BHARATHIAR UNIVERSITY

Coimbatore – 641046

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION

M.Sc. Electronics & Instrumentation Syllabus

(For the Candidates admitted during the academic year **2018-2019 onwards**)

BHARATHIAR UNIVERSITY: COIMBATORE – 641 046
SCHOOL OF PHYSICAL SCIENCES

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION (DEI)

M.Sc., ELECTRONICS AND INSTRUMENTATION

ELIGIBILITY CONDITIONS FOR STUDENTS

(For the Candidates admitted during the academic year **2018-2019 onwards**)

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.

ALL THE ABOVE CHANGES SHALL TAKE EFFECT FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2018-2019 AND ONWARDS.

BHARATHIAR UNIVERSITY: COIMBATORE – 641 046
SCHOOL OF PHYSICAL SCIENCE
DEPT. OF ELECTRONICS AND INSTRUMENTATION
M.Sc. ELECTRONICS AND INSTRUMENTATION

VISION:

- To create an academically sound environment that nurtures, motivates and inspires excellence in research and teaching in Electronics and Instrumentation applicable to the needs concern for the society.

MISSION:

- To impart theoretical and practical training in advanced areas of Electronics and Instrumentation for the contribution of newer knowledge through research which encourages creativity, insight development and a passion for science towards the technological development.

PROGRAM EDUCATIONAL OBJECTIVES

Master of Science in Electronics and Instrumentation curriculum for full-time is designed to develop the post graduates having attitude and knowledge to

1. To be successful in their respective professional careers in the field of Electronics & Instrumentation

2. Engross in life long process of learning to keep themselves abreast of new developments in the field of Electronics & Instrumentation

3. To provide necessary foundation and advanced techniques on computational and software platforms related to the field of Electronics and Instrumentation

PROGRAMME OUTCOMES

The post graduates will have the ability to

A. Understand and apply the basic Mathematical knowledge of Circuit Theory, Electro Magnetic theory, Control Theory and Signal Processing concepts and to solve the problems pertaining to Electronics and Instrumentation field.

B. Identify and solve the Electronics and Instrumentation problems from research literature and be able to analyse the problems using the physical concept of Electronic Sciences

C. Understand, analyze and apply Embedded Systems, LabVIEW and PLC systems in their applications to various industries.

D. Self and life-long learning, keeping pace with advanced technological challenges in the broadest sense.

PEO / PO	A	B	C	D
1	X	X	X	X
2	X	X	X	X
3	X	X	X	X

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION

M.Sc. Electronics and Instrumentation

Scheme of Examination

Sem	Code No.	Subject	Class Hours	University Examination			
				Internal (%)	External (%)	Total	Credit
I		Sensors and Transducers	4	25	75	100	4
		Analog and Digital Electronics	4	25	75	100	4
		Circuit Theory	4	25	75	100	4
		Electro Magnetic theory	4	25	75	100	4
		Analog and Digital Electronics Laboratory	3	25	50	75	3
		Circuit Theory 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
		ARM Processor	4	25	75	100	4
		Intelligent Instrumentation	4	25	75	100	4
		Medical electronics & instrumentation	4	25	75	100	4
		Embedded Systems Laboratory	3	25	50	75	3
		Intelligent Instrumentation and Medical Electronics 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
		VLSI System Design	4	25	75	100	4
		Digital Signal Processing Laboratory	3	25	50	75	3
		VLSI Laboratory	3	25	50	75	3
		Elective- III	4	25	75	100	4
		Supportive – III	2	12	38	50	2
IV		PLC and Its Applications	4	25	75	100	4
		PLC, SCADA and Instrumentation Laboratory	3	25	50	75	3
		Project, Viva-Voce and Industrial Visit	3	---	75	75	3
		Online course (1^{st} sem to 4^{th} sem)	--	---	--	50	2
Total Marks: 2300				**Credits: 92**			

ELECTIVE AND SUPPORTIVE PAPERS

Sem	Code No.	Subject	Class Hours	University Examination			
				Internal (%)	External (%)	Total	Credit
I	**Elective –I (Semester-I)**						
		Electronic Test Instruments	4	25	75	100	4
		Embedded Systems	4	25	75	100	4
		Analytical Instrumentation	4	25	75	100	4
II	**Elective –II (Semester-II)**						
		Data Communication Networks	4	25	75	100	4
		Computer Aided Instrumentation.	4	25	75	100	4
		Microwave Theory and Techniques	4	25	75	100	4
III	**Elective –III (Semester-III)**						
		Ocean Electronics and Marine Instrumentation	4	25	75	100	4
		Communication System and Fiber Optics	4	25	75	100	4
		Power Plant Instrumentation	4	25	75	100	4
	Supportive – (Semester-I, II, III)						
		Digital Electronics and Microprocessor	2	12	38	50	2
		Biomedical Instrumentation.	2	12	38	50	2
		Analytical Instrumentation	2	12	38	50	2

Title of the subject : **SENSORS AND TRANSDUCERS** No. of Credits: **4**

Code No. : **13A** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide an adequate knowledge in resistance, inductance and capacitance transducers.
- Study the characteristics of Transducers, sensors and MEMS
- Provide knowledge on various types of transducers, sensors.

UNIT I: SCIENCE OF MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS

Units and Standards-Calibration Methods-Static Calibration-Classification of Errors –Error Analysis-Statistical Methods-Odds and Uncertainty-Classification of Transducers-Selection of Transducers.

CHARACTERISTICS OF TRANSDUCERS: Static characteristics Accuracy, precision, Resolution, Sensitivity, Linearity, Threshold Resolution, Hysteresis and Dead Space, Dynamic Characteristics - Mathematical model of Transducer-Zero, II order Transducers and I. Response to Impulse, Step, Ramp and Sinusoidal Inputs.

UNIT II: RESISTANCE, INDUCTANCE AND CAPACITANCE TRANSDUCERS
Principle of operation, construction details, Characteristics and application of resistance potentiometer, Strain Gauge, Resistance Thermometer, Thermistor, Hotwire Anemometer, Piezeoresistive Sensor and Humidity Sensor. Induction potentiometer-Variable Inductance Transducers- EI picks up LVDT-Capacitive transducer and types-Capacitor Microphone-Frequency response.

UNIT III: TRANSDUCERS
Piezoelectric transducer, Magnetostrictive - IC sensor-Digital Transducers-Smart sensor- Fibre optic sensors, SQUID sensors, Film sensors. Ultrasonic sensors – IR sensors.

UNIT IV: MEMS
Overview of MEMS and Microsystems-Working principles of Microsystems: Micro sensors-Microactutation-MEMS with Microactuators- Microaccelerometers

UNIT V : MICROSYSTEMS FABRICATION PROCESSES
Introduction- Photolithography-Ion Implementation-Diffusion-Oxidation-Chemical vapor deposition-Physical vapor deposition- Deposition by Epitaxy-Etching.
OVERVIEW OF MICRO MANUFACTURING: Bulk Micro manufacturing-Surface Micromachining-The LIGA Process.

TEXT BOOKS:

- A.K.Sawhney, "A course in Electrical & Electronic Measurement and Instrumentation" Dhanpat Raj and Co (P) Ltd.2004
- E.O.Doebelin, "Measurement Systems-Applications and Design",Tata McGraw Hill, New Work, 1990
- D.V.S Murthy, "Transducer and Instrumentation", Prentice Hall of India, 1995.
- Tai-Ran Hsu **"**MEMS and microsystems: design and manufacture"McGraw-Hill, 2002.

REFERENCE BOOKS:

- D.Patranabis, "Sensors and Transducers", Prentice Hall of India, 1999.
- John P.Bentley, "Principles of Measurement Systems",III Edition, Pearson Education, 2000.
- Hermann K.P.Neubert, "Instrument Transducers", Oxford University Press, 2000.
- D.V.S.Murthy, "Transducers and Instrumentation", Prentice Hall of India, 2001.
- S.Ranganathan, "Transducer Engineering", Allied Publishers Pvt.Ltd.2003.
- AlSulko and J.D.Fault, "Industrial Instrumentation", Vikas Publications, Delhi, 1996

Course Outcomes:

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

CO 1 - Understand the working principles and characteristics of sensors, transducers and MEMS.

Course prepared by : Dr. S. Muruganand
Course verified by : Dr. J. Vijayakumar

Title of the subject : **ANALOG AND DIGITAL ELECTRONICS**

No. of Credits: **4**

Code No. : **13B** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide a basic knowledge of the fundamentals of electronic components.
- Demonstrate and Analyze Operational Amplifier circuits, Digital Logic Circuits and their applications

UNIT I: 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 II: 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 III: 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 IV: 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 – Kmap. Logic families: TTL, ECL, CMOS– comparison

UNIT V: 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:

- R S Sedha, “A Textbook of Applied Electronics”, S. Chand and Company Ltd.
- Ramakant A Gayakwad, “Op-amp and Linear Integrated Circuits”, Prentice-Hall of India Pvt., Ltd.
- Thomas L. Floyd, “Digital fundamentals”, Pearson Education, 8th Edition.
- M. Morris Mano, “Digital Design”, Pearson Prentice Hall, 2003

REFERENCE BOOKS:

- K.R. Botkar, “Integrated Circuits”, Khanna Publishers.
- Millman&Halkias, “Integrated Electronic”, Tata McGraw-Hill Publishing Ltd.

- Herbert Taub & Donald L. Schilling, "Digital Integrated circuits", McGraw-Hill.
- Albert Paul Malvino& Donald P. Leach, "Digital principles and applications", McGraw-Hill

Course Outcomes:

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

CO 1 - Student will get more be emphasis on fundamental knowledge on both analog as well as digital components. This syllabus will help the students to create the Design/Development of circuit with Analog and Digital components.

