

Digital carrier modulation schemes: ASK, FSK (coherent & Non Coherent), PSK, DPSK, Baseband signal receiver, Optimum & matched filters, Correlator, Comparison of digital modulation schemes- Bandwidth requirement, Power requirement, Immunity to channel impairments, Equipment complexity, M-ary signaling schemes (8/16PSK, QPSK, QAM), Synchronization methods.

Text Books:

1. Simon Haykin, "Communication Systems", 3rd Edition, Wiley Estern
2. Sam Shanmugam,, K "Analog & Digital Communication Systems", John Willey & Sons (I, II, III, IV, V)
3. B.P. Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press, 2nd Edition, 1996

Reference Books:

1. George Kennedy and Bernard Davis, "Electronics & Communication System", TMH, 2004.
2. R.P. Singh & S.D. Sapre, "Communication Systems, Analog & Digital", Tata McGraw-Hill.
3. Taub, H & Schilling D.L.", Principles of Communication System, McGraw Hill, 3rd Edition, 2009.
4. Bernard Sklar, "Digital Communications", Prentice-Hall PTR, 2nd Edition, 2001.

V Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504504	PJ	Antennas & Wave Propagation	4	0	0	30	70	3

Course Objectives:

- The student will learn the fundamental principles of transmission line theory related to communications including the propagation of signals on a transmission line and in free space.

Learning Outcomes:

- Apply the antenna basics to analyze different antennas practically
- Analyze different antenna Arrays, VHF, UHF and micro wave antennas.
- Able to solve engineering problems with wide range of solutions in antennas and wave propagation.
- Apply the knowledge of antenna measurements and wave propagation concepts in antenna design.

UNIT- I

Antenna Basics: Introduction, Basic antenna parameters- patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Effective height, Antenna Apertures, Friis transmission formula, Illustrative problems. Fields from oscillating dipole, Antenna temperature, front–to-back ratio, basic Maxwell's equations, retarded potential-Helmholtz Theorem, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Field Components, Radiated power, Radiation Resistance, Beam width, Directivity, Effective Area and Effective Height, Natural current distributions, far fields.

UNIT- II

Antenna Arrays: Point sources- Definition, Patterns, arrays of 2 Isotropic sources. Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, Derivation of their characteristics and comparison, BSA with Non-uniform Amplitude Distributions, Bionomial Arrays.

UNIT- III

VHF, UHF AND Microwave Antennas: Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded Dipoles & their characteristics. Helical Antennas, Horn Antennas, Parabolic Reflector, Micro strip Antennas.

Antenna Measurements: Introduction, Directivity Measurement, Gain Measurements (by comparison, Absolute and 3-Antenna Methods).

UNIT- IV

Wave Propagation-I: Introduction, Characterizations and general classifications, different modes of wave propagation, Ray/ Mode concepts. Ground wave propagation (Qualitative treatment) - Introduction, Plane earth reflections, Space and surface waves, wave tilt, curved earth reflections. Space wave propagation- Introduction, field strength variation with distance and height, effect of earth's curvature, absorption, Super refraction, M-curves and duct propagation, scattering phenomena, tropospheric propagation, fading and path loss calculations.

UNIT- V

Wave Propagation-II: Sky wave propagation- Introduction, structure of Ionosphere, refraction and reflection of sky waves by Ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, Multi-HOP propagation, Energy loss in Ionosphere, Summary of Wave Characteristics in different frequency ranges.

Text Books:

1. John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and wave propagation", TMH, New Delhi, 4th Edition, (Special Indian Edition), 2010
2. E.C. Jordan and. Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2nd Edition, 2000.
3. C.A. Balanis, "Antenna Theory" John Wiley & Sons, 2nd Edition, 2001.

Reference Books:

1. K.D. Prasad, "Antennas and Wave Propagation", Satya Prakashan, Tech India Publications, New Delhi, 2001
2. F.E. Terman, "Electronic and Radio Engineering," McGraw-Hill, 4th Edition, 1955.

V Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1515505	**PN**	**Computer Organization**	**4**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

- To give the concepts related to Computer Organization and Design
- To introduce CPU, Memory, I/O Devices

Learning Outcomes:

- Acquire the knowledge of Digital Computer Hardware that is essential for a student of any branch of Engineering
- Learn the basic concepts of various units of computer which is essential in all fields of Engineering and Science
- Use their knowledge in Embedded system Applications which are common for the fields "CSE" and "ECE"
- They can use these concepts as "Domain Knowledge" for various industrial applications

UNIT-I

Basic Structure of Computers: Computer Types, Functional Units, Basic operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi Computers.

Register Transfer and Micro Operations: Register transfer, Bus and Memory transfers, Arithmetic micro operations, Logic micro operations, Shift Micro Operations, Arithmetic Logic shift units.

UNIT-II

Basic Computer Organization and Design: Instruction codes, computer Registers and instructions, Timing and control, instruction cycles, memory- reference instructions, Input-Output and interrupt.

Microprogrammed Control: Control Memory, Address Sequencing, Micro Program Example, Design of Control Unit.

UNIT-III

Central Processing Unit: General register Organization, Stack Organization, Instruction formats, Addressing Modes, Program Control, RISC, Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline.

UNIT-IV

Input-Output Organization: Peripheral Devices, Input-Output interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, DMA, Input-Output Processor, Serial Communication.

UNIT-V

Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associative Memory, Cache Memory, Virtual memory, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration, Inter Processor Communication and Synchronization, Cache Coherence, Shared Memory Multiprocessors.

Text Books:

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky, "Computer Organization", 5th Edition, Tata McGraw-Hill.(Unit I-1chapter)
2. M. Moris Mano, "Computer Systems Architecture", 3rd Edition, Pearson/PHI.

Reference Books:

1. William Stallings, Computer Organization and Architecture, 6th Edition, Pearson/PHI.
2. S Andrew S. Tanenbaum, Structured Computer Organization, 4th Edition, PHI/Pearson
3. P. Sivarama, Dandamudi, "Fundamentals or Computer Organization and Design", Springer Int. Edition.
4. John L. Hennessy and David A. Patterson, "Computer Architecture a quantitative approach", 4th Edition, Elsevier.
5. Joseph D. Dumas II, "Computer Architecture: Fundamentals and principles of Computer Design", BS Publication.

V Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504506	**PJ**	**Digital IC Applications**	**4**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

- To introduce VHDL and its language elements to design digital systems.
- Make students familiar with design of different combinational and sequential digital circuits.

Learning Outcomes:

- Able to use computer-aided tools for development of complex digital logic circuits
- Able to model, simulate, verify, analyze and synthesize with HDL.
- Able to design and prototype with standard cell technology and programmable logic.
- Able to design tests for digital logic circuits, and design for testability.

UNIT-I

CMOS & Bipolar Logic: Introduction to logic families, CMOS logic, CMOS logic families, Bipolar logic, Bipolar logic families (TTL, ECL), ROM- Internal structure, Static RAM and Dynamic RAM.

UNIT-II

The VHDL Hardware Description Language: Design flow, program structure, types and constants, functions and procedures, libraries and packages. Structural design elements, data flow design elements, behavioral design elements, time dimension, simulation and synthesis.

UNIT-III

Combinational Logic Design: Decoders, encoders, three state devices, multiplexers and demultiplexers, Code Converters, EX-OR gates and parity circuits, comparators, adders & subtractors, Combinational multipliers. VHDL models for the above ICs.

UNIT-IV

Design Examples (USING VHDL): Design examples (using VHDL) - Barrel shifter, comparators, floating point encoder, dual parity encoder.

UNIT-V

Sequential Logic Design: Latches and flip-flops, PLDs, counters, shift register and their VHDL models, synchronous design methodology.

Text Books:

1. John F. Wakerly, "Digital Design Principles & Practices" PHI/Pearson Education Asia, 3rd Edition, 2005.
2. J. Bhasker, "A VHDL Primer", Pearson Education/ PHI, 3rd Edition.

