BHARATHIAR UNIVERSITY: COIMBATORE – 641 046

M.Sc., ELECTRONICS AND INSTRUMENTATION

(For the Candidates admitted for the academic year **2014-2015)**

THE ELIGIBILITY CONDITIONS FOR ADMISSION TO M.Sc. ELECTRONICS & INSTRUMENTATION SHALL BE AS FOLLOWS:

1. A PASS IN B.Sc. ELECTRONICS / INDUSTRIAL ELECTRONICS/ ELECTRONIC SCIENCE / ELECTRONICS AND COMMUNICATION SYSTEMS/ B.Sc. HONS/ B.Sc. ELECTRICAL EQUIPMENT MAINTENANCE, INSTRUMENTATION / B.E.S.
2. A PASS IN TRIPLE MAJOR (MATHS, PHYSICS & ELECTRONICS) OR (MATHS, ELECTRONICS & COMPUTER SCIENCE).
3. A PASS IN B.Sc. ELECTRONICS WITH COMPUTER HARDWARE, TECHNOLOGY OF APPLIED SCIENCE, B.SC COMPUTER TECHNOLOGY, B.E WITH ECE, EEE, EIE, AND A.M.I.E IN RESPECTIVE BRANCHES IS ALSO ELIGIBLE FOR JOINING THE ABOVE SAID COURSES.

Scheme of Examination

Sem	Code No.	Subject	Class Hours	University Examination			
				Internal	External	Total	Credit
I		Sensors and Transducers	4	25	75	100	4
		Signals and Systems	4	25	75	100	4
		Embedded Systems and RTOS	4	25	75	100	4
		Bio-Medical Instrumentation	4	25	75	100	4
		Embedded System Laboratory	3	25	50	75	3
		Medical Electronics Laboratory	3	25	50	75	3
		Elective – I	4	25	75	100	4
		Supportive – I	2	12	38	50	2
II		Control Systems	4	25	75	100	4
		Fiber optics and Laser Instrumentation	4	25	75	100	4
		Programmable Logic Controllers and its Applications	4	25	75	100	4
		Analytical Instrumentation	4	25	75	100	4
		PLC, SCADA & Instrumentation Laboratory	3	25	50	75	3
		Intelligent Instrumentation Laboratory	3	25	50	75	3
		Elective II	4	25	75	100	4
		Supportive – II	2	12	38	50	2
III		Process Control	4	25	75	100	4
		Digital Signal Processing	4	25	75	100	4
		Analog and Digital Electronics	4	25	75	100	4
		Digital Signal Processing Laboratory	3	25	50	75	3
		Analog and Digital Electronics Laboratory	3	25	50	75	3
		Elective- III	4	25	75	100	4
		Supportive – III	2	12	38	50	2
IV		VLSI System Design	4	25	75	100	4
		VLSI Laboratory	3	25	50	75	3
		Project, Viva-Voce and Industrial Visit	3	---	75	75	3
Total Marks: 2250			**Credits: 90**				

1. PROCESS CONTROL **Semester III**

UNIT I

FINAL CONTROL ELEMENTS: Final control operation: Signal conversion, actuators, control element- signal conversions: analog electrical signals, digital electrical signals, neumatic signals- power electronics, switching devices, controlling devices – actuators: electrical actuators, pneumatic actuators – control elements: mechanical, electrical, fluid walls

UNIT II

DISCRETE STATE PROCESS CONTROL: Definition of Discrete state process control – characteristics of the system: Discrete state variables, process specification, event sequence description – Process characteristics: Process equation, Process load, Process Lag, Self –regulation – Control system parameters: Error, variable range, Control parameter range, Control Lag, Dead time, Cycling, Controller modes- Discontinuous Controller Modes: Two-position Mode, Multiposition Mode, Floating control Mode – Continuous control Modes: Proportional control Mode, Integral control Mode, Derivative –control Mode- Composite Control Mode: Proportional –Integral Control, Proportional –Derivative Control Mode, Three Mode controller (PID)

UNIT III

ANALOG AND LOGIC CONTROLLERS: General features of analog controllers: Physical layout, front panel, side panel – Electronic controllers: Error detector, Single mode, composite controller mode – Pneumatic Controllers: General features, Mode Implementation – Relay controllers: Background, Ladder diagrams- Programme Logic Controllers: Relay sequences, Programmable Logic Controller Design, PLC operation, Programming, Functions of PLC software