Course prepared by : Dr. K. G. Padmasine
Course verified by : Dr. J. Vijayakumar

Title of the subject : **CIRCUIT THEORY** No. of Credits: **4**

Code No. : **13C** No. of Teaching Hours: **4**

Course Objectives:

- To provide theoretical knowledge of electrical circuits and verifying circuit theorems, RC, RL & RLC Circuits

UNIT I: BASIC COMPONENTS

Introduction, Systems of units, Charge and current, Voltage, Power and Energy, Circuit elements: Resistors, Applications. Basic Laws: Ohm's Law, Nodes, Branches and Loops, Kirchhoff's Law, Series resistors and voltage division, Parallel resistance and current division, Wye-Delta transformations, Applications. Capacitor,Serial and Parallel Capacitor. Inductor, Serial and Parallel Inductor.

UNIT II: METHODS OF ANALYSIS

Introduction, Nodal Analysis, Nodal Analysis with voltage sources, Mesh analysis, Mesh analysis with current sources, Nodal and Mesh analysis by inspection, Nodal Vs. Mesh analysis, Applications.

UNIT-III: CIRCUIT THEOREM

Introduction, Linearity property, Superposition theorem, Source transformation, Thevenin‟s theorem, Norton‟s theorem, Reciprocity theorem, Millman‟s theorem, Maximum power transfer theorem, Applications.

UNIT-IV: DC TRANSIENT ANALYSIS

Initially charged RC circuit, RL circuit with initial current, time constant, RL and RC circuits with sources, DC response of series RLC circuits (using differential equations).

UNIT-V: AC CIRCUIT ANALYSIS

Sinusoidal voltage and current, Definition of instantaneous, peak, peak to peak, root mean square and average values. Voltage-current relationship in resistor, inductor and capacitor. Phasor, complex impedance, power in AC circuits: instantaneous power, average power, reactive power, power factor. Sinusoidal circuit analysis for RL, RC and RLC circuits. Mesh analysis, node analysis and network theorems for AC circuits.

TEXT BOOKS:

- Alexander and Sadiku," Fundamentals of Electric Circuits", Tata McGraw Hill, 3rd Edition.
- Roy D.Choudhury, "Networks and Systems", New age international Publishers, 2005.

REFERENCE BOOKS:

- W.H Hayt, J.E. Kemmerly, S.M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 2005.

Course Outcomes:

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

CO – 1 Understand and apply circuit theorems, RC, RL & RLC Circuits and its real time applications.

Course prepared by : Dr. J. Vijayakumar
Course verified by : Dr. J. Vijayakumar

Title of the subject : **ELECTRO MAGNETIC THEORY** No. of Credits: **4**

Code No. : **13D** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide clear understandings on fundamentals to advanced electromagnetic theory.
- Introduce the basic mathematical operators required for higher electromagnetic theory problems solving.
- To provide the concept of charges (Static and Dynamic), current and then radiation along with the introduction to the state of the art measurement systems used.

UNIT-I: FUNDAMENTAL MATHEMATICS

Fundamental vector operations, Coordinate systems and transformation, Integrals of vector functions, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stokes's theorem, Physical Interpretation of Gradient, divergent and curl.

UNIT-II: ELECTROSTATICS

Electric charge and fields, Postulates of electrostatics, Conductor, Insulator, Triboelectricity, Electric potential, Electric flux, Electrostatic induction, dielectrics, Electric dipole moment, Polarization density, Coulomb's law, Gauss's law and applications, Electrostatic energy and forces, Poisson's and Laplace's equations, Uniqueness theorem, Electrostatic Boundary value problems.

UNIT-III: MAGNETOSTATICS

Electric Currents, current density and ohms law, Electromotive force and Kirchoffs voltage law, Equation of continuity and Kirchhoff's current law, Biot-Savart Law, Gauss and Ampere's Law, Magnetic dipole, Boundary conditions for magnetostatic fields, Magnetic energy, Energy stored in magnetic field.

UNIT-IV: ELECTROMAGNETIC FIELDS AND WAVES

Faraday's law of electromagnetic induction, Inconsistency of Amperes law, Maxwell's equations , Integral and differential forms, conduction current and displacement current, Boundary conditions for Electromagnetic fields, Helmholtz wave equation, Wave polarisation, Poynting vector and powerflow in EM field.

UNIT-V: ANTENNAS & RADIATING SYSTEMS

Radiation fundamentals, Antenna parameters, Hertz dipole, Wire antennas, Loop antennas, Introduction of Antenna arrays. Printed microstrip antennas: Basic characteristics, types and feeding methods of microstrip antennas, Introduction to Photolithography, Anechoic chamber and RF Network Analyzer.

TEXT BOOKS:

- R. K. Shevgaonkar, "Electromagnetic Waves", McGraw Hill, 2006.
- Haytt "Engineering Electromagnetics", McGraw-Hill Education
- G. S. N. Raju,"Electromagnetic Field Theory and Transmission Lines",Pearson Education.
- Elements of Electromagnetics; M. N. O. Sadiku: Oxford University Press, 2000.

REFERENCE BOOKS:

- C. A. Balanis "Antenna Theory: Analysis and Design", John Wiley, 2005,.
- D. K. Cheng, "Field and Wave Electromagnetics", Pearson, 2001.
- N. Ida, "Engineering Electromagnetics", Springer, 2000.
- J. Griffiths, "Introduction to Electrodynamics", PHI, 1999.
- B. S. Guru & H. R. Hiziroglu, "Electromagnetic Field Theory Fundamentals", Thomson, 1997.

Course Outcomes:

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

CO – 1 The basic mathematics taught will be used for deriving advanced EM filed problems. The student will get an insight in to the role of charges in the presence and absence of electric and magnetic field. By understanding the details of state of the art instruments, the enthusiastic students will be attracted towards higher studies/relevant industry.

Course prepared by : Dr. Sujith Raman
Course verified by : Dr. J. Vijayakumar

Title of the subject : **ANALOG AND DIGITAL ELECTRONICS LAB**

No. of Credits: **3**

Code No. : **13P** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide the basic knowledge of semiconductor device based on experimentation
- Learn the characteristics of basic electronic devices such as Diode, BJT, FET, SCR
- Learn the functionality of combinational and sequential circuits

LIST OF EXPERIMENTS (Any 12 experiments)

1. Rectifier circuits and Filter designing
2. IC fixed voltage regulation and its characteristics
3. Series Voltage Regulator
4. IC 723 variable voltage regulator

5. RC coupled Amplifier using BJT
6. UJT relaxation oscillator
7. Astable and Monostable Multivibrator using BJT
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. Symmetrical and Asymmetrical square wave generation using IC 555
12. DIAC and TRIAC characteristics.
13. Half adder, Full adder, Half subtractor and Full subtractor using Logic gates.
14. SR & JK flip flops using logic gates.
15. Johnson counter, Ring counter and Up/Down Counter.
16. MUX and DEMUX using NAND gate.

Course Outcomes:

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

CO – 1 Understand and analyse, the practical experience of analog and digital electronic circuits.

Course prepared by : Dr. K. G. Padmasine
Course verified by : Dr. J. Vijayakumar

Title of the subject : **CIRCUIT THEORY LAB** No. of Credits: **3**

Code No. : **13Q** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide practical experience of electrical circuits and verifying circuit theorems, RC, RL & RLC Circuits

LIST OF EXPERIMENTS (Any 12 experiments)

1. Verification of Ohm's and Kirchhoff's laws
2. Verification of Superposition Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Norton's theorem.
5. Verification of Millman's' theorem
6. Verification of Maximum power transfer theorem.
7. To plot frequency response of a series resonant circuit.

8. To plot frequency response of a parallel resonant circuit.
9. To measure input impedance and output impedance of a given two port network.
10. To design a ∏ attenuator which attenuate given signal to the desired level.
11. Three phase power measurement by two wattmeter method.
12. Calculate parameters of Two Port Network.
13. Analyse time response of R-C circuit to a step D.C. voltage input.
14. Analyse time response of R-L circuit to a step D.C. voltage input.
15. Transient analysis of RLC circuit.
16. Design low pass, High pass and band-pass filter using passive components.

Course Outcomes:

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

CO 1 - Understand and apply circuit theorems, RC, RL & RLC Circuits and concepts and its applications.

Course prepared by : Dr. J. Vijayakumar
Course verified by : Dr. J. Vijayakumar

Title of the subject : **CONTROL SYSTEMS** No. of Credits: **4**

Code No. : **23A** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Introduce the elements of control system and their modelling using various Techniques.
- Introduce methods for analysing the time response, the frequency response and the stability of systems
- Introduce the state variable analysis method.

UNIT I: SYSTEMS AND THEIR REPRESENTATION

Basic elements in control systems – Open and closed loop systems – Mathematical modelling of Physicalparameters-Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – ACand DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT II: TIME RESPONSE

Time response – Time domain specifications – Types of test input – I and II order System response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

UNIT III: FREQUENCY RESPONSE

Frequency response – Bode plot – Polar plot – Constant M an N circles – Nichols chart – Determinationof closed loop response from open loop response – Correlation between frequency domain and timedomain specifications.

UNIT IV: STABILITY OF CONTROL SYSTEM

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

UNIT V: COMPENSATOR DESIGN

Performance criteria- Frequency response- LagCompensator- lead Compensator- lag-lead Compensator– Compensator design using bode plots.

TEXT BOOKS:

- Nagrath, I.J., and Gopal, M., "Control systems Engineering", Wiley Eastern Ltd., 1992. Shanmuga Priya Publishers, 1998.
- Katsuhiko Ogata, "Modern control Engineering", Fourth Edition, Pearson Education, First Indian Reprint 2002.

