

J.S.S Mahavidyapeetha
Sri Jayachamarajendra College of Engineering
Mysuru - 570 006

(Autonomous Institution under Visveswaraya Technological University, Belgaum)



Scheme of Teaching, Examination
And
Syllabus for B E
Instrumentation Technology
&
Electronics and Instrumentation Engineering
Department of Instrumentation Technology
May 2016

ELECTRICAL AND ELECTRONIC MEASUREMENTS

Sub code : IT310

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Basic electrical engineering.

Course Objective:

1. To introduce the students to the units and dimensions used for measurement of electrical parameters and techniques used for their measurement.
2. To introduce the students to the working of important laboratory instruments like digital meters, oscilloscopes and signal generators.

Course Outcome:

Students will be able to

1. Explain the basic concepts related to units and dimensions and also identify and classify error sources, and explain how their effects can be minimized in particular measurement situations.
2. Assess and select the suitable bridge for the measurement of electrical parameters.
3. Assess and select the suitable instrument for the measurement of current, voltage, power and related parameters.
4. Explain the concepts of analog and digital instruments used for the measurement of electrical quantity.
5. Assess and select the suitable oscilloscopes and signal generators.

Introduction: Units and Dimensions, Review of fundamental and derived units, SI units, dimensional equations. **Measurement Errors:-** Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution and Significant figures, Problems. 6 Hrs

Measurement of Resistance, Inductance, Capacitance and Q factor: Wheatstone bridge, sensitivity analysis, limitations, Kelvin double bridge, Earth resistance measurement using Megger, Anderson bridge, Maxwell bridge, DeSaughty bridge, Schering bridge, sources and detectors, shielding of bridges, Q meters. Problems. 8 Hrs

Measurement of Current & Voltage: Introduction, Multirange voltmeter, Extension of ranges by shunts & multipliers, Loading, AC voltmeter using Rectifiers – Half wave and full wave, Peak responding and True RMS voltmeters 7 Hrs

Measurement of Power and related Parameters: Wattmeter: LPF wattmeter, induction type energy meter, construction, theory, errors, adjustments and calibration, principle of electronic energy meter, construction and operation of electro-dynamometer, single phase PF meter, Weston frequency meter, phase sequence indicator, problems. 7 Hrs

Digital Meters: Introduction to Digital voltmeters (DVM), Ramp type, Integrating type, Staircase Ramp type and Successive approximation type, Resolution and sensitivity, General

specifications, Digital multimeter. 8 Hrs

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram, Vertical amplifier, Horizontal deflecting system, Dual beam and dual trace CROs, Electronic switch, Digital Storage Oscilloscopes 8 Hrs

Signal Generators: Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator 8 Hrs

TEXT BOOKS:

1. **Electronic Instrumentation**, H. S. Kalsi, Second edition, Tata McGraw Hill Publications.
2. **Electrical & Electronic Measurement and Instrumentation**, A.K.Sawhney, 10th Edition, Dhanpat Rai & sons, Delhi.

REFERENCE BOOKS:

1. **Modern electronic instrumentation and measuring Techniques**, Cooper.D and A.D.Helfrick, PHI 1998.
2. **Principles of measurement systems**, John P. Bentley, 3rd Edition, Pearson Education, 2000

TRANSDUCER AND INSTRUMENTATION I

Sub code : IT320

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisite: Basic Electronic.

Course Objectives : To gain knowledge about the measuring instruments and the methods of measurement of physical parameters.

Course Outcomes

Students will be able to

- 1 Express the importance of functional elements of an instrumentation system, the errors associated with measurement and generalized performance characteristics of instruments
2. Explain the Instruments for measurement of displacement, force and torque using various sensors and do the appropriate conversions.

3. Describe the Instruments for measurement of temperature using contact type sensors, do the appropriate conversions. and use them for physical applications.
4. Explain the measurement of temperature using Radiation methods and do the appropriate conversions.
5. Describe the Instruments for measurement of pressure and sound using various sensors and do the appropriate conversions.

Generalized configurations & functional descriptions of measuring instruments: Functional elements of an instrument, Active & Passive transducers, Analog & Digital modes of operation, Null & Deflection methods, I/O configuration of measuring instruments & instrument system- methods of correction for interfering & modifying inputs.

Generalized performance characteristics of instruments: Static characteristics: Meaning of static calibration, accuracy, precision and bias. Combination of component errors in overall system accuracy calculation. Static sensitivity, linearity, threshold, resolution, hysteresis and dead space. Scale readability, Span, generalized static stiffness & input impedance. 12 Hrs

Measurement of displacement: Principle of measurement of displacement, resistive potentiometers, Resistance strain gage, variable inductance & variable reluctance pickups, LVDT, capacitance pickup. 6 Hrs

Force, torque & shaft power Measurement: Principle of measurement of Force, Torque, Shaft power standards and calibration: basic methods of force measurement; characteristics of elastic force transducer- Bonded strain gauge, differential transformer, Piezo-electric transducer, variable reluctance/ FM- Oscillator digital systems, loading effects; torque measurement on rotating shafts, shaft power measurement (dynamometers). 6 Hrs

Contact type Temperature measurement: Standards & calibration; thermal expansion methods-bimetallic thermometers, liquid-in-glass thermometers, pressure thermometers; thermoelectric sensor (thermocouple)- common thermocouples, reference junction consideration, special materials, configuration & techniques; electrical resistance sensors- conductive sensor (resistance thermometers), bulk semiconductors sensors (thermistors), junction semiconductor sensors; digital thermometers. 8 Hrs

Non- contact type Temperature measurement: Radiation methods- radiation fundamentals, radiation detectors, automatic null balance radiation thermometers, optical pyrometers. Two color radiation thermometers, Black body-tipper fiber optic radiation thermometer. IR imaging systems, Fluoroptic temperature measurement. 8 Hrs

Pressure and Sound measurement: Standards & calibration; basic methods of pressure measurement; dead weight gauges & manometer, manometer dynamics; elastic transducers, high pressure measurement; low pressure (vacuum) measurement- McLeod gage, Knudsen gage, momentum-transfer (viscosity) gages, thermal conductivity gages, ionization gages, Sound – Level meter, microphones, acoustic intensity, acoustic emission, 12 Hrs

TEXT BOOK:

1. **Measurement Systems**, Ernest O Doebelin, VI th Edition, TMH, 2007

REFERENCE BOOKS:

1. **Instrument Engineers Hand book (Process Measurement.)**, B G Liptak, 3rd Edition, 1995, Chilton book.
2. **Instrumentation Devices and Systems**, Rangan sharma mani, TMH, second Edition.
3. **Transducers and Instrumentation**, Murty.D.V.S. second Edition, PHI, 2008.

ANALOG ELECTRONIC CIRCUITS

Sub code : IT330

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisite: Basic Electronics.

Course Objective: This course will introduce the basic concepts of electronic circuits and their analysis. By the end of the course the student will be able to model the various BJT amplifiers, FET amplifiers and also be able to analyze power amplifiers, feedback amplifiers and oscillators.

Course Outcomes

Upon completion of this course student should be able to,

1. Explain various models of BJT amplifier circuits and do their analysis.
2. Describe multistage amplifiers and frequency response of the amplifiers.
3. Design and analysis FET amplifiers.
4. Describe various power amplifiers.
5. Analyze feedback amplifiers and oscillators.

BJT Transistor Modeling: Amplification in the AC domain, transistor modeling and important parameters, the re transistor modeling, Hybrid equivalent model, variations of transistor parameters. 6 Hrs

BJT small signal analysis: CE fixed-bias configuration, voltage divider bias, CE emitter-bias configuration, Emitter follower configuration, common-base configuration, collector feedback configuration, collector DC feedback configuration, complete hybrid equivalent model. 8 Hrs

System Approach Effects of R_S and R_L : Two port systems, effect of load impedance R_L , effect of source impedance R_S , combined effect of R_S and R_L , BJT CE networks, BJT Emitter-Follower networks, BJT CB networks. 6 Hrs

Compound configuration: BJT cascade connection, cascode connection, Darlington connection, feedback pair, current source circuits, current mirror circuits. 6 Hrs

BJT Frequency Response: General frequency considerations, low frequency analysis- bode plot, low frequency response- BJT amplifier, Miller effect capacitance, High frequency response- BJT amplifier, multistage frequency effects. 6 Hrs

FET small signal analysis: FET small-signal model, Biasing of FET, common drain common gate configuration, MOSFETs, FET amplifier network. 6 Hrs

Power Amplifiers: Classification of power amplifiers, series-fed class A amplifier, transformer coupled class A amplifier, Class B power amplifier, class B amplifier circuits, Amplifier distortion, power transistor heat sinking, Class C and Class D amplifier. 7 Hrs

Feedback and Oscillator circuits: Feedback concept and types, Feedback amplifier- phase and frequency considerations, oscillator operation, Phase shift, Wien Bridge, Tuned and Crystal oscillator. 7 Hrs

TEXT BOOK:

Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, 10th Edition, Pearson.

REFERENCE BOOKS:

1. **Integrated Electronics**, Jacob Milman & Christos C. Halkias, TMH, 2009
2. **Electronic Devices and Circuits**, David A. Bell ,PHI, 5th Edition, 2004.
3. **Microelectronics Circuits, Analysis and Design**, Muhammad H Rashid, Cengage Learning, 1999.

LOGIC DESIGN

Sub code : IT340

Credit Pattern : 3:1:0

Total Hours : 39 Hrs

Contact Hours : 05/Week

13 Tutorial sessions each of 2Hrs

Pre-requisite: Basic Electronics.

Course Objective: This course will introduce the basic concepts in digital circuits and design of digital subsystems, sequential circuits its analysis and use of MSI logic circuits. By the end of the course, students will be able to design optimal logic circuits using different reduction techniques, design and analyze synchronous and asynchronous circuits and will have awareness of characteristics of different logic families.

Course Outcomes:

Students will be able to

1. Simplify the Boolean expressions and design of digital logic subsystems.
2. Design logic systems using MSI logic circuits.
3. Have knowledge of basic memory element (Flip-flop) and design of shift registers and counters.
4. Design and analyze the synchronous counters.
5. Apply the knowledge of IC technology and characteristics to analyze the digital circuits and have an awareness of concepts of PLDs and its design.

Boolean Algebra and Combinational Networks: Principal of Duality, min/max terms, Canonical formulas, Complements of equations, Universal Gates, combinational network. 3 Hrs

Simplification of Boolean Expressions: Prime Implicants, Prime Implicates, Two, Three, four variables Karnaugh Maps, Sum of Products, Product of Sums, The Quine –Mc Cluskey method, the binary method, the decimal method of obtaining prime implicants, The Variable Entered Maps. 6 Hrs

Logic Design with MSI Components and Programmable Logic Devices: Binary Adders and Subtractors, Carry Lookahead adder, Decimal adders comparators Decoders, logic design using decoders, Encoders, Multiplexers, logic design using Multiplexers, Programmable Logic Devices: PROMS, PLAs, PALs. 7 Hrs

Flip Flops and Applications: SR Flip Flop, RS Flip Flop the switch debouncer, Gated SR, Gated D Flip Flops, JK Flip Flops, Master Slave Flip Flops, Race around condition, Shift Registers, Unidirection/Bidirection Shift registers, Universal shift register, Counters, Binary ripple counters N Modulus, ring counter, Johnson counter, Synchronous Binary counters using T, SR, JK, D Flip Flops. 12 Hrs

Synchronous Sequential Networks: The Mealy model, the Moore model, The excitation and Transition equations, the excitation and transition tables, state tables, state diagrams. 7 Hrs

The Logic Families: IC terminology, logic families, TTL loading fan-out, Tristate TTL, MOSFET, MOSFET Circuits, Characteristics of MOSFET, CMOS logic, CMOS Characteristics.

4 Hrs

Text Books:

1. Digital Principles and Design, Donald D.Givone, TMH, 2002
2. Digital Systems Principles and Applications, Ronald J Tooci, PHI, 2001

Reference Books:

1. Fundamental of Logic design, Charles H Roth Jr, Thomson learning, 2004
2. Digital Logic Applications & Design, John M Yarbogh, Thomson learning, **2001**

NETWORK ANALYSIS

Sub code : IT350**Credit Pattern : 3:1:0****Total Hours : 39 Hrs****Contact Hours : 05/Week****13 Tutorial sessions each of 2Hrs****Pre-requisite: Basic Electronics, Elements of Electrical engineering.**

Course objective: To introduce the nodal and mesh analysis methods, transient and steady state analysis, analysis using Thevenin and Norton equivalent forms, resonant circuits and two port networks. By the end of the course, students will be familiar with circuit analysis methods and transient and steady behaviour of a circuit.

Course outcome

Students will be able to

1. Express various electrical circuit terminologies, analyse the given circuit applying nodal and mesh methods.
2. Perform transient and steady state analysis.
3. Express electrical circuits in their simpler Thevenin and Norton equivalent forms and to apply linearity and superposition concepts to analyze RL, RC, and RLC circuits in time and frequency domains.
4. Analyse the electrical circuits using Laplace transform
5. Express the behaviour of resonant circuits and analyze two port networks.

Basic concepts: Introduction, Network terminologies, Review of KVL & KCL, Energy sources – ideal & practical, Source Transformations, Mesh Analysis of DC & AC circuits, Circuits with independent voltage sources only Mesh analysis – circuits containing independent current sources

& dependent sources, Nodal analysis - Circuits containing independent current sources, Nodal analysis – circuits containing dependent sources, Star – Delta transformations.

10 Hrs

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorem. 6 Hrs

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions using differential equations for AC and DC excitation circuits. 8 Hrs

Resonance: Series resonance, resonant frequency, reactance curves, voltage & current variable with frequency, Selectivity & bandwidth, Q – factor, circuit magnification factor Selectivity with variable C & variable L Parallel resonance, resonant frequency, impedance, selectivity, bandwidth Maximum impedance conditions with C, L, & f variable, current & Q – factor. 6 Hrs

Circuit Analysis using Laplace Transforms: Review of Laplace transforms, Natural & Forced responses, Advantages of LT techniques, Modeling R, L, & C in s – domain, DC transients, Step response of RC, RL & RLC circuits, Circuit analysis with LT using partial fraction expansion. 5Hrs

Two Port parameters: Short – Circuit admittance parameters, Open circuit impedance parameters, Transmission parameters, Hybrid parameters, Relationships between parameters. 4 Hrs

TEXT BOOK:

1. **Network Analysis**, M.E.Van Valkenburg, 3rd edition, Pearson/ PHI, Reprint 2006

REFERENCE BOOKS:

1. **Engineering Circuit Analysis**, William H.Hayt, Jr, Jack E.Kimmerly, Steven M.Durbin, 6th edition, Tata McGraw-Hill, 2002
2. **Networks and Systems**, D. Roy Choudhury, New Age International, Reprint 2005 .
3. **Basic Engineering Circuit Analysis**, J. David Irwin, R. Mark Nelms, 8th edition, John Wiley & Sons, 2006

ANALOG ELECTRONICS LAB

Sub code : IT36L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs

Contact Hours : 03/Week

Pre-requisite: Basic Electronics.

Course objective: This course provides the skills to design and analyze different analog electronic circuits like amplifiers, oscillators and resonant circuits.

Course outcome:

Students will be able to

1. Apply fundamental knowledge of Electrical Engineering and design the various circuits.
2. Test the designed circuits and observe the outcomes.
3. Analyze and draw inference/ conclusion on the results obtained.
4. Express/demonstrate the importance and applications of various circuits.

LIST OF EXPERIMENTS:

1. Verification of KVL ,KCL,
2. Thevenins and Max power transfer theorem.
3. Design and testing of single stage RC coupled amplifier-using BJT.
4. Design and testing of Feed back amplifier-using BJT.
5. Design and testing of BJT Darlington emitter follower.
6. Hartley and colpitts oscillator.
7. Series and parallel resonance circuits
8. Crystal oscillator.
9. Relaxation oscillator.
10. SCR, Triac & Diac characteristics.
11. Controlled half wave/full wave rectifier.
12. Design and testing of IC 723 regulator.

