Akkamahadevi Women's University
Vijayapura

Department of Electronics

M.Sc. Electronics

Syllabus

(under CBCS and CAGP)

with effect from
2018-2019

Details of Courses and Credits, Scheme of Examination and Syllabus for M.Sc. in Electronics

Semester	Course Code	Courses	Credits L:T:P	Instruction Hrs./week	Duration of Exam Hrs.	Marks		
						IA	Exam	Total
I	**Hard Core Courses**							
	ELH-1.1	Solid State Semiconductor Devices	4:0:0	4	3	30	70	100
	ELH-1.2	Programming in C++	4:0:0	4	3	30	70	100
	ELH-1.3	Digital Electronics and Verilog HDL	4:0:0	4	3	30	70	100
	ELP-1.4	C++Programming lab	0:0:4	8	4			
	ELP-1.5	Verilog HDL Lab	0:0:4	8	4			
	Soft Core Courses							
	ELS-1.6	(Students have to choose any one of the following) a) Analog Devices and Circuits b) Signals and Systems c) Network Analysis	4:0:0	4	3	30	70	100
	OE	Offered by the other department	4:0:0	4	3	30	70	100
II	**Hard Core Courses**							
	ELH-2.1	8086 Architecture, Programming and Interfacing	4:0:0	4	3	30	70	100
	ELH-2.2	Electronic Instrumentation and Microcontrollers	4:0:0	4	3	30	70	100
	ELH-2.3	Electronic Communication	4:0:0	4	3	30	70	100
	ELP-2.4	8086 Programming and Interfacing with PIC Microcontroller Lab	0:0:4	8	4			
	ELP-2.5	Electronic Communication Lab	0:0:4	8	4			
	Soft Core Courses							
	ELS-2.6	(Students have to choose any one of the following) a) Computer Networks b) Power Electronics and Circuits c) Multimedia Communications	4:0:0	4	3	30	70	100
	OE	Offered by the other department	4:0:0	4	3	30	70	100

III	**Hard Core Courses**							
	ELH-3.1	Digital Signal Processing	4:0:0	4	3	30	70	100
	ELH-3.2	Advanced Digital Communication	4:0:0	4	3	30	70	100
	ELH-3.3	Control Engineering	4:0:0	4	3	30	70	100
	ELP-3.4	Digital Signal Processing and Digital Communication Lab	0:0:4	8	4			
	Soft Core Courses							
	ELS-3.5	(Students have to choose any one of the following) a) Microwave Electronics b) Image Processing c) ARM Processors and Real-Time Operating Systems	4:0:0	5	3	30	70	100
	Open Elective Course (offered to the other department students)							
	OE	Offered by the other department						
	ELO-3.6	Introductory Aspects of Digital Electronics	4:0:0	4	3	30	70	100
IV	**Hard Core Courses**							
	ELH-4.1	Embedded Systems	4:0:0	4	3	30	70	100
	ELH-4.2	Project Work	0:0:8		50 (Viva) + 120 (Dissertation)	30	170	200
	Soft Core Courses (Students have to choose any one of the following)							
	ELS-4.3	a) Introduction to VLSI Circuits b) MEMS and Microsystems Technology c) Wavelet Transforms	4:0:0	4	3	30	70	100
	Open Elective Course (offered to the other department students)							
	OE	Offered by the other department						
	ELO-4.4	Basics Electronics	4:0:0	4	3	30	70	100

ELH-1.1: SOLID STATE SEMICONDUCTOR DEVICES

52 Hours

UNIT I **20 Hours**

Crystal properties: semiconductor materials, crystal lattices, bonding forces in solids.
Growth of semiconductors: bulk crystal growth from melt, float zone process, epitaxial growth.
Energy bands: energy band formation, Kronig – Penney model, metals, semiconductors and insulators.
Carrier concentration in thermal equilibrium: charge carriers in semiconductors – electrons and holes, effective mass, intrinsic and extrinsic materials, Fermi level, density of states, carrier concentration at equilibrium, law of mass action, temperature dependence of carrier concentration.
Carrier transport phenomena: Conductivity and mobility, carrier drift, effects of temperature and doping on mobility, high field effects, the Hall Effect. Diffusion of carriers, built in fields, continuity equation, Haynes – Shockley experiment.

UNIT II **12 Hours**

p-n junctions: Fabrication of p-n junctions, equilibrium conditions, contact potential, current flow at a junction, junction breakdown, capacitance of p-n junctions, charge storage and transient behavior.
Metal semiconductor junctions: Schottky barriers, rectifying and ohmic contacts, Heterojunctions.
p-n junction diodes: rectifiers, switching diodes, tunnel diodes, photo diodes, solar cells,photo detectors, light emitting diodes.

UNIT III **10 Hours**

Bipolar transistors: BJT fabrication, transistor action, minority carrier distributions, terminal currents, Ebers – Moll model, switching.
Secondary effects: drift in base region, base narrowing, avalanche breakdown, injection level effects, emitter crowding.

UNIT IV **10 Hours**

Field effect transistors: Junction FET, working, VI characteristic, metal semiconductor FET, GaAs MESFET, high electron mobility transistor.
Metal oxide semiconductor FETs: operation, ideal MOS capacitor, threshold voltage, MOSFET.

References:

1. Solid State Electronic Devices: Ben G Streetman, PHI, 2003
2. Semiconductor Devices Physics and Technology: S M Sze, John Wiley, 2002
3. Foundation of Electronic Devices: M Sathyam & K Ramkumar, New Age International Pub, 1st Ed, 2000
4. Semiconductor Devices: Kanaan Kano, Pearson Education, 2004.
5. Semiconductor Physics and Devices – Basic Principles, Donald A Neamen, TMH, 2003.

ELH-1.2: PROGRAMMING IN C++

52 Hours

UNIT I **12 Hours**

Introduction: Tokens, keywords, identifier and constants, basic data types, user defined data types, derived data types, arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, special operators, expressions and evaluation of expressions, scope resolution operator, member dereferencing operators, manipulators, type cast operator, implicit conversions, precedence of operators, new and delete operators.
Arrays, pointers and structures.

UNIT II **12 Hours**

Decision making, branching and looping: if, if-else, else-if, switch statement, break, continue and go to statement, for loop, while loop and do loop.
Functions: Defining function, function arguments and passing, returning values from functions, referencing arguments, function overloading, virtual functions, library functions, local, static and global variables.

UNIT III **18 Hours**

Introduction: Object oriented programming, characteristics of object-oriented language**.Classes and objects:** Classes and objects, member functions, class constructors and destructors, array of objects, operator overloading.
Class inheritance: Derived class and base class, multiple inheritance, polymorphism.
Managing Console I/O Operation: C++ streams, C++ stream classes, unformatted I/O operations, formatted console I/O operations, managing output with manipulators.
Templates: class templates, class templates with multiple parameters, function templates, function templates with multiple parameters, overloading of template function, member function templates, non-type template arguments.

UNIT IV **10 Hours**

Exception handling: basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exception.
Introduction to the standard template library: components of STL, containers, algorithms, iterators, application of container classes, function objects.
Manipulating strings: creating string objects, manipulating string objects, relational operations, string characteristics, accessing characters in strings, comparing and swapping.

References:

1. Object-oriented Programming with C++: Balagurusamy E, TMH, 2005
2. The Waite group's object oriented programming in Turbo C++: Robert Lafore, Galgotia Publication. Pvt. Ltd, 2005.
3. Let Us C++, Yashavant P. Kanetkar , BPB Publications, 2003
4. Object-Oriented Programming in C++, Robert Lafore, SAMS publishing, 4th Ed, 2002

ELH-1.3: DIGITAL ELECTRONICS AND VERILOG HDL

52Hours

UNIT I **14 Hours**

Digital circuit analysis and design: Review of Boolean algebra, Karnaugh map and tabulation procedure for minimization of Boolean expression, prime implicant charts, design with basic logic gates. Review TTL and CMOS logic families

Combinational logic design: Code converters, encoders, decoders, multiplexers, demultiplexers, implementation of combinational logic using decoders and multiplexers.