REFERENCE BOOKS:

- Richard C.Dorf and Robert H.Bishop, "Modern control systems", Addison - Wesley, Eight Edition.
- A. Nagoor Kani, "Control Systems", Second Edition, RBA Publications 2009.

Course Outcomes:

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

CO 1 - Perform time domain and frequency domain analysis of control systems required for stability analysis.

CO 2 - Design the compensation technique that can be used to stabilize control systems

Course prepared by : Dr. J. Vijayakumar
Course verified by : Dr. J. Vijayakumar

Title of the subject : **ARM PROCESSOR** No. of Credits: **4**

Code No. : **23B** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide basic knowledge about the ARM Processor.
- Facilitate to write simple programs in ARM processor
- Provide the usage of peripherals in ARM processor.

UNIT I: INTRODUCTION TO ARM

Introduction to ARM7TDMI Core – Pin Diagram - Architecture – Instruction Pipeline- Memory Access and Interface - Registers – ARM State and Thumb State Register Set - Program Status Registers.

UNIT II: DATA TYPES AND SIGNALS

Program's Model – Memory Formats – Data Types — Exceptions – Interrupt Latencies – Reset – Memory Interface – Bus Cycle – Addressing Signals – Address Timing – Data Timed Signals - Power-up Mode.

UNIT III: COPROCESSOR AND DEBUGGING TECHNIQUES

Introduction – Coprocessor Interface Signals – Pipeline Signals – Interface Handshaking – Connecting Coprocessor – Undefined Instructions – Privileged Instructions - Debug Systems – Debug Interface Signals – Enabling and Disabling Embedded ICE – Communication Channels.

UNIT IV: INTRODUCTION TO LPC 2378

Introduction – Features of LPC 2378 – Block Diagram – Pin Description – Functional Description: On-chip Flash Program Memory – On-chip SRAM – Memory Map – Interrupt Controller – External Memory Controller – General Purpose DMA Controller – Fast General Purpose Parallel I/O.

UNIT V: FEATURES OF LPC 2378

Ethernet – USB Interface – CAN Controller – ADC – DAC – UART – SPI Serial I/O Controller – SSP – I^2C Bus Serial I/O Controllers – I^2S Bus Serial I/O Controllers General Purpose 32-bit Timers/Counters – PWM – Watchdog Timer – RTC.

TEXT BOOKS:

- David Seal, "ARM Architecture Reference Manual", Addison Wesley, 2nd Edition, 2000.
- Steve Furber, "ARM System On-Chip Architecture", Addison Wesley, 2nd Edition, 2000.

REFERENCE BOOKS:

- E. Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill, 5th Edition.
- V Rajaraman, "Computer Programming in C", Prentice Hall India.
- ARM Processor datasheet

Course Outcomes:

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

CO 1 - Write 'C' programs in ARM Processor.
CO 2 - Develop applications using ARM Processor.
CO 3 - Enriched skills to solve real time problems through arm Processor

Course prepared by : Dr. S. Rathinavel
Course verified by : Dr. J. Vijayakumar

Title of the subject : **INTELLIGENT INSTRUMENTATION** No. of Credits: **4**

Code No. : **23C** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide knowledge about data acquisition and control an external measuring device by interfacing to a computer
- Familiarize in signal conditioning and various processing tools.
- Become competent in designing virtual instruments for various industrial measurements and applications.

UNIT I: **INTRODUCTION**

Virtual Instrumentation- Virtual Instrument and Physical Instrument- Hardware and software in Physical Instrumentation- Virtual Instrumentation for Test, Control, and Design- Virtual Instrumentation in the Engineering Process- Graphical system design using LabVIEW, Graphical programming and Textual Programming.

UNIT II: INTRODUCTION TO LABVIEW AND LOOPS

Introduction- Advantages of LabVIEW- Software Environment – Front Panel Control and Indicators- Block diagram- Data Types- Data Flow Program- LOOPS: For Loop- While Loop- Structure Tunnels- Shift registers- Feedback Nodes- Control Timing- Communication among multiple loops- Local variables- Global variables.

UNIT III: ARRAYS AND CLUSTERS

Introduction- Arrays in LabVIEW- One Dimensional array- Two Dimensional array- Multi dimensional array- Initializing arrays- Deletion, Inserting and Replacing – Array functions- Matrix operations with array. Clusters: Introduction- creating controls, Indicators and constant,- Cluster operations- Assembling and Disassembling clusters- conversion between arrays and clusters. Waveforms - waveform chart- XY graphics.

UNIT IV: DATA ACQUISITION

Introduction- signals- signal conditioning- DAQ hardware configuration- DAQ hardware-

Analog Inputs- Analog outputs- Counters- DAQ software architecture- DAQ assistant- Selecting and configuring a data acquisition device- Components of computer based measurements system.

UNIT V: ANALYSIS TOOLS AND APPLICATIONS IN VIRTUAL INSTRUMENTATION

Fourier transform-Power spectrum-Correlation-Windowing and filtering tools Simple temperature indicator-ON/OFF controller-P-I-D controller – Oscilloscope emulation Simulation of a simple second order system

TEXT BOOKS:

- Jovitha Jerome, “Virtual Instrumentation Using LabVIEW”, Eastern Economy Edition, PHI Learning private ltd, 2010.

REFERENCE BOOKS:

- S.Gupta and J.P.Gupta, "PC Interfacing for Data Acquisition and Process Control" Instrument society of America, 1994.
- Peter W. Gofton, "Understanding Serial Communications" Sybex International.
- Robert H.Bishop, "Learning with LabVIEW" Prentice Hall, 2003.

Course Outcomes:

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

CO 1 - Design interfacing circuits to acquire real time data and process it using software.
CO 2 - Develop intelligent instrumentation systems for industrial and biomedical applications.
CO 3 - Use communication protocols for data transmission.

Course prepared by : Dr. S. Muruganand
Course verified by : Dr. J. Vijayakumar

Title of the subject : **MEDICAL ELECTRONICS & INSTRUMENTATION**

No. of Credits: **4**

Code No. : **23D** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Make students understand various physiological signal measurements, Identification and classification.
- Make students understand various Biomedical Instruments used for Bio-potential measurement and non-electrical parameter measurement.
- Make students familiarized with the medical imaging and understanding the concept of assisting and therapeutic devices.

UNIT I: BASIC CONCEPTS OF MEDICAL INSTRUMENTATION

Terminology of medicine and medical devices – Generalized medical Instrumentation systems – Classification of Biomedical instruments – Medical measurement constraints – Interfering and modifying inputs – Compensation Techniques – Bio-statics – Design criteria – Transducers Selection criteria – The origin of Bio-potentials – Electrical activity of excitable cells – Volume conductor fields – Bio-potential Electrodes: The electrode-Electrolyte interface, Polarization: Polarizable and non-polarizable electrodes, Electrode behavior and circuit models, Electrode arrays, Surface and Microelectrodes.

UNIT II: ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS

Types and Classification of biological signals – Electrical parameters acquisition: Origin, recording schemes and analysis of biomedical signals – ECG, EEG, EMG, ERG – Lead systems and recording methods – Typical waveforms – Noise and artifacts – Electrical safety in medical environment: Physiological Effect of Electrical Current, shock hazards – leakage current – Instruments for checking safety parameters of biomedical equipment.

UNIT III: NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES

Measurement of blood pressure – Cardiac output – Blood flow – Heart rate – Heart sound –

Pulmonary function measurements – Spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analyzers, pH of blood – Measurement of blood pCO2, pO2, finger-tip oximeter – ESR, GSR measurements.

UNIT IV: MEDICAL IMAGING SYSTEMS

X-ray machine- Computer radiography – Computer tomography – Magnetic resonance imaging – Nuclear medicine – Single photo emission computer tomography – Positron emission tomography – Ultrasonography – Endoscopy – Thermal Imaging.

UNIT V: LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialyzers – Lithotripsy – Therapeutic and Prosthetic Devices – Infant Incubators – Drug Delivery Devices – Surgical Instruments.

TEXT BOOKS:

- John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, 4th Edition New York, 2009.
- Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.

REFERENCE BOOKS:

- Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, 3rd Edition, New Delhi, 2014.
- Ed. Joseph D. Bronzino, "The Biomedical Engineering Hand Book", 2nd Edition, Boca Raton, CRC Press LLC, 2000.
- Joseph J. Carr and John M. Brown," Introduction to Biomedical Equipment Technology", John Wiley and sons, 4th Edition, New York, 2000.
- Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., "Health Care Systems, Technology and Techniques", Springer, 1st Edition, 2011.
- Duane Knudson," Fundamentals of Biomechanics", Springer, 2003.

Course Outcomes:

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

CO 1 - Understand the operation of different medical devices.
CO 2 - Measure and analyze the Biological signals.
CO 3 - Apply these instruments in diagnosis, therapeutic treatment and imaging fields.

Course prepared by : Dr. S. Muruganand
Course verified by : Dr. J. Vijayakumar

Title of the subject	: **EMBEDDED SYSTEMS LAB**	No. of Credits: **3**
Code No.	: **23P**	No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Write simple programs in PIC microcontroller and ARM Processor.
- Understand the functions of peripherals in PIC microcontroller
- Solve the real world problems through embedded System.

LIST OF EXPERIMENTS (Any 12 experiments)

PIC 16F87X BASED EMBEDDED SYSTEMS & RTOS

1. Arithmetic and logical operation
2. Single digit timer using seven segment displays.
3. DAC interface.
4. ADC INTERFACE.
5. LCD interface.
6. Stepper motor control.
7. Serial communication using RS232C.
8. PWM

ARM BASED EMBEDDED SYSTEMS

1. 8 Bit Digital output (LED interfacing).
2. 4X4 matrix Keypad interfacing
3. 128X64 pixels Graphics LCD interface
4. CAN interface

PSoC BASED EMBEDDED SYSTEMS

1. LED interfacing and Switch
2. Keypad interfacing
3. LCD interface
4. ADC interface

Course Outcomes:

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

CO 1 - Write programs in both PIC microcontroller and ARM processor.
CO 2 - Capable to solve real world problems through embedded system.
CO 3 - Enriched knowledge over the functions of peripherals in PIC microcontroller.