Reference Books:

1. Stephen Borwn and Zvonko Vramesic, “Fundamentals of Digital Logic with VHDL Design” McGraw Hill, 2nd Edition, 2005.
2. Charles H. Roth Jr., “Digital System Design Using VHDL”, PWS Publications, 2nd Edition, 2008.

V Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504507	**PJ**	**IC Applications Lab**	**0**	**0**	**3**	**50**	**50**	**2**

Learning Outcomes:

- Develop applications using OP-AMPs, PLLs and Timers
- Apply active filters (LPF and HPF) in analog applications and VCO (IC 566) and Voltage Regulator (IC 723) needed in many Electronic applications
- Design and simulation of Combinational and Sequential circuits using VHDL
- Select and design appropriate data converters needed for analog and digital circuits

Part A: Analog IC Application Lab:

1. OP AMP Applications – Adder, Subtractor, Comparator Circuits.
2. Active Filter Applications – LPF, HPF (first order).
3. Function Generator using OP AMPs.
4. IC 555 Timer – Monostable and Astable Operation Circuit.
5. IC 566 – VCO Applications.
6. Voltage Regulator using IC 723.
7. 4 bit DAC using OP AMP.
8. Precision Diodes

Part B: Digital IC Applications:

(Simulate the internal structure of the following Digital IC's using VHDL)

1. Logic Gates- 74XX.
2. Half Adder, Half Subtractor, Full Adder, Full Subtractor & Ripple Carry Adder.
3. 3-8 Decoder -74138 & 8-3 Encoder- 74X148.
4. 8 x 1 Multiplexer -74X151 and 2x4 Demultiplexer-74X155.
5. 4 bit Comparator-74X85.
6. D Flip-Flop 74X74.
7. JK Flip-Flop 74X109.
8. Decade counter-74X90.

V Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504508	**PJ**	**Communication Engineering Lab**	**0**	**0**	**3**	**50**	**50**	**2**

Course Objectives:

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

Learning Outcomes:

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

Part- A: Analog Communication Lab:

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

Part- B: Digital Communication Lab:

1. Sampling Theorem – verification.
2. Time division multiplexing.
3. Pulse Code Modulation.
4. Delta modulation.
5. Frequency shift keying - Modulation and Demodulation.
6. Phase shift keying - Modulation and Demodulation.
7. Differential phase shift keying - Modulation and Demodulation.
8. QPSK - Modulation and Demodulation.

VI Sem. (ECE) **(Common to ECE, CE & ME)**

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1525601	HS	Managerial Economics and Financial Analysis	4	0	0	30	70	3

Objectives:

- To equip the budding engineering student with an understanding of concepts and tools of economic analysis.
- Provide knowledge of managerial economics through differential economics concepts, accounting concepts are necessary to analyze and solve complex problems relating financial related matters in bog industries.
- An understanding of professional and ethical responsibility and ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global and societal context.
- Recognition of the need for, and an ability to engage in life-long learning and to meet contemporary issues.

Course Outcomes:

- Expected to achieve the overall course objective to understand and enhancing the knowledge regarding managerial concepts and obtaining optimal solutions. And to get an idea of analysis of firm's financial position with the techniques of financial analysis and ratio analysis.

UNIT-I

Introduction to Managerial Economics:

Definition, nature and scope of Managerial Economics – relation with other disciplines. Demand analysis – Determinants, Law of Demand and its exceptions – Elasticity of Demand – Types and Measurement of Elasticity of Demand – Methods of Demand Forecasting.

UNIT-II

Theory of Production And Cost Analysis:

Production Functions: Law of variable proportion, Isoquants and Isocost, least cost combination of inputs, Returns to Scale and Cobb- Douglas production function. Internal and external economies of scale.

Cost Analysis: Cost concepts – Break-Even Analysis (BEA) – Break Even Point – significance and limitations of BEA.

UNIT-III

Introduction to Markets and Pricing

Markets Structures: Perfect and Imperfect competition – features of Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly. Price- Output determination under perfect competition, monopoly and monopolistic competition – Price rigidity in Oligopoly.