UNIT II **12 Hours**

Asynchronous sequential logic: Ripple counters, design of mod N ripple counters using flip-flops, IC 7493, IC 7492, IC 7490.

Synchronous sequential circuits: State diagram and state assignments: Binary counters, shift registers, ring counter, Johnson counter, serial adder, sequence detector, serial parity bit generator, PRBS generators.

UNIT III **10 Hours**

Verilog: Introduction, lexical conventions-whitespace, operators, identifiers, keywords, data types-nets, registers, vectors, arrays, memories, parameters, strings, modules, ports.

Brief description of modeling - data flow style, behavioral style, structural style, mixed design style, introduction to simulation and test benches.

UNIT IV **16 Hours**

Gate level modeling: Introduction, built in primitive gates, multiple input gates, tri-state gates, gate delay, array instances, examples.

Data flow modeling: Continuous assignment,net declaration assignments, delays, net delays, examples.

Behavioral Modeling: Structured procedures-initial statement, always statement, timing controls-delay control, edge triggered event control, level sensitive event control, sequential block, parallel block, procedural assignments, conditional statement, loop statement, generate blocks, examples.

References:

1. Digital Logic and Computer Design: M Morris Mano, PHI, 1979.
2. Switching and Finite Automata Theory: Z V Kohavi, TMH, 2nd Edition, 2002.
3. Verilog HDL-A guide to digital design and synthesis: Samir Palnitkar, Pearson, 2nd Edn,1999
4. A Verilog HDL Primer: J. Bhasker, BSP, 2nd Edition.2003.
5. Modern Digital Electronics: R.P. Jain, 2ndEdn, TMH, 2003.
6. Introduction to System Design using ICs: B.S. Sonde, Wiley Eastern Ltd, 1992.

ELP-1.4: C++ Programming Lab

1 a] To generate the Fibonacci series up to the given limit N and also print the number of elements in the series

b] Find the GCD of 2 integer numbers

c] Write a function to calculate factorial of a given number

2. To find minimum and maximum of N numbers

3. Find all the roots of a quadratic equation $Ax^2 + Bx + C = 0$ for non – zero coefficients: A, B and C. Else report error.

4. Calculate the value of sin (x) and cos (x) using the series.
i] to a given accuracy ii] using n terms.
Also print sin (x) and cos (x) value using library function

5. To generate and print prime numbers and perfect dividing numbers up to an integer N.
Print also the number of prime and perfect dividing numbers in the series.

6. a] To sort given N numbers in ascending order.
b] To sort given N names in alphabetical order.

7. To find the sum, difference and product of two matrices of order MxN and PxQ.

8. To determine if the given matrix of order MxN is symmetric or skew symmetric.

9. a] To find the transpose of given MxN matrix
b] To find the sum of principle and secondary diagonal elements of the given MxN matrix

10. To sort the rows of a given MxN matrix.

11. To write the sum and difference of 2 clock times (hr: min: sec)
a] using functions (member and friend)
b] using operator overloading(member and friend)

12. To find sum, difference, product and division of two complex numbers.
a] using functions (member and friend)
b] using operator overloading(member and friend)

13. a] Write a C++ program to create a class to handle student marks record, include name, roll number, marks in 3 subjects, total and result as data members and write member function to create new records, display records, sort according to name or total, edit record, add record, delete record and search record.
b] Write the above program using inheritance

14. Write a C++ program to create a class to handle telephone directory include name, phone number (landline, mobile), STD/ISD code, city and country as data members and write member functions to create new directory, display directory, sort according to name, edit, add, delete and search as per name or telephone numbers.

ELP-1.5: Digital Electronics and Verilog HDL Experiments

1. a] Transfer characteristics of TTL gates.
   b] Implementation of basic logic gates and derived logic gates using Verilog.
2. Implement 4-bit adder and subtractor using Verilog.
3. a] Implement half adder, half subtractor, full adder and full subtractor using universal gates and also implement using behavioral, dataflow and structural modeling in Verilog.
4. Implementation of multiplexer (4X1 and 8X1) and demultiplexer (1X4 and 1X8) using Verilog.
5. Implement decoder (2x4, 3x8) using Verilog.
6. Implement Encoders and Priority encoders using Verilog
7. Implement 4 - bit magnitude comparator using Verilog.
8. Implement Code converters – Gray to Binary, Binary to Gray, 8421 to 2421 and 2421 to 8421 using Verilog.
9. Implement RS, D, JK and T flip-flops using Verilog.
10. Implement asynchronous binary and decade counters using Verilog.
11. Implement synchronous binary and decade counters using Verilog.
12. Implement 4-bit SISO shift register, ring counter, Johnson counter using Verilog.
13. Implement universal shift register using Verilog.
14. Implement 8-bit ALU using Verilog.

ELS-1.6 (a): ANALOG DEVICES AND CIRCUITS

52 Hours

UNIT I **12 Hours**

Semiconductor Diode: Construction, working, characteristics of PN junction diode and Zener diode, **Bipolar Junction Transistors**- construction, operation, common-emitter configuration, common-base configuration, common-collector configuration, introduction to BJT transistor modeling, the important parameters- Z_i, Z_o, A_v, A_i, the r_e transistor model, hybrid equivalent model.
Operating point, need for biasing, voltage-divider bias, transistor switching networks, bias stabilization.

UNIT II **10 Hours**

Need for amplification, classification of amplifier based on various parameters, amplification in the AC domain, BJT small signal analysis for voltage divider bias using the $r_e$transistor model.
Field-Effect Transistors- construction and characteristics-JFETs, depletion-type MOSFET, enhancement-type MOSFET, self-bias configuration of enhancement-type MOSFET.

UNIT III **15 Hours**

Operational Amplifier- Introduction, block diagram, ideal characteristics, voltage follower circuit, inverting amplifier, non-inverting amplifier, Op-Amp parameters- input and output voltage, common mode and supply rejection, offset voltages and currents, input and output impedances, slew rate and frequency limitations, Op-Amps as DC Amplifiers, direct coupled voltage followers, direct coupled inverting amplifiers, direct coupled non-inverting amplifiers, summing amplifier, difference amplifier, differentiator, integrator.

UNIT IV **15 Hours**

Op-Amp applications: Voltage sources, current sources and current sinks, precision current sources and current sinks, current amplifiers, instrumentation amplifier, precision rectifiers, limiting circuits, clamping circuits, peak detectors, sample and hold circuits, triangular / rectangular wave generators, phase shift oscillator, Wein bridge oscillator, zero crossing detectors, Schmitt trigger circuits, astable and monostablemultivibrator, introduction to active filters, all pass phase shifting circuits, first order and second order low pass and high pass filters.

References:

1. Electronic Devices and Circuit Theory: Robert L. Boylestad and Louis Nashelsky, PHI/Pearson Education, 9th Ed, 11th Edition, 2015
2. Textbook of Applied Electronics: R. S Sedha, S. Chand & Co Ltd, Multicolor Edition, 2008
3. Operational Amplifiers and Linear IC's: David A. Bell, PHI/Pearson, 2nd edition, 2004
4. Op - Amps and Linear Integrated Circuits: Ramakant A. Gayakwad, PHI, 4th Ed, 2009
5. Principles of Electronics, V K Mehta & Rohit Mehta, S. Chand & Co Ltd, 3/e, 1980

ELS-1.6 (b): SIGNALS AND SYSTEMS

52 Hours

UNIT I **10 Hours**

Introduction: Definitions of a signal and a system, classification of signals, basic operations on signals, basic continuous-time signals, systems viewed as interconnections of operations, properties of systems.