LOGIC DESIGN LAB

Sub code : IT37L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs

Contact Hours : 03/Week

Pre-requisite: Basic Electronics.

Course objective: This course provides the skills to design different digital circuits like flip flops, counters, shift registers using universal gates and MSI chips

Course outcomes:

Upon completion of this course students will be able to

1. Apply the fundamental knowledge of Boolean algebra to realize & test various circuits using Universal gates
2. Design various circuits using LSI & MSI chips
3. Test the various circuits which have been designed & draw the inference on the result obtained
4. Demonstrate the importance & application of the circuit individually & in a team effectively.

LIST OF EXPERIMENTS:

1. Simplification and realization of Boolean expressions using universal gate. Realization of half/full adder and subtractor using logic gates .
2. Realization of parallel adder/ subtractor using 7483 IC.
3. Realization of BCD to EX 3 code conversion and vice versa.
4. Realization of Binary to gray code converter and vice versa.
5. Arithmetic circuits and code converters using MUX/DEMUX IC's
6. Realization of one/two bit comparators and study of 4 bit magnitude comparator (7485).
7. Use of decoder chip to drive LED display and Priority encoder.
8. Flip Flops using logic gates SR, T, D, JK, JK master slave.
9. Realization of 3 bit counters as sequential circuit and Mod N counter design-using 7476, 7490, 74192, 74193.
10. Study of Shift Register 7495.
11. Design of Ring and Johnson Counter.
12. Design of Sequence Counters.

TRANSDUCERS AND INSTRUMENTATION –II

Sub code : IT410

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Transducers and instrumentation-I

Course Objective: This course will introduce the principle of operation, construction and application of flow and level transducers, operation of DAC and ADC .By the end of the course, the students will be able to identify the transducer for a particular application in flow and level measurement, the role of DAC, ADC, sample and hold circuit in data acquisition and distributive system.

Course outcomes:

Students will be able to

1. Understand the working principles of different local flow velocity flow meters, its merits, demerits and application.

2. Express the importance of understanding the principle of various detectors used in gross volume flow rate measurement and level measurement.
3. Knowledge the working of each element of a data acquisition system.
4. Design and analysis of DACs. Have an awareness of the general applications of DAC's.
5. Design and analysis of ADCs, its general applications and concepts of delta-sigma converters.

Flow measurement: Local flow velocity, magnitude and direction. Flow visualization. Velocity magnitude from pitot static tube. Velocity direction from yaw tube, pivoted vane, servoed sphere, dynamic wind vector indicator. Hot wire and hot film anemometer. Hot film shock-tube velocity sensors. Laser Doppler velocimeter; gross volume flow rate; calibration and standards. Constant-area, variable-pressure-drop meters (obstruction meters). Averaging pitot tubes. Constant pressure-drop, variable area meters (rotameters), turbine meters, positive displacement meters. Metering pumps. Electromagnetic flow meters. Drag force flow meters. Ultrasonic flow meters, vortex-shedding flow meters. 16 Hrs

Level measurement: Capacitance probe; conductivity probes; diaphragm level detector, differential pressure level detector, radiation level sensors, level transmitter, ultrasonic level detector. 8 Hrs

Data acquisition systems: Introduction to data acquisition systems, Analog switches, high and low level analog multiplexers, Sample and Hold circuits and their specifications, accuracy considerations and applications. 8 Hrs

Digital to analog converters: Classification, R-2R, Weighted resistor DACs and inverted ladder DACs, Monolithic DACs, current DACs, Multiplying DACs, Discussions on DAC0800 & AD7542 Monolithic DACs, General applications of DACs. 10 Hrs

Analog to digital converters: General classification of ADCs, Counter, Successive approximation, Ramp comparison, Dual slope, Voltage to frequency, Voltage to time and Flash type ADCs, Discussions on ADC 0816 and ICL 7109 monolithic ADCs, concepts of Delta-Sigma Converters. 10 Hrs

TEXT BOOKS:

1. **Measurement Systems Application and Design**, Ernest O Doebelin, VI th Edition,2007, TMH.
2. **Instrument Engineers Hand book (Process Measurement.)**, B G Liptak, 1995, 3rd edition, Chilton book.
3. **Hand book of A/D & D/A converters**, HNATEK , John Wiley

Reference Books:

1. **Basics of Instrumentation**, NJATC , Cengage learning, 2008
2. **Principles of data conversion system design**, behzad razavi, IEEE press 1995.

BIOMEDICAL INSTRUMENTATION

Sub code : IT420

Credit Pattern : 3:0:0

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisites: Basic science, Transducers and instrumentation-I and II

Course Objectives : To gain knowledge about the Biomedical instruments for measurement of biomedical signals.

Course outcomes:

Students will be able to

1. Explain source and types of biomedical signals, Electrodes that can be used for acquisition and specific problems related to designing of biomedical devices.
2. Express the importance of the electrodes arrangements and instruments that can be used for acquisition of ECG and EEG.
3. Explain the methods used for measuring biomedical parameters like Pulse rate, Heart rate, Blood pressure and Respiration rate in Patient Monitoring System.
4. Describe the methods used for measuring blood flow and cardiac output.
5. Explain the working of life saving devices like Cardiac Pacemakers and Defibrillators

Fundamentals: Sources of biomedical signals, Basic instrumentation system, General constraints in design of biomedical instrumentation systems 3 Hrs

Bioelectric Signals and Electrodes: Origin of bioelectric signals, Types of bioelectric signals, Recording electrodes, Electrode-Tissue interface, Polarization, Skin contact impedance, Silver-silver chloride electrodes, Electrodes for ECG, EEG, EMG, Microelectrodes 5 Hrs

Electrocardiograph & Phonocardiograph: Electrical activity of the heart, Genesis & characteristics of Electrocardiogram (ECG), Block diagram description of an Electrocardiograph, ECG lead system, Multi-channel ECG machine, Phonocardiograph. 5 Hrs

Electroencephalograph: Genesis of Electroencephalogram (EEG), Block diagram description of an Electroencephalograph, 10-20 electrode system, computerized analysis of EEG. 4 Hrs

Patient Monitoring System: Bedside patient monitoring systems, Central monitors, Measurement of heart rate – Instantaneous heart rate meter (cardio tachometer), Measurement of pulse rate, Measurement of Blood pressure – Direct & Indirect method, Automatic blood pressure measuring apparatus using Korotkoff's method, Oscillometric method, Ultrasonic Doppler shift method, Measurement of Respiration rate – Impedance pneumography, CO2 method, Apnea detectors. Pulse Oximeters 10 Hrs

Blood Flow and Cardiac Output Measurement: Electromagnetic blood flow meters, Ultrasonic blood flow meters, dilution method, Dye dilution method, Thermal dilution techniques, Measurement of continuous cardiac output derived from the aortic pressure waveform, 6 Hrs

Cardiac Pacemakers and Defibrillators: Need for cardiac pacemaker, External pacemaker, Implantable pacemaker, Types of Implantable pacemakers, Programmable pacemaker, Rate-responsive pacemakers, AC & DC defibrillators. Patient Safety: Electric shock hazards, Leakage currents. 6 Hrs

TEXT BOOK:

1. **Handbook of Biomedical Instrumentation**, R. S. Khandpur, Tata McGraw-Hill Publishing Company Limited, Second Edition, 2003

REFERENCE BOOKS:

1. **Biomedical Electronics & Instrumentation**, Prof. S. K. Venkata Ram, Galgotia Publications Pvt. Ltd., 3rd Edition, 2009.
2. **Principles of applied biomedical instrumentation**, Lesely Cromwell & others, John Wiley and sons, Second Edition.
3. **Encyclopedia of medical devices and instrumentation**, J. G. Webster, John Wiley, 1999.

SIGNAL CONDITIONING CIRCUITS

Sub code : IT430

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Basic Electronics, Network Analysis

Course Objectives: This course aims to expose the students to the general analog principles and design methodologies using operational amplifiers and applications, develop signal conditioning circuits for temperature and pressure transducers and expose to principle and applications of Phase locked loops and timers.

Course Outcomes:

Students will be able to:

1. Know the characteristics and design of negative feedback amplifiers using opamp
2. Design and develop wave shaping circuits, filters, rectifiers & oscillators using opamp
3. Design positive feedback amplifiers and its applications using opamp
4. Describe the working of timers, phase locked loop and its applications
5. Develop signal conditioning circuits for temperature transducers and strain gauge

Operational amplifier Basics & negative feedback amplifiers: Introduction to differential amplifiers, equivalent circuit of Opamp, Ideal and practical parameters of operational amplifiers, operational amplifier parameters, measurement of OPAMP parameters. Inverting amplifier, noninverting amplifier, Summing amplifier, Differential amplifier, instrumentation amplifier. Log and anti log amplifiers, Current to voltage and voltage to current converters. 12 Hrs

Applications of Negative feedback amplifiers: Integrating and Differentiating circuits with frequency response, Precision rectifiers, Peak detectors, active filters I and II order butter worth filter (In detail). Problems **Waveform generators:** Principle, Sine wave oscillators, Wein Bridge and phase shift oscillator 10 Hrs

Comparators & Positive feedback amplifiers and its applications: Inverting & non inverting comparators. ZCD, window detector, Schmitt Trigger (Design). Monostable and Astable multivibrators, Triangular & Sawtooth wave generator. 10 Hrs

Phase locked loop: Operating principles, lock range, capture range, working of NE565. PLL as frequency multiplier, FSK demodulator, frequency synthesizer, frequency translation, FM & AM detection. **Timer and its applications:** 555 timer, astable, monostable and Elementary design of specific applications 10 Hrs

Design: Const Current Source, Const Voltage Source, OPAMP signal conditioning and linearizing circuit for sensors, (Thermocouple, RTD, AD590, thermistor and strain gage), design of high gain amplifiers with offset nulling 10 Hrs

TEXT BOOKS:

1. **Linear Integrated Circuits & OPAMP**, Gayakwad, PHI, 3rd edition, 2002
2. **OPAMP and applications**, Coughlin and Driscoll, 4th edition, 2000, PHI

REFERENCE BOOK:

Design of Operational Amplifiers & Analog IC's, Sergio Franco, 3rd edition, 2002, McGraw

SIGNALS AND SYSTEMS

Sub code : IT440

Credit Pattern : 4:1:0

Total Hours : 52 Hrs

Contact Hours : 06/Week

13 Tutorial sessions each of 2Hrs

Pre-requisite: Knowledge of Mathematics.

Course Objective: This course will introduce the basic concepts of signals and systems in time and frequency domains. By the end of the course the student will be able to represent and analyse discrete and continuous time signals and also analyse LTI systems in time and frequency domains using Fourier representation and Z-transformation.

Course Outcomes:

Student will be able to

1. Characterize and analyze the continuous time and discrete time signals and systems.
2. Analyze and interpret LTI systems in time domain
3. Express the importance of frequency domain representation of continuous time and discrete time periodic signals using complex Fourier series.
4. Explain the frequency domain representation of continuous time and discrete time non periodic signals using Fourier transform.
5. Describe the discrete time signals and systems using Z-transform.

Introduction: Signal classification, Signal processing systems.

Continuous time signals and Systems: Standard signals, Classification of signals Basic operations on signals, System, Classification of systems, LTI systems, Inverse system and deconvolution process, differential equation representation of LTI systems. 6 Hrs

Discrete time signals and systems: Sampling theorem, frequency concepts in signals, Standard signals, Classification of signals ,Basic operations on signals, Discrete time systems. Matlabprograms. 6 Hrs

Discrete time linear time invariant system: LTI systems, Classification of LTI systems, deconvolution, difference equation representation for LTI systems, solution of difference equation, Matlabprograms. 6 Hrs

Correlation: Correlations of continuous and discrete time signals, correlation coefficient, Matlabprograms. 2 Hrs

Fourier Series and Fourier Transform of continuous time signals: Frequency domain representation of a sinusoidal signal, FS representation of signals, properties of continuous time Fourier series, FT representation of a continuous time non periodic signals, properties of FT, FT for periodic signals, analysis of LTI system using FT. 10 Hrs

Fourier Series and Fourier Transform of discrete time signals: Fourier series for discrete time periodic signals (DTFS), properties of DTFS, Fourier transform of discrete time non periodic signal, properties of DTFT, DTFT of periodic signals, analysis of LTI discrete time system using DTFT. 10 Hrs

Z-Transform: Introduction, Z-transform, Properties of Z-transform, Pole zero model, Region of convergence, Inversion of Z-transforms, Analysis of LTI discrete time system using Z transform, stability and causality analysis. 12 Hrs

TEXT BOOKS

1. **Signals and Systems**, Simon Haykin and Barry Van Veen, John Wiley & Sons, 2002
2. **Modern Digital Signal Processing**, V. Udayashankara, Third edition, PHI, 2012.

REFERENCE BOOKS

1. **Signals and Systems**, Nagoor Kani, TMH, 2011 “Signals and Systems”, Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, Pearson education Asia/PHI, 2Nd edition, 1997.Indian Reprint 2002.
2. **Signals and Systems**, H P Hsu, R Ranjan, Scham’s Outlines, TMH, 2006.
3. **Linear Systems and Signals**, B P Lathi, Oxford University Press, 2005.

SYSTEM DESIGN USING HDL

Sub code : IT 450

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisites: Logic Design, Concepts of Computer Programming.

Course Objectives: The course objective is to provide the basic knowledge necessary to synthesize and simulate systems using hardware description languages. The VHDL and verilog HDL's descriptions in dataflow, behavioral, structural, mixed type and mixed language are discussed. Provide the knowledge of FPGA programming and interfacing with external hardware.

Course outcomes:

Students will be able to

1. Explain the concept of HDL as a software tool and design of digital circuits using dataflow description
2. Design and develop digital circuits in behavioral and structural description styles
3. Describe the Advanced topics of HDL programming using procedures, functions and file processing
4. Develop Programming skills using mixed type and mixed language descriptions
5. Exhibit the Skills in optimal design of computing systems using FPGA and its interfacing

Introduction: A brief history of HDL, structure of HDL module, operators, data types, types of descriptions, simulation and synthesis, brief comparison of VHDL and Verilog. Data Flow Descriptions, Highlights of data-flow descriptions, structure of data-flow description, data type vectors. 10 Hrs

Behavioral Descriptions: Behavioral description highlights, structure of HDL behavioral description, VHDL variable assignment, signal assignment statement, sequential statements. Structural Descriptions: Highlights of structural description, organization of the structural descriptions, binding, generate generic, and parameter statements. 12 Hrs

Procedures, Tasks, and Functions: Highlights of procedures, tasks, and functions, procedures and tasks examples, functions examples. Advanced HDL Descriptions: File Processing, examples of file processing 10 Hrs

Mixed Type Descriptions: VHDL user- defined data Types, VHDL packages, mixed type description examples. Mixed Language Descriptions, Highlights of mixed-language description, how to invoke One language from the other, mixed-language description examples, limitations of mixed-language description 10 Hrs

Concept of FPGA, VHDL programs to interface switch, LED, 7segment display, stepper motor, DC motor, DAC and ADC. 10 Hrs

TEXT BOOKS:

1. **HDL Programming VHDL and Verilog**, NazeihM.Botros, Thomson Learning, 2007
2. **Digital System Design Using VHDL**, Charles H Roth, Thomson Learning.

REFERENCE BOOKS:

1. **Verilog HDL**, Samir Palnitkar, Pearson Education
2. **VHDL**, Douglas perry, Tata McGraw-Hill
3. **Circuit Design with VHDL**, Volnei A. Pedroni-PHI

TRANSDUCERS AND INSTRUMENTATION LAB

Sub code : IT46L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs/Sem

Contact Hours : 03/Week

Pre-requisites: Transducers and Instrumentation I and II.

Course Objectives: This course provides to know the characteristics of various temperature and optoelectronic transducers and also expose to measurement of resistance, capacitance and inductance using bridges

Course outcomes:

Students will be able to

1. Apply the fundamental knowledge of transducers and measurement systems
2. Test the different circuits, modules and observe the output
3. Analyze the result and draw the characteristics.
4. Express the importance of various circuits & modules.