Course prepared by : Dr. S. Rathinavel
Course verified by : Dr. J. Vijayakumar

Title of the subject : **INTELLIGENT INSTRUMENTATION & MEDICAL ELECTRONICS LAB** No. of Credits: **3**
Code No. : **23Q** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide knowledge about data acquisition and control an external measuring device by interfacing to a computer
- Familiarize in signal conditioning and various processing tools.
- Become competent in designing virtual instruments for various industrial measurements and applications.

LIST OF EXPERIMENTS (Any 12 experiments)

INTELLIGENT INSTRUMENTATION LAB: (USING Lab VIEW)

1. Converting VI in to Sub VI
2. ADC using DAQ Interface
3. DAC using DAQ Interface
4. Temperature control using WSN
5. Implementation of Digital filters using LabVIEW DSP Module
6. ADC and LCD interface using LabVIEW ARM Module
7. Tank level monitoring system using DAQ Interface
8. Traffic light control using DAQ Interface

MEDICAL ELECTRONICS

9. Hand Grip heart rate monitor.
10. Characteristics of O_2 gas sensor.
11. Measuring blood pressure using Sphygmomanometer and give the tabular column for various stages.
12. Plethysmograph and to measure the heart rate.
13. Spiro meter used to perform an air flow and lung volume.
14. Hand Dynamometer.
15. pH meter
16. Observe the output wave form of heart rate monitoring using pulse oximeter in DSO

Course Outcomes:

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

CO 1 - Identify salient traits of a virtual instrument and incorporate these traits in projects.

CO 2 - Experiment, analyze and document in the laboratory prototype measurement systems using a computer, plug-in DAQ interfaces and bench level instruments.

Course prepared by : Dr. S. Muruganand

Course verified by : Dr. J. Vijayakumar

Title of the subject : **PROCESS CONTROL** No. of Credits: **4**

Code No. : **33A** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Introduce dynamics of various processes
- Educate on the effect of various control actions
- Impart knowledge on the final control elements
- Introduce the evaluation criteria and tuning techniques of controllers
- Introduce the concept of multi loop control techniques

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:

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

REFERENCE BOOKS:

- Bela G. Liptak “Process Control”, butterworth – Heinemann
- Frank D. Petruzella, “Programmable Logic Controllers”, Third Edition, Tata McGraw Hill Education Private Limited, 2010.
- Michael P.Lukas, “Distributed Control Systems”, Van Nostrand Reinfold Company,1995

Course Outcomes:

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

CO 1 - Understand and analyze of process control techniques.

Course prepared by : Dr. K. G. Padmasine
Course verified by : Dr. J. Vijayakumar

Title of the subject : **DIGITAL SIGNAL PROCESSING** No. of Credits: **4**

Code No. : **33B** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Introduce the basic properties of signal & systems and the various methods of classification
- Make the students to design Digital Filters, based on the Filter specifications.
- Provide the exposure to the architectures of DSP processors.

UNIT I: INTRODUCTION

Continuous Time (CT) and Discrete Time (DT) signals – classification of CT and DT signals – Basic CT and DT signals – Signal Operations – Representation of signals by impulses- Linear Time Invariant(LTI) system.

UNIT II: SAMPLING AND TRANSFORMS

Sampling: Introduction – sampling theorem –reconstruction of a signal from its samples using interpolation – Aliasing – DT processing of a CT signal – sampling of DT signals Laplace Transform: Introduction – Laplace transform – region of convergence for LT – Inverse Laplace Transform – properties of Laplace transform.

Z-TRANSFORM: Definition of the z-Transform – z-Transform and ROC - Stability and ROC – Properties of Region of Convergence – Properties of the z-Transform- Relationship between the Fourier Transform and the z-Transform – Relationship between s-plane and z-plane – Inverse zTransform.

UNIT III: 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. 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 IV: DESIGN OF DIGITAL FILTERS

Block diagram representation - Equivalent structures - Basic FIR Digital filter structures- Basic IIR digital filter structures- Amplitude and phase response of fir filters – linear phase filters –windowing techniques for design of linear phase FIR filters – rectangular, Hamming – Frequency sampling techniques – IIR Filters – magnitude response – Phase response – group delay – Design of Low Pass Butterworth filters(low pass)- Bilinear transform – Prewarping. Impulse invariant transformation.

UNIT V: DIGITAL SIGNAL PROCESSORS

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

TEXT BOOKS:

- J.G.Proakis and D.G.Manollakis, "Digital Signal Processing Principles Algorithms and Applications" Pearson education, New Delhi 2003/PHI.
- S.K.Mitra, "Digital Signal Processing – A Computer Based Approach" Tata McGraw Hill, New Delhi, 2001.
- Alen V Oppenheim Alen S. Wilsky and Hamid Nawab S "Signals and Systems", second Edition, PHI, New Delhi, 1997

REFERENCE BOOKS:

- Alan V.Oppenheim, Ronald W.Schafer and John R.Buck,"Discrete-Time Signal Processing" Pearson Education, New Delhi, 2003.
- B.Venkataramani, M.Baskar,"Digital Signal Processors, Architecture, Programming and Applications"TataMcGraw Hill, New Delhi, 2003.
- S.Salivahanan, A.Vallavaraj, C.Gnanapriya, Digital Signal Processing"Tata McGraw Hill, New Delhi, 2003.
- J.R.Jhonson, Introduction to Digital Signal Processing Prentice Hall of India, 1989.

Course Outcomes:

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

CO 1 - Analyze the basic properties of signals & systems
CO 2 - Analyze digital Filters and understand the Filter specifications
CO 3 - Understand the architectures of DSP processors

Course prepared by : Dr. J. Vijayakumar
Course verified by : Dr. J. Vijayakumar

Title of the subject : **VLSI SYSTEM DESIGN** No. of Credits: **4**

Code No. : **33C** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Give an insight to the students about the significance of CMOS technology and fabrication process.
- Teach the basic VLSI design techniques, Logic synthesis and simulation of digital system with VHDL and Verilog HDL
- Teach the importance and architectural features of programmable logic devices.
- Introduce the ASIC construction and FPGA design algorithms
- Make the students to know the salient features of low power VLSI design and computational aspects.
- Involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT I: INTRODUCTION TO VLSI DESIGN

Introduction to VLSI Systems -CMOS logic, fabrication and layout -MOS Transistor theory -Layout Design Rules -Circuit characterization and performance estimation -Circuit Simulation - Combinational and sequential circuit design -Memory system design -Design methodology and tools.

UNIT II: VHDL & VERILOG

VHDL: VHDL History, Existing Languages, VHDL Requirements, The VHDL Language. -Elements of VHDL, Top down Design, Top down Design with VHDL, Subprograms, Controller Description, VHDL Operators, Conventions and Syntax.

Verilog: Overview of Digital design with Verilog HDL, Hierarchical modelling concepts, basic concepts, modules & ports, Realization of Combinational and sequential circuits, RTL coding guidelines, Coding organization and writing a test bench.

UNIT III: PROGRAMABLE LOGIC DEVICES

Programming Techniques-Anti fuse-SRAM-EPROM and EEPROM technology –Re-Programmable Devices Architecture- Logical blocks, I/O blocks, Interconnects, Xilinx- XC9500, Cool Runner - XC5200, SPARTAN, Virtex - Altera MAX 7000-Flex 10K-Cyclone, Stratix.

UNIT IV: ASIC DESIGN AND FPGA

Introduction to ASICS, CMOS Logic and ASIC Library Design Types of ASICs - Design flow - CMOS transistors CMOS Design rules - Combinational Logic Cell – Sequential logic cell - Data path logic cell.

ASIC Construction, Floor Planning, Placement and Routing System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow - global routing - detailed routing - special routing - circuit extraction - DRC. • Design using Xilinx family FPGA

UNIT V: LOW POWER VLSI DESIGN

LOW POWER DESIGN: Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre computation logic.

COMPUTATIONAL ASPECTS OF VLSI ANALYSIS AND DESIGN OF ALGORITHMS: Abstract Data Types - Time and Space Analysis of Algorithms - Big Oh and Theta Notations - Average, best and worst case analysis - Simple recurrence relations and use in algorithms – Mappings. Algorithms Analysis - Sorting - Searching - Design Techniques- Greedy Methods - Dynamic Programming - Divide and Conquer - Back Tracking –Applications.

TEXT BOOKS:

- The textbook for the course is Weste & Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3rd ed, Addison Wesley, 2005.
- M.J.S .Smith, - " Application - Specific Integrated Circuits " - Addison -Wesley Longman Inc., 1997
- Skahill, Kevin," VHDL for Programmable Logic", Addison-Wesley, 1996
- John F. Wakherly, " Digital Design: Principles and Practices", 2nd Edn 1994, Prentice Hall International Edn
- Charles W. Mckay, "Digital Circuits a proportion for microprocessors", Prentice Hall

REFERENCE BOOKS:

- Principles of CMOS VLSI design by N H E Weste & K Eshraghian
- Modern VLSI Design: System on Silicon by Wayne Wolf

- Gary K. Yeap, Farid N. Najm, "Low power VLSI design and technology", World Scientific Publishing Ltd., 1996.
- Dimitrios Soudris, Christian Piguet, Costas Goutis," Designing CMOS circuits for low power",Kluwer Academic Publishers,2002
- Christian Piguet, "Low-power CMOS circuits: technology, logic design and CAD tools", CRC Press, Taylor & Francis Group, 2006.
- Digital Design, 3rd edition by M. Morris Mano.
- Alfred .V. Aho, John .E. Hop croft, Jeffrey .D. Ullman, "Data Structures and Algorithms", Addison-Wesley Publications.,1985.
- Jeffrey D. Ullman, "Computational aspects of VLSI", Computer Science Press (1984).