UNIT II **14 Hours**

LTI systems: Introduction to Linear Time-Invariant systems, convolution sum, properties of convolution sum, convolution integral, properties of convolution integral, representations for LTI systems, properties of systems with impulse response representation, step response of a LTI system, Frequency-Domain representation of systems, solution of differential equations, the natural, forced and total responses, solution of linear differential equations by computing the zero-state response and zero-input response, stability of LTI systems and the characteristic equation.

UNIT III **14 Hours**

Fourier Series: Introduction to Fourier analysis, Fourier series representation of continuous-time periodic signals, derivation of complex coefficients of exponential Fourier series, convergence of Fourier series, amplitude and phase spectra of a periodic signal, properties of Fourier series

UNIT IV **14 Hours**

Fourier Transform: Fourier representation of non-periodic signals, mathematical development of Fourier transform, magnitude and phase spectra, existence and uniqueness, properties of Fourier transform, Fourier transform of a periodic signal, applications of Fourier transform

References:

1. Signals and Systems: Ganesh Rao and Satish Tunga, Sanguine Technical Publishers, 2004
2. Signals and Systems: Simon Haykin and Barry Van Veen, John Wiley & Sons, 2002
3. Signals and Systems: Alan V Oppenheim, Alan S Willsky and A Hamid Nawab, Pearson Education Asia / PHI, 2nd edition, Indian Reprint 2002
4. Signals and Systems: H. P Hsu, R. Ranjan, Scham's outlines, TMH, 2006
5. Linear Systems and Signals: B. P. Lathi, Oxford University Press, 2005

ELS-1.6 (c): NETWORK ANALYSIS

52 Hours

UNIT I **18 hours**

Introduction:

Kirchoff's laws: Node voltage analysis and mesh voltage analysis, network solutions using first order differential equation, initial conditions in networks.

Analysis of networks using Laplace transformation: Basic theorems of Laplace transformation, examples of solutions of networks using Laplace transformation. Transforms of signalwaveform:the shifted unit step function, the ramp and impulse functions. Waveform synthesis, the initial and final value theorems, convolution integral, convolution as summation.

UNIT II **10 hours**

Impedance functions and network theorems: Concept of complex frequency, transform impedance and transform circuits, series and parallel combinations of elements, superposition and reciprocity, Thevenin's, Norton's, maximum power transfer and Tellegen's theorem.

UNIT III **10 hours**

Two–port parameters: Relationship of two-port variable, the open circuit impedance parameters, short- circuit admittance parameters, transmission parameters, inverse transmission parameters, the hybrid parameters, inverse hybrid parameters, relationships between parameter sets, series, parallel and cascade connection of two-port networks.

UNIT IV **14 hours**

Network functions, poles and zeros: Terminal pairs or ports, network functions for one port and two port networks, the calculation of network functions, poles and zeros of network functions, restriction on pole and zero locations for driving – point functions and transfer functions, time domain behaviour from the pole and zero plot, stability of active networks, transient response, sinusoidal steady state analysis.

Frequency response plots: Network response due to sinusoidal input functions, plots from s-plane phasors, magnitude and phase plots.

References:

1. Network Analysis: Van Valkenburg, PHI, 2003
2. Network Analysis and Synthesis: Bakshi A V, Bakshi U A, Technical Publications, 2009.
3. Electric circuits: Joseph Edminister, Schaum's series-Mc Graw Hill, 1997
4. Network analysis and synthesis: Franklin F Kuo, John Wiley and sons, 2nd Ed, 1966.
5. Networks and systems: Roy Choudhury D, New Age International, 2004.

ELH-2.1: 8086 ARCHITECTURE, PROGRAMMING AND INTERFACING

52 Hours

UNIT I **12 Hours**

8086Architecture and programming: 8086 Architecture and programming model, pin description, registers, flags, interfacing of memory RAM and EPROM.

Addressing modes: Immediate addressing, register addressing, memory addressing, base indexed addressing with displacement as the general memory addressing mode, I/O port addressing.

UNIT II **16 Hours**

Programming the 8086: Instruction template for 8086 instructions, code generation using template.

Data Transfer Instructions, Data Conversion instructions, Arithmetic Instructions, Logical Instructions, Process Control Instructions,String Instructions,Branch Instructions.

UNIT III **12 Hours**

Interrupts of 8086: Hardware interrupt, software interrupt and exception, priority of interrupts, 8259A priority interrupts controller.

assembly language programming: Assembly language programming examples, subroutines and macros, examples.

Hardware features of 8086: Bus buffering, latching, timing diagrams, wait state, MIN/MAX modes of operation.

UNIT IV **12 Hours**

Coprocessor and interfacing: Overview of 8087 arithmetic coprocessor, pin description, data types, programmer's view, overview of 8087 instruction set.

I/O Interfacing: 8237 DMA controller, 8284, 8288

Introduction to advanced microprocessors: Introduction to 80286, 80386, 80486, 80586, Pentium and recent advances in microprocessor architecture.

References:

1. Microprocessors and Interfacing: Douglas V.Hall, Second Edition, TMH, 1974.
2. Advanced Microprocessors and IBM-PC Assembly Language Programming: Dr.K.Udayakumar, B.S.Umashankar, TMH, 1996
3. Advanced Microprocessors and Peripherals, Architecture, Programming and Interfacing : Ray Bhurchandi, Tata McGraw Hill, 2009
4. 8088/8086 Processors Programming, Interfacing, Software, Hardware and applications: Walter A.Triebel and Avatar Singh, PHI.

ELH-2.2: ELECTRONIC INSTRUMENTATION AND MICROCONTROLLERS

52 Hours

UNIT I **16 Hours**

Basic concepts of measurement: Instrumentation system configuration, problem analysis, errors, static characteristics of measurement system, calibration. Classification of instrumentation system according to transfer function, examples, dynamic characteristics of systems.

Basic requirements of transducers, transducers used in displacement, strain, pressure, temperature, flow, vibration and force measurements.

UNIT II **08 Hours**

Data acquisition systems: Block diagram, brief description of preamplifier, signal conditioner, instrumentation amplifier, waveform generator, A/D and D/A converter blocks, computer controlled test and measurement system with examples.

UNIT III **08 Hours**

Bio-medical instrumentation: Origin of bio-electric signals, electrodes for ECG, EEG and EMG, block diagram of ECG and EEG systems, brief analysis of graphs.

UNIT IV **20 Hours**

Microcontrollers: Introduction, different types of microcontrollers, embedded microcontrollers, processor architectures. Harvard vs. Princeton, CISC vs. RISC architectures, memory types.

PIC16F887 microcontroller: core features, pin diagram, device overview, memory organization, I/O ports, oscillator module, Timer0,Timer1, Timer2 module, comparator module, ADC module, data EEPROM and FLASH program memory control, enhanced capture/compare/PWM module, EUSART, master synchronous serial port (MSSP) module, special features of the CPU, instruction set, addressing modes, programming examples.

References:

1. Instrumentation devices and systems: Rangan, Sarma, Mani, TMH, 1997
2. Microchip PIC16F887 Datasheet
3. Programming and customizing the microcontroller: MykePredko – McGrawHill, 1999.
4. Instrumentation Measurement and analysis: Nakra B C, Chaudry K K, TMH, 2003
5. Handbook of biomedical instrumentation: Khandpur R S, TMH, 2014
6. Microprocessor and Digital systems : Doughlas V Hall, TMH, 1983
7. Measurement systems applications and design: Doeblin E O, McGraw Hill, 1990.
8. Electron measurements and instrumentation techniques: Cooper W D and Helfric A D, PHI.
9. Biomedical instrumentation and measurements: Leslie-Cromwell, Fred J Weibell, Erich A Pfieffer, PHI, 1994.
10. Programming and customizing the microcontroller: MykePredko – McGrawHill, 1999.