LIST OF EXPERIMENTS:

1. Characteristic of resistance transducer: potentiometer, strain gauge/quarter, half and full bridge.
2. Characteristics of LVDT.
3. Characteristics of Capacitive transducer for variable area & variable distance
4. Characteristics of AD590, thermocouple, thermistor & RTD.
5. Characteristics of LDR, for variable illumination & displacement.
6. Characteristics of Photo Diode & phototransistor for variable illumination.
7. Measurement of sensitivity of wheatstone bridge.
8. Measurement of Self- inductance by Maxwell Bridge, Anderson's bridge.
9. Measurement of unknown capacitance by Desauty's and Schering's bridge
10. Measurement of Low resistance by Kelvin double Bridge
11. Obstacle detection using IR sensor
12. Characteristics of piezoelectric sensor and electromechanical relay.

HDL PROGRAMMING LAB

Sub code : IT47L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs/Sem

Contact Hours : 03/Week

Course Objectives: To provide practical exposure to program FPGA using VHDL and verilog HDL's and interface the hardware modules.

Course outcomes:

Students will be able to

1. Develop interaction skills and competence in design of digital systems using HDL
2. Synthesize, simulate and test digital circuits using HDL and interface FPGA to external devices
3. Design of program modules using HDL descriptions styles, record and analyze the results
4. Exhibit the continuous up gradation of skills of HDL programming systematically

LIST OF EXPERIMENTS:

PROGRAMMING

1. Write HDL code to synthesize and simulate all the logic gates
2. Write a HDL program for the following combinational designs
 - a. 8 to 3 (encoder without priority & with priority)
 - b. 8 to 1 multiplexer
 - c. 4 bit binary to gray converter
 - d. 2 bit comparator
3. Write a HDL code to describe the functions of a Full Adder using three types of descriptions dataflow, structural and behavioral
4. Write behavioral description of 8 bit ALU with the following operations
 - A + B
 - A – B
 - A Complement
 - A * B
 - A AND B
 - A OR B
 - A NAND B
 - A XOR B
5. Develop the HDL description code for the D, JK, T flip-flops

6. Behavioral description and simulation of 4 bit binary, BCD up/down counters

INTERFACING

7. Synthesize binary and BCD counters and interface LED and switches to display results
8. Interface seven segment display and write HDL code to display counter output and messages
9. Interface 4x4 matrix keyboard and write HDL code to read and display the key pressed
10. Interface LCD display and write HDL code to display the message
11. Write HDL code to control the speed of DC motor using PWM technique
12. Write HDL code to operate and control direction of Stepper motor.
13. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc..) using DAC

AIRCRAFT INSTRUMENTATION

Sub code : IT510

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisites: Transducers & Instrumentation, Basic Electronics.

Course Objectives:The course objective is to provide the basic knowledge in aircraft, components and design issues. The working principle of different instruments, displays and engine instruments of aircrafts. The study the warning systems and safety systems used in aircrafts.

Course outcomes:

Students will be able to

1. Explain the working principle of flight instrument systems and laws involved in the flight
2. Describe the principles of air data instruments
3. Design the warning systems and alerting systems
4. Express the importance of the principles of gyroscopic flight instruments and their working
5. Describe the working of aircraft engine instruments and able to determine the performance analysis

Aircraft Basics: Definition of Aircraft, basic components of aircraft, forces involved in flight, Newton laws Bernoulli's principle in applicable to flight. Aircraft Instruments, Introduction, Instruments grouping, Instrument Displays, Quantitative and Qualitative displays, Director Displays, Cockpit Layout, Glass Cockpits 10 Hrs

Air data Instruments: Basic air data system, pitot static probe, heating circuit arrangement, Air speed indicator, Mach/airspeed indicator, Altimeters, Vertical airspeed indicators, Instantaneous vertical airspeed indicator, Air temperature indicator, Effects of atmospheric variations with altitude,

10 Hrs

Warning systems: Air data Alerting system, Mach warning system, Altitude alert system. Direct reading compasses: Terrestrial Magnetism, Compass construction, Errors in indication, Acceleration error, and compensation.

10 Hrs

Gyroscopic Flight Instruments: The gyroscope and its properties, determining direction of precession, limitations of gyroscopes, operating gyroscopic flight instruments, Gyro horizon, Erection systems for gyro horizons, errors due to acceleration and turning, Direction Indicator, Turn and bank indicator.

10 Hrs

Engine Instruments: Pressure measurement, Indicating systems, pressure switches, Temperature measurement, Indicating systems, Fuel quantity Indicating Systems: Capacitance type system, indicating system, Effects of fuel temperature changes, Measurement of fuel quantity by weight, Engine power and control instruments: RPM measurement, Generator and indicating system, Tacho probe and indicator system, Exhaust gas temperature, engine pressure ratio measurement, fuel flow measurement system.

12 Hrs

TEXT BOOK

1. **Aircraft Instruments and Integrated Systems**, EHJ Pallet, Longman Scientific & Technical, 1992

REFERENCE BOOKS

1. **Aircraft Instrument Design**, WH Coulthard, Pitman & sons 1981
2. **Aircraft Instruments**, C A Williams, Golgotia Publications, New Delhi
3. **Aircraft Instrumentation and Systems**, S.Nagabhushana, L.K.Sudha

CONTROL SYSTEMS

Sub code : IT520

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisite: Knowledge of Mathematics and signals.

Course Objective: This course will introduce the basic concepts of control systems, feedback systems and their representation and analysis. By the end of the course the student will be able to model, represent and analyse the systems and also be able to find the stability of the systems using RH criterion, Root locus, Bode and Nyquist criterion.

Course Outcomes

Student will be able to

1. Explain the concepts of control systems, feedback systems, the mathematical modeling and analysis of electrical, mechanical and electromechanical systems.
2. Gain the knowledge of representation of systems using block diagram and Signal flow graph and the reduction
3. Analyze and interpret the control systems in time domain.
4. Evaluate the stability of the system using RH criterion, Root locus.
5. Determine the stability of the system using Polar plot Bode plot and Nyquist criterion.

Introduction to control systems: Definition, open loop and closed loop systems, types of feedback. 4 Hrs

Mathematical modeling of systems: Modeling of electrical, mechanical, and electromechanical systems, differential equations of physical systems. 6 Hrs

Block diagrams and Signal flow graphs: Transfer function, block diagram representation and reduction, signal flow graph representation and reduction using Mason's gain formula. 7 Hrs

Time response of feedback control systems: Standard test signals, steady state error analysis, unit step response of first and second order systems, time domain specifications and transient response of a prototype second order system. 7 Hrs

Stability Analysis: Bounded input and bounded output stability, zero input and asymptotic stability, methods of determining stability, Routh-Hurwitz criterion. 6 Hrs

Root – Locus techniques: Basic properties and construction. 7 Hrs

Frequency domain analysis: Polar plots, Bode plots, gain and phase cross over points, relative stability using polar plot and Bode plot, frequency domain specifications – resonant peak, resonant frequency and bandwidth, effect of adding a zero or pole to the forward path transfer function. Nyquist stability criterion. 15 Hrs

TEXT BOOKS

1. **Control Systems Engineering**, I J Nagarath and M Gopal, New age international publishers, Fifth edition, 2008.
2. **Modern Control Engineering**, D Roy Choudhury, PHI, 2009

REFERENCE BOOK

1. **Feedback Control system analysis and Synthesis**, J J D'Azzo and C H Houpis,

McGraw Hill International student edition.

MICROCONTROLLER

Sub code : IT530

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisite: Boolean algebra, Digital Circuits, Basic C Programming

Course Objective:

1. To introduce the students to the architecture, instruction set and addressing modes of 8051 microcontroller.
2. To introduce the students to the programming and interfacing concepts of 8051 microcontroller.

Course Outcome:

Students will be able to

1. Understand the different architectures used in microcontrollers design.
2. Understand the working of 8051 instructions and their addressing modes.
3. Develop 8051 programs using Assembly language and C.
4. Design systems by interfacing external devices to 8051
5. Design systems using built – in devices in 8051.

Microprocessors and microcontroller: Introduction to 8 bit and 16 bit microprocessors, Comparison between Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture. 6 Hrs

The 8051 Architecture: Introduction, Features of 8051, Architecture of 8051, Pin diagram of 8051, Memory organization, Ports, External Memory interfacing, 7 Hrs

Addressing Modes & Instruction Set: Introduction, Instruction syntax, Data types, Addressing modes: Immediate addressing , Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. Instruction set: Instruction timings, Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. 8 Hrs

8051 programming: Assembler directives, Assembly language programs and Time delay calculations. 8051 programming in C: Data types for 8051, time delay, I/O programming, logical operations, Accessing code ROM space and RAM space. 7 Hrs

8051 Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C. 6 Hrs

8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, Serial Communication Modes, connections to RS-232, 8051 Serial communication Programming in assembly and C. 6 Hrs

8051 Interfacing and Applications: Basics of I/O concepts, Interfacing 8051 to LCD, Keyboard, ADC, DAC, Stepper motor and DC motor, Programming in assembly and C. 7 Hrs

8255A Programmable Peripheral Interface: Features of 8255A, Architecture of 8255A, I/O addressing, Interfacing 8255A with 8051, I/O devices interfacing with 8051 using 8255A. 5 Hrs

TEXT BOOKS:

1. **8051 Microcontroller-Hardware, Software and Applications**, V. Udayashankara and M.S. Mallikarjunaswamy;, Tata McGraw-Hill, 2009

Reference Book:

1. **The 8051 Microcontroller and Embedded Systems – using assembly and C**, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006.
2. **The 8051 Microcontroller and embedded systems**, Kenneth J. Ayala and Dhananjay V.Gadre Cenegage learning.

ANALOG AND DIGITAL COMMUNICATION

Sub code : IT540

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Analog & digital electronics, Signals and Systems

Course objective: In this course, students receive an introduction to the principles, performance and applications of communication systems. Students expose to analog modulation/demodulation systems (amplitude - AM, DSB & SSB; and angle - PM & FM) and digital modulation/demodulation systems (binary and M-ary) in noise and interference. Sub-topics include filtering, sampling, quantization, encoding and the comparison of coherent & noncoherent detection techniques to improve signal-to-noise ratio (SNR).

Course Outcomes:

Students will be able to

1. Study and develop various types of modulation and demodulation schemes for amplitude modulation
2. Describe modulation and demodulation schemes for angle modulation
3. Analyze the noise and threshold effect in amplitude and angle modulation schemes
4. Differentiate between low pass and band pass sampling theorem
5. Evaluate digital modulation concepts and advantages

Amplitude modulation: Time-Domain Description, Frequency domain description, Generation of AM waves, Detection of AM waves, AM/DSB, Time-Domain Description, Frequency domain description Generation of DSBSC waves, Coherent Detection of DSBSC Modulated waves. Costas loop, Quadrature Carrier multiplexing, AM-SSB/SC generation, Frequency-Domain Description, Frequency discrimination method for generation an SSB Modulated wave, time domain description, phase discrimination method for generating an SSB modulated wave, Demodulation of SSB waves, Comparison of amplitude modulation techniques, frequency translation, FDM. 10 Hrs

Angle modulation: Basic Concepts, frequency modulation, Spectrum analysis of sinusoidal FM wave, NBFM, WBFM, Constant Average power, Transmission bandwidth of FM waves, Generation of FM waves, Direct FM, demodulation of FM waves, frequency discriminator, ZCD, phase locked loop (1st order), of AM and FM 10 Hrs

Noise in analog modulation: Signal to noise Ratios, AM Receiver Model, Signal to noise ratios for Coherent Reception, DSBSC Receiver, SSB Receiver, Noise in AM Receivers using envelope Detection, Threshold effect, FM Receiver Model, Noise in FM Reception, FM Threshold effect, Pre-Emphasis and De-Emphasis in FM. 10 Hrs

Pulse modulation: Sampling theorem for low pass and band pass signal, statement and proof, PAM, Channel bandwidth for a PAM signal, Natural Sampling, Flat-Top sampling, Signal recovery through Holding, Quantization of Signals, Quantization error, PCM, Electrical representations of Binary digits, The PCM Systems, DPCM, Delta Modulation, ADM. 10 Hrs

Digital modulation: Introduction, Binary Shift Keying, DPSK, QPSK, Type D flip-flop, QPSK Transmitter, Non-offset QPSK, The QPSK receiver, Signal space representation, BFSK, Spectrum, Receiver for BFSK, Geometrical Representation of Orthogonal BFSK, line codes, TDM, Problems 12 Hrs

TEXTBOOKS:

1. **Analog and Digital communication**, Simon Haykin, 2001, 2nd edition, John Willey
2. **Principles of communication systems**, Taub and Schilling, 3rd edition, 2009, TMH

REFERENCE BOOKS:

1. **Electronic Communication Systems**, 2nd Edition, Blake, Thomson
2. **Electronic Communication Systems**, George Kennedy
3. **Principles of Electronic Communications Analog & Digital**, Pradip Kumar Ghosh, University Press.

DIGITAL SIGNAL PROCESSING

Sub code : IT550

Credit Pattern : 3:1:0

Total Hours : 39 Hrs

Contact Hours : 05/Week

13 Tutorial sessions each of 2Hrs

Prerequisites: Signals and systems

Course Objective: This course will introduce the basic algorithms in digital signal processing and implementation of these algorithms using MATLAB. By the end of the course, students will be familiar with concepts of DFT, FFT, design of FIR, IIR filters, adaptive filters and Multirate digital signal processing concepts.

Course outcomes:

Students will be able to

1. Develop the concept of discrete signals and systems, discrete Fourier transforms and its properties.
2. Explain DIF and DIT FFT and IFFT algorithm and identify their advantages.
3. Realization of different forms of IIR and FIR filter structures.
4. Design FIR filters using different window and frequency sampling techniques. Design IIR Butterworth and chebyshev filters. Know the different transformation.
5. Explain digital filter banks, concepts of multirate signal processing, adaptive filter and its applications.

Introduction: Review of discrete signal and systems, DFT, Properties of DFT, and IDFT. 5Hrs

Computation of FFT: Radix-2 Decimation in Time FFT, Radix-2 Decimation in Frequency FFT, inverse FFT Algorithm. Introduction to DCT, DCT-2 and IDCT-2 algorithm, implementation using Matlab program. 5 Hrs

Digital Filter Realization: Basic IIR filter structures: Direct form (I & II), Parallel, Cascade form and lattice form. Basic FIR Filter structures: Direct and cascade form structure and lattice form. 6 Hrs

FIR filters: Properties, Filter Design using Windows (Rectangular, Hamming, Hanning and Kaiser Window), Filter design using Frequency sampling technique, implementation using Matlab program. 6 Hrs

IIR Filters: Specification and design techniques, Impulse Invariant and Bilinear Transformation techniques. Design of digital Butterworth and Chebyshev low pass filters using Analog filter design techniques, Transform of Low pass to High pass, Band pass and Band rejection filters, Comparison of IIR and FIR filters, implementation using Matlab program. 9 Hrs

Multirate digital signal processing: Introduction, decimation by a factor D, interpolation by a factor I, application of multirate signal processing: Interfacing of digital systems with different sampling rate, implementation of digital filter banks, DFT filter banks, Quadrature mirror filter banks. 4 Hrs

Adaptive filters: Adaptive filters, LMS adaptive algorithms, Recursive least square algorithms, Applications of adaptive filters. 4 Hrs

TEXT BOOKS:

1. **Digital Signal Processing**, Proakis and Manolakis, Prentice Hall of India / Pearson, Third edition.
2. **Modern digital signal processing**, Dr.V.Udayashankara, PHI, 3rd edition 2015.

REFERENCE BOOKS:

1. **Digital Signal Processing**, S K Mitra, Mc Graw-Hill 4th edition.
2. **Theory and Application of DSP**, Rabinar L R and Gold B, PHI, 1999.
3. **Introduction to digital signal processing**, Johnson, Prentice Hall of India 1999.
4. **Digital Signal Processing**, Alan V Oppenheim, Prentice Hall of India.

C++ AND DATA STRUCTURES

Sub code: IT560

Credit Pattern: 3:0:1

Total Hours: 39 Hrs

Contact Hours: 05/Week

13 Lab sessions each of 2Hrs

Prerequisites: Basic programming knowledge.