Course Outcomes:

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

CO 1 - The learning process delivers insight into developing design logic/arithmetic functionalities of various embedded & computational arithmetic/logic functionalities evolvable in processors with improved design strategies.

CO 2 - Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.

Course prepared by : Dr. Azha. Periasamy
Course verified by : Dr. J. Vijayakumar

Title of the subject : **DIGITAL SIGNAL PROCESSING LAB** No. of Credits: **3**

Code No. : **33P** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide practical experience of Linear Convolution, Circular Convolution, FIR filter, IIR filter methods and DSP processor

LIST OF EXPERIMENTS (Any 12 experiments)

USING TMS320C5X/TMS320C54XX/TMS320C67XX (Any 6 Experiments)

1. Arithmetic operations.
2. Waveform generation.
3. Study of Sampling and effect of under sampling
4. DFT computations.
5. FFT Computations.
6. Convolution of two discrete signals.
7. FIR Filter design
8. IIR filter design

SIMULATION USING MATLAB (Any 6 Experiments)

1. Generation of signals andImpulse, Step, Exponential & Ramp functions.

2. DFT computations.
3. FFT Computations.
4. Design of FIR filter.
5. Design of IIR filter.
6. Image Segmentation.
7. Study of various noises and filtering
8. Convolution of two Sequences.

Course Outcomes:

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

CO 1 - Carry out simulation of Linear Convolution, Circular Convolution, FIR filter, IIR filter methods

CO 2 - Understand and implement DSP processor for various applications

Course prepared by : Dr. J. Vijayakumar
Course verified by : Dr. J. Vijayakumar

Title of the subject : **VLSI LAB** No. of Credits: **3**

Code No. : **33Q** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Introduce the relevance of this course to the existing technology through demonstrations,
- case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- Learn the Hardware Description Language (Verilog/VHDL)
- Learn the fundamental principles of VLSI circuit design in digital and analog domain
- Familiarize fusing of logical modules on FPGAs
- Provide hands on design experience with hardware/software based embedded system**.**

LIST OF EXPERIMENTS (Any 12 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.

Course Outcomes:

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

CO 1 - Write HDL code for basic as well as advanced digital integrated circuits.
CO 2 - Import the logic modules into FPGA Boards.
CO 3 - Synthesis, Place and Route the digital IPs.

Course prepared by : Dr. Azha. Periasamy
Course verified by : Dr. J. Vijayakumar

Title of the subject	: **PLC AND ITS APPLICATIONS**	No. of Credits: **4**
Code No.	: **43A**	No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide theoretical knowledge of PLC and SCADA
- Train the students to create ladder diagrams from PLC, SCADA functions and Data Handling Functions.
- Train the students to create PLC and SCADA systems in their applications to various industries.

UNIT I: BASIC PLC PROGRAMMING

General PLC programming procedures - Programming on/off inputs and outputs: Relation of digital gate logic to contact/ coil logic - Creating ladder diagrams from process control descriptions - Logic gates. PLC Register Basics.

UNITII: BASIC PLC FUNCITON AND INTERMEDIATE FUNCTION

Programming Timers - On Delay Timer Instruction - Off Delay Timer Instruction. Programming Counters - Up Counter - Down Counter. Math Instruction - Addition - Subtraction - Multiplication - Division. Number comparison functions - Numbering systems and PLC number conversion functions.

UNIT III: DATA HANDLING FUNCITONS AND PLC FUNCTIONS WORKING WITH BITS

The PLC SKIP and MASTER CONTROL RELAY functions - JUMP Functions - Data Move Systems - Other PLC Data Handling Functions - Digital Bit Functions and Applications - Sequencer functions - Controlling Robot with a PLC - Matrix functions.

UNIT IV: PLC INSTALLATION PRACTICES, EDITING AND TROUBLESHOOTING

PLC Enclosures - Electrical Noise - Leaky Inputs and Outputs - Grounding - Voltage Variations and Surges - Program Editing - Programming and Monitoring - Preventive Maintenance - Troubleshooting - Connecting your Personal Computer and Your Programmable Logic Controller.

UNIT V: INTRODUCTION TO SCADA

SCADA definitions, SCADA Functional requirements and components, SCADA Hierarchical concept, SCADA architecture, General features, SCADA Applications, Benefits. Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED). Introduction - Communication Network, SCADA Server, SCADA Control systems and Control panels. Introduction to DCS - Difference between DCS and SCADA.

TEXT BOOKS:

- John W. Webb &Ronald A., Reis, "Programmable Logic Controllers Principles and Applications", Fifth Edition, Prentice Hall Publication, New Delhi, 2002.
- Frank D. Petruzella, "Programmable Logic Controllers", Third Edition, Tata McGraw Hill Education Private Limited, 2010.
- Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications,USA,2004.
- David Bailey, Edwin Wright, Practical SCADA for industry, Newnes, 2003

REFERENCE BOOKS:

- W.Bolton, "Programmable Logic Controllers", Fifth Edition, Elsevier Publication.
- John R. Hackworth, Frederick D. Hackworth, "Programmable Logic Controllers Programming Methods and Applications", Pearson Publication.
- Michael P.Lukas, "Distributed Control Systems", Van Nostrand Reinfold Company,1995
- Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK,2004.

Course Outcomes:

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

CO 1 - Understand and create ladder diagrams from PLC and SCADA functions.

CO 2 - Understand, analyze and apply PLC and SCADA systems in their applications to various industries.

Course prepared by : Dr. Azha. Periasamy

Course verified by : Dr. J. Vijayakumar

Title of the subject : **PLC, SCADA & INSTRUMENTATION LAB** No. of Credits: **3**

Code No. : No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide practical knowledge of PLC and SCADA
- Train the students to create ladder diagrams from PLC, SCADA functions and Data Handling Functions
- Train the students to create PLC and SCADA systems in their applications to various industries.

LIST OF EXPERIMENTS (Any 12 experiments)

1. Study of Displacement measurement using LVDT
2. Study of Instrumentation amplifier
3. Study of P.I.D Controller.
4. Study of Flow measurement
5. Study of Thermocouple characteristics
6. Study of Strain measurement using strain gauge
7. Develop the Ladder diagram for the Arithmetic and Logic Gates.
8. Develop and test the control circuit for dynamic braking of DC motor using ladder programming (Timer and UP/Down Counter).
9. Develop and test the control circuit for Conveyor using ladder programming.
10. Develop the control circuit for automatic tank filling using ladder programming with SCADA.
11. Develop the control circuit for automatic Traffic Light using ladder programming with SCADA.
12. Monitoring of industrial drive through SCADA system.
13. Interfacing of PLC with SCADA system.
14. Develop the control circuit for automatic Vehicle parking using ladder programming with SCADA.
15. Develop the control circuit for automatic tank filling using SCADA.
16. Develop the control circuit for automatic Traffic Light using SCADA.

Course Outcomes:

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

CO 1 - Understand and create ladder diagrams from PLC and SCADA functions.

CO 2 - Understand, analyze and apply PLC and SCADA systems in their applications to various industries.

Course prepared by : Dr. Azha. Periasamy

Course verified by : Dr. J. Vijayakumar

Title of the subject : **ELECTRONIC TEST INSTRUMENTS** No. of Credits: **4**

Code No. : **1EA** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide the basics of analog meters & signal sources
- Provide the basics of display and recording devices.
- Provide the basic measurement of oscilloscopes.

UNIT I: ANALOG METERS

D.C,A.C voltmeters, ammeters, multimeter, power meter, Q-meter, true RMS meter, vector impedance meter, vector voltmeter, component measuring instrument.

UNIT II: SIGNAL SOURCES

Sine wave generator-Frequency synthesized sine wave generator-Sweep frequency generator, pulse and square wave generator-Function generator-Wave analyzer-ApplicationsHarmonic distortion analyzer-Spectrum analyzer-Applications-Audio Frequency generatorNoise generator.

UNIT III: OSCILLOSCOPES

General purpose oscilloscope-CRO- Logic analyzer, its architecture & operation and Use of logic analyzer, Spectrum analyzer Network analyzer, Oscilloscope , DSO trigger modes Examples using MSO Use & limitations of different types of analysis.

UNIT IV: DIGITAL INSTRUMENTS

Digital method for measuring frequency, period, phase difference, pulse width, time interval, total count-Digital voltmeter-Types-Automatic polarity indication, automatic ranging, and auto zeroing-DMM-Microprocessor based DMM-DPM-swept – spectrum analyzer-network analyzer-discharge analyzer- logic probes-logic analyzer.

UNIT V: DISPLAY AND RECORDING DEVICES

Bar graph display-Segmental and dot matrix display-X-Y recorders, magnetic tape recorders-Digital recording-Data loggers-Interference and screening-Electrostatic and electromagnetic interference & earth loops.

TEXT BOOKS:

- Albert D. Herlfrick& William D. Cooper, "Modern electronic Instrumentation & Measurement Techniques", Prentice Hall of India,2002 .
- A.J.Bouwens,"Digital Instrumentation", Tata McGrawHill, 1997.
- Robert A.Witte, "Electronic Test Instruments, Theory and applications" Prentice Hall, 1993.

REFERENCE BOOKS:

- B.M.Oliver and J.M.Cage, "Electronic Measurements & Instrumentation" McGraw Hill International Edition, 1975.

- Joseph, J.Carr, "Elements of Electronic Instrumentation & Measurements" III edition, Pearson Education,2003.