ELH-2.3: ELECTRONIC COMMUNICATION

52 Hours

UNIT I **18 Hours**

Introduction: Elements of communication system, channel capacity.
Noise: Introduction, types, atmospheric noise, extraterrestrial noise, industrial, shot noise, thermal noise, transit-time noise, Noise Figure, noise temperature
Sampling theory and practice, Sampling theorem, type of sampling, ideal sampling and reconstruction, Pulse Modulation techniques- PAM, PWM, PPM, PCM-quantization and the folded binary code.
Delta modulation, adaptive delta modulation, differential PCM.

UNIT II **16 Hours**

Need for modulation, types of modulation, Amplitude Modulation: Introduction, modulation index, power relation, DSB, SSB, SSBSC, DSBSC, VSB, generation of AM wave-square law modulator, switching modulator, detection of AM waves- square law detector, envelop detector, Super heterodyne receiver.
Frequency Modulation (FM): Introduction, modulation index, frequency spectrum, bandwidth, generation of FM waves, demodulation of FM waves, phase locked loop, nonlinear effects in FM systems.
Introduction to multiplexing techniques: TDM, FDM, OFDM.

UNIT III **08 Hours**

Optical fiber communications: Introduction, block diagram of OFC system, principles of light propagation in a fiber, index profiles, losses in fibers, light sources for fiber optics, photodetectors, connectors and splices, communication links.

UNIT IV **10 Hours**

Satellite communications: Kepler's laws of motion, orbits, stationary orbits, geostationary orbits, power systems, attitude control, satellite station keeping, antenna look angles, limits of visibility, frequency plans and polarization, transponders, power budget calculations-uplink, downlink, overall link.
Application of satellite communication: GPS and remote sensing.

References:

1. Kennedy's Electronic Communication Systems: George Kennedy, Bernard Davis and SRM Prasanna, McGraw Hill Publication, 5th edition, 2011.
2. Electronic Communications System: Fundamentals Through Advanced- Wayne Tomasi, Pearson Education, 5th edition, 2009.
3. Electronic Communications: Dennis Roddy and John Coolen, Pearson Education, 4th edition, 1995
4. Digital and Analog communication systems: Sam Shanmugam, Wiley India, 2008
5. Communication System: Simon Haykin, Wiley,2009

ELP-2.4: 8086 Programming and Interfacing with PIC Microcontroller

8086 Programming:

1. Addition, subtraction, multiplication and division of 8-bit, 16-bit binary and decimal numbers.
2. Addition and subtraction of two 6 digit binary and decimal numbers.
3. Average of N- 8-bit/16-bit binary and decimal numbers.
4. a) To generate the Fibonacci series up to the given limit N and also print number of elements in the series (both binary and decimal)
   b) Minimum and maximum out of N numbers
   c) To sort given N numbers in ascending order
   d) Find the GCD of 2 integer numbers (both binary and decimal)
   e) To calculate factorial of a given number using recursion technique.
5. To generate and print prime numbers and perfect dividing numbers up to a limit N (both binary and decimal). Print also the number of prime and perfect dividing numbers in the series.
6. a) Conversion of array of Binary code to Gray code.
   b) Conversion of array of Gray code to Binary code
7. a) To find the sum and difference of two matrices of order MxN and PxQ (both binary and decimal)
   b) To find the transpose of given MxN matrix
8. Reverse of an array of numbers, byte and word
9. Display current time using DOS service.
10. Display system date using DOS service.
11. Search for an element using binary search in an array of 8-bit signed numbers. Array is sorted in ascending order.
12. Check for authentic password and display suitable message.

Interfacing with PIC Microcontroller

1. Interfacing of stepper motor and Rotating stepper motor by N steps clockwise/anticlockwise with speed control.
2. Generate sine, square, saw tooth, triangular and staircase waveform using DAC interface.
3. Display of 4- digit decimal number using the multiplexed 7-segment display interface.
4. To test all the gates of a given IC74XX is good or bad.
5. LCD (2X16) interfacing.
6. Analog to digital conversion using internal ADC and display the result on LCD.
7. Implementation of DC-Volt meter (0-5V) using internal ADC and LCD
8. Digital to Analog conversion using PWM (pulse delay to be implemented using timers).
9. Speed control of DC motor using PWM (pulse delay to be implemented using timers).
10. Interfacing of matrix keyboard (4X4) using change on interrupt feature of.
11. Serial communication between microcontroller and PC.
12. Interfacing of Real Time Clock (DS1307).
13. Interfacing of serial ADC (MCP320x).
14. Traic based Ac voltage controller (using zero crossing detector and interrupt).
15. Interfacing of I^2C based EEPROM/RAM/Flash.

(Note: Programs written using C programming language)

ELP-2.5: Electronic Communication Lab

Experiments to be constructed and done

1. Amplitude modulation and demodulation using transistor.
2. Frequency modulation using IC 8038.
3. Voltage controlled oscillator (VCO-IC-566) and Phase locked loop (PLL-IC 565).
4. Frequency multiplier using PLL (IC 565) and IC 7490.
5. Time division multiplexing using IC 4051.
6. Active filters: Low-pass, high-pass, band-pass, narrow band-pass and narrow band reject filters of second order.
7. PAM, PWM and PPM modulation.
8. IF amplifier design.
9. Measurement of losses in a given optical fiber (propagation loss, bending loss) and numerical aperture, modulation, multiplexing.

Experiments to be done using communication kits

1. Delta, sigma, adaptive modulation and demodulation.
2. TDM Pulse amplitude modulation and demodulation.
3. Pulse code modulation and demodulation.
4. Pulse amplitude, pulse position, pulse position modulation and demodulation.
5. Data conditioning and carrier modulation and demodulation.
6. Analog signal sampling and reconstruction.

ELS-2.6 (a): COMPUTER NETWORKS

52 Hours

UNIT I **14 Hours**

Introduction to Networks, Categories of Networks, Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Switching, Telephone and cable networks for data transmission,
Telephone networks, Dial up modem, DSL, Cable TV for data transmission.

UNIT II **10 Hours**

Data Link Control-Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, Data link protocols-HDLC, Multiple Accesses- Random access, Controlled access, Channelization.

UNIT III **14 Hours**

Wired LAN, Ethernet, IEEE standards, Standard Ethernet, Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11, Connecting LANs, Backbone and Virtual LANs, Connecting devices, Back bone Networks, Virtual LANs, Virtual circuit networks-Architecture and Layers of Frame Relay and ATM.

UNIT IV **14 Hours**

Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6, Address mapping – ARP, RARP, BOOTP, DHCP, ICMP, IGMP.
Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols. Transport layer process to process Delivery, UDP, TCP, Domain Name System, Resolution, Congestion Control – Quality of SServices (QoS),techniques to improve QoS.

References:

1. Data Communication and Networking- B Forouzan, 4thEdtion, TMH, 2006.
2. Computer Networks- Andrew S. Tanenbaum, David J. Wetherall, Prentice hall, 5th Ed.

ELS-2.6 (b): POWER ELECTRONICS AND CIRCUITS

52 Hours

UNIT I **15 hours**

Introduction to power electronics.
Power Semiconductor Devices: power diodes, thyristors, power MOSFETs, power transistors, IGBT, MCT, LTT, smart power devices.
Thyristor firing circuits: limitations of di/dt and dv/dt ratings, main features of firing circuits, R and RC firing circuits, UJT firing circuit.
Commutation Techniques: Class A to Class F commutation methods, series and parallel operation of thyristors.
Diode circuits: Diode circuits with DC source – R, L, C, RL, RC, RLC load, recovery of trapped energy, RL load with freewheeling diode.
Diode rectifiers: Half-wave rectifiers with R, L, C, RL, RC load, RL load with freewheeling diode, load with electromotive force.