Methods of Pricing: Cost plus pricing, marginal cost pricing, skimming pricing, penetration pricing, differential pricing and administrative pricing.

UNIT-IV

Business Organizations and Capital Budgeting

Business Organizations: Types of business organizations- Sole Proprietorship, Partnership, Joint Stock Company, Public Ltd and Private Ltd companies, Public Private Partnership (PPP).

Capital Budgeting: Types of capital, methods and sources of raising Capital. Capital Budgeting Techniques: Payback Period Method, Accounting Rate of return (ARR) and Net Present Value Method (NPV) (simple problems).

UNIT-V

Financial Accounting and Analysis:

Double Entry Book keeping, Journal, Ledger, Trail Balance – Final Accounts (Preparation of Trading Account, Profit and Loss Account and Balance Sheet without adjustments). Analysis and interpretation of financial statements through ratios (Liquidity, Profitability and Activity Ratios) (Simple problems).

Text Books:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand Publishers.
2. Prasad and K.V.Rao: Financial Accounting, jaibharth Publishers, Vijayawada.

Reference Books:

1. P.L Mehtha: Managerial Economics, Sulthan Chand Publishers
2. K K Dewett - Managerial Economics ,S. Chand Publishers
3. S.P Jain & K.L Narang: Financial Accounting, Kalyani publishers.
4. M.Sugunatha Reddy: Managerial Economics and Financial Analysis, Research India Publication, New Delhi.

VI Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504602	PJ	Digital Signal Processing	4	0	0	30	70	3

Course Objectives:

- To become familiar with Discrete Fourier Transform and its efficient computation.
- To understand various IIR and FIR realization techniques.
- To know the design of IIR and FIR filters.

Learning Outcomes:

- Get the knowledge of discrete time signals and systems
- Apply Z-Transforms in digital system design
- Write algorithms for Fast Fourier Transforms
- Realize Digital Filters
- Design IIR and FIR filters for the desired characteristics.

UNIT-I

Z–Transforms: Review of Discrete-time signals and systems, z-transform- definition, ROC and its properties, analysis of LTI system using z-transform, The Inverse z-transform using- contour integration, long division, inspection method, convolution method & residue method. Z-transform properties, solution of linear constant coefficient difference equations using z-transforms.

UNIT-II

Discrete Fourier series: DFS representation of periodic sequences, Properties of discrete Fourier series, Discrete Fourier Transform (DFT), properties of DFT, linear convolution of sequences using DFT.

Fast Fourier Transforms: Efficient computation of the DFT, Decimation in time and decimation in frequency FFT algorithms, FFT algorithms for composite N.

UNIT-III

Realization of Digital Filters: Block diagram representation of linear constant-coefficient difference equations, basic structures of IIR filters- direct form I, direct form II, transposed form, cascade form, parallel forms, basic structures of FIR filters-Direct form, Cascade form, Linear phase structure, Lattice structures.

UNIT-IV

IIR Digital Filters: General considerations-Causality and its implications, Characteristics of Practical Frequency-selective filters, Design of analog filters-Butterworth and chebyshev approximations, IIR filter design by backward difference, Impulse Invariance, Bilinear transformation, design examples: frequency transformations, Illustrative Problems.

UNIT-V

FIR Digital Filters: Symmetric and Anti-symmetric FIR filters, Design of Linear Phase FIR digital filters using windows, Frequency sampling technique, comparison of IIR and FIR filters, Illustrative Problems, applications of DSP (Dual Tone Multifrequency signal detection, Spectral analysis of sinusoidal and nonstationary signals).

Text Books:

1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd ed., Pearson Education, 2012.
2. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and Aapplications", Pearson Education/PHI, 4th Edition, 2007.
3. Sanjit K Mitra, "Digital signal processing", A computer base approach- Tata McGraw-Hill, 3rd Edition, 2009.

Reference Books:

1. Andreas Antoniou, Digital signal processing: Tata McGraw-Hill, 2006.
2. Digital signal processing: M H Hayes, Schaum's Outlines, Tata McGraw-Hill, 2007.
3. A. Anand Kumar, "Digital Signal Processing," PHI Learning, 2011.