Course Outcomes:

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

CO 1 - Familiar with the basics of analog meters, signal sources & display and recording devices.
CO 2 - Familiar with the measurement of oscilloscopes.

Course prepared by : Dr. S. Rathinavel
Course verified by : Dr. J. Vijayakumar

Title of the subject : **EMBEDDED SYSTEMS** No. of Credits: **4**

Code No. : **1EA** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide the basics of embedded system.
- Study the architecture of PIC microcontroller.
- Familiarize in PIC programming.

UNIT I: INTRODUCTION TO C PROGRAMMING

Structure of C programming - Various data types, C Tokens, Keywords and Identifier, Constants, Variables, Data types, Variable declarations. C-Operators: Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, special operators, arithmetic expressions, evaluation of expressions, precedence of arithmetic operators.

UNIT II: DECISION MAKING, BRANCHING AND LOOPING

Decision making - IF statement, Switch statement, Conditional operator. Go to statement. Looping: While loop, Do-While, and For Loops - Nesting of loops - skipping of loops (break and continue).

UNIT III: INTRODUCTION TO EMBEDDED SYSTEMS

Embedded Systems –processors embedded into a system, embedded hardware units and devices in system, embedded software in a system – Embedded System on chip – Design process in embedded systems – Examples of embedded system.

UNIT IV: PIC PROGRAMMING

PIC 16F877 – Features – Device overview and Architecture – WREG register – File Registers – access bank – Status Register – Data types and directives – I/O Ports.Introduction to PIC assembly programming – Assembling and linking – Program counter and program ROM space – RISC architecture –Instruction set

UNIT V: PIC PERIPHERALS

Timers – Capture/ Compare/PWM Module - MSSP: SPI – I^2C – USART - Analog to Digital Converter Module – CPU Special features – Interrupts – WDT.LCD and Keyboard interfacing – ADC, DAC, Stepper motor and 7 Segment display interfacing

TEXT BOOKS:

- Yashavant P. Kanetkar, "Let Us C", BPB publications, 5^{th} Edition.

- Brian W. Kernighan & Dennis M. Ritchie, "The C Programming Language", Prentice Hall, 2nd Edition.
- Raj Kamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw Hill publishing – 2nd Edition.
- Muhammed Ali Mazidi, "PIC microcontroller and Embedded Systems Using assembly and C for PIC 18", Pearson Education

REFERENCE BOOKS:

- E. Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill, 5th Edition.
- V Rajaraman, "Computer Programming in C", Prentice Hall India.
- PIC16F87X datasheet
- John B Peatman, "Design with PIC microcontrollers", Pearson Education

Course Outcomes:

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

CO 1 – Write Programs in both assembly and 'C' programming Language.
CO 2 – Solve real world problems through PIC microcontroller.
CO 3 – Enriched skills in embedded systems.

Course prepared by : Dr. S. Rathinavel
Course verified by : Dr. J. Vijayakumar

Title of the subject : **ANALYTICAL INSTRUMENTATION** No. of Credits: **4**

Code No. : **1EA** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide a various techniques and methods of analysis which occur in the various regions of the spectrum.
- Study important methods of analysis of industrial gases.
- Provide the important radio chemical methods of analysis.

UNIT I: COLORIMETRY AND SPECTROPHOTOMETRY

Special methods of analysis- Beer-Lambert law-colorimeters-UV-ViS spectrophotometers-Single and double beam instruments-Sources and detectors-IR Spectrophotometers-Types-Attenuated total reflectance flame photometers- Atomic absorption spectrophotometers-sources and detectors-FTIR spectrophotometers-Flame emission photometers.

UNIT II: CHROMOTOGRAPHY

Different techniques - Gas chromatography – Detectors - Liquid chromatographs – Applications - High pressure liquid chromatographs - Applications.

UNIT III: INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS

Types of gas analyzers-Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation-dust and smoke measurements.

UNIT IV: pH METERS AND DISSOLVE COMPONENT ANALYZERS

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer-sodium analyzer-silicon analyzer.

UNIT V: RADIO CHEMICAL AND MAGNETIC RESONANCE TECHNIQUES

Nuclear radiationsDetectors-GM Counter-Proportional counter-Solid state detector-Gamma cameras-X-ray spectroscopy-Detectors-Diffract meters-Absorption meters-Detectors NMR-Basic principles-NMR spectrometer-Applications. Mass spectrometers-Different types-Applications.

TEXT BOOKS:

- R.S. Khandpur, "Handbook of Analytical Instruments" Tata Mc Graw Hill publishing Co.Ltd.2003.
- H.H.Willard, L.L.Merrit, J.A.Dean, F.A.Settle, "Instrumental methods of analysis" CBS publishing & distribution, 1995.

REFERENCE BOOKS:

- Robert D.Braun, "Introduction to Instrumental Analysis" Mc Graw Hill, Singapore, 1987.
- G.W. Ewing, "Instrumental Methods of Analysis" Mc Graw Hill 1992.
- DA Skoog and D.M.West, "Principles of Instrumental Analysis" Harper and Row publishers, 1974.

Course Outcomes:

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

CO 1 - Understand and analyse Instrumentation systems and their applications to various industries

Course prepared by : Dr. S. Muruganand
Course verified by : Dr. J. Vijayakumar

Title of the subject : **DATA COMMUNICATION NETWORKS**

No. of Credits: **4**

Code No. : **2EB** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide a different interface buses
- Familiarize with different transmission protocols used and made to understand the concept of multiplexing

UNIT-I INTRODUCTION

Modern Instrumentation and Control Systems – Introduction to Networks –232-overview - EIA-485-overview – current loop & EIA converters GPIB, interface buses:USB, PCMCIA, VXI, SCXI and PXI: Networking Basics for industrial automation instrumentation Bus – MOD BUS, HART, RS 422, IEC/ISA Field Bus.

UNIT-II : TRANSMISSION

D/D conversion: Line coding, A/D conversion, PCM, Delta modulation, Parallel and serial transmission. D/A conversion: ASK, FSK, PSK, DPSK and QPSK. MODEM.

UNIT-III: MULTIPLEXING

FDM, WDM and TDM. Multiple accesses: CSMA/CD, Polling and token passing. Channelization: FDMA, TDMA and CDMA. LAN, WAN and MAN

UNIT-IV: INTERNET AND WIRELESS DATA NETWORK

TCP/IP standards, IPv4, IPv6, Worldwide web. Wireless LAN, IEEE standards: 802.11a/b/g/n, ZigBee and Bluetooth.

UNIT-V: DEVICENET

Overview – layers. Profibus -overview-protocol stack. HART protocol – overview-layers. Foundation field bus- layers – Error Detection and Diagnostics. Local interconnect networks, Redundancy Overview – Actuator- sensor Interface- CAN bus – overview-layers. Device Net and SDS (Smart Distributed Systems)-Physical Layer and Wiring Rules- The Data link Layer- The Application Layer.

TEXT BOOKS:

- Behrouz A. Forouzan, “Data Communications and Networking”, 4th Edition, Tata McGraw-Hill, Delhi, 2006
- John Park, Steve Mackey and Edwin Wright, “Data Communications for Instrumentation and Control”, Elsevier, 2003
- Steve Mackay, Edwin Wright and Deon Reynders, “Practical Industrial data networks: Design, Installation and troubleshooting”, Elsevier international projects ltd., 2004

REFERENCE BOOKS:

- William Buchanan, “Computer Buses-Design and Application”, CRC Press, 2000
- Theodore S Rappaport, “Wireless Communications: Prentice and Practice”, Prentice Hall PTR, second edition, 2002.
- Perry Marshall and John Rinaldi, ”Industrial Ethernet”, The Instrumentation, Systems and Automation Society, 2005
- Richard Zurawski ,”Industrial Communications Technology Handbook”, CRC Press, 2005

Course Outcomes:

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

CO 1 - Understand different transmission protocols and interface buses used.
CO 2 - Get a concept of multiplexing, TCP/IP standards and IEEE standards.

Course prepared by : Dr. Sujith Raman
Course verified by : Dr. J. Vijayakumar

Title of the subject : **COMPUTER AIDED INSTRUMENTATION**

No. of Credits: **4**

Code No. : **2EB** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Get familiarise with various data transmission and computer aided tools that can be implemented in various industrial applications
- Develop a thorough understanding of the common instrument interface, Different transmission protocols and ethernet.

UNIT – I: DATA ACQUISITION SYSTEMS AND DIGITAL SIGNAL TRANSMISSION

General Configuration – single and multichannel DAS – A/D and D/A converters – Digital data Acquisition Systems – Sample and Hold Circuit – Anti-aliasing filter –Introduction to noise and ground/ shielding – Introduction to protocols and standards - Data Transmission systems – Pulse code formats – Analog and Digital modulation Techniques

UNIT – II: TELEMETRY AND INDUSTRIAL ETHERNET

Telemetry systems – RF network analyzer – Higher frequency signal sources – Introduction to wireless communication - Introduction-IEEE standards – Ethernet MAC layer – IEEE 802.2 and Ethernet SNAP – OSI and IEEE 802.3 standard. Ethernet transceivers, Ethernet types, switches & switching hubs, 10 Mbps Ethernet, 100 Mbps Ethernet, Gigabit Ethernet. TCP/IP overview-Internet layer protocols – Host-to-Host layer.

UNIT – III: COMMON INSTRUMENT INTERFACES

Current loop, RS 232c/RS485, GPIB, interface buses: USB, PCMCIA, VXI, SCXI and PXI: Networking Basics for industrial automation instrumentation Bus – HART, RS 422, IEC/ISA Field Bus, ZigBee and Bluetooth - Open System interconnection (OSI) model – MOD BUS

UNIT – IV: DEVICENET

Overview – layers. Profibus-overview-protocol stack. HART protocol – overviewlayers. Foundation field bus-layers – Error Detection and Diagnostics. Local interconnect networks, Redundancy Overview – Actuator- sensor Interface- CAN bus – overview-layers. Device Net and SDS(Smart Distributed Systems)-Physical Layer and Wiring Rules- The Data link Layer- The Application Layer.

