Employability Final

Electronics: Courses focusing on employability

Year : 2018-19, 2019-20

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

1.1.3

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.

1.1.3

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.

1.1.3

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.

1.1.3

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.

1.1.3

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)

1:1:3

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

1.1.3

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.

1.1.3

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.

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

1.1.3

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

1.1.3

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

UNIT I **52 Hours**

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

1.1.3

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 Organizations/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.