VI Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504603	PJ	Microwave Engineering	4	0	0	30	70	3

Course Objectives:

- To impart Knowledge about various microwave components, microwave junctions, microwave tubes and microwave signal characteristic measurements

Learning Outcomes:

- Implement Wave guide and Microwave components for various applications.
- Analyze various micro Wave Oscillators and Amplifiers
- Know the significance, types and characteristics of the slow wave structures used for transmission of microwave frequencies.
- Perform Microwave measurements

UNIT-I

Microwave tubes-I: Limitations and losses of conventional tubes at microwave frequencies. Microwave tubes-O type and M type classifications. O type tubes: Two cavity klystron-structure, Reentrant cavities, Velocity modulation process and Applegate diagram, Bunching process and small signal theory-Expressions for output power and efficiency. Reflex Klystron – structure, Velocity Modulation, Applegate diagram, Mathematical theory of bunching, Output power, efficiency, Oscillating modes and output characteristics, Effect of repeller Voltage on output Power, Illustrative Problems.

UNIT-II

Helix TWTS: Significance, Types and characteristics of slow wave structures; Structure of TWT and amplification process, Suppression of oscillations, gain considerations.

M -Type Tubes: Introduction, Magnetrons, Different types, Cylindrical magnetron-Hull cutoff and Hartree conditions, Modes of resonance and PI-mode operation, Separation of PI-mode, Output characteristics, Illustrative Problems.

UNIT-III

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

UNIT-IV

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

UNIT-V

Microwave Measurements: Measurement of frequency, Power, VSWR, Impedance, Reflection coefficient, Attenuation constant, S-parameters and Q of a cavity Resonator.

Microwave ICs: Advantages of MICs, Hybrid MICs, Monolithic MICs- advantages, materials and fabrication, Striplines and micro striplines.

Text Books:

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

Reference Books:

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

VI Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1512604	**PN**	**Control Systems**	**4**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

In this course it is aimed to introduce to the students the principles and applications of control systems in everyday life. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems It also deals with the different aspects of stability analysis of systems in frequency domain and time domain and to design compensators in frequency domain to improve the performance.

COURSE OUTCOMES: On successful completion of this course, the students will be able to

1. Demonstrate knowledge on
   - modelling of physical systems
   - time and frequency domain specifications used for stability analysis.
   - various methods of determining the stability of the system
   - realization of various compensators
2. Analyze the stability of the system in time and frequency domains.
3. Design
   - lag, lead, lag-lead compensators in frequency domain.

4. Evaluate
   - the transfer function using block diagram reduction technique and signal flow graph.
   - steady state error and static error constants.
   - system stability in time and frequency domains.

UNIT-I

Control System Concepts: Introduction to Control Systems, Classification. Transfer function, Effect of feedback, mathematical modelling of Physical Systems, block diagram, reduction techniques – signal flow graphs and mason's gain formula. Transfer function of simple electrical systems.

UNIT-II

Time Domain Analysis: Standard test signals, Time response of first and second order systems- Time response specifications – Steady state error and error Constants- Response of P, PI, and PID Controllers.

UNIT-III

Concept of Stability and Root Locus: The Concept of Stability, necessary Conditions for stability – Routh Hurwitz's Criterion – Limitations of Routh's stability – Root Locus Concept – Construction of Root Loci, Effect of Poles & Zeros on stability.

UNIT-IV

Frequency Domain Analysis: Introduction, Correlation between time and frequency response, Frequency domain Specifications. Bode Plots, Nyquist stability Criterion - Gain and Phase margin.

UNIT-V

Compensation Techniques for Linear Control Systems: System Design and Compensation – Realization of basic lead, lag and lead – lag cascade Compensations in frequency domain.