UNIT II **12 hours**

Phase controlled rectifiers:
Single phase half wave rectifiers: with R load, RL load, RL load with freewheeling diode.
Single phase full wave converters: single phase semi converters, single phase two pulse converters with continuous and discontinuous current.
Three-phase converter: systems using diodes and thyristors, three-phase full converters, three-phase semi converters, dual converters.

UNIT III **12 hours**

AC voltage controllers: types of AC voltage controllers, integral cycle control, single phase voltage controllers with R and RL loads, single-phase transformer tap changers, single-phase sinusoidal voltage controllers. Working of three-phase controllers with star & delta loads.
Cycloconverters: Principle of cycloconverter operation, single-phase to single-phase circuit step-up and step-down cycloconverter, three-phase half wave cycloconverter, output voltage equation of a cycloconverter, load commutated cycloconverter.

UNIT IV **13 hours**

Inverters: Principle of operation, single-phase voltage source inverters, basic series and parallel inverter circuits, types of inverters, three-phase bridge inverters, voltage control in single-phase inverters, pulse-width modulated inverters, current source inverters.
Choppers: Basic principle, control strategies, step-up and step-down choppers, types of chopper circuits, forced and load commutated chopper circuits.

References:

1. Power Electronics: Bimbhra P S, Khanna publishers, 2003.
2. Power Electronics Circuit, Devices and Applications: Rashid M H, PHI, 2009
3. Thyristor Engineering: Berde M S, Khanna publishers, 2009
4. Power Electronics: VedamSubrahmanyam, New Age International, 2002
5. Modern Power Electronics and AC Drives: BimalK.Bose, Pearson education, 2002.
6. Power Electronics: Mohan, Undeland, Robbins, John Wiley, 2003

ELS-2.6 (c): MULTIMEDIA COMMUNICATIONS

52 Hours

UNIT I **14 Hours**

Multimedia communications: Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QoS, application QoS. Multimedia information representation-Introduction, digital principles, text, images, audio, video

UNIT II **13 Hours**

Text and image compression: Introduction, compression principles, text compression, image compression. Audio and Video compression-Introduction, audio compression, DPCM, ADPCM, APC, LPC, video compression, video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, and MPEG-4.

UNIT III **13 Hours**

Multimedia information networks: Introduction, LANs, Ethernet, Token ring, Bridges, FDDI High-speed LANs, LAN protocol. The internet-Introduction, IP Datagrams, Fragmentation, IP Address, ARP and RARP, QoS Support, IPv8.

UNIT IV **12 Hours**

Broadband ATM networks: Introduction, Cell format, Protocol Architecture ATM LANs.
Transport protocol: Introduction, TCP/IP, TCP, UDP, RTP and RTCP.

References:

1. Multimedia communications: Applications, Networks, Protocols and Standards, Fred Halsall, pearson education, Asia, 2nd Indian reprint 2002.
2. Multimedia information networking- Nalin K. Sharda, PHI, 2009.
3. Multimedia fundamentals: Volume 1 - media coding and content processing, Ralf Steinmetz, KlaraNarstedt, Pearson education, 2004.
4. Multimedia Systems Design, PrabhatK. Andleigh, KiranThakrar, PHI,2015

ELH-3.1: DIGITAL SIGNAL PROCESSING

52 Hours

UNIT I **14 Hours**

Digital signals and systems: DSP system concept, design, digitization of analog signals, recovery of analog signals, classification and manipulation of digital signals, properties of a DSP system, convolution summation, interconnection of DSP systems.
Z-transforms: Z-transformation via partial fraction expansion and via residue method, useful z-transform properties, inverse z-transform, digital transfer function, bilinear z-transform, chirp notch filter design.

UNIT II **12 Hours**

Discrete Fourier Transform (DFT): Discrete Fourier series, Discrete-time Fourier transform, DFT and its useful properties, Fast Fourier Transform (FFT), DFT properties of circular convolution, fast convolution by signal segmentation correlation, circular correlation, DFT property of circular correlation, spectrum analysis. Error sources, spectral windows, power density, spectrum, joint time frequency analysis, electro cardiogram data compression.

UNIT III **14 Hours**

Digital filters: Introduction to digital filters, FIR digital filters, the moving average digital filter, frequency sampling design method, the window method, the comb filter.
IIR Digital filters: Design based on prototype analog filters, Butterworth normalized low-pass filter, Chebyshev normalized low-pass filter, impulse invariant design method, bilinear z-transform design method, (sin x)/x digital correction filter.

UNIT IV **12 Hours**

Quantization and rounding problems: Quantization of the input signal, effects of finite word length on stability and frequency response, arithmetic errors, digital filters for FSK modem, DSP chips.
Practical implementation considerations: Implementation using microprocessor and DSP chips.

References:

1. Digital Signal Processing: Terrell T J and Lik-Kwan Shark, Macmillan, 1996.
2. Digital Signal Processing: Ganesh Rao, Pearson, 2011
3. Discrete-Time Signal Processing: Alan V Oppenheim, Ronald W Schafer and John R Buck, Pearson Education, 2nd edition, 2009.
4. Introduction to Digital Signal Processing: Kur R, McGraw Hill, New York, 1988.
5. Theory and application of DSP: Rabiner L R and Gold B, PHI, 1975.

ELH-3.2: ADVANCED DIGITAL COMMUNICATION

52 hours

UNIT-I **14 hours**

Introduction, Differences between digital and analog communication systems, Block diagram of a digital communication system, source coding, Huffman coding, channel coding-linear block codes, binary cyclic codes, convolution codes, Error detection and correction codes.

UNIT-II **16 hours**

Digital modulation: introduction, information capacity, bit rate, baud and minimum bandwidth, digital modulation techniques-ASK, FSK, PSK, BPSK, QPSK, 8PSK, 16QPSK, differential BPSK,QAM, 16QAM, 64QAM.

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UNIT-III **12 hours**

Multiple access techniques: FDMA, TDMA, comparison of FDMA and TDMA, space division and polarization multiple access, access algorithms-ALOHA (excluding derivations), multiple access technologies for local area networks (excluding derivations).
Introduction to spread spectrum, direct sequence spread spectrum, frequency hopping spread spectrum, direct sequence CDMA.
OFDMA

UNIT-IV **10 hours**

Overview of wireless systems: fundamentals of cellular communications, first, second and third generation cellular systems, road map for higher data rate capability of wireless 4G systems, **Overview of wireless standards:** personal area networks- Bluetooth, wireless sensor networks (Zigbee), wireless local area networks, Wireless interoperability for Microwave Access (WiMAX), Long Term Evolution (LTE).

References:

1. Digital Communications: Simon Haykins, Wiley, 1988
2. Electronic Communications System: Fundamentals Through Advanced- Wayne Tomasi, Pearson Education, 5th edition, 2009
3. Digital Communications Fundamentals and Applications: Bernard Sklar, 2nd Edition, 2001.
4. Wireless Communications and Networking: Vijay K. Garg, Elseveir, 2007
5. 4G LTE/LTE-Advanced for Mobile Broadband: Erik Dahlman, Stefan Parkvall, and Johan Sköld, Academic Press, 2011

ELH-3.3: CONTROL ENGINEERING

52 Hours

UNIT I **16 Hours**

Introduction to control system, open loop and closed loop control systems, servomechanisms. Applications of control theory.

Mathematical models of physical systems: Differential equations of physical systems, mechanical systems, friction, translational systems (mechanical accelerometer, levered systems excluded), rotational systems, gear trains, electrical systems, analogous systems, transfer functions, block diagram algebra, signal flow graphs, Mason's gain formula.