Course Objectives: The objective of the course is to learn how to design, write, and analyze the performance of C++ programs that handle structured data and perform more complex tasks,

Course Outcomes:

Students will be able to

1. Explain the Basics of OOPS, Structures Functions and Storage classes.
2. Design and develop programs based on the concepts of class, objects and operator overloading
3. Design and develop programs based on the concepts of inheritance.
4. Understand the usage of pointers in OOPS and Input/output operation on files
5. Apply the basic knowledge of various data structures while constructing a program.

13 lab sessions each of 2Hrs

C++ programming Basics: Need of object oriented programming, procedural languages, characteristics of OOP, preprocessor directives, data types, manipulators, Type Conversion.

Structures: Structures, enumerated data types, Boolean type, Functions: passing arguments, returning values, reference arguments, overloaded functions, inline functions, Default Arguments variable and storage classes. 9 Hrs

Objects and classes: objects as data types, constructors, destructors, Objects as Function Arguments, Returning Objects from Function. Arrays: Arrays as class member data types, passing arrays, arrays as objects, strings, arrays of strings.

Operator overloading: overloading of unary operators, binary operators, Data conversion. 9 Hrs

Inheritance: Inheritance, derived class and base class, Derived Class Constructors, Overriding member functions, scope resolution, Inheritance in the English Distance Class, Class Hierarchies, Public and Private Inheritance, levels of inheritance, multiple inheritance, Ambiguity in Multiple Inheritance. 7 Hrs

Pointers: pointers to objects, linked list, virtual functions, static functions, files and streams, input/output operations. 7 Hrs

Data structures: Data representation, Matrices, Stacks, Queues, Skip lists and Hashing, Binary trees. 7 Hrs

List of programs

Write a C++ programs for the following.

1. To count the number of words in a phrase typed in by the user.
2. To Understand Different Function Call Mechanism.
 - i) Call by reference. ii) Call by Value
3. To demonstrate
 - i) Function overloading ii) Default arguments
4. To Understand Storage classes.
5. To demonstrate constructor and destructor.
6. To return an object from function.
7. To implement a software stack.
8. To
 - i) Overload Unary operators
 - ii) Overload Binary Operators
 - iii) Conversion between basic type and user defined type.
 - iv) Conversion between objects of two different classes.
9. To Implement
 - i) Inheritance and Function Overriding.
 - ii) Multiple inheritance –Access Specifiers
10. To sort an array of integer using pointers
11. To implement pointer to an object using ‘New’ and ‘delete’ operator.
12. To implement Linked list
13. To demonstrate the effect of declaring a function as static.
14. To Demonstrate working of Virtual function.
15. To read/write the data to a file.
16. To implement
 - i) Stack
 - ii) Queue
 - iii) Skip list
 - iv) Hash Table
 - v) Binary tree

TEXT BOOKS:

1. **Object oriented programming in TURBO C++**, Robert Lafore, Galgotia Publications.2002
2. **Data Structures, Algorithms and Applications in C++**, Sartaj Sahni, Tata McGrawHill Publications.

REFERENCE BOOKS:

1. **Object Oriented Programming with C++**, E Balaguruswamy, Third edition, TMH2006
2. **C++ the complete reference**, Herbert Schildt, Fourth edition, TMH, 2003
3. **Data Structures using C++**, D.S.Malik, Thomson, 2003
4. **Data Structures Using C and C++**, Tanenbaum A. M, Second Edition, Pearson Education, 2007

SIGNAL CONDITIONING CIRCUITS LAB

Sub code : IT57L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisites: Signal conditioning circuits, Transducer & Instrumentation 1

Course Objectives: This course aims to expose the students to design elementary applications using operational amplifiers & also develop signal conditioning circuits for temperature and pressure transducers. Designing of multivibrators using timers for different duty cycles.

Course Outcomes:

Students will be able to

1. Apply the fundamental knowledge of an amplifier and design using an opamp.
2. Test the designed circuit using an opamp & Timer and observe the output
3. Analyze and draw conclusion on the result
4. Demonstrate the application of various circuits using an opamp

LIST OF EXPERIMENTS

1. Inverting amplifier, non- inverting amplifiers, Differential amplifiers
2. Adders & subtractors
3. Instrumentation amplifiers for different gains.
4. Precision half wave and full wave rectifiers.
5. Differentiator and integrator.
6. II order Low pass and High pass filters.
7. Current to voltage and voltage to current converters.
8. Comparators, Schmitt triggers.
9. Astable and monostable multivibrators using Opamp.
10. Astable and monostable multivibrators using 555 Timer
11. Signal conditioning circuit for thermocouple and AD590
12. Design of linearizing circuit for RTD & Thermistor

MICROCONTROLLER LAB

Sub code : IT58L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisites: Basic Programming Concepts, Basics of C Programming, Familiarity with 8051 Features & Instruction set.

Course Objective: To make the students capable of programming and controlling the working of 8051 microcontroller using assembly language and C language.

Course Outcome:

The students will be able to

1. Apply fundamental knowledge of microcontroller 8051 to write the programs for the given problem.
2. Test the programs written for the interfacing circuits and observe the outcome
3. Analyze and draw inference/conclusion on the results obtained
4. Express/ demonstrate the importance and applications of various programs.

LIST OF EXPERIMENTS:

NOTE: All the Programs Should Be Executed Using 8051 Family Microcontroller. (Ex: P89C61X2)

Basic Programming: Write Assembly Language Programs for the following

1. Data Transfer Operations
2. Arithmetic Operations
3. Boolean & Logical Operations
4. Code conversions
5. Timer/Counter Programming
6. Serial Communication

Interfacing: Write C Language Programs for the following

1. LED and Keypad interface.
2. Stepper motor & DC Motor Control.
3. Waveforms generation using DAC.
4. ADC interface.
5. LCD display interface.
6. 7 Segment display interface.

PROCESS CONTROL

Sub code : IT610

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisite: Transducers & Instrumentation, Basics of Control Systems, Analog and digital signal conditioning.

Course Objective: To introduce the basics of process control, Controller design, Annunciator systems, Tuning concepts. By the end of the course, students will be familiar with various controller design, representation of a process plant using P& ID.

Course Outcomes

Students will be able to

1. identify the elements of a process control loop and represent a process plant using P and ID.
2. define the process control terminologies and understand various controller modes.
3. design controllers by analog and digital means.
4. apply tuning methods of controllers.
5. express the importance of annunciators and displays in a process plant

Introduction to Process Control: process control block diagram, control system evolution, Identification of elements in process control loops - examples. 4 Hrs

Final Control: Introduction to final control operation, signal conversions, , actuators, control elements. 8 Hrs

Controller principles: Introduction, process characteristics, control system parameters, discontinuous control modes, continuous control modes, and composite control modes.10 Hrs

Analog controllers: Introduction, general features, electronic controllers, pneumatic controllers, design considerations. 8 Hrs

DigitalControllers: Introduction, digital electronics methods, computers in process control, characteristics of digital data, controller software, computer control examples. 6 Hrs

Discrete-State Process Control: Introduction, definition and characteristics of discrete state process control. 3 Hrs

Control-loop characteristics: Introduction, control system configuration, multivariable control systems, control system quality, stability, and process loop tuning. 6 Hrs

Alarms and Annunciators.

3 Hrs

Control

drawings: P& ID symbols and Diagrams: Flow sheet symbols, Inter logic symbols, graphic symbols, sensors time response

4 Hrs

TEXT BOOKS:

1.Process Control Instrumentation Technology, C D Johnson, PHI,8th edition,2009.

2.Instrument Engineers Handbook (Vol 1 & 2), B G Liptak, 3rd edition, Chilton Book Company, 1995

REFERENCE BOOK:

1. Chemical process control: an introduction to theory and practice, Stephanopoulos, PHI, 2006.

ADVANCED CONTROL SYSTEMS

Sub code : IT 620

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisite: Control systems

Course Objective: This course will introduce the basic concepts of modeling and analysis of linear continuous and discrete time control systems and nonlinear control systems. By the end of the course the student will be able to represent and analyze discrete and continuous time control systems in state space and using Z-transformation and also have the knowledge of compensators using Bode/Root Locus techniques.

Course Outcomes

Students will be able to

1. Analyze the discrete time control systems using Z-Transform
2. Express the importance of the modeling and analysis of control systems using state space approach.
3. Explain the concepts of controllability and observability along with pole placement design and gain the knowledge of optimal and adaptive control systems.
4. Describe nonlinear control systems.
5. Design different compensators using Bode/Root locus techniques.

- Review of vector matrix analysis.** 4 Hrs
- Discrete time control systems and the Z-Transform method:** Introduction to discrete systems, pulse transfer function, stability analysis in the Z-plane. 6 Hrs
- State space analysis of control systems:** State space representation of systems, solving the time invariant state equations, transfer matrix, linear time invariant systems, state space representation of discrete time systems and solving discrete time state equation. 10 Hrs
- Pole Placement:** Controllability, Observability for continuous time systems, Pole placement design and state observabilities. 8Hrs
- Optimal and Adaptive control systems:** optimal control system based on quadratic performance index, adaptive control system. 4 Hrs
- Describing function analysis of Nonlinear Control systems:** Introduction to nonlinear systems, describing function analysis of nonlinear control systems, stability of nonlinear control system. 8 Hrs
- Compensation Techniques:** Lead, lag, lead lag network and compensator design using Bode/Root locus techniques. 12 Hrs

TEXT BOOKS:

1. **Modern Control Engineering**, K. Ogata, Fifth edition, 2006, PHI
2. **Discrete time Control Systems**, K.Ogata, PHI

REFERENCE BOOKS:

1. **Digital control and state variable methods**, Madan Gopal, PHI
2. **Modern Control Engineering**, Roy Choudhury, PHI,2009.

ARM PROCESSOR

Sub code : IT630

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre requisite: Boolean algebra, Digital Circuits, Basics of Microprocessors & Microcontrollers, Basics of C programming.

Course Objective:

1. To introduce the students to the architecture, instruction set and addressing modes of ARM Processors.
2. To introduce the students to the programming and interfacing concepts of ARM Processors.

Course Outcome:

The students will be able to

1. Explain the fundamentals of ARM processor design.
2. Develop program using ARM Instruction set.
3. Express the importance of THUMB Instruction set.
4. Assess the importance of Interrupts and Exception handling in ARM processor
5. Design systems using GPIO and built-in devices of LPC 2148

ARM embedded systems: The RISC design philosophy, The ARM design philosophy, embedded system hardware, embedded system software. ARM Architecture. 7Hrs

ARM processor fundamentals: Registers, current program status register, pipeline, exceptions, interrupts and vector table, core extensions, Architecture revisions, ARM processor families 8 Hrs

Introduction to ARM instruction Set: Data Processing Instructions, Branch Instructions, Load Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, ARMv5E Extensions, and Conditional Execution. 10 Hrs

Introduction to the THUMB Instruction set: Thumb register Usage, ARM-Thumb Interworking, other branch instructions, Data Processing Instructions, Single register Load –store Instructions, Multiple register Load Store Instructions, Stack Instructions and Software Interrupt Instruction. 10 Hrs

Interrupts & Exception Handling: Exception Handling, Interrupts, Interrupt handling schemes. 7 Hrs

LPC 2148: Features, Design of system using GPIO's, Internal Timers, ADC, DAC, UART. 10 Hrs

TEXT BOOKS:

1. **ARM system Developers Guide**, Andrew N.Sloss, Elsevier, 2008
2. **LPC 2148 User Manual**

REFERENCE BOOKS:

1. **ARM Assembly Language – Fundamentals and Techniques**, William Hohl, CRC Press,2009
2. **ARM Assembly language An Introduction**, J.R.Gibson, Cengage Learning, 2010

DSP ARCHITECTURE

Sub code : IT640

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisite: Signals and systems, Digital signal processing

Course Objective: This course will introduce the basic concepts in digital signal processing and implementation of these algorithms on digital signal processor TMS 320VC5416 and TMS 320C6713. By the end of the course, students will be familiar with TMS 320VC5416 and TMS 320C6713 architecture, addressing modes, instruction set, Assembly language programming and C programming of DSP algorithms.

Course Outcomes:

Students will be able to

1. Explain basic concepts in digital signal processing.
2. Express the importance of data formats, arithmetic operations, errors and basic architectural elements of Digital signal processor.
3. Describe architectural features and interfacing concept of DSP devices TMS 320VC5416.
4. Explain Addressing modes, Instruction set, Assembly language programming of DSP algorithms using TMS 320VC5416.
5. Express the importance of architectural features, Practical implementation of DSP algorithms using TMS 320C6713 and applications of DSP devices.

Introduction to digital signal processing: Introduction, A digital signal processing system, the sampling process, discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), linear time invariant systems, Digital FIR filters, Decimation and Interpolation process. 8 Hrs

Data formats, arithmetic operations and errors in digital signal processors: Introduction, Fixed and floating point DSP, Data formats, Fixed and floating point arithmetic operations, Dynamic range, precision and resolution, sources of errors in DSP. 4 Hrs

Introduction to digital signal processing devices: Architectural features of DSP, Bus architecture, DSP Computational building blocks, On-chip memory, Special function instructions, Special addressing modes, parallel move support and pipelining. 6 Hrs

Architecture of TMS 320c54xx processor: Features, architecture, Interrupts, Internal memory organization, On-chip peripherals. 6 Hrs

Addressing modes and instruction set of TMS 320c54xx processor: Addressing modes, Instruction set. 4 Hrs

TMS 320VC5416 Assembly language programming: DSP System Design kit, Assembly language programming. 8 Hrs

Interfacing with TMS 320c54xx processor: Memory space organization, External memory interface, Parallel I/O interface, Serial I/O interface. 6 Hrs

TMS 320C6713 Architecture: Features, architecture, Addressing modes, Programming, Applications of DSP devices. 10 Hrs

TEXT BOOKS:

1. **Modern Digital Signal Processing**, V. Udayashankara, Third edition, PHI, 2015.
2. **Digital Signal Processing**, Avtar Singh and S Srinivasan, Thomson Publishing, 2004, Singapore.

REFERENCE BOOKS:

1. **Digital Signal Processing- A Practical Approach**, Emmanuel C Ifeachor and B W Jervis, Pearson Education, New Delhi.
2. **Digital Signal Processors**, B Venkataramani and M Bhaskar, Tata-McGraw Hill, New Delhi, 2002.
3. **DSP and applications with TMS320C6713**, wiley IEEE press, 1/e, 2008
4. **TMS320C67x/C67x+ DSP CPU and Instruction Set Reference Guide**, literature number SPRU733A, 2006.
5. **Data sheets of TMS320C6713B Floating-Point Digital Signal Processor**, literature number: SPRS294B, 2005.

DIGITAL IMAGE PROCESSING

Sub code : IT650

Credit Pattern : 3:0:1

Total Hours : 39 Hrs

Contact Hours : 05/Week

Pre-requisite: Signals and systems, Digital signal processing

Course Objectives: This course gives the students the fundamentals of digital image processing, image enhancement compression restoration and edge detection techniques.

Course Outcomes:

1. Explain the various steps involved, Components required and basic transformation that can be applied for digital image processing.
2. Describe and apply various methods of enhancement and Restoration of the image in spatial domain
3. Describe and apply various methods of enhancement and Restoration of the image in frequency domain

4. Describe and apply different methods of reducing data size of digital images
5. Explain the methods of extracting some information from images.