UNIT – V: PC IN REAL TIME ENVIRONMENT AND PROGRAMMING

Introduction-PC system and facilities – PC BUS and signals – Interrupts – Interfacing PC to outside world – PC in real time environment - Real-Time applications of PC – PC based distributed control systems – Real time programming: Introduction – Multi-Tasking – Task Management – Inter-Task communication – RealTime operating systems versus Real-time programming languages.

TEXT BOOKS:

- John Park, Steve Mackey and Edwin Wright, “Data Communications for Instrumentation and Control”, Elsevier, 2003
- Steve Mackay, Edwin Wright and Deon Reynders, “Practical Industrial data networks: Design, Installation and troubleshooting”, Elsevier international projects ltd., 2004
- Krishna Kant, “Computer Based Industrial Control”, Prentice Hall India Ltd., 2004.

REFERENCE BOOKS:

- Bouwens, A.J., "Digital instrumentation", McGraw Hill, Reprint 2007.
- S. Gupta and J.P Gupta, "PC Interfacing for Data Acquisition and Process Control", 2nd Edition 2002.
- Doeblin, "Measurement and system, Application and Design", McGraw-Hill, 5th Edition 2003.
- John lenk, D., "Handbook of **M**icro computer based Instrumentation and control", Prentice Hall, 1984.
- M.M.S.,Anand, Electronic Instruments and Instrumentation Technology, Prentice Hall, 2004.

Course Outcomes:

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

CO 1 - Get familiarize with computer aided tools for various industrial applications, telemetry and Ethernet

CO 2 - Get familiarized with PC in real time, different common instruments interface and idea about Ethernet.

Course prepared by : Dr. Sujith Raman
Course verified by : Dr. J. Vijayakumar

Title of the subject : **MICROWAVE THEORY AND TECHNIQUES**

No. of Credits: **4**

Code No. : **2EB** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide a clear understanding about the concept of wave propagation especially in the microwave frequency range.
- Introduce students to various microwave components, devices and oscillators used in the field of microwave electronics.

UNIT I: INTRODUCTION TO MICROWAVES

History of Microwaves, Frequency spectrum, Microwave frequency bands, Applications of microwaves in different fields , Plane waves and free space propagation, TE and TM waves, TEM (Transverse electromagnetic) waves, group and phase velocities

UNIT II: MICROWAVE TRANSMISSION LINES AND ANALYSIS

Review of transmission lines, characteristic impedance-open circuit, closed circuit, quarter wavelength and half wavelength lines, Standing wave ratio, VSWR, Reflection coefficient, Impedance matching, coaxial, strip and microstrip transmission lines (introduction).

UNIT III: WAVEGUIDES AND DEVICES

Introduction to waveguides, Propagation through wave guides, Guided waves slow waves and fast waves, rectangular and circular wave guides, cut off frequency, group velocity, Waveguide Tees, Magic Tees, Rat Race, Directional couplers, Isolators, attenuators, resonator and circulators.

UNIT IV: MICROWAVE LINEAR BEAM TUBES AND CROSS FIELD DEVICES

Introduction, Microwave tubes, limitations of conventional tubes, Transit time effects, Multi cavity Klystron, re-entrant cavities, Velocity modulation and beam bunching, bunching diagrams, reflex klystron, magnetron, working of magnetron, travelling wave tubes-slow wave structures-amplification mechanism.

UNIT V: TRANSFERRED ELECTRON DEVICES AND TRANSIT TIME DEVICES

Gunn Effect and Gunn diode-modes of operation, Microwave Semiconductor devices, Tunnel diodes-negative resistance-band theory for forward and reverse biasing, Schottky diodes, Point contact diodes, Varactor diodes, IMPATTT diode-structure-negative resistance-efficiency and output power, TRAPATT diode-principle of operation and performance.

TEXT BOOKS:

1. D. M. Pozar, "Microwave Engineering" 3rd Edition, John Wiley & Sons Inc, 2004.
2. R. E. Collin, "Foundations for Microwave Engineering" 2nd Edition, Wiley-IEEE Press, 2000.
3. A. Das and S. K. Das, "Microwave Engineering", 1st Edition, Tata McGraw-Hill, 2005

REFERENCE BOOKS:

1. Samuel Y. Lio, "Microwave devices and circuits", (Prentice Hall)
2. Kennedy and Davis, "Electronic communication systems", – (Tata Mc Graw Hill)
3. P. A. Rizzi, "Microwave Engineering Passive Circuits", 1st Edition, Pearson, 1998.

Course Outcomes:

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

CO 1 - Knowledge about EM field propagation in free space and guided media will be known. Various components and devices used for microwave research and microwave generation will be known, which will be useful for the students future career. Thus the student understands the generation, transmission and modification of microwave signals.

Course prepared by : Dr. Sujith Raman
Course verified by : Dr. J. Vijayakumar

Title of the subject : **OCEAN ELECTRONICS AND MARINE INSTRUMENTATION** No. of Credits: **4**

Code No. : **3EC** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Establish underwater Electronics Support Facility
- Develop underwater components
- Develop marine sensors, underwater acoustic transducers and systems for Oceanographic applications like shallow water sub bottom profilers, sensor technologies and systems to detect and classify buried objects under sea bed and various custom based sensors.

UNIT I: OCEANOGRAPHIC INSTRUMENTS

Classification of oceanographic instruments – buoys – Temperature Measurements – Salinity, Temperature and Depth Measurements – flow measurements – Wave and Tide Parameter Measurement – Sound Velocity

UNIT II: UNDER WATER ACOUSTICS

Introduction and Fundamentals – Exploring technologies –SONAR Equations – Masking by noise and reverberation – Passive and Active SONAR – Passive detection hydrophones - Side Scanning SONAR – Multibeam SONAR – Doppler SONAR – Integrated Data
Acquisition System – Integrated Underwater Survey System - Applications

UNIT III: UNDERWATER COMMUNICATION

Introduction: Perfectly secure communication – Underwater communication channel – VLF, ELF - Underwater Optical Communication Technology.

UNIT IV: OCEAN REMOTE SENSING

Sensors for observing the ocean– Ocean properties measurable from satellite - Ocean colour remote sensing: Recovering useful information from ocean colour – Satellite sensors for ocean colour measurement.

UNIT V: OCEAN RENEWABLE ENERGY

Introduction – Wave and Tidal Current Energy –Tidal Turbine – Concept of Salinity gradient power generation and Ocean Thermal Energy Conversion.

TEXT BOOKS:

1. Baldev Raj, "Science and Technology of Ultrasonic," Narosa Publication House Ian.
2. S. Robinson, "Measuring the Oceans from Space: The principles and methods of satellite oceanography", Springer 2004 edition.
3. Marco Lanzagorta, "Underwater Communications", (Synthesis Lectures on Communications) Morgan & Claypool Publishers.
4. AlirezaKhaligh, "Energy Harvesting: Solar, Wind, and Ocean Energy Conversion Systems", (Energy, Power Electronics, and Machines), CRC Press.

REFERENCE BOOKS:

1. Robert J Urick, "Principle of underwater sound".
2. A.D. Waite, "SONNAR for practicing engineers" 3rd Edition.

Course Outcomes:

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

CO 1 - Students will understand the development of deep ocean pressure recorders for tsunami detection and data acquisition & processing unit in the surface buoy.

Course prepared by : Dr. S. Muruganand
Course verified by : Dr. J. Vijayakumar

Title of the subject : **COMMUNICATION SYSTEM AND FIBER OPTICS**

No. of Credits: 4

Code No. : **3EC** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Provide a fiber optic concept to information transmission.
- Identify the elements of an optical fiber transmission link.
- Understand optical fiber structure, wave guiding and fabrication
- Understand, compute and simulate the modes in slab waveguide, step index fiber and graded index fiber

UNIT I: LINEAR MODULATION

Basic Elements of Communication system – Need for Modulation – Linear and angle Modulation Techniques – AM – frequency spectrum – Representation of AM - Power relation – Generation of AM –DSB SC - SSB – Suppression of unwanted sideband – VSB.

UNIT II: ANGLE AND PULSE MODULATION

FM – Frequency spectrum – Pre-emphasis and De-emphasis – FM Methods: Direct method, AFC & Indirect Method – Pulse Modulation: PAM, PWM, PPM, PCM.

UNIT III:RADIO RECEIVERS AND TRANSMITTERS

AM Transmitters – classification – low level and high level –FM transmitter – Radio Receiver –TRF receiver – super heterodyne receiver –AM Receiver – envelop detector– Automatic Gain control – FM receiver – FM demodulators.

UNIT IV: OPTICAL FIBER

Structure of Fibres– Refractive index – Snell‟s Law – Total internal reflection – step Index fiber structure and types– Ray optics representation –Numerical Aperture – wave equation for step index fiber –graded index fiber structure – Fibre materials and properties. Signal degradation in optical fibers: Overview of attenuation - Attenuation units - scattering and absorption losses - core & cladding losses - Bending losses.

UNIT V: OPTICAL SOURCES

LED: LED structures, Light source materials, Quantum efficiency, Modulation Capability, Transient response, Power-Bandwidth Product.LASER Diodes: Modes and threshold conditions, resonant frequencies, structure and radiation pattern, Single mode laser, modulation of Laser Diodes, Temperature Effects.