UNIT II **14 Hours**

Time response analysis: Introduction, standard test signals, time response of first and second order systems subjected to unit step input, time response specifications, steady state errors and error constants.

Stability analysis: Concepts of stability, necessary conditions for stability, Routh's stability criterion, relative stability analysis.

Root Locus Techniques: Introduction, the root locus concepts, construction of root loci.

UNIT III **10 Hours**

Frequency domain analysis: Introduction, polar plots, inverse polar plots, Bode plots, concept of gain margin and phase margin, assessment of relative stability using Bode Plots.

Stability analysis in the frequency domain: Mathematical preliminaries, Nyquist stability criterion, assessment of relative stability using Nyquist criterion.

UNIT IV **12 Hours**

Control systems (introductory aspects only): Introduction, P controller, PD controller, PI controller, PID controller. Compensators-realization of basic lead, lag, lead-lag compensations

State variable analysis: Introduction, concepts of state, state variable and state models for electrical systems, solution of state equations-properties of state transition matrix, computation of state transition matrix (Laplace transformation method)

References:

1. Control Systems Engineering: J. Nagarath and M.Gopal, New Age International (P) Limited, Publishers, 4th edition, 2005
2. Modern Control Engineering: K. Ogata, Pearson Education Asia/PHI, 4th Edition, 2002.
3. Concepts of Control Systems: P. S. Satyanarayana; Dynaram publishers, Bangalore, 2001
4. Control Systems Principles and Design: M. Gopal, TMH, 1999
5. Feedback control system analysis and synthesis: J. J. DAzzo and C. H. Houpis; McGraw Hill, student edition.

ELP-3.4: Digital Signal Processing and Digital Communication Lab

Part-A: Digital Signal Processing Lab

1. **Discrete time signals:**
   Impulse sequence, step sequence, sinusoidal sequence, periodic sequence,
   Problems.
2. **Operation on sequences**
   Signal addition, multiplication, folding, shifting, implementing all operations, decomposing into even and odd parts, decimation and up-sampling.
   Problems.
3. **Linear convolution and cross correlation Problems**
4. **Difference equation Problems**
5. **Discrete time Fourier transforms**
   Infinite sequence, finite sequence, periodicity, conjugate symmetry,
   Properties of DTFT- linearity, symmetry time shifting, frequency shifting, high density and high resolution.
   Problems
   Discrete Fourier series - Discrete Fourier series and inverse discrete Fourier series – Implementation.
   Discrete Fourier transform - Discrete Fourier transform and inverse discrete Fourier transform
   Properties of DFT - Circular folding, circular shifting, circular symmetry, circular convolution.
6. **FFT -** Execution time
7. **Overlap-save method -** Convolution and correlation
8. **Z-Transforms** problems
9. **Inverse Z-Transforms-** pole-zero plot residue method
10. **Digital filters**
11. **IIR Filters -** Butterworth filter, chebyshev filter
12. **FIR Filters**

Part-B: Digital Communication Lab

1. Amplitude shift keying and pulse amplitude modulation using IC 4016 and transistor.
2. FSK modulation and demodulation using CD74HC4046A
3. Generation and detection of BPSK
4. DPSK modulation and demodulation
5. TDM of two band limited signals.

Additional Experiments Using Simulation Software

1. Study of Time Division Multiplexing system.
2. Study of pulse code modulation and demodulation.
3. Study of delta modulation and demodulation and observe effect of slope overload.
4. Study pulse data coding techniques for various formats.
6. Data decoding techniques for various formats.
7. Study of amplitude shift keying modulator and demodulator.
8. Study of frequency shift keying modulator and demodulator.
9. Study of phase shift keying modulator and demodulator.
10. Error Detection & Correction using Hamming Code

ELS-3.5 (a): MICROWAVE ELECTRONICS

52 Hours

UNIT I **15 Hours**

Introduction: Review of vector algebra, review of field theory-Motion of an electron in an electric field and magnetic fields, Gauss's law, Laplace's equation, Faraday's law and Ampere's law, Maxwell's equations, boundary conditions, Poynting's energy theorem, wave equation, reflection of waves.

UNIT II **13 Hours**

Introduction to microwaves: Microwave frequencies and applications of microwaves, microwave transmission lines-transmission line equations and solutions, reflection and transmission coefficients, standing waves and standing wave ratio, line impedance and admittance, Smith chart, impedance matching – single stub and double stub matching.

UNIT III **12 Hours**

Microwave waveguides and components: Rectangular waveguides, TE and TM modes, power transmission and power losses, excitation of modes in rectangular waveguides. Circular waveguides, possible modes, power transmission and power losses, co-axial waveguides.
Microwave cavities: rectangular and circular cavity resonators, reentrant cavities, Q factor of a cavity resonator.
Waveguide tees, magic tee, hybrid ring, waveguide corners, bends and twists, two-hole directional coupler, hybrid coupler, microwave circulators and isolators.

UNIT IV **12 Hours**

Microwave tubes: High frequency limitation of conventional vacuum tubes, Klystron, multicavity klystron amplifier, helix and coupled cavity TWT, cylindrical magnetron– construction, principle of operation, performance characteristics and applications
Microwave solid state devices and circuits: Microwave transistor, tunnel diode, FET, MESFET, HEMT, MOSFET, Gunn diode-modes of operation, LSA diode, READ diode, IMPATT, TRAPATT and BARRIT diode, varactor diode, parametric devices. Application and circuits of varactor, Gunn and tunnel diodes.

References:

1. Microwave Devices and Circuits: Liao Samuel Y – PHI,1990
2. Microwave Engineering: Annapurna Das, Sisir K Das TMH Publication, 2001.
3. Introduction to Electrodynamics: Griffiths D J – TMH
4. Microwaves: David M Pozar, Wiley 3rd Ed.
5. Electronic Communication Systems: Kennedy – TMH, 4th Ed.
6. Foundations of Microwave Engineering: Collin – TMH, 2nd Ed.
7. Microwave Engineering: Chatterjee R. – PHI
8. Electronics of Microwave Tubes: W Kleen, Academic Press, 1958
9. Microwave Integrated Circuits: Gupta K G and Singh A

ELS-3.5 (b): IMAGE PROCESSING

52 Hours

UNIT I **10 Hours**

Digital Image Fundamental: Elements of Visual Perception, Digital Image Processing, Fundamental Steps in Digital Image Processing, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

UNIT II **14 Hours**

Image Enhancement:
Image Enhancement in the Spatial Domain**,** Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing and Shaping using Spatial Filtering.
Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency Domain**,** Smoothing and shaping using Frequency Domain Filtering, Homomorphic Filtering.

UNIT III **14 Hours**

Color Image Processing: Color Fundamentals, Color Models, Pseudo-color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images.
Image Restoration: Model of the Image Degradation/Restoration Process, Restoration in the Presence of Noise Only–Spatial Filtering, Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Geometric Transformations.

UNIT IV **14 Hours**

Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, the Hit-or-Miss Transformation, Basic Morphological Algorithm, Extensions to Gray-Scale Images.
Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds.

References:

1. Digital Image Processing-Rafael C. Gonzalez and Richard E.Woods, Pearson Education, 2nd Edition, 2001.
2. Fundamental of Digital Image Processing- Anil K. Jain, Pearson Education, 2001.
3. Digital Image processing and Analysis- B.Chanda and D. Dutta Majumbar, PHI, 2006

ELS-3.5 (c): ARM PROCESSORS AND REAL-TIME OPERATING SYSTEMS

52 Hours

UNIT I **12 Hours**

Introduction: Introduction to embedded systems, ARM embedded system, ARM processor fundamentals-Registers, Current program status register, pipeline, exceptions, Interrupts, the Vectortable, Core extensions, ARM processor families.