13 lab sessions each of 2Hrs

Fundamentals: Introduction, Fundamental steps in DIP, Components of DIP system, A simple image formation model, Image sampling and quantization, Basic relationship between pixels, Color image processing fundamentals and models. 5 Hrs

Image Transforms: Basic theory, Fourier transform, Hadamard transform, Discrete cosine transform, Applications of discrete image transforms. 4 Hrs

Image Enhancement and Restoration in Spatial Domain: Background, Point processing – Image negatives, Log transformations, Contrast stretching, Gray level slicing, Bit plane slicing, Histogram processing – Histogram equalization, Histogram matching (specification), Local enhancement, Arithmetic/Logic operations – Image subtraction, Image averaging, Basics of spatial filtering, Smoothing spatial filters – Smoothing linear filters, order statistics filters, Sharpening spatial filters – Foundation, The Laplacian, The Gradient,

Image degradation/restoration model, Noise models, Restoration using spatial filtering – Mean filters, Geometric mean filters, Harmonic mean filters, Median filter, Max & min filters, Midpoint filter, 8 Hrs

Image Enhancement and Restoration in Frequency Domain: Background, Basic properties of the frequency domain, Basic filtering in the frequency domain, Basic filters and their properties, Smoothing frequency domain filters – Ideal lowpass filters, Butterworth lowpass filters, Gaussian lowpass filters, Sharpening frequency domain filters – Ideal highpass filters, Butterworth highpass filters, Gaussian highpass filters, Homomorphic filtering,

Noise filtering by frequency domain filtering – Band reject filters, Band pass filters, Notch filters, Inverse filtering, Minimum mean square error (Wiener) filtering.

8 Hrs

Image Compression: Fundamentals, Variable length coding, LZW coding, Bit plane coding, Run length coding, Lossless predictive coding, Lossy predictive coding, Transform coding.

7 Hrs

Image Segmentation: Introduction, Thresholding – Threshold detection methods, Optimal thresholding, Multi-spectral thresholding, Edge-based segmentation – Edge image thresholding, Border tracing, Hough transform, Region-based segmentation – Region merging, Region splitting, Splitting & merging. 7Hrs

List of programs

1. Write program to (a) read an image file (b) format conversion of an image
2. Write programs for intensity transformations of images using (a) logarithmic (b) Histogram processing
3. Write programs to perform (a) arithmetic operation on images (b) spatial domain filtering of images
4. Write programs to perform DFT /FFT of an image
5. Write a program to perform Frequency domain filtering of an image
6. Write a program to perform geometric transformation
7. Write programs to perform image compression in any two different techniques
8. Write programs for image segmentation using (a) edge detection (b) thresholding

TEXT BOOK:

1. Digital Image Processing, Rafael C. Gonzalez & Richard E. Woods, Second Edition. Pearson Education Inc.

REFERENCE BOOKS:

1. Fundamentals of Digital Image Processing. Anil K. Jain, Prentice Hall of India.
2. Image Processing, Analysis and Machine Vision, Milan Sonka, Vaclav Hlavac & Roger Boyle, Second Edition, Thomson Publication.

AUTOMOBILE INSTRUMENTATION

Sub code : IT661

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Measurement Techniques, Instrument Transducers

Course objective: In this course, students receive an introduction to the principles, performance and applications of automobile instrumentations. Students expose to electrical, electronic and mechatronic components used in automobile engineering. Understanding the working of various sensors and actuators used in automotive electronics. Expose to new systems like ABS, EDC, ESP & ACC.

Course outcomes

Students will be able to:

1. Know the working OPS, ABS, ACC and TCS in gasoline and diesel engines
2. Analyze the architecture and role of electronic components in a vehicle
3. Determine the functions of control units and mechatronics in an automobile engineering
4. Analyze the requirement of sensors and actuators for automobile applications
5. Describe the working of various sensors used in automotive electronics.

1. Electrical and electronic systems in the vehicle: Overview, Motronic-engine management system, Electronic diesel control (EDC), Electronic stability program (ESP), Adaptive cruise control (ACC), Occupant protection systems 12 Hrs

2. Architecture of electronic systems: Overview, vehicle system architecture

Electronic components in the vehicle: Basic principles of semiconductor technology, passive components, semiconductor components, manufacture of semiconductor components and circuits 10 Hrs

3. Mechatronics: Mechatronic systems and components, development methods, outlook:
Control units: Operating conditions, design, data processing, digital modules in the control units, control unit software 10 Hrs

4. Automotive sensors: Basics and overview, automotive applications, details of the sensor market, features of vehicle sensors, sensor classification, error types and tolerance requirements, reliability, main requirements, trends, overview of the physical effects for sensors, overview and selection of sensor technologies.

Actuators: Electromechanical actuators, fluid mechanical actuators, electrical actuators. 10 Hrs

5. Sensor measuring principles: Position sensors, speed and rpm sensors, acceleration sensors, pressure sensors, force and torque sensors, flowmeters, gas sensors and concentration sensors, imaging sensors (video) 10 Hrs

TEXT BOOK:

Automotive electrics Automotive electronics, 5th edition, Robert Bosch GmbH.

REFERENCE BOOK:

Understanding Automobile electronics, William B Ribbon, 6th Edition, 2003 Elsevier Science.

OPERATING SYSTEMS

Sub code : IT662

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisite: Computer concepts and programming.

Course Objectives : This course aims at providing the students with the concepts and techniques that are applied to the design, planning, control and improvement of manufacturing and service operating systems. After completing the course, we hope that the students can identify the important role of operations management in Örms, and use the quantitative and qualitative tools to analyze the basic operations-related issues.

Course outcomes:

Students will be able to:

1. Explain the objectives, features, design issues, support/services and evolution of operating systems.
2. Apply main principles and techniques used to implement processes and threads as well as the different algorithms for process scheduling.
3. Apply address translation in memory management schemes and be able to give the rationale for virtual memory abstractions in operating systems.
4. Describe disk organization and file system structure.
5. Evaluate security risks in operating systems and demonstrate the role operating systems in establishing security

Introduction to operating systems: Concepts, OS objectives, OS functions, OS views, OS design issues, OS supports & services, evolution of system structure. 08 Hrs

Process management: Concept, process models, threads: thread states, types of threads, thread priority, multithreading, scheduling: short-term scheduler types of schedulers, non-preemptive & preemptive strategies, interprocess synchronization: concepts, critical section problem, peterson's solution, synchronization hardware, semaphores, bounded buffer problem, readers-writers problem, dining philosophers problem, deadlocks: deadlocks & starvation, conditions for deadlocks, deadlock detection, deadlock prevention, deadlock recovery, deadlock avoidance, starvation. 12 Hrs

Memory management : Key Characteristics, memory management functions, logical address & physical address, address translation, management schemes: contiguous memory allocation & non contiguous memory allocation, virtual memory: paging, segmentation, cache memory design issues. 12 Hrs

Device & file management: Device Characteristics, types, device controller, operations, buffering & types of buffering, clock, disk, management, disk arm scheduling policies, RAID, File system, server, management, design, organization, directory, sharing, blocking, management, allocation, file system reliability. 11 Hrs

Security & Protection: Overview, goals, security threats, attacks, design issues, protection structure, intruders, authentication, malicious programs, encryption: symmetric encryption, public key encryption. 09 Hrs

TEXT BOOK:

1. **Operating Systems**, A concept-based evolutionary approach, P Chakraborty, Jaico publishing house.

REFERENCE BOOKS:

1. **Operating System Principles**, Abraham Silberschatz, Peter Galvin, Greg Gagne, Wiley-India.
2. **Modern Operating Systems**, Andrew S Tanenbaum, PHI.
3. **Operating Systems**, Deitel, Deitel, Choffnes, PHI.
4. **Operating Systems, Internals & design principles**, William Stallings, PHI.

POWER ELECTRONICS

Sub code : IT663

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Basic Electronics, Analog Electronic circuits.

Course objective: To introduce the various Power semiconductor devices, controlled rectifiers, choppers, inverters and SMPS. By the end of the course, students will be familiar with the characteristics of Power semiconductor devices in Able to demonstrate the application of Power semiconductor devices in rectifiers, choppers and SMPS.

Course Outcomes

Students will be able to

1. Determine the characteristics of various Power semiconductor devices.
2. Express the use of Power semiconductor devices in controlled rectifiers.
3. Express the importance of Power semiconductor devices in Choppers
4. Express the use of Power semiconductor devices in inverters .
5. Build SMPS.

Power Semiconductor Devices: Introduction to Power Electronics. Types of Power Electronic circuits. Power Diodes and Transistors – Types and switching characteristics. Thyristors – Construction, operation, switching characteristics and types. Series and Parallel operation of power devices. di/dt and dv/dt protections. Firing circuits 10 Hrs

Controlled Rectifiers: Introduction. Single phase Half-wave and Full-wave converters. .Semiconverters .AC Voltage Converters: Introduction, On-Off and Phase control. Single phase Half-wave ac voltage controllers. Single - phase Bidirectional controllers with resistive and inductive loads 10 Hrs

DC – DC Converters or Choppers: Introduction. Step-down chopper with R and RL loads. Step-up operation. Chopper Classification. Switching-Mode regulators – Buck and Boost regulators. 8 Hrs

Inverters: Introduction. Single phase Bridge inverters. Voltage control of Single phase inverters. Introduction to Three phase inverters. Current source inverters. 8 Hrs

Power supplies : UPS, SMPS AC and DC Power scavenging, Battery Systems. 8 Hrs

Recent Developments and Case Studies based on Current Technical Literatures (Reference Books and Journals) 8 Hrs

TEXT BOOKS:

1. **Power Electronics** – Circuits, Devices and Applications, Muhammad H. Rashid: 3rd edition, Pearson Education/ PHI, 2007

2. **Power Electronics**, R.S. Ananda Murthy, V. Nattarasu, 2nd edition Sanguine Technical Publishers, India, 2005.

REFERENCE BOOK:

Introduction to Power Electronics, Daniel W. Hart, Addition Wesley, 1997.

PRODUCT DESIGN TECHNOLOGY

Sub code : IT 664

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Basic Science, Concepts of Analog Electronic circuits.

Course objective: To introduce need analysis. Basic concepts of product design and development and aspects of ergonomics. By the end of the course, students will be familiar with design concepts in product design and development and able to develop a prototype right from PCB design considering all technical and ergonomic aspects.

Course Outcomes

Students will be able to:

1. Describe need analysis.
2. Apply the principles of product design and development.
3. Apply all design concepts in product design and development.
4. Develop a prototype right from PCB design.
5. Apply ergonomic aspects in product development.

Introduction, Development process and Organizations: characteristics of successful product development, duration and cost of product development, challenges of product development.

7 Hrs

Generic development process, concept development – Front-end process, adapting the generic product development process.

6 Hrs

Identifying Customer needs and Establishing Product specifications: defining scope, gathering data from customers, establishing relative importance of needs. Target specifications & refining specifications.

7 Hrs

Concept generation: five-step methodology of concept generation, with a case study of any electronic instrument.

6 Hrs

Human Engineering Considerations in product Design: anthropometry, The design of controls, the design of displays, man/machine information exchange.

7 Hrs

Concept Embodiment: overview, basic methods, advanced methods, case study-computer monitor with reference to ergonomics and esthetics. 7 Hrs

PCB Technology: introduction, types, applications, base materials, design methods and fabrication processes. 12 Hrs

TEXT BOOKS:

1. **Product Design and Development**, Karl T Ulrich, Steven D Eppinger, Tata McGraw -3rd edition.
2. **Printed Circuit board Design and Technology**, Walter C Boshart, McGraw International

REFERENCE BOOKS:

1. **Product design and manufacturing**, AK. Chitale and RC Gupta – Prentice Hall,
2. **Product Design**, Kevin Otto, Kristin Wood, Pearson Education, 2nd edition.

CONTROL SYSTEMS AND DATA CONVERTERS LAB

Sub code : IT67L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisites: Transducer & Instrumentation II, Control system

Course Objectives: This course aims to expose the students to design I and II order systems and understand the response of lead, lag & lead-lag systems. Testing the performance of DAC and ADC and also designing relay driving circuits using optoelectronic components. Writing the matlab codes for nyquist, bode and root locus problems.

Course outcomes:

Students will be able to:

1. Apply the fundamental knowledge of control system & converters to design the different circuits.
2. Test the designed circuits and observe the output
3. Analyze and draw conclusion on the result
4. Express the importance of various circuits

LIST OF EXPERIMENTS

1. Determine the response of first order system for step input
2. Determination of step response of a second order system using RLC circuit. Determine rise time, overshoot, settling time for over damped, under damped and critically damped condition and verify with theoretical values.
3. Determine the response of lead, lag and lead-lag circuit.
4. Design of Relay driving circuits using LDR and Optocoupler.
5. Plot the Root locus with and without compensation for a given transfer function using MATLAB/SCILAB and verify with theoretical values.
6. Draw the Bode plot with and without compensation for a given transfer function using MATLAB/SCILAB and verify with theoretical values.
7. Plot the Nyquist diagram for a given transfer function using MATLAB/SCILAB and verify with theoretical values.
8. Sample and hold circuit using IC
9. Analog multiplexers.
10. 4 bit Binary weighted and R-2R DAC.
11. Digital to analog converter using DAC0800
12. Analog to Digital converter using ADC0804

ARM PROCESSOR LAB

Sub code : IT68L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisite: Basic Programming Concepts, Basics of Assemble Language Programming, Familiarity with LPC 2148 Features & Instruction set

Course Objective: To make the students capable of programming and controlling the working of ARM processor using assembly language and C language.

Course Outcome:

Students will be able to

1. Apply fundamental knowledge of ARM Processor to write the programs for the given problem.
2. Test the programs written for the interfacing circuits and observe the outcome
3. Analyze and draw inference/conclusion on the results obtained
4. Express/ demonstrate the importance and applications of various programs.

LIST OF EXPERIMENTS:

NOTE: All The Programs Should Be Executed Using Arm7 Processor (Eg: LPC2148)

Basic Programming: Write Assembly language programs for the following

1. Data Transfer Operations

2. Array Operations
3. Arithmetic Operations
4. Boolean & Logical Operations
5. Code conversions

Interfacing: Write C Language Programs for the following

1. LED and Keypad interface.
2. Stepper motor & DC Motor Control.
3. Waveforms generation using DAC.
4. Internal ADC control.
5. Internal Timer control.
6. LCD display interface.
7. 7 Segment display interface.

AUTOMATION IN PROCESS CONTROL

Sub code : IT 710

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Familiarity about Logic design is necessary

Course Objectives: This course is to provide the student with basic skills useful in identifying the concepts of Programmable logic controller and its types. Expose to principles of SCADA, DCS and their communication with process control system and also understand different bus configuration used in industrial automation.

Course outcomes:

Students will be able to:

1. Know the basic requirement of a PLC, internal elements in a PLC and their types , working with specifications and basic logic in PLC.
2. Know the different I/O modules of PLC and their working principles and specifications and basic instructions.
3. Competent in using the different instructions for PLC programming, motivated to solve all analytical problems using ladder logic.
4. Memorize the basic concepts of use of computers in process control through data loggers, DCS, DDC and SCADA, Analyze different network topologies and their inter connection.
5. Classify various industrial protocols and bus configurations used in process automation

Introduction to programmable logic controllers, introduction to plc operation: The digital concept, Analog Signals, The input status file, the output status file, Input and output status files, sixteen point I/O modules, PLC memory. 7 Hrs

Introduction to logic: What is logic, Conventional Ladder v/s LPLC ladder, series and parallel function of OR, AND, NOT logic, XOR logic, Analysis of rung. Input modules: Discrete input modules, Discrete AC and DC input modules. Output Modules: Discrete output modules, solid-state output module switching, relay output modules. 7 Hrs

PLC instructions: The basic relay instructions, Normally open and normally closed instructions, output latching instructions, Understanding Relay instructions and the programmable controller input modules- interfacing start stop pushbutton and motor to PLC, developing ladder diagram with analytical problems. 12 Hrs

Timer and Counter instructions: On delay and off delay and retentive timer instructions, PLC counter up and down instructions, combining counters and timers. 6 Hrs

Comparison and data handling instructions: Data handling instructions, Sequencer instructions: Programming sequence output instructions, developing ladder diagram with analytical. 6 Hrs

Introduction to supervisory control and data acquisition (SCADA) as applied to process control systems. distributed control system (DCS): Evolution of digital controllers, advantages of digital control, process control requirements of digital control, computer network, interconnection of networks, communication in DCS. 7 Hrs

Different bus configurations used for industrial automation -RS232, UART, RS485, GPIB, CAN, USB, I2C, TCP/IP, HART and OLE protocol, Industrial field bus- FIP (Factory Instrumentation protocol), PROFIBUS (Processfieldbus), Bitbus. 7 Hrs

TEXT BOOKS:

1. **Introduction to Programmable Logic Controllers**, Garry Dunning, 2nd Edition, Thomson, ISBN: 981-240-625-5.
2. **Computer control of processes**, M.Chidambaram, Narosa publishing,
3. **Computer Based Industrial control**, Krishna Kant, Prentice Hall of India.