UNIT IV

COMPUTER BASED CONTROL: Digital applications: Single and multivariable alarms, Two position control – Computer based controllers: Hardware configuration, Smart sensors, multiloop controllers- Software requirements- algorithms to implement the control equations: errors, proportional mode, integral mode, derivative mode,PID Control mode – Data Loggers – Supervisory control – Process control system networks, field bus operations, General characteristics of buses

UNIT V

CONTROL LOOP CHARACTERISTICS: Control System configurations: Single variable, Cascade Control – Multivariable control system: analog control, supervisory and direct digital control – Control system quality: definition of quality, measure of quality – Stability: Transfer function frequency dependence, stability criteria- Process Loop Tuning: Open Loop Transient Response Method, Ziegler-Nichols Method, Frequency Response Method

TEXT BOOK

1. Curtis D. Johnson, Process control instrumentation Technology, Eight editions, Prentice Hall of India, 2006

REFERENCE BOOK

1. Bela G. Liptak “Process Control” butterworth – Heinemann

2. DIGITAL SIGNAL PROCESSING **Semester III**

UNIT I

THE Z-TRANSFORM: Definition of the z-Transform – z-Transform and ROC of Finite and Infinite Duration Sequences –ROC of Two-sided Sequence – Stability and ROC – Properties of Region of Convergence – Properties of the z-Transform – The system Function – Poles and Zeros of a System Function – Stability Criterion – Relationship between the Fourier Transform and the z-Transform – Relationship between s-plane and z-plane – Inverse z-Transform – Solution of Difference Equations using One Sided z-Transform – Deconvolution using z-Transform.

UNIT II

DISCRETE FOURIER TRANSFORM & COMPUTATION: The Discrete Fourier Transform – Relation of The DFT to Other Transforms – Properties of the Discrete Fourier transform – Comparison between Circular Convolution and Linear Convolution – Methods to Evaluate Circular Convolution of Two Sequences – Linear Convolution From Circular Convolution – Filtering Long Duration Sequences – Parameter Selection to Calculate DFT. Introduction of DFT – Efficient Computation of DFT – Properties of DFT – FFT algorithms – Radix – FFT algorithm – Decimation in Time – Decimation in Frequency algorithms – Use of FFT- algorithms in Linear Filtering and correlation.

UNIT III

DESIGN OF DIGITAL FILTERS: Amplitude and phase response of fir filters – linear phase filters – windowing techniques for design of linear phase FIR filters – rectangular, Haming, Kaiser windows – Frequency sampling techniques – IIR Filters – magnitude response – Phase response – group delay – Design of Low Pass Butterworith filters(low pass)- Bilinear transform – Prewarping.impulse invariant transformation

UNIT IV

FINITE WORD LENGTH EFFECTS: Introduction - Number of representation - Types of Number representation - Floating Point Numbers - Block Floating Point Numbers - Quantization noise - Input Quantization Error - Product Quantization Error - Coefficient Error - Zero input Limit Cycle Oscillations - Overflow Limit cycle Oscillation - Signal Scaling - Quantization in Floating Point Realization of IIR Digital Filters - Finite Word Length Effect in FIR Digital Filters - Quantization Effect in the Computation of the DFT - Quantization Error in FFT Algorithms.

UNIT V

DIGITAL SIGNAL PROCESSORS: Introduction to DSP architecture – Von Neumann Architecture – Harvard architecture- Dedicated MAC unit – Multiple ALUS, Advanced addressing modes, pipelining, Overview of instruction set of TMS320CSX and C54XX

TEXT BOOKS

1.J.G.Proakis and D.G.Manollakis,"Digital Signal Processing Principles. Algorithms and Applications" Pearson education, New Delhi 2003/PHI.
2.S.K.Mitra, Digital Signal Processing – A Computer Based Approach Tata Mc Graw Hill, New Delhi, 2001.

REFERENCE BOOKS

1. Alan V.Oppenheim, Ronald W.Schafer and John R.Buck,"Discrete-Time Signal Processing" Pearson Education, New Delhi, 2003.
2. B.Venkataramani, M.Baskar,"Digital Signal Processors, Architecture, Programming and Applications"Tata Mc Graw Hill, New Delhi, 2003.
3. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, Digital Signal Processing"Tata McGraw Hill, New Delhi, 2003.
4. Texas TMS 320C54X user manual (website)
5. J.R.Jhonson, Introduction to Digital Signal Processing Prentice Hall of India, 1989.