ARM Instruction Set: Introduction to ARM instruction set- Data processing instructions, Branchinstructions, load-store instructions, software interrupt instructions, program status registerinstructions, and Coprocessor instructions.

UNIT II **12 Hours**

Thumb Instruction Set and Programming: Introduction to thumb instruction set, Thumbprogrammer's model, Thumb branch instructions, data processing instructions, Single register loadstoreInstructions, Multiple-Register load-store instruction, Stack instruction, Software interruptsinstruction, ARM assembly language Programming.

Architectural Support for High-Level languages: Data types, Floating-point data types, TheARM floating point architecture, Expressions, Conditional statements, Loops, functions andprocedures.

UNIT III **13 Hours**

Real-Time Operating Systems: Real-time concepts, Hard Real-time and SoftReal-time, Differences between General Purpose OS & RTOS, Basic architecture of an RTOS,Scheduling Systems, Inter-process communication, Performance Metric in scheduling models,Interrupt management in RTOS environment, Memory management, File systems, I/O Systems,Advantage and disadvantage of RTOS. POSIX standards. RTOS Issues - Selecting a Real TimeOperating System, RTOS comparative study.

VxWorks Memory Management: Vx Works and Tornodo, Features of IDE – Host Target Architecture, Project Management, Thread Scheduling algorithm, Inter task Communication using shared memory – Pipes, Message, Queues, Semaphores, Mutual exclusion.

UNIT IV **15 Hours**

File Formats of VxWorks: Hardware and software interrupt handling, RAM Disk File systems, Using DOS file systems on RAM disks, I/O systems, Memory Management WDT, Message logging, Overview of networking on Vx Works, Managing host table, Managing IP

Socket Programming: Address, Sockets, Accessing remote files using FTP, TFTP, RSH and NSF, configuring Vx Works as FTP server and FTP client, TFTP server and client, NFS server and NFS client, NFS Client Rlogin, Using Crosswind for Debugging, Using WindView as a Runtime Analyzer, Using Browser and Winds, Using Integrated Simulator, BuildingVx Works image, Creating a Boot image, Download and Booting Vx Works on the Target system.

References:

1. ARM system developer's guide- Andrew N Sloss, Dominic Symes and Chris Wright, Elsevier, Morgan Kaufman publishers, 2008.
2. Embedded Real-Time Systems: Concepts, Design and Programming The Ultimate Reference- Prasad K.V.K.K, DREAMTECH PRESS, NEW DELHI,2003
3. VxWorks Programmers Gide and VxWorks Reference Manual
4. Real-Time Systems Design and Analysis- Phillip. A. Laplante, 2nd Edition, PHI, 2005

ELO-3.6: INTRODUCTORY ASPECTS OF DIGITAL ELECTRONICS

52Hours

UNIT I **08 Hours**

Binary Systems: Introduction to Digital Systems, Number systems- binary, octal, decimal, hexadecimal, decimal to binary & binary to decimal conversion, representation of binary using hexadecimal.

UNIT II **12 Hours**

Binary arithmetic -addition, subtraction, multiplication and division, 1's and 2's complement method for binary subtraction, Hexadecimal addition and subtraction, Binary Codes-BCD code, Gray code, Excess-3 code, BCD addition and subtraction, Excess-3 addition and subtraction, ASCII Code.

UNIT III **16 Hours**

Boolean Algebra and Logic Gates: Basic definitions, operators of Boolean algebra, basic theorems and properties of Boolean algebra, basic gates-AND, OR,NOT,XOR,NAND,NOR (only truth table & gate representation),Boolean functions, canonical or standard forms, K-maps (upto three variables only).

UNIT IV **16 Hours**

NAND and NOR gate as universal building blocks, Half adder, Full adder, Half subtractor, Full subtractor, 4-bit parallel adder and subtractor, 2's complement adder/subtractor, 3-bit binary decoder, decimal to BCD encoder, 8:1 multiplexer, 1:8 demultiplexer.

REFERENCE BOOKS:

1. Digital Fundamentals, Floyd T L,Pearson Education Asia, 7th Edition. 2002
2. Digital Logic and Computer Design,M. Morris Mono,Pearson, 4th Edition,2009

ELH-4.1: EMBEDDED SYSTEMS

52 hours

UNIT I **16 hours**

Hardware Considerations: Introduction, overview, design metrics, processor technology, design technology, custom single-purpose processors-introduction, RT-level combinational & sequential components, custom single-purpose design, optimizing program, FSMD, data path & FSM.

General purpose processors and ASIC's: Basic architecture and operation of general purpose processors, programmer's view - development environment - ASIP's – microcontrollers, DSP and less general ASIP environments.

UNIT II **12 hours**

Standard processor peripherals: timers, counters and watchdog timers, applications, UART, PWM application, LCD controller, keypad controllers, stepper motor control, ADC and DAC.

Memory: Different types of ROM & RAM, cache system design

Interfacing: introduction to interfacing, communication basics, basic protocol concepts, interrupts and DMA, arbitration, multilevel bus architectures, communication – serial protocols-I^2C, CAN, USB, Firewire, parallel and wireless protocols.

UNIT III **12 hours**

Software Considerations: Basics of real time concepts, bus transfer mechanism, software concepts, system concepts, real time definitions, events and determinism, synchronous and asynchronous events, time loading, real time design issues, examples of real time systems.

Software life cycle: phases of the software life cycle, interrupts: basics - shared data problem, interrupt latency.

Survey of software architecture: round robin, round robin with interrupts, function queues, scheduling, RTOS architecture.

UNIT IV **12 hours**

Introduction to RTOS: tasks, states, data – semaphores and shared data. More operating system services – message queues, mail boxes & pipes, timer functions, events, memory management, interrupt.

Basic design using RTOS: Principles - an example, encapsulating semaphores and queues, hard real time scheduling considerations, saving memory, space and power.

Embedded software development tools: Host and target machines, linkers/locators for embedded software.

References:

1. Embedded system Design - Frank Vahid and Tony Givargis, John Wiley, 2002
2. An Embedded Software Primer- David E.Simon, Pearson Education, 1999.
3. Real Time System design and analysis, Phillip A Laplante, PHI, 4th Edition, 2011.
4. Mechatronics – principles and applications, Godfrey C Onwubolu, Elsevier, 2006

ELH-4.2: PROJECT WORK

Project work can be carried out in industries/R&D Organization/IITs/IISc/Any Universities. Project shall be conceptualized soon after the completion of the II Semester; Students shall work for the project during the mid-term vacation of III semester examinations and IV Semester.

The Board resolved that Study Tour is compulsory for M.Sc Electronics students. The students will be accompanied by a staff member and one attender. The students may take up their study tour during midterm vacation of III semester.

ELS-4.3 (a): INTRODUCTION TO VLSI CIRCUITS

52 Hours

UNIT I **10 Hours**

Introduction to MOS technology, basic MOS transistors, enhancement and depletion mode transistor action, nMOS and CMOS fabrication, BiCMOS technology

Logic design with MOSFETs: MOSFETs as switches, logic gates in CMOS, transmission gate circuits.

Basic electrical properties of MOS transistor: I_{ds} versus V_{ds} relationships, aspects of threshold voltage V_t, transconductance.

UNIT II **15 Hours**

Basic MOS circuits: **NMOS transistor**: pass transistor, inverter transfer characteristics, pull-up to pull-down ratio Z_{pu}/Z_{pd} for nMOS inverter driven by another nMOS inverter and nMOS inverter driven by one or more pass transistors, alternative forms of pull-up.

CMOS inverter: transfer characteristics, MOS transistor circuit model, latch-up in CMOS circuits, BiCMOS inverters

MOS circuit design fundamentals: MOS layers, stick diagrams, lambda based rules for nMOS and CMOS process, layout diagrams, examples.