TEXT BOOKS:

- George Kennedy & Bernard Davis, “Electronic Communication Systems”, Tata McGraw Hill – Forth Edition.
- Gerd Keiser, “Optical Fiber Communications”, McGraw Hill.

REFERENCE BOOKS:

- Simon S. Haykin, “Communication systems”, Wiley Publication.
- J M Senior, “Optical Fibre Communication”, Principles & Practice by–Prentice Hall of India.

Course Outcomes:

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

CO 1 - The student will be able to understand, compute and simulate the modes in step index fiber and graded index fiber**.**

CO 2 - The principles of operation and properties of optoelectronic components, as well as the signal guiding characteristics of glass fibers, are discussed.

Course prepared by : Dr. J. Vijayakumar
Course verified by : Dr. J. Vijayakumar

Title of the subject : **POWER PLANT INSTRUMENTATION** No. of Credits: **4**

Code No. : **3EC** No. of Teaching Hours: **4**

Course Objectives:

The student should be made to:

- Understand the various ash and fuel handling equipment's, equipment's for burning the fuel, mechanical strokes, draught, and condenser types
- Study and learn the processes and cycles followed in Thermal Power Plants and nuclear power plants and components used in the power plants.
- Gain the knowledge on steam power plants, steam generators and gas turbine power plants, their analyses on fuel and fluidized bed combustion, ash handling systems,
- Learn the practices followed in Thermal Power Plant and Nuclear Power Plants, to better environmental conditions and the safety measures.
- Gain the knowledge on Power Load calculation, distribution and optimum loading. Etc.,
- Know various methods for the Economies of Power Generation and power plant instrumentation.

UNIT I: **FUNDAMENTALS OF POWER PLANT**

Classification of Power Plant- Energy and Power- Power Distribution in India- Power generation- Power corporations- Classifications of Power Plant Cycle- Fuels and Combustion- Steam Generator- Steam Condenser- Turbines.

UNIT II: STEAM POWER PLANT

Essentials of Steam Power Plant Equipment- Coal handling- Fuel Burning Furnaces- Method of Fuel Firing- Automatic Boiler Control- Pulverized Coal- Water Walls- Ash Disposal- Smoke and Dust Removal- Dust Collectors.

UNIT III: STEAM GENERATOR

Introduction- Types of Boilers- Cochran Boiler- Lancashire Boiler- Locomotive Boiler- Industrial Boiler- Requirement of Good Boiler- High Pressure Boiler.

UNIT IV: STEAM TURBINE

Introduction- Principal and operation of steam Turbine- Classification of Steam Turbine-Simple Impulse Turbine- Compound Impulse Turbine- Pressure Compound Impulse Turbine- Impulse Reaction Turbine- Steam Turbine Governing- Steam Turbine Testing- Choice of Steam Turbine- Steam Turbine Generators- Steam Turbine Specifications.

UNIT V: NUCLEAR POWER PLANT AND POLLUTION CONTROL

Atomic Structure- Nuclear Energy Concepts and Terms- Nuclear Fusion and Fission- Nuclear Reactor- Comparison of Nuclear Power Plant and Steam Power Plant.

Pollution Control: Environmental Pollution due to Energy use, Industrial Trail Emission and Road Transport Noise Pollution and Control- Pollution due to Combustion of fuel- Air Pollution and water pollution by thermal power plants- Radiations from Nuclear Power Plant Effluents.

TEXT BOOK:

- A.K. Raja, Amit Prakash Srivastava, Manish Dwivedi " Power Plant Engineering " 2008.

REFERENCE BOOKS:

- A.B.Gill, "Power Plant Performance", Elsevier India, New Delhi , 2003.
- S.M.Elonko and A.L.Kohal, "Standard Boiler Operations", McGraw Hill, New Delhi, 1994
- Sam G. Duke Low, "The Control of Boiler", ISA Press, 1991.
- R.K.Jain, "Mechanical and Industrial Measurements", Khanna Publishers, New Delhi, 1995

Course Outcomes:

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

CO 1 - Analyze the processes and cycles followed in Thermal Power Plants and nuclear power plants and components used in the power plants and identify the losses to get better efficiency.
CO 2 - Apply the knowledge gained by analyzing the steam power plants, steam generators and gas turbine power plants, to improve the efficiency and reduce the thermal losses.
CO 3 - Apply the knowledge in calculating the Power Load Calculations and Distribution.
CO 4 - Develop the methods for the Economies of Power Generation and Power plant instrumentation.

Course prepared by : Dr. S. Rathinavel
Course verified by : Dr. J. Vijayakumar

Title of the subject : **DIGITAL ELECTRONICS AND MICROPROCESSOR**

No. of Credits: **2**

Code No. : **GS87** No. of Teaching Hours: **2**

Course Objectives:

The student should be made to:

- Expose the students to the fundamentals of Digital Electronics.
- Develop skill in simple applications development with microprocessors.
- Introduce commonly used peripheral / interfacing.

UNIT I: LOGIC GATES

Different Logic gates such as AND, OR, NOT, NAND, NOR, EXOR, Symbol and Truth Table, De Morgan‟s Theorems: Statement, verification and applications, Half-adder. Full adder, Half Subtractor and full subtractor, Shift register

UNIT II: NUMBER SYSTEMS

Introduction to Decimal, Binary, Octal, Hexadecimal Number Systems, BCD Codes, Inter conversions of Decimal, Binary, and BCD Numbers, Parity, Excess-3.

UNIT III: MICROPROCESSOR

Architecture and Programming of 8085 - functional Block diagrams, bus systems, Instruction set and addressing modes- timing diagram and assembly level programme- Interfacing RAM and ROM sections.

TEXT BOOKS:

- Ramesh Gaonkar, "Microprocessor Architecture, Programming and applications", with the 8085/8080A, 3rd Edition, Penram International Publishing house.
- Donald P. Leach, Albert Paul Malvino, "Digital Principles and Applications", 5th edition, TataMcGraw Hill Company

REFERENCE BOOK:

- Salivahanan, "Electronic Devices and Circuits", 2nd edition, Tata-McGraw Hill Company.

Course Outcomes:

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

CO 1 - Ability to understand and analyze, linear and digital electronic circuits.
CO 2 - Understand and apply computing platform and software for specific microprocessors applications.

Course prepared by : Dr. K. G. Padmasine
Course verified by : Dr. J. Vijayakumar

Title of the subject : **BIO-MEDICAL INSTRUMENTATION** No. of Credits: **2**

Code No. : **GS51** No. of Teaching Hours: **2**

Course Objectives:

The student should be made to:

- Gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters.
- Study about the various assist devices used in the hospitals.
- Gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT I: MEDICAL INSTRUMENTATION BASICS

Cells and their structure – Transport of ions through the cell membrane – Resting and action potentials Characteristics of Resting potential - Bio-electric potentials – Design of Medical Instruments – Components of the Bio-Medical Instrument System.

UNIT II: BIOPOTENTIAL RECORDERS

Electrocardiography (ECG) - Electroencephalography (EEG)–Electromyography (EMG) - Electroretinography (ERG) – Electrooculography (EOG)

UNIT III: SPECIALISED MEDICAL EQUIPMENT

Angiography – Endoscopes – Different types of endoscopes - Computer tomography – Application of Computer tomography - Ultrasonic imaging systems – Magnetic resonance imaging

TEXT BOOK:

- Arumugam M., "Bio Medical Instrumentation", Anuradha agencies Publications.

REFERENCE BOOK:

- R.S. Khandpur, "Hand book of Biomedical instrumentation", Tata mc graw hill New Delhi, 2nd edition, 2003

Course Outcomes:

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

CO 1 - Discuss the application of electronics in diagnostic and therapeutic area.
CO 2 - Measure biochemical and various physiological information.
CO 3 - Describe the working of units which will help to restore normal functioning

Course prepared by : Dr. K. G. Padmasine
Course verified by : Dr. J. Vijayakumar

Title of the subject : **ANALYTICAL INSTRUMENTATION** No. of Credits: **2**

Code No. : **GS95** No. of Teaching Hours: **2**

Course Objectives:

The student should be made to:

- Provide a various techniques and methods of analysis which occur in the various regions of the spectrum.
- To study important methods of analysis of industrial gases.
- Understand the important radio chemical methods of analysis.

UNIT I: COLORIMETRY AND SPECTROPHOTOMETRY

Electromagnetic radiation-Electromagnetic spectrum-Interaction of radiation with matter-Beer Lambert law-Absorption instruments-UV-ViS spectrophotometers- Single beam null type (Beckman model), Spectronic 21 Spectrophotometer- IR Spectrophotometers-Block diagram of double beam IR Spectrophotometer- Atomic absorption spectrophotometers-FTIR spectrophotometers-Flame photometers-Principle- Essential Parts- Block Diagram- Emission System.

UNIT II: CHROMOTOGRAPHY

Gas chromatography-Block diagram-Basic parts-Sample injection system chromatography columns-Thermal conductivity detector - Liquid chromatographs-Types of liquid chromatography- High pressure liquid chromatographs

UNIT III: pH METERS AND DISSOLVED COMPONENT ANALYZERS

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer-sodium analyzer-silicon analyzer.

TEXT BOOK:

- R.S. Khandpur, "Handbook of Analytical Instruments", Tata Mc Graw Hill publishing Co.,

REFERENCE BOOKS:

- Robert D.Braun, "Introduction to Instrumental Analysis", Mc Graw Hill, Singapore, 1987.
- G.W. Ewing, "Instrumental Methods of Analysis", Mc Graw Hill 1992.
- D.A Skoog and D.M.West, "Principles of Instrumental Analysis", Harper and Row publishers, 1974.

Course Outcomes:

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

CO 1 - Ability to understand and analyze Instrumentation systems and their applications to various industries

Course prepared by : Dr. Sujith Raman
Course verified by : Dr. J. Vijayakumar