3. ANALOG AND DIGITAL ELECTRONICS **Semester I**

Unit 1: Devices and Circuits

Passive and Active components.PN junction diode, LED, Zener diode, Varactor Diode. BJT, Transistor Configuration, CE Transistor Amplifier and Power Amplifier. Concept of feedback. LC Oscillator and RC Phase shift oscillator.UJT, JFET and MOSFET. SCR, DIAC and TRIAC.

Unit 2: Operational Amplifiers

IC741 block diagram and ideal OpAmp Characteristics - Inverting and Non-Inverting amplifiers, Voltage Follower, Summing Amplifier, Difference Amplifier, Differentiator, Integrator, Comparator and Schmitt trigger.

Unit 3: Linear Integrated Circuits

First order Butterworth Low Pass filter, High Pass filter, Band Pass filter, Band Reject and Notch filter. Square Wave Generator, Triangular Wave Generator and Phase Shift Oscillator. Timer IC 555: Block diagram, Astable and Monostable multivibrator. Voltage Controlled Oscillator (VCO), Phase Locked Loop (PLL).

Unit 4: Number System and Logic Operations

Review of number system and coding, Code conversion, Logic gates and Logic operations. Boolean expression - laws and rules – Demorgan's theorem. Minimizing techniques – K-map. Logic families: TTL, ECL, CMOS– comparison

Unit 5: Digital Circuits

Adders, subtractors, flip-flops, Shift registers - serial& parallel, counters- up, down, ring and decade..ADC and their types- successive approximation, flash ADC, dual slope, sigma delta. DAC - different types: weighted resistors, R2R. Mealy moore models, state machine notation, state diagram, state table, transition table, excitation table and equations-Analysis of synchronous and asynchronous sequential circuits.

Text Books:

1. R S Sedha, "A Textbook of Applied Electronics", S. Chand and Company LTD.
2. Ramakant A Gayakwad, "Op-amp and Linear Integrated Circuits", Prentice-Hall of India Private LTD.
3. Thomas L. Floyd, "Digital fundamentals", Pearson Education, 8th Edition.
4. M. Morris Mano, "Digital Design", Pearson Prentice Hall, 2003

References:

1. K.R. Botkar," Integrated Circuits", Khanna Publishers.
2. Millman&Halkias,"Integrated Electronic", Tata McGraw-Hill Publishing LTD.
3. Herbert Taub & Donald L. Schilling, "Digital Integrated circuits", McGraw-Hill.
4. Albert Paul Malvino& Donald P. Leach, "Digital principles and applications", McGraw-Hill

DIGITAL SIGNAL PROCESSING LAB - PRACTICAL V **Semester III**

(Any 16 Experiments)

USING TMS320C5X/TMS320C54XX/TMS320C67XX (Any 6 Experiments)

1. Study of addressing Modes of DSP using simple examples.
2. Arithmetic operations.
3. Waveform generation.
4. Study of Sampling and effect of under sampling
5. DFT computations.
6. FFT Computations.
7. Convolution of two discrete signals.
8. Design of Chebychev and Butterworth analog filters.
9. FIR Filter design
10. IIR filter design

SIMULATION USING MATLAB (Any 6 Experiments)

1. Generation of signals.
2. Impulse, Step, Exponential & Ramp functions.
3. DFT computations.
4. FFT Computations.
5. Design of FIR filter.
6. Design of IIR filter.
7. Image Segmentation.
8. Study of various noises and filtering
9. Convolution of two Sequences.
10. Concept of Aliasing

ANALOG AND DIGITAL ELECTRONICS LABORATORY – PRACTICALVI

Semester III

(Any 16 Experiments)

1. Rectifier circuits and Filter designing
2. IC fixed voltage regulation and its characteristics
3. IC 723 variable voltage regulator
4. RC coupled Amplifier using BJT

5. UJT relaxation oscillator
6. Astable and Monostable Multivibrator using BJT
7. Series Voltage Regulator
8. Inverting and Non – inverting Op-amp configuration
9. Voltage follower and Instrumentation Amplifier
10. Differentiator, Integrator, Summing and Difference amplifier using Op-Amp
11. Low Pass and High Pass Filter using Op-Amp
12. Schmitt triggers using Op-Amp
13. RC Phase shift oscillator using Op-Amp
14. Triangular and square wave generator using Op-Amp
15. Symmetrical and Asymmetrical square wave generation using IC 555
16. Diac and Triac characteristics.
17. Half adder, Full adder, Half subtractor and Full subtractor using Logic gates.
18. SR & JK flip flops using logic gates.
19. Johnson counter, Ring counter and Up/Down Counter.
20. MUX and DEMUX using NAND gate.