Text Books:

1. "Control Systems Engineering" by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 5th edition, 2007.
2. "Automatic Control Systems" by B. C. Kuo and Farid Goinaraghi – John Wiley and Son's, 8th edition, 2003.
3. "Control Systems" by A. Anand Kumar, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. "Modern Control Engineering" by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. "Control Systems Engineering" by NISE, 5th edition, John Wiley.
3. "Modern Control Systems" by C. Dorf, Robert H.Bishop, 12th edition, Pearson New International Edition.

VI Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504605	**PJ**	**Microcontrollers and Applications**	**4**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

- To become familiar with 8051, ARM Microcontroller Architecture, Instructions, Programming.

Learning Outcomes:

- Understand Architecture and instruction set of 8051Microcontrollers
- Get the ability to write programs and execute using 8051 Microcontroller.
- Understand the Architecture of ARM Microcontrollers
- Understand the Instruction Set of ARM Microcontrollers
- Understand IOT.

UNIT I

The 8051 Architecture: Introduction, architecture of 8051, pin diagram, memory organization, external memory interfacing, stack, addressing modes, instruction set.

UNIT II

The 8051 Programming: Assembler directives, Assembly Language programs and Time delay Calculations.
8051 Interrupts and Timers/Counters: 8051 interrupt structure, 8051 counters and Timers, programming 8051 timers.

UNIT III

ARM Architecture: ARM Design philosophy, Registers, Program Status Register, Instruction pipeline, Interrupts and vector table, Architecture Revision, ARM Processor Families, Introduction to ARM 9 processor.

UNIT IV

ARM Programming Model: Addressing Modes, Instruction Set- Data Processing Instructions, Branch, Load-Store, Software interrupt, PSR instructions, Conditional instructions, Thumb instruction Set: Register Usage, Other Branch instructions, Data processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions.

UNIT V

Introduction to IOT: Introduction, Physical Design of IOT, Logical design of IOT, IOT enabling Technologies, IOT levels and Deployment Templates, Domain Specific IOTs.

Text Books:

1. The 8051Microcontroller and Embedded Systems, Mazidi Muhammad Ali, Mazidi Janice Gillespie & McKinlay Rolin D, 2nd Edition, Pearson Education, 2008.

2. ARM System Developer's Guide-Designing and Optimizing system software, Andrew N.Sloss, Dominic Symes, Chris Wright, Elsevier, 2008.

3. Internet of Things A Hands-on-Approach, Vijay Madisetti & ArshdeepBahga, Universities Press,2015.

Reference Books:

1. The 8051 microcontroller: Architecture, Programming & Applications, Kenneth J Ayala, penram publications, 2nd edition.

2. Microcontrollers Architecture, Programming, Interfacing and System Design – Raj Kamal, Pearson Education, 2005.

3. Steve Furbur, ARM System onchip Architecture, 2nd Edition, Addison Wesley, 2000.

VI Sem. (ECE)

Elective-I

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1515606	**PN**	**Data Structures**	**4**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

- To develop skills to design and analyze linear and non linear data structures
- To develop algorithms for manipulating linked lists, stacks, queues, trees and graphs
- To develop recursive algorithms as they apply to trees and graphs.

Learning Outcomes:

- Get thorough understanding of Abstract Data Types, primitive & non-primitive, and linear and non-linear data structures
- Design Arrays and Linked lists
- Apply Trees and Graphs
- Select appropriate searching technique and sorting technique

UNIT-I

Introduction: Concepts of Abstract Data Types (ADTs), Data Structures, primitive and non-primitive data structures, Linear and non-linear data structures. **Arrays**: Definition, single and Multidimensional arrays, Representation of arrays, Application of arrays, **Linked lists:** Representation of linked list in memory, Single inked list, Double linked list, Circular linked list, Operations on a linked list: Insertion, Insertion, Deletion, Traversal, Memory allocation and Garbage collection.

UNIT-II

Stacks: Abstract Data type, Stack operations: Push, Pop, Full and Empty, Array and linked implementation of stack, Applications of stack: Prefix and postfix expressions, Evaluation of postfix expression, Tower of Hanoi problem, Recursion. **Queues:** Abstract Data Type, Queue operations: Create, Add, Delete, Full and Empty, Array and linked implementation of queue, circular queue, Dequeue and priority queue.