UNIT III **15 Hours**

Basic circuit concepts: Sheet resistance R_s, R_s concept applied to MOS transistors and inverters, standard unit of capacitance, capacitance calculations, delay unit τ, inverter delays, CMOS inverter delay in terms of rise and fall times, driving large capacitance loads, propagation delays.

Scaling of MOS circuits: Scaling factors, advantages of scaling, limitations to scaling, scaling of wires and interconnections.

UNIT IV **12 Hours**

Subsystem design and layout: Switch logic, gate logic, design of combinational logic circuits, design of clocked sequential circuits.

Reliability and testing of VLSI circuits: General concepts, CMOS testing, test generation methods.

References:

1. Basic VLSI Design: , Douglas A Pucknell and , Kamran Eshraghian, PHI, 3rd edition
2. Introduction to VLSI circuits and systems: John P Uyemura, John Wiley
3. Principals of CMOS VLSI design:, Neil H E Weste and David Harris, Addison Wesley, 3rd edition, 2004
4. Silicon VLSI technology: James D Plummer, Michael D Deal and Peter B Griffin, Prentice Hall, 2000
5. CMOS Digital Integrated Circuits, Analysis and Design: Sung-Ho(Steve) Kang and Yusuf Leblebici, McGraw Hill, 3rd edition, 2002

ELS-4.3 (b): MEMS AND MICROSYSTEMS TECHNOLOGY

52 Hours

UNIT I **12 Hours**

Introduction: Overview of MEMS and Microsystems, Working Principles of Microsystems Mechanical Sensors and Actuators, Thermal Sensors and Actuators, MOEMS, RFMEMS **Microelectronics:** Microelectronic Technologies for MEMS, Micromachining Technology: Surface and Bulk Micromachining, Micro machined Micro sensors- Mechanical, Inertial, Chemical, Acoustic. Polymer MEMS, Piezoelectric Sensing and Actuation, Micro Fluidics Applications.

UNIT II **12 Hours**

Microsystems: Microsystems Technology, Integrated Smart Sensors and MEMS, Engineering Mechanics for Microsystems Design, Thermo fluid Engineering and Microsystems Design, Scaling Laws in Miniaturization.

UNIT III **12 Hours**

Microsystems Design and Packaging: Introduction, Design Considerations, Process Design, Mechanical Design, Mechanical Design Using Finite Element Method, Design of a silicon Die for a micropressure sensor, Design of Microfluidic N/W Systems, Computer Aided Design, Microsystems Packing, Interfaces in Microsystems Packing, Essential Packaging Technologies, 3D packing, Assembly of Microsystems, Signal Mapping and Transduction, Problems.

UNIT IV **16 Hours**

Micro sensors Actuators, Systems, and Smart Materials:
Silicon Capacitive Accelerometer, Overview, Advantages of silicon capacitive accelerometer, typical applications, Materials used, fabrication process, and principle operation, **Pressure Sensors:** Overview Advantages of piezoresistive pressure sensors, materials used, fabrication process, Principle of operations.
Conductive Gas Sensor: Overview Typical applications , materials used fabrication used An Electrostatic Comb –drive, A magnetic micro relay, Portable blood analyzer, Piezoelectric Inkjet Print Head, Micromirror array for video projection, smart materials and systems. Modeling of solids in Microsystems.

References:

1. MEMS and Microsystems Design and Manufacture**:**Hsu, Tai- Ran, Mac Graw Hill
2. Introduction to Microelectromechanical Systems Engineering: NadimMaluf and Kirt Williams, Artech House Publishing
3. MEMS Mechanical Sensors: Steve Beeby and Graham Ensel and Michael Kraft and Neil White, Artech House Publishing
4. MEMS:NitaigourPremchandMahalik
5. Foundations of MEMS:Chang Liu
6. MEMS and Microsystems design and Manufacture: Tai Ran Hsu
7. Micro and Smart Systems: G.K.Anathasureesh, K.J.Vinoy

ELS-4.3 (c): WAVELET TRANSFORMS

52 hours

UNIT I **13 Hours**

Continuous Wavelet Transform: Introduction, C-T wavelets, Definition of CWT, The CWT as a correlation. Constant Q-Factor Filtering Interpolation and time frequency resolution, the CWT as an operator, inverse CWT.

Introduction to Discrete Wavelet Transform and Orthogonal Wavelet Decomposition: Introduction, Approximation of vectors in nested linear vector spaces, (i) example of approximating vectors in nested subspaces of a finite dimensional linear vector space, (ii)Example of approximating vectors in nested subspaces of an infinite dimensional linear vector space. Example MRA. (i) Bases for the approximations subspaces and Harr scaling function, (ii) Bases for detail subspaces and Haar wavelet.

UNIT II **13 Hours**

MRA, Orthonormal Wavelets and their Relationship to Filter Banks: Introduction, Formal definition of an MRA. Construction of a general orthonormal MRA, (i) scaling function and subspaces, (ii) Implication of dilation equation and orthogonality, a wavelet basis for MRA. (i) Two scale relations for (t), (ii) Basis for the detail subspace (iii) Direct sum decomposition, Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction.

Examples of Wavelets: Examples of orthogonal basis generating wavelets, (i) Daubechies D_4 scaling function and wavelet. (ii) band limited wavelets, Interpreting orthonormal MRAs for Discrete time MRA, (iii) Basis functions for DTWT.

UNIT III **8 Hours**

Alternative Wavelet Representations: Introduction, Bi-orthogonal wavelet bases, Filtering relationship for bi-orthogonal filters, Examples of bi-orthogonal scaling functions and wavelets, 2-D wavelets.

UNIT IV **18 Hours**

Non-separable multidimensional wavelets, wavelet packets, Wavelets Transform and Data Compression: Introduction, transform coding, DTWT for image compression (i) Image compression using DTWT and run-length encoding.(i) embedded tree image coding (ii) compression with JPEG audio compression (iii) audio masking, (iv) wavelet based audio coding.

Construction of Simple Wavelets: Construction of simple wavelets like Harr and DB1.

Other Applications of Wavelet Transforms: Introduction, wavelet de-noising, speckle removal, edge detection and object isolation, Image fusions, Object detection by wavelet transforms of projections.

References:

1. Wavelet transforms- Introduction to theory and applications-Raghuveer M. Rao and Ajit S. Bapardikar, Pearson Education, 2000.
2. Wavelet transforms- Prasad and Iyengar, Wiley estern, 2001.
3. Wave-let and filter banks- Gilbert Strang and Nguyen Wellesley Cambridge press,

ELO-4.4: BASIC ELECTRONICS

52 hours

UNIT-I **13 hours**

Basic components used in Electronics: Resistor, capacitor, inductor and their different types - Diodes - Light Emitting diode (LED), Photo diode, Zener diode, LCD, solar cell.

UNIT-II **13 hours**

Power Supplies: Need of a power supply, Types of power supplies, Different types of unregulated and regulated power supplies, IC Regulated power supply, switched mode power supply.

UNIT-III **13 hours**

Amplifiers: Transistor as an amplifier, Types of Amplifiers, Single stage amplifier, Amplifiers with feedback, Negative feedback amplifiers.

UNIT-IV **13 hours**

Oscillators & Switching circuits: Transistor as an oscillator, Barkhausen criteria, Hartley and Colpitt's oscillators, Multivibrators, Differentiating circuits, integrating circuits, clipping and clamping circuits.

References:

1. Principles of Electronics - V.K. Mehta - S.Chan Publication, New Delhi
2. Electronic devices and circuits - G.J.Mithal, Khana publishers, New Delhi
3. Modern Physics - R.Murugesan - S.Chan publication, New Delhi
4. Basic Electronics - B.L. Theraja - S.Chan publication, New Delhi
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