1. VLSI SYSTEM DESIGN **Semester IV**

UNIT - I

VLSI DESIGN METHODOLOGY: VLSI design process – Architectural design – Logical Design – Physical design – Layout Styles – Full custom – Semicustom approaches.

BASIC ELECTRICAL PROPERTIES OF MOS AND CMOS CIRCUITS: MOS transistor - Threshold Voltage – Threshold Voltage equations- MOS device equations – Basic DC equations - Second order effects – MOS Models – Small signal AC characteristics – NMOS inverter – Depletion mode and Enhancement mode pull ups – CMOS inverter – DC Characteristics – inverter delay – Pass Transistor – Transmission gate – power consumption in CMOS gates – Static Dissipation – Dynamic Dissipation.

UNIT - II

VLSI FABRICATION TECHNIWQUES; An overview of wafer fabrication – wafer processing – oxidation patterning – diffusion – ion implantation – deposition – silicon gate NMOS process – CMOS process N-Well and P-Well process – Twin tub – Silicon on insulator – CMOS process enhancements – Interconnect – Circuit elements – latch up prevention techniques.

UNIT - III

LAYOUT DESIGN RULES; Need for design rules – Mead Conway design rules for the silicon gate NMOS process – CMOS based design rules –simple layout examples – sheet resistance – area capacitance – wiring capacitance – driving large capacitive loads.

UNIT - IV

LOGIC DESIGN: Switch logic – pass transistor and transmission gate based design – gate logic – inverter – two input NAND gate – NOR gate – Other forms of CMOS logic – Clocked CMOS Logic – recharged Domino CMOS Logic – Structured design – simple combinational logic design examples – Parity generator – Multiplexers – Clocked Sequential circuit – Two phase clocking – Charge Storage – Dynamic Shift register Semi static register – JK flip flop circuit.

UNIT - V

SUBSYSTEM DESIGN PROCESS: General arrangement of a 4 bit arithmetic processor – Design of 4-bit shifter – Design of ALU sub system – implementing ALU function with an adder – Carry look ahead adders – multipliers – serial parallel multipliers – pipelined- multiplier array – Modified Booth's algorithm – increment / decrement – Two Phase non-overlapping clock generator.

TEXT BOOKS

1. Kamran Eshraghian, Douglas A Puknel and Sholeh Eshraghian, "Essentials of VLSI Circuits and Systems," prentice Hall of India, New Delhi, 2005.
2. Neil H.E West and Kamran Eshranghian, "Principles of CMOS VLSI Design: A system perspective ", Addison-Wesley, 2nd Edition, 2004.

REFERENCE BOOKS

1. Sung-Mo Kang and Yusuf Leblebici," CMOS Digital integrated circuits", Tata McGraw Hill 3rd Edition, New Delhi, 2008.
2. Jan M Rabaey, Chandrasekaran A and Nikolic B, "Digital Integrated Circuits," Pearson Education, 3rd edition, 2004.
3. Amar Mukharjee, "Introduction to NMOS and CMOS VLSI System," Prentice Hall, USA, 1986.
4. Wayne wolf," Modern VLSI Design : System on chip design", Pearson Education Inc., 3rd Edition, Indian Reprint, 2007.

VLSI LABORATORY – PRACTICAL VII **Semester IV**

(Any 16 Experiments)

Design and simulation of Combinational Logic Circuit using VHDL/Verilog

1. Test benches in VHDL/Verilog
2. Adder
3. Logic gates verification
4. Multiplexer and Demultiplexer
5. Encoder and Decoder
6. Multiplier

Design and simulation of Sequential Logic Circuit using VHDL/Verilog

1. Flip Flops
2. Counter
3. Shift registers
4. Frequency Divider
5. Modeling of sequential digital system

FPGA Implementation

1. Implementation of ALU
2. 4- bit Adder
3. 8- bit ALU
4. Real Time Clock
5. Implementation of MAC unit
6. Multiplexer and Demultiplexer
7. Encoder and Decoder
8. Multiplier
9. Flip Flops.