UNIT-III

Trees: Basic Terminology, **Binary Trees:** Definition, properties, Array and linked representation, complete Binary Tree, Tree Traversal algorithms: Inorder, Preorder and Postorder, Heaps, Balanced Binary search Trees: AVL, Read-Black and splay Trees.

UNIT-IV

Graphs: Terminolgy, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency list, Adjacency Multilist, Graph Traversal: Depth First search and Breadth First Search, connected components, spanning Trees, Minimum cost Spanning Trees: Prims and Kruskal algorithm and Dijikstra Algorithm.

UNIT-V

Sorting: Selection, Insertion, Bubble, Merge, Quick, Heap and Radix sorting techniques, **Searching:** Sequential search, Binary search, comparison and Analysis.

Text Books:

1. Aaron M.Tenenbaum, Yedidyah Langsam and Moshe J.Augestein, “Data Structures using C and C++ “, PHI.
2. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia publication.

Reference Books:

1. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with applications”, McGraw Hill.
2. G A V Pai, “Data Structures and Algorithms”, TMH
3. Lipschutz, “Data Structures”, Schaum’s Outline series, TMH
4. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education.

VI Sem. (ECE)

Elective-I

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1515607	PN	Computer Networks	4	0	0	30	70	3

Course Objectives:

1. To give the concepts of various network reference models and their layers
2. To introduce cryptography

Learning Outcomes:

- This course describes and distinguishes between OSI and TCP/IP reference models and introduces various types of Networks
- It describes various layers of the reference models
- Students get familiarity with the concepts of DNS, E-mail and multimedia
- They grasp the concepts-Cryptography and Firewalls

UNIT-I

Types of Networks: Reference Models-OSI reference model, TCP/IP reference model, OSI vs TCP. Network hardware architecture topologies, devices, Introduction to types of networks-optical networks, sensor networks

UNIT-II

Physical Layer: Transmission media, Guided and Unguided transmission media, communication Satellites.

Data Link layer: Design Issues, Error detection and Correction, Elementary and sliding window Data link protocols

UNIT-III

MAC & Network layers: Media Access Protocols, carrier senses multiple access, collision free protocols, Ethernet, Wireless LANs-Types.

Network layer: Network Layer design issues- Routing Algorithms, IPV4 and IPV6 protocols.

UNIT-IV

Transport Layer: Transport services, Elements of Transport protocols, simple Transport protocols-UDP-TCP-performance Issues.

UNIT-V

Application Layer: DNS, E-mail, WWW, multimedia.

Introduction to Cryptography: Basic concepts, firewalls.

Text Books:

1. Andrew S. Tanenbaum , "Computer Networks ", 4th Edition, Pearson Education.
2. S. Keshav, "An Engineering Approach to Computer Networks", International Student Edition, Addisson Wesley.

Reference Books:

1. Behrouz A.Forouzan " Data communication and Networking", Tata McGraw-Hill,2004
2. James F.Kurose and Keith W.Ross," Computer Networking: A Top-Down approach featuring the Internet", Pearson Education, 3rd Edition 2003.

VI Sem. (ECE)

Elective-I

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1515608	PN	Database Management Systems	4	0	0	30	70	3

Objectives:

- Introduction to relational model and SQL
- To make students learn the various concepts related to the RDBMS

Learning Outcomes:

- Draw an efficient E-R diagram, which is the basic and essential step in academic or Industrial Software project
- Apply Relational Model and SQL for the most widely used relational databases
- Apply Normalization Techniques for Database Administration
- Demonstrate the ability to perform Query Processing and Transaction Management
- Gain the knowledge required for Database Administrator

UNIT-I

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database languages, Database Users and Administrators, History of Database Systems.

Introduction to the Relational Model - Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations.

Database Design and the E-R Model - Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling Data.

UNIT-II

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database.

Intermediate SQL: Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization

Advanced SQL: Functions and Procedures, Triggers.