REFERENCE BOOKS:

1. **Instrumentation Engineers Hand Book**, Process Control, Bela G Liptak, Chilton Book Company, Pennsylvania.
 2. **Programmable logic controller**, W. Bolton, Elsevier
 3. **Industrial Control and Instrumentation**, W.Bolton, Universities Press.
- Industrial Electronic Control:** Including PLC, Paul.B. 2nd edition, Prentice Hall India

VLSI DESIGN

Sub code : IT 720

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Familiarity about Logic design is necessary

Course Objectives: The course objective is to provide the basic knowledge VLSI fabrication, circuit elements and design issues of CMOS circuits. To understand the design issues of scaling, delay, power dissipation and memory.

Course Outcomes:

Student will be able to

1. Explain the existing IC technologies and latest developments in VLSI and electrical properties of CMOS circuits
2. Describe and analyze the constraints in the VLSI design like power dissipation, noise margin, operating frequency, in nMOS and CMOS circuits
3. Design nMOS, CMOS circuits with design rules and estimation of delay
4. Describe scaling issues of MOS circuits and alternate forms of CMOS circuits
5. Design modules and memory in nMOS/CMOS using structured design approach and explain mixed signal processing

Introduction to MOS technology: Moores law, speed –power performance, nMOS fabrication, CMOS fabrication: nwell, pwell processes, BiCMOS technology, comparison of bipolar and CMOS. Basic electrical properties of MOS & BiCMOS circuits: Drain to source current versus voltage characteristics, threshold voltage, transconductance, MOS transistor figure of merit, pass transistor 12 Hrs

Inverters: nMOS inverter, determination of pull up to pull down ratio, nMOS inverter driven through one or more pass transistors, alternative forms of pull-up, CMOS inverter, MOS transistor circuit model, BiCMOS inverters, latch up. 10 Hrs

Basic circuit concepts: Sheet resistance, area capacitance calculation. Delay unit, inverter delay, and estimation of CMOS inverter delay, driving of large capacitance loads, super buffers,

BiCMOS drivers, propagation delays and wiring capacitances. Design rules: nMOS design style; CMOS design style, Design rules and layout. 10 Hrs

Scaling of MOS circuits: scaling factors for device parameters, limitations of scaling. Alternate CMOS logics, Switch logic, pass transistor logic, gate logic, pseudo nMOS, dynamic CMOS, Clocked sequential circuits, dynamic shift registers 10 Hrs

Structured design: Design methodology, structured design techniques, FPGA architecture, cell based design parity generator, Bus arbitration, Multiplexers, logic function block, code converter, Array Subsystems: SRAM, DRAM, Analog integrated circuit design: examples analog VLSI, mixed signal circuit design. 10 Hrs

TEXT BOOKS:

1. **Basic VLSI design**, 3rd Edition Douglas APucknell, KamaranEshraghian, Prentice Hall of India publication, 2005.
2. **CMOS VLSI design**, A Circuit and Systems Perspective, 3rd edition, Neil H. Weste, David Harris, Ayan Banerjee, Pearson, 2012
3. **CMOS Analog Circuit Design**, 2nd edition, Phillips E. Allen, Douglas R Holberg, Oxford University Press

REFERENCE BOOKS:

2. **Analog Systems for CMOS VLSI Systems**, Franco Maloberti, Springer International Edition, 2011

ANALYTICAL INSTRUMENTATION

Sub code: IT731

Credit Pattern: 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Basic science.

Course Objectives: The subject Provide a knowledge about the interaction of electromagnetic radiations with matter and apply analytical techniques to accurately determine the elements present in the given sample.

Course outcome:

Students will be able to

1. Explain the fundamental principles of analytical science and apply UV, Visible, spectrometer for quantitative and qualitative applications.
2. Describe and apply IR spectrometer for quantitative and qualitative applications.
3. Explain and apply Flame photometers, Fluorimeters and phosphorimeters for quantitative and qualitative applications
4. Explain and apply Mass spectrometer and NMR spectrometer for quantitative and qualitative applications.
5. Describe and apply gas/ liquid chromatography for quantitative and qualitative applications.

Visible ultraviolet spectrophotometers: Electromagnetic radiation, Beer Lambert law, absorption instruments, colorimeters, spectrophotometers. 7 Hrs

Infrared spectrophotometers infrared spectroscopy theory, Basic components of infrared spectrophotometers, Types of infrared spectrophotometers, Sample handling techniques. 7 Hrs

Flame photometers: Principle of flame photometers constructional details of flame photometers, accessories of flame photometers, interference in flame photometry and determinations. 8 Hrs

Fluorimeters & phosphorimeters: Principle of fluorescence, measurement of fluorescence, spectro fluorescence, microprocessor based spectro fluorescence, Measurement of Phosphorescence. 8 Hrs

Mass spectrometer & NMR spectrometer: Basic concept, types of mass spectrometer, components of mass spectrometer, resolution and applications. Principle of NMR, constructional details, sensitivity enhancement for analytical NMR spectroscopy. Use of computers with NMR spectrometers. 10 Hrs

Chromatography: Gas chromatograph- basic concepts, parts of gas chromatograph. Method of peak areas, liquid chromatography- basic concepts, types of liquid chromatography, the liquid chromatograph. 12 Hrs

TEXT BOOK

1. Hand book of analytical Instruments by R. S. Khandpur, TMH Publications 1st Ed 1989, New Delhi

REFERENCE BOOKS

1. Instrumental methods of analysis by H. H. Willard, L. L. Merritt & J. A. Dean, CBS Publications 7th Ed 1988
2. Principles of Instrumental analysis by S. J. Holler & T. A. Nilman Saunders college Publications 5st Ed 1998

MEDICAL IMAGING

Sub code : IT 732

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Basic science.

Course Objective: This course will introduce the concept of X-Rays, Ultrasound, MRI, Nuclear and thermograph imaging techniques. By the end of the course, the students will be able to discuss the physics of generation of these sources, imaging techniques, reconstruction algorithms and the relevant applications.

Course outcomes:

Students will be able to

1. Understand the physics and generation of X-Rays, CT, reconstruction algorithms, its applications, conventional machine and biological effects.
2. Understand the physics of ultrasound, generation, different modes of operations, applications.
3. Understand the physics of MRI, definitions, reconstruction algorithms, its applications machine.
4. Understand and physics and generation of gamma rays, machine and applications like SPECT and PET
5. Understand the physics of thermograph, machine and applications.

X-Rays: Interaction between X-Rays and matter, Intensity of an X-Ray, Attenuation, X-Ray Generation and Generators, Beam Restrictors and Grids, Intensifying screens, fluorescent screens and Image intensifiers, X-Ray detectors, Conventional X-Ray radiography, Fluoroscopy, Angiography, Digital radiography, Dynamic spatial reconstructor, X-Ray image characteristics, Biological effects of ionizing radiation. 12 Hrs

Computed Tomography: Conventional tomography, Computed tomography principle, Projection function Generations of CT machines, Electron beam CT, Reconstruction algorithms, Helical CT. 6 Hrs

Ultrasound Imaging: Acoustic propagation, Attenuation, Absorption and Scattering, Ultrasonic transducers, Arrays, A mode, B mode, M mode scanners, Tissue characterization, Color Doppler flow imaging. 8 Hrs

Magnetic Resonance Imaging: Angular momentum, Magnetic dipole moment, Magnetization, Larmor frequency, Rotating frame of reference, Free induction decay, Relaxation times, Pulse sequences, Block of a magnetic resonance imager, Slice selection, Frequency encoding, Phase encoding, Spin-Echo imaging, Gradient-Echo imaging, Imaging safety. 12 Hrs

Radionuclide Imaging: Interaction of nuclear particles and matter, Nuclear sources, Radionuclide generators, Nuclear radiation detectors, Rectilinear scanner, scintillation camera, SPECT, PET. 8 Hrs

Thermal Imaging: Medical thermography, Infrared detectors, Thermographic equipment, Pyroelectric vidicon camera. 6 Hrs

TEXT BOOKS:

1. **Principles of Medical Imaging**, Kirk shung, Academic Press.
2. **Medical Imaging Signals and Systems**, Jerry L Prince and Jonathan M Links, Pearson Prentice Hall Bioengineering.

REFERENCE BOOKS:

1. **Handbook of Biomedical Instrumentation**, Khandpur, Tata McGraw-Hill Publishing Company Ltd., Second edition, 2003.
2. **Fundamentals of medical Imaging**, Zhong Hicho and Manbir singh, John Wiley.

MICRO AND SMART SYSTEMS TECHNOLOGY

Sub code : IT733

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Basic science, Transducer and Instrumentation

Course Objective: To introduce the students to the importance of miniaturization, principles suitable for designing micro devices, fabrications techniques that can be used and modeling of microdevices.

Course Outcome:

Students will be able to

1. Express the importance of miniaturization, different fields involved and the materials that can be used.
2. Interpret the working of micro devices.

3. Explain the methods used for the fabrication of micro devices.
4. Explain the importance of and special issues in packaging of micro devices.
5. Describe the importance of CAD in design and modelling of micro devices

Introduction: MEMS & Microsystems, Microsystems & Microelectronics, Multidisciplinary nature of Microsystems, Advantages and Applications 6 Hrs

Working Principles of Microsystems: Micro sensors: Silicon Capacitive Accelerometer, Piezo-Resistive Pressure, Sensor, Biomedical Sensors, Blood Analyzer, Conductometric Gas Sensor, Fiber-Optic Gyroscope And Surface-Acoustic-Wave Based Wireless Strain Sensor.

Micro actuators: Silicon Micro-Mirror Arrays, Piezo-Electric Based Inkjet Print-Head, Electrostatic Comb-Drive, Magnetic Micro Relay, Shape-Memory-Alloy Based Actuator, Electro-Thermal Actuator, Microgrippers, Micromotors, Microvalves, Micropumps. 8 Hrs

Microsystem Fabrication Processes Introduction, Silicon Structure, Silicon Wafer Processing Method, Thin Film Deposition Processes: Physical Vapor Deposition, Chemical Vapor Deposition, Epitaxial Growth, Thermal Oxidation. Lithography: Photolithography, Lift off Technique. Silicon Micromachining: Bulk Micromachining, Surface Micromachining, Advanced MEMS Fabrication Processes: Wafer Bonding Techniques, LIGA Process. Etching: Wet Etching, Dry Etching, Isotropic & Anisotropic Etching, Etch Stops. 10 Hrs

Microsystem Integration And Packaging Introduction, Important Considerations, Objectives of Packaging, Special Issues, Integration of microelectronics and microdevices, Three Levels of Packaging, Interfaces in Packaging: Biomedical, Optical, Mechanical, Electromechanical, Microfluidic. Essential Packaging Technologies: Die Preparation, Surface Bonding, Wire Bonding, Sealing. Pressure Sensor Packaging Case Study. 10 Hrs

Computer-Aided Simulation And Design Background To The Finite Element Method. Simulation Of Microfabrication Process: Surface Micromachining, LIGA, Bulk Micromachining. Computer Aided Design. 10 Hrs

Modelling Elastic Deformation And Stress Analysis Of Beams And Plates. Thermal Issues. Basic Fluids Issues. Electrostatics. Electromagnetic Actuation. Capillary Electro-Phoresis. Piezoresistive Modeling. Piezoelectric Modeling. Magnetostrictive Actuators. 8 Hrs

TEXT BOOKS:

1. **MEMS & Microsystems: Design and Manufacture**, Tai-Ran Hsu, Tata Mc-Graw-Hill Publication.
2. **Micro and Smart Systems**, G.K. Ananthasuresh, K.J. Vinoy et.al., Wiley India.

REFERENCE BOOKS:

1. **The MEMS Handbook – Design and Fabrication**, Mohamed Gad – el – Hak. 2nd Edition, CRC Taylor & Francis.
2. **Microsystem Design**, Stephen D. Senturia MIT, Springer.

FUZZY LOGIC AND APPLICATIONS

Sub code : IT734

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Knowledge of Mathematics

Course Objective: To introduce the students to the importance of fuzzy sets, fuzzy relations and fuzzy measures and its applications in engineering and medicine.

Course Outcomes:

Students will be able to

1. Have a knowledge of crisp sets, fuzzy sets.
2. Understand the different operations performed on fuzzy sets.
3. Understand the different fuzzy relations.
4. Understand the different fuzzy measures.
5. Have a knowledge of fuzzy applications in engineering and medicine.

Crisp sets and fuzzy sets: Introduction, crisp sets, the notion of fuzzy sets, Basic concepts of fuzzy sets, classical logic, fuzzy logic. 7 Hrs

Operations on fuzzy sets: General discussion, fuzzy complement, fuzzy union, fuzzy intersection, and combinations of operations 7 Hrs

Fuzzy relations: Crisp and fuzzy relations, Binary relation, Binary relations on a single set, equivalence and similarity relations, compatibility or tolerance relations, ordering morphism, fuzzy relations equations. 12 Hrs

Fuzzy measures: General discussion, Belief and plausibility measures, probability measures, possibility and necessity measures, relationship among classes of fuzzy measures. 14 Hrs

Applications: General discussion, natural life and social sciences, engineering, medicine, management and decision-making, computer science and systems science 12 Hrs

TEXT BOOKS:

1. **Fuzzy sets, Uncertainty and information**, Klein and Folger, Prentice Hall, 1987.
2. **Fuzzy logic with engineering applications**, Timothy. J. Ross, McGraw Hill International edition, 1997.

INDUSTRIAL INSTRUMENTATION

Sub code : IT741

Credit Pattern : 3:0:0

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisites: instrumentation basics, process control flow diagrams

Course objectives: This course is to provide the student to expose the various instrumentation systems used in steel, food, steam power, electric power generation, paper & pulp, nuclear reactor and air space applications.

Course outcomes:

Students will be able to

1. Describe the functions and responsibilities in the industries, standardization, maintenance and economics of process industries.
2. Know the process of manufacturing the steel and types of manufacturing and instrumentation required for the process,
3. Able to know the instrumentation required for brewing, canning, baking and dairy industry. Understand the different types of pulping, pulp bleaching, pulp blending, wet end and drier instrumentation.
4. Know the primary and secondary power plant and instrumentation for steam power plant, able to understand General characteristics of interconnected systems, classification of economy dispatch control systems, Digital computer for economy dispatch applications.
5. Learn the concept of Nuclear reactor dynamics, reactor instrumentation, reliability aspects of protective systems. Know the basics of Air craft's and aerospace vehicle instrumentation, air flight simulation instrumentation

Instrumentation practices in process industries: Department functions and responsibilities, development, process analysis, maintenance, standardization, economics of process instrumentation. 3 Hrs

Steel production instrumentation: Selection of instruments, black furnace instrumentation, open-hearth process instrument, End product measurement, continuous casting of steel. 6 Hrs

Food industry instrumentation: Instrumentation in brewing, canning industry, baking, dairy industries. 6 Hrs

Steam power plant instrumentation: Instrument selection, primary and secondary plant measurement, 3 Hrs

Electric power generation & Distribution: General characteristics of interconnected systems, classification of economy dispatch control systems, Digital computer for economy dispatch applications. 6 Hrs

Paper and pulp instrumentation: Different types of pulping, pulp bleaching, pulp blending, wet end and drier instrumentation 6 Hrs

Nuclear reactor instrumentation: Nuclear reactor dynamics, reactor instrumentation, reliability aspects of protective systems 4 Hrs

Air space instrumentation: Air craft's and aerospace vehicle instrumentation, air flight simulation instrumentation. 5 Hrs

TEXT BOOK:

Hand book of applied instrumentation, Considine and Ross, Publisher McGraw-Hill's.

REFERENCE BOOKS:

- 1.**Industrial instrumentation** donald P. ECKMAN, Wiley
- 2.**Industrial Instruments** K.Krishnaswamy, S.Vijayachitra, New age international publishers
- 3.**Food Processing Principles & Applications,** J.S.Smith, University press(US)2004.

SPEECH SIGNAL PROCESSING

Sub code : IT742

Credit Pattern : 3:0:0

Total Hours : 39 Hrs

Contact Hours : 03/Week

Pre-requisites: Signals and systems, Digital signal processing.

Course Objective: This course will introduce the digital models and processing of speech signals. By the end of the course, students will be familiar with speech analysis and synthesis, enhancement, and recognition.

Course Outcomes:

Students will be able to

1. Explain the sources of speech production and develop the digital model for speech signals.

2. Determine Time dependent processing and Fourier analysis of speech signals.
3. Determine Spectrogram, Cepstrum and LPC analysis of speech signals.
4. Express the importance of sampling and different types of quantization of speech signals and speech synthesis.
5. Explain principles and different methods of speech enhancement, speech recognition and speaker recognition techniques

Digital models for speech signals: Process of Speech Production, Acoustic phonetics, Digital models for Speech signals. 6 Hrs

Time domain models for speech processing: Time dependent processing of speech, Short time Energy and average magnitude, Short time average zero crossing rate, Speech Vs silence discrimination using energy and zero crossing. Pitch period estimation using a parallel processing approach, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function. 5 Hrs

Short time fourier analysis: Definition, Linear filtering interpretation, Filter bank summation method, Design of digital filter banks, Spectrographic displays. Cepstrum analysis. 4 Hrs

Linear predictive coding of speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Applications of LPC parameters. 6 Hrs

Digital representations of the speech waveform: Sampling speech signals, Instantaneous quantization, Adaptive Quantization, General theory of differential quantization, Delta modulation. 5 Hrs

Speech synthesis: Principles of Speech synthesis, Synthesis based on waveform coding, analysis synthesis method, speech production mechanism, Synthesis by rule, Text to speech conversion. 3 Hrs

Speech Enhancement: Principles of Speech enhancement, Evaluation of speech intelligibility, Speech enhancement algorithms: Spectral subtraction, Adaptive filtering: LMS and RLS algorithm 5 Hrs

Speech recognition: Principles of Speech recognition, Classification to speech recognition, approaches to speech recognition, speech recognition on pattern recognition approach, Dynamic time warping (DTW), vector quantization. 3 Hrs

Speaker recognition: Principles of Speaker recognition, Speaker recognition methods. 2 Hrs

TEXT BOOKS:

1. **Digital Processing of Speech Signals**, L R Rabiner and R W Schafer, Pearson Education 2004.
2. **Digital Speech Processing, Synthesis and Recognition**, Sadoaki Furui, 2nd Edition, Mercel Dekker 2002.

REFERENCE BOOKS:

1. **Introduction to Data Compression**, Khalid Sayood, 3rd Edition, Elsevier Publications.
2. **Digital Speech**, A M Kondo, 2nd Edition, Wiley Publications.

NEURAL NETWORKS

Sub code : IT743

Credit Pattern : 3:0:0

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisite: Basic science, Concepts of computer

Course Objective: This course will introduce the fundamentals of neural network, linear network architecture, non linear network architecture and their relevant algorithms. By the end of the course, the students will be able to identify the different networks and write algorithms for the different networks in different applications.

Course Outcome:

Students will be able to

1. Have knowledge of fundamentals of neural network.
2. Understand the different structure of network, different learning algorithms.
3. Have knowledge of single layer perceptron, algorithms used.
4. Have a knowledge of Multi layer perceptron, algorithms, problems in algorithms, its improvement.
5. Have a knowledge of nonlinear network architecture and its analysis

Introduction: What is neural network? Human Brain, Models of a Neuron, Neural Networks viewed as directed graphs, Feedback, Network architectures, Knowledge Representation, Artificial Intelligence and Neural Networks. 7 Hrs

Learning processes: Introduction, Error correction algorithm, Memory based learning, Hebbian Learning, Competitive learning, Boltzmann learning, learning with a teacher, learning without a teacher, Learning tasks, Memory, adaptation. 8 Hrs

Single layer perceptions: Introduction, Perceptron, and perception convergence theorem, Examples. Multilayer perceptron: Introduction, Some preliminaries. 8 Hrs

Back Propagation Algorithm, Summary of the Back Propagation Algorithm, XOR Problem, and Heuristics for making the Back propagation algorithm to perform better. 8 Hrs

Radial basis function networks: Architecture, learning algorithms, Applications. Hopfield Networks – Architecture, Capacity of Hopfield models, Energy analysis of Hopfield networks.

8 Hrs

TEXT BOOKS:

1. **Neural Networks A comprehensive foundation**, Simon Haykin, McMillan College public company, Newyork 1994.
2. **Artificial neural networks**, B. Yegnanarayana Prentice Hall of India 1999.

REFERENCE BOOKS:

1. **Introduction to Artificial Neural Systems**, Jacek M. Zurada Jaico Publishing House
2. **Neural Network Fundamentals with Graphs, Algorithms, and applications**, N.K. Bose, P.Liang, Tata McGraw Hill Edition.1998
3. **Artificial Neural networks**, Robert J Schalkoff, McGraw Hill international Edition,1997
4. **Neural networks and Fuzzy Systems**, A Dynamical systems approach to machine intelligence, Bart Kosko, Prentice Hall of India Publications, 2006

COMPUTER NETWORKS

Sub code : IT744

Credit Pattern : 3:0:0

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisites: Concepts of Computer.

Course Objectives :This subject introduces students to computer networks and concentrates on building a firm foundation for understanding Data Communications and Computer Networks. It is based around the OSI Reference Model which deals with the major issues in the bottom four (Physical, Data Link, Network and Transport) layers of the model.

Course outcome:

Students will be able to

1. Understand fundamental principles of computer networking.
2. Explain theoretical analysis of data transmission and key transmission technologies used in modern networks.

3. Understand the protocols used for reliable and efficient communication between two adjacent machines at the data link layer and channel allocation for data transmission.
4. Understand the topologies of communication subnets, routing, congestion control and illustrate these issues using internet and its network layer protocol.
5. Understand transport layer services, design, protocols, performance and some real network applications.

Introduction: Uses of computer networks, Network Hardware, Network Software, Reference Models, Example Networks, Network Standardization.

6 Hrs

The physical layer: The theoretical basis for Data communication Guide Transmission media, Wireless Transmission, Communication Satellites. The public Switched Telephone Network, The mobile telephone System, Cable Television.

7 Hrs

The data link layer: Data link layer Design Issues, Error Detection and correction, Elementary Data Link Protocols, Sliding Window protocols, Protocol Verification, Data Link Protocol.

6 Hrs

The medium access control sub layer: The Channel Allocation Problem Multiple Access Protocols, Ethernet, Wireless LANS, Broadband Wireless,

4 Hrs

The network layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, **Internet:** working, the network layer in the network

7 Hrs

The transport layer: The transport service. A Sample Transport Protocol, the Internet Transport Protocol (TCP and UDP), Performance Issues.

5 Hrs

The application layer: domain name system (DNS), Electronic Mail, Worldwide Web, Multimedia

4 Hrs

TEXT BOOK:

1.Computer Networks, Andrews S. Tanenbaum, 4th Edition, Pearson Education.

REFERENCE BOOKS:

1. **ATM Protocols concepts,** Hondel and Fluber, AdditionWesley
2. **Data and Computer Networks,** W Stallings 5th Edition Prentie Hall of India 1998

PROCESS INSTRUMENTATION AND CONTROL LAB

Sub code : IT76L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisites: Transducers and Instrumentation I & II, Concepts of Signal conditioning

Course objectives: This course is to provide the student with basic skills of obtaining optimum response using various types of controllers for temperature, flow and level process loops. Developing programming skills using programmable logic controllers and also creation of CRO, Function generator and Multimeter using Labview software.

Course outcomes:

Students will be able to

1. Apply the fundamental knowledge of automation & process control and write the program.
2. Test the program and observe the output
3. Analyze and draw conclusion on the result
4. Demonstrate the application of various controllers.

LIST OF EXPERIMENTS:

1. Using different controllers obtain the optimum response of the given temperature controller.
2. Using different controllers obtain the optimum response of the given flow controller.
3. Using different controllers obtain the optimum response of the given level controller.
4. Sequential Control experiments using PLC. The logic should be solved using ladder diagram technique.
5. Bottle filling process using PLC. The logic should be solved using ladder diagram technique.
6. Elevator using PLC. The logic should be solved using ladder diagram technique
7. Developing an integrated application with PLC, HMI, Drive and I/O 's
8. Basic operations, simple programming structure using lab view.
9. Creation of a CRO using VI and measurement of frequency and amplitude.
10. Creation of a digital multimeter using VI and measurement of voltage and current.
11. Design variable function generator using VI (sine, square and triangle)
12. Data acquisition using VI for temperature measurement with thermo couple and AD590

DSP LAB

Sub code : IT77L

Credit Pattern : 0:0:1.5

Total Hours : 39 Hrs

Contact Hours : 03/Week

Prerequisites: Signal and systems, Digital signal processing

Course Objective: This course will introduce assembly language and C programs using TMS320C5416 and on TMS320C6713 processor. By the end of the course, students will be familiar with Convolution, FFT, Filter programs, interpolation and decimation assembly language programs on TMS320C5416 and C programs using TMS320C6713.

Course Outcome:

Students will be able to

1. Apply fundamental knowledge to implement DSP algorithms.
2. Design the steps and implement various algorithms for DSP processors.
3. Execute various programs written and interpret the results.
4. Explain the logic and demonstrate the functioning of the program efficiently.

LIST OF EXPERIMENTS:

1. Implementation of Assembly language programs using TMS320C5416.
2. Implementation of linear convolution and correlation on TMS320C5416.
3. Implementation of Circular convolution on TMS320C5416.
4. Implementation of FIR & IIR filters on TMS320C5416.
5. Implementation of interpolation concepts using TMS320C5416.
6. Implementation of decimation concepts using TMS320C5416
7. Implementation of linear convolution on TMS320C6713 using assembly language program.
8. Implementation of linear convolution and correlation on TMS320C6713 using C program
9. Implementation of FIR Filters on TMS320C6713 using C program
10. Implementation of IIR Filters on TMS320C6713 using C program
11. Implementation of FFT on TMS320C6713 using C program
12. Implementation of FIR Filters using codec of TMS320C6713.

Note: Above experiments are conducted using TMS processor and results are verified with MATLAB and Theoretical results.

Text books:

Modern digital signal processing: V.Udayashankara, PHI, Third Edition, 2015.

MANAGEMENT AND ENTREPRENEURSHIP

Sub code : IT 810

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Course Objectives: The course objective is to provide the basic knowledge Management, planning, organizing, controlling. To understand the issues of staffing, placement, small scale industries and their role in economic development of the country.

Course Outcomes:

Student will be able to

1. Express the importance of functional areas of management and role of managers in managing people and processes of multidisciplinary organizations.
2. Develop the Knowledge of professional way of planning, recruitment and staffing in an organization
3. Express the importance of communication skills, coordination, and leadership in the development of an organization.
4. Express the importance of Importance of directing and control in organization
5. Develop and assess the challenges of entrepreneur, small scale industries and Motivated to become an entrepreneur

Management: Importance of Management, Definition, nature and characteristics of Management, Scope and Functional areas of management, Roles of a Manager, Levels of Management, Management and administration, Management as a science, art of profession, Development of Management Thought, early management approaches, Modern management approaches. 08 Hrs

Planning: Nature, importance and purpose of planning process, Objectives, standing plans, polices, types of policies, Importance of planning, steps in planning and planning premises, limitations of planning, Hierarchy of plans. Decision making: types of decision making, step sin rational decision making, Environment of decision making, common difficulties in decision making 12 Hrs

Organizing: Nature and purpose of organization, span of management, Principles of organization, Types of organization, Departmentalisation, organization structure, Committees. Authority delegation and decentralization: difference between authority and power, Centralization Vs Decentralization of authority, advantages and disadvantages, Staffing: Nature

and importance of staffing, manpower planning, process of selection, process of recruitment, placement, coordination, need for coordination. 12 Hrs

Directing: Meaning and nature of directing, motivation, Motivation Theories, Communication, meaning and importance, forms of communication, barriers of communication, leadership and its characteristics Controlling: steps in control process, need for control, Essentials of a effective control system, Methods of establishing control and benefits. 10 Hrs

Entrepreneur: Meaning of Entrepreneur; Functions of an Entrepreneur, Types of Entrepreneur, Role of entrepreneurs in Economic Development. Small scale industries: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development, Project Selection; Project Report 10 Hrs

TEXT BOOKS:

1. **Principles of Management**, P.C.Tripathi, P.N.Reddy , Tata McGraw Hill,
2. **Entrepreneurship Development**, Poornima.M.Charantimath, Small Business Enterprises, Pearson Education, 2006.

REFERENCE BOOK:

1. **Management Fundamentals, Concepts, Application, Skill Development**, RobersLusier, Thomson

LASERS AND OPTICAL INSTRUMENTATION

Sub code : IT 821

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Physics

Course outcomes:

Students will be able to

1. Express the basic concepts of lasers, know the types of lasers
2. Explain the concept of Q switching, mode locking and their types, frequency stability in lasers, application lasers in engineering and medicine and lasers safety.
3. Describe the laser instruments used for measuring distance, and velocity, welding cutting and printing, know the concept in spectroscopy holography and its application.
4. Explain different optoelectronic devices and components and their operations.
5. Describe the fiber optic principles, losses in fibers, materials used and manufacturing Process; know the types of fiber optic sensors its principle and application.

Lasers: Principles, classification, construction of Ruby, He-Ne, Nd-YAG, semiconductor, Argon and Carbon dioxide lasers. 7 Hrs

Characteristics of stabilization, Q-switching and mode locking, frequency stabilization. 6 Hrs

Line shape function, lasing threshold, application of lasers in engineering and medicine, safety with lasers. 6 Hrs

Laser instruments: Laser interferometer, laser strain gauges, velocimetry, pulse echo technique, beam modulation telemetry and holography, application of holography, laser welding, laser machining and laser spectroscopy 7 Hrs

Optoelectronic devices and components: Photo diodes, PIN diodes, solar cells, LED's phototransistors, opt-isolators, photo-couplers. 6 Hrs

Fiber optics: Light Modulation schemes, optical fibers, intermodal dispersion, graded index fiber, low dispersive fibers 7 Hrs

Fiber losses, fiber materials, integrated optics, optical instability, laser printing, optical multiplexers. 6 Hrs

Optical fiber sensors: Multimode passive and active fiber sensors, phase modulated sensors, fiber optic gyroscope, Polarization: polar metric sensors, polarization, and rotation sensors.

7 Hrs

TEXT BOOKS:

1. **Optoelectronics**, Wilson & Hawkes, Prentice Hall of India.
2. **Laser principles and applications**, Wilson and Hawkes, Prentice Hall of India.

REFERENCE BOOKS:

1. **Essentials of Opto Electronics with Applications**, A.J.Rogers, CRC Press.
2. **Principles of Optical Communication & Opto Electronics**, I.Ravikuamar, Bala N.Saraswathi, Lakshmi Publications.
3. **Optoelectronics Devices & Systems**, Guptha, Prentice Hall of India.

ROBOTICS

Sub code : IT822

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisites: Mathematics

Course Objective: This course will introduce the basic concepts of Robotics and Sensors. By the end of the course, students will be familiar with basics, transformation, kinematic analysis and motion planning.