Formal Relational Query Languages: The Relational Algebra, the Tuple Relational Calculus, the Domain Relational Calculus.

UNIT-III

Schema Refinement and Normal Forms: Schema Refinement – Problems Caused by Redundancy, Decompositions, Problems related to decomposition. Reasoning about Functional Dependencies, First, Second, Third Normal forms, BCNF. Lossless join Decomposition, Dependency- preserving Decomposition. Schema refinement in Data base Design, Multi valued Dependencies, Fourth Normal Form, Join Dependencies, Fifth Normal Form, Inclusion Dependencies.

UNIT-IV

Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions

Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans.

Transactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.

UNIT-V

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multi version Schemes, Snapshot Isolation, Insert Operations, Delete Operations, and Predicate Reads, Weak Levels of Consistency in Practice.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, Early Lock Release and Logical Undo Operations, Remote Backup Systems.

Text Books:

1. Silberschatz, Korth, "Database system Concepts", 5th Edition, McGrawhill.
2. Raghurama Krishnan, Johannes Gehrke, "Data base Management Systems", 3rd Edition, Tata McGraw-Hill.

Reference Books:

1. Elmasri, Navathe, "Fundamentals of Database Systems", Pearson Education.
2. Peter Rob, Ananda Rao and Carlos Corone, "Database Management Systems", Cengage Learning.
3. C.J.Date, "Introduction to Database Systems", Pearson Education.

VI Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504609	**PJ**	**Microprocessors and Micro-controllers Lab**	**0**	**0**	**3**	**50**	**50**	**2**

Course Objective:

- To write 8086microprocessor and 8051 microcontroller programs for various operations
- Learning interfacing of processor with various Peripherals.

Learning Outcomes:

- Student will be able to perform programming on microprocessors and microcontrollers
- Student will be able to interface and control real time peripherals.

Microprocessor 8086 & Microcontroller 8051: (Any four from 1 – 6. Experiments 7 and 8 are compulsory)

1. Arithmetic operation – Multi byte Addition and Subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.
2. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
3. By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.
4. Reading and Writing on a parallel port.
5. Timer in different modes.
6. Serial communication implementation.
7. 8259 – Interrupt Controller: Generate an interrupt using 8259 timer.
8. 8279 – Keyboard Display: Write a small program to display a string of characters.

General Problems

1. Addition and Subtraction of two 8- bit/16 bit numbers, Multiplication of two 8-bit & two 16-bit numbers, Division of 16-bit by 8-bit and 32-bitby 16-bit number
2. Addition and Subtraction of 6 data bytes with 6-data bytes of another location.
3. Check the given Number is even or odd, Counting of 0's and 1's in a given data, Check the given number is logical palindrome or not.
4. Finding the maximum and minimum numbers in a given string of data.
5. Sorting the given numbers in ascending and descending order.
6. Finding the Factorial and Generating Fibonacci Series.
7. Conversion of BCD to hexadecimal number, Multiplication of two 3x3 matrices.
8. Addition, Subtraction, Multiplication, Division using Microcontroller.

Interfacing

1. Dual DAC interface (waveform generation).
2. Stepper motor control.
3. Display of flags using logic controller.
4. Traffic light controller.

VI Sem. (ECE)

Subject Code	Subject Category	Subject Title	L	T	P	IM	EM	CR
1504610	PJ	Digital Signal Processing Lab	0	0	3	50	50	2

Course Objective:

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

Learning Outcomes:

- Able to write MATLAB programmes
- Able to implement FFT algorithms
- Able to design FIR and IIR filters for desired specifications

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

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

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

1. Introduction to DSP Processors.
2. Generation of fundamental signals and plot the same as a waveform showing all the specifications.
3. Finding Power and (or) Energy of a given signal.
4. Convolution of two discrete-time sequences.
5. Correlation between two discrete-time sequences
6. DFT of a given signal
7. Design of FIR filter using windowing technique and verify the frequency response of the filter.
8. Design of IIR filter using any of the available methods and verify the frequency response of the filter.
9. Design of analog filters.

Equipment/Software Required:

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

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