Course Outcome:

Students will be able to:

1. Explain Classification of robotics and drives
2. Explain classification of sensors and their applications in robotics
3. Express the importance of Transformation.
4. Apply Direct and inverse kinematic analysis
5. Apply joint space, Cartesian, point-to-point planning

Basic Concepts: Definition of robotics- classification of robotics- degrees of freedom –Links-Joints-rigid body-manipulator-various subsystems of robotics-Power sources- Hydraulic, pneumatic, electric drives, Grippers 10 Hrs

Internal and External Sensors: Internal sensors-Position sensors- incremental encoder-absolute encoder-resolver velocity sensors-tachometer and Hall Effect sensor, acceleration and forces sensors-hall effect-touch sensors Proximity sensors- ultrasonic sensors-laser sensors for range measurements- machine vision sensors. 10 Hrs

Transformation: Arm Equation – Dot and Cross Products,coordinate Frames, Rotation matrix-composite rotations, homogenous transformation matrix- DH representation- homogenous transformation for various arm configurations 10 Hrs

Kinematics: Direct and inverse kinematics- forward position analysis - inverse position analysis Jacobian matrix – **velocity analysis**, acceleration analysis 12 Hrs

Motion planning: Joint space planning - Cartesian space planning -Position and Orientation trajectories - Point-to-point Planning - continuous path generation. Collision avoidance algorithms. 10 Hrs

TEXT BOOKS:

1. **Introduction to Robotics** ,S.K.Saha, Tata McGraw Hill, 2008

2. **Robotics**, K.S.Fu,R.C.Gonzalez,C.S.G.Lee, Tata McGraw Hill, 2008

REFERENCE BOOKS:

1. **Industrial Robotics** , Mikell P, Weiss G M , Nagel R N, McGraw Hill 1996
2. **Control in Robotics and Automation: Sensors based integration**, Ghosh, Allied publishers ,1998
3. **Robotics Technology and flexible automation**, Deb S R, John Wiley 1992
4. **Robots and manufacturing automation**, Asfahl C. R. John Wiley 1992
5. **Fundamentals of Robotics**, Robert J.Schilling

INDUSTRIAL COMMUNICATION

Sub code : IT 823

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Prerequisite: Electrical Measurements and Measuring Instruments, Communication Theory

Course Objective: This course will introduce the basic concepts of data communication, serial communication standards, Industry protocols and wireless communication systems. By the end of the course, students will be familiar with basics industrial communication standards and industrial protocol.

Course Outcomes:

Students will be able to

1. Explain various methods of data communication.
2. Express the importance of Serial communication standards.
3. Understand serial communication standards
4. Explain various protocols used for data communication.
5. Express the importance of Cabling, noise, LAN and wireless communication system

Basic of Communication System: Communication, Communication systems, Modulation, Bandwidth requirement. Channel Capacity, Baud Rate, Data Rate. 2 Hrs

Modulation: Amplitude Modulation, Frequency Modulation, Phase Modulation, Comparison of different modulations. Modulation for Digital signal: Introduction, modulation circuit, demodulation circuit, ASK, FSK, PSK, PWM, PAM, PPM. 12 Hrs

Data Communication: Data communication principle, Communication modes, Synchronous and asynchronous system, Error detection, Transmission Characteristics, Data coding, UART. 4 Hrs

Serial Communication Standard: Serial data communication interface standards, Balanced and unbalanced transmission lines, RS 232 interface standard, Troubleshooting serial data communication circuits, Test equipment, RS 422 Standard, RS 485 Standard, Troubleshooting and testing with RS 485, 20 mA Current loop, GPIB,USB and Ethernet. 10 Hrs

Industrial Protocols: Introduction to protocols, Modbus protocol, HART Fieldbus and DeviceNet system, TCP / IP. 12 Hrs

Cabling and Interference: Cabling: Introduction, Copper based cable, Coaxial cable, Twisted pair cable, Fiber optic cable. 3 Hrs

Noise and Interference : Definition of noise, External and Internal noise, Noise calculation, Noise Figure, Noise Temperature, , Frequency analysis of noise, Source of electrical noise, Electrical coupling of noise, Shielding, Cable ducting, Cable spacing, Earthing and grounding requirement, Suppression techniques. 3 Hrs

LAN and Wireless Communication Systems: Overview of class of network, Network Topologies, Transmission Techniques, Ethernet. Wireless LAN using CSMA/CA, Cellular Digital Packet Network, Satellite communication. 6 Hrs

TEXT BOOKS:

- 1 Electronic Communication Systems, Kennedy and Devis
- 2 Practical Data Communications for Instrumentation and Control, John Park
- 3 Introduction to Data and Network Communication, Michael A. Miller
- 4 Instrument Engineers Handbook Vol. III, B.G.Liptak

REFERENCE BOOK:

HART application Guide, Romily Bowden, HART Communication Foundation, 1999.

LOW POWER VLSI

Sub code : IT824

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisites: Logic Design, VLSI Design

Course Objectives: The course objective is to provide the basic knowledge low power VLSI, circuit elements and design issues, models of CMOS circuits. To understand the design issues of low power architecture, delay, power dissipation and memory.

Course Outcomes:

Student will be able to

1. explain the design constraints in design of digital systems using VLSI technology
2. Student will be able to develop the Knowledge of engineering challenges in design of low power CMOS circuits
3. Student will be able to assess the constraints in design low power CMOS circuits
4. Student will be able to describe of low power systems and architectures
5. Student will be able to design circuits using structured design methodology in Low power VLSI

Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices. Device & technology impact on low power: Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

12 Hrs

Power estimation, simulation power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

10 Hrs

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy. 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 .

12 Hrs

Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design. low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.

10 Hrs

Algorithm & architectural level methodologies: Introduction, design flow, Algorithmic level analysis & optimization, Architectural level estimation & synthesis.

08 Hrs

TEXT BOOKS:

1. **Practical Low Power Digital VLSI Design**, Gary K. Yeap, KAP, 2002
2. **Low power design methodologies**, Rabaey, Pedram, Kluwer Academic, 1997

REFERENCE BOOK:

1. **Low-Power CMOS VLSI Circuit Design**, Kaushik Roy, Sharat Prasad, Wiley, 2000

IoT and SMART SENSORS

Sub code : IT831**Credit Pattern : 4:0:0****Total Hours : 52 Hrs****Contact Hours : 04/Week****Prerequisite:** Transducers and Instrumentation, Communication systems,**Course Objectives:**

To give an introduction to Internet of Things and its building block

To give information about basics of Smart Sensors, protocols and standards used in its design.

Course outcomes:

Students will be able to

1. Understand the basics, applications and technologies of IoT.
2. Know the IoT Processes, Data Management and related issues.
3. Understand the basics of smart sensors.
4. Know the methods of conditioning sensor signal and controlling sensor working.
5. Learn the communication protocol and IEEE standard used with smart sensors.

Basics of IoT, Applications and Technologies: IoT Today, IoT Future, IoT Vision, IoT common Definitions, IoT Strategic Research and Innovations, IoT Functional View, IoT Applications Areas, IoT SmartX Applications, Cloud Computing, Semantic Technologies, Networking Technologies, Communication Technologies. 10 Hrs

IoT Processes, Data Management and Issues: Processes: Adaptive and Event Driven Processes, Processes Dealing with Unreliable Data, Processes Dealing with Unreliable Resources, Highly Distributed Processes, Data Management: DCA, Big Data, Semantic Sensor Networks and Semantic Annotation of Data, Virtual Sensors. Issues: Trust of IoT, Security of IoT, Privacy of IoT, Energy Issues and Harvesting. 12 Hrs

Basics of Smart Sensors: Introduction, Mechanical-Electronic transitions in sensing, Smart Sensor Model, Sensing Technologies: Capacitive, Piezoresistive, Hall Effect, Chemical, Digital Output Sensor: Incremental Optical Encoder, Digital Techniques. 10 Hrs

Sensor Signal Conditioning and Control: Introduction, SLEEPMODE™ Operational Amplifiers, Rail – to – Rail Operational Amplifiers, Switched Capacitor Amplifier, 4 – to 20 mA Signal Transmitter, Separate vs Integrated Signal Conditioning. Analog to Digital Converter: Σ - Δ ADC, MCU control, Modular MCU Design, DSP control 10 Hrs

Protocols and Standards for Smart Sensors: Introduction, CAN protocol, CAN Module, Neuron Chips, MCU Protocols, IEEE 1451 working relationship, IEEE 1451.1, IEEE 1451.2, IEEE P1451.3, IEEE P1451.4. 10 Hrs

TEXT BOOK:

1. **Internet of Things – From Research and Innovation to Market Deployment**, Ovidiu Vermesan and Peter Friess, River Publisher Series in Communication
2. **Understanding Smart Sensors**, Randy Frank, 2nd Edition, Artech House Publications, 2000.

REFERENCE BOOK:

1. **Rethinking the Internet of Things: A Scalable Approach to Connecting Everything**, Francis Da Costa, Apress Open, Intel.
2. **Learning Internet of Things**, Peter Waher, PACKT Publishing
3. **Smart Sensor Systems**, Gerard Meijer, Wiley, Sept 2008

BIOMEDICAL SIGNAL PROCESSING

Sub code : IT832

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisites: Biomedical Instrumentation, Signals and systems, Digital signal processing.

Course Objective: This course will introduce the fundamentals of human physiological signal its characteristics, morphology, signal modeling. By the end of the course, the students will be able to write algorithms to detect events, data reduction and signal estimation using modeling techniques.

Course Outcomes:

The students will be able to

1. Learn the sources of biomedical signals, their characteristics and understand the basic associated with human physiology.
2. Apply the knowledge of signal processing to analyze the various events and waveform complexities of different biological signals like ECG and algorithms available in biomedical equipments.
3. Learn the different ECG compression techniques.
4. Understand the basics of neurological signal processing, parametric modeling and nonparametric modeling.
5. Understand the basic of noise elimination techniques and have a knowledge of different algorithms.

Introduction to Biomedical Signals: The nature of biomedical signals, The action potential, objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, computer aided diagnosis. 7 Hrs

Neurological signal processing: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis, Linear prediction theory, The Autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination- The case of epileptic patients, overall performance. Data acquisition and classification of sleep stages, The Markov model and Markov chains, Dynamics of sleep-wake transitions, Hypnogram model parameters, Event history analysis for modeling sleep. 12 Hrs

Adaptive Interference/Noise Cancellation: A review of Wiener filtering problem, Principle of an Adaptive filter, The steepest-descent algorithm, the Widrow-Hoff least mean square adaptive algorithm, Adaptive noise canceller, Cancellation of 60Hz interference in ECG, canceling of maternal ECG in fetal ECG. 7 Hrs

Cardiological Signal Processing: Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, The use of multi-scale analysis for parameter estimation of ECG waveforms, Arrhythmia analysis monitoring, long term continuous ECG recording. 9 Hrs

ECG Data Reduction Techniques: Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Transformation compression techniques, Other data compression techniques, Data compression techniques comparison. 9 Hrs

Prony's Method: Exponential modeling, Exponential parameter estimation, The original Prony problem, Least squares prony method, The covariance method of linear prediction, Prony's method in the presence of noise, clinical application of prony's method. 8 Hrs

TEXT BOOKS:

1. **Biomedical Signal Processing Principles and Techniques**, D C Reddy, The McGraw-Hill publications.
2. **Biomedical Signal Analysis A case study approach**, Rangaraj M. Rangayyan, The John Wiley publications.

REFERENCE BOOK:

1. **Biomedical Digital Signal Processing**, Willis J. Tompkins, The Prentice Hall of India publications.

PHOTOVOLTAICS THEORY AND DESIGN**Sub code : IT833****Credit Pattern : 4:0:0****Total Hours : 52 Hrs****Contact Hours : 04/Week****Prerequisites:** Basic Electronics

Course Objectives: This course aims to expose the students to understand fundamentals of semiconductor materials, Expose to principle & design of solar cells and designing of solar PV modules.

Course outcomes:

Students will be able to:

1. Describe the behavior of PN Junction under illumination
2. Able to understand the limits of cell parameters, losses and design of solar cells.
3. Differentiate between the performance of series and parallel connections of solar photovoltaic cell
4. Ability to differentiate performance of solar cells in series and parallel connection
5. Designing a solar PV module for required specifications

Fundamentals of Semiconductors and charge carriers and their motion: semiconductors as solar materials, arrangements of electronics in atom, formation of energy bands, charge carriers in semiconductors, carrier concentration and distribution, carrier motion in semiconductors, electrical field and energy band bending, generation of carries and recombination of carriers.8h

An introduction to Solar Cells: Introduction to P-N junction –equilibrium condition, non-equilibrium condition, P-N junction under illumination: solar cell 8 Hrs

Design of Solar Cells: Upper limits of Cell Parameters, losses in solar cells, solar cell design, Design of High I_{sc} , V_{oc} and FF. analytical techniques. 8 Hrs

Solar photovoltaic modules: Solar PV modules from solar cells, mismatch in series connection, mismatching in parallel connection, PV module power plants. 8 Hrs

Balance of Solar PV systems: Basics of electromechanical cell, factors affecting battery performance, batteries for PV systems, DC to DC converters, Charge controllers, DC to Ac converter, MPPT 12 Hrs

Photovoltaic system design and applications: introduction to Solar PV systems, design methodology of PV systems, Hybrid PV systems, grid-connected PV systems, simple playback period, life cycle costing. 10 Hrs

TEXT BOOK:

1. **Solar Photovoltaics, Fundamentals, technologies and applications**, Chetan Singh Solanki, second edition, PHI 2011

REFERENCE BOOKS:

1. **Applied Photo voltaics**, Stuart R Wenhem, earth scan, 2007

2. **Solar electric hand book, Photo voltaic fundamentals and applications**, Solar energy international.

MOBILE COMMUNICATION

Sub code : IT834

Credit Pattern : 4:0:0

Total Hours : 52 Hrs

Contact Hours : 04/Week

Pre-requisite: Knowledge of communication systems

Course Objectives: To strengthen students' knowledge in mobile/wireless communication systems and to design mobile/wireless communication systems

Course outcome:

Students will be able to

1 Explain the Infrastructure to develop mobile Communication system, cellular Theory, and characteristics of different multiple access techniques in mobile/wireless communication.

2. Describe the need of coding, Channel models, Diversity, Equalization and Channel estimation techniques.

3. Apply analytical and empirical models in the design of wireless links.

4. Explain the Ad Hoc networks, new trends in Mobile/wireless communication, radio propagation over wireless channel and different limitations.

5. Apply analytical and empirical models in the design of wireless links.

Wireless transmission: Frequencies for radio transmission, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum. 5 Hrs

Medium access control: Motivation for a specialized MAC, SDMA, FDMA, TDMA, fixed TDM, Classical aloha, slotted aloha carrier sense multiple access, PRMS packet reservation multiple access, Reservation TDMA, multiple access with collision avoidance, polling inhibit sense multiple access, CDMA, spread aloha multiple access, Comparison. 5 Hrs

Telecommunications systems: GSM, mobile services, system architecture, radio interface, protocols, localization and calling, handover, security, new data services, DECT, system architecture TETRA, UMTS and IMT-2000, UMTS releases and standardization, architecture, radio interface, UTRAN, core network, handover 8 Hrs

Satellite systems: Basics GEO, LEO, MEO, Routing, localization, handover. 5 Hrs

Broadcast systems: Cyclic repetition of data, digital audio broadcasting, digital video broadcasting, convergence of broadcasting and mobile communications. 5 Hrs

Wireless lan: Infrared Vs radio transmission, infrastructure and ad-hoc network, IEEE802.11, HIPERLAN, Blue tooth 8 Hrs

Mobile network layer: Mobile IP, Goals, assumptions and requirements, entities and terminology, IP packet delivery, agent discovery, registration, tunneling and encapsulation, optimizations, reverse tunneling, IPv6 343, IP micro- mobility support, Dynamic host configuration, protocol, mobile ad-hoc networks Routing, destination sequence distance vector, Dynamic source routing, alternative metrics, overview 8 Hrs

Mobile transport layer: Traditional TCP, Congestion control, slow start, fast retransmit/ fast recovery, implications of mobility, Classical TCP in improvements, indirect TCP, Snooping,

mobile, Fast retransmit/ fast recovery, Transmission/time-out freezing, selective retransmission, Transaction-oriented TCP, TCP over 2.5/3G wireless networks. 8 Hrs

TEXT BOOK:

Mobile Communications, Second edition, Jochen Schiler, Pearson education. 2003

REFERENCE BOOKS:

1. **Mobile Communications engineering**, Theory and applications, second edition, Willim C.Y. Lee, McGraw-hill, 1997, Singapore
2. **Introduction to Wireless and Mobile Systems**, Dharma Prakash Agarwal, Qing An Zeng, Second edition, THOMSON, 2007
3. **Electronic Communications systems Fundamentals through advanced**, Fifth edition, Wayne Tomasi, Pearson education 2007.
