w.e.f 2016-2017

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA 533 003
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Specialization: I&CS

COURSE STRUCTURE

M. Tech- I Semester

Code	Name of the Subject	L	P	C	INT	EXT	TOTAL
Core							
	1. Transducers and Sensors	4	-	3	40	60	100
	2. Digital Control Systems	4	-	3	40	60	100
	3. Fiber Optic Sensors and Devices	4	-	3	40	60	100
	4. Digital System Design	4	-	3	40	60	100
Elective I		4	-	3	40	60	100
	1. Adaptive Control Systems						
	2. Soft Computing Techniques						
	3. Cyber Security						
	4. Object Oriented Programming						
Elective II		4	-	3	40	60	100
	1. Fuzzy Based Control Systems						
	2. VLSI Technology and Design						
	3. Advanced Digital Signal Processing						
Laboratory							
	1. Transducers & Instrumentation Lab	-	3	2	40	60	100

M. Tech- II Semester

Code	Name of the Subject	L	P	C	INT	EXT	TOTAL
Core							
	1. Data Acquisition Systems	4	-	3	40	60	100
	2. Bio-Medical Instrumentation	4	-	3	40	60	100
	3. Process Control Instrumentation	4	-	3	40	60	100
	4. Embedded System Design	4	-	3	40	60	100
Elective III		4	-	3	40	60	100
	1. Non Linear and Optimal Control Systems						
	2. PC Based Instrumentation						
	3. DSP Processors & Architecture						
Elective IV		4	-	3	40	60	100
	1. EMI / EMC						
	2. Control and guidance systems						
	3. Analytical Instrumentation						
Laboratory							
	1. Process Control Instrumentation Lab	-	3	2	40	60	100

TRANSDUCERS AND SENSORS

Unit – 1

Introduction: functional elements of an instrument, Generalized performance characteristics of instruments – static characteristics, dynamic characteristics.

Zero order, first order, second order instruments – step response, ramp response and impulse response. Response of general form of instruments to periodic input and to transient input Experimental determination of measurement system parameters, loading effects under dynamic conditions.

Unit – 2

Transducers for motion and dimensional measurements: Relative displacement, translation and rotational resistive potentiometers, resistance strain guages, LVDT, synchros, capacitance pickups. Piezo-electric transducers, electro-optical devices, nozzle – flapper transducers, digital displacement transducers, ultrasonic transducers.

Magnetic and photoelectric pulse counting methods, relative acceleration measurements, seismic acceleration pickups, calibration of vibration pickups.Gyroscopic sensors.

Unit – 3

TRANSDUCERS FOR FORCE MEASUREMENT: Bonded strain guage transducers, photoelectric transducers, variable reluctance pickup, torque measurement dynamometers.

TRANSDUCERS FOR FLOW MEASUREMENT: Hot wire and hot-film anemometers, electromagnetic flow meters, laser dopplervelocimeter.

TRANSDUCERS FOR PRESSURE MEASUREMENT: Manometers, elastic transducers, liquid systems, gas systems, very high pressure transducers. Thermal conductivity guages, ionisationguages, microphone.

Unit – 4

TRANSDUCERS FOR TEMPERATURE MEASUREMENT: Thermal expansion methods, thermometers (liquid in glass), pressure thermometers, Thermocouples. Materials configuration and techniques.Resistance thermometers, Thermistors, junction semiconductors.Sensors, Radiation methods.Optical pyrometers. Dynamic response of temperature sensors heat flux sensors. Transducers for liquid level measurement, humidity, silicon and quartz sensors, fibre optic sensors.

Unit –5

Smart sensors: Introduction, primary sensors, converters, compensation. Recent trends in sensor technology – film sensors, semi conductor IC technology, MEMS, Nano-sensors.

Text Book:

1. Doebelin, E.O., “Measurement systems – Application and Design”, McGraw Hill. 4 th Ed.
2. D. Patranabis, “Sensors and Transducers”, PHI, 2nd Edition.

Reference:

1. Instrumentation Measurement & Analysis, by B.C. Nakra, K.K. Choudry, (TMH)
2. Transducers and Instrumentation, by D.V.S. Murthy (PHI)

M. Tech – I&CS I Year – I Semester - 2016

DIGITAL CONTROL SYSTEMS

UNIT –I:

Sampling and Reconstruction:

Introduction, sample and hold operations, Sampling theorem, Reconstruction of original sampled signal to continuous-time signal.

The Z – Transforms:

Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, the inverse Z – transforms, Modified Z- Transforms.

Z-Plane Analysis of Discrete-Time Control System:

Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane: Primary strips and Complementary Strips.

UNIT –II:

State Space Analysis:

State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and its Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations

UNIT –III:

Controllability and Observability:

Concepts of Controllability and Observability, Tests for controllability and Observability, Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.

Stability Analysis:

Stability Analysis of closed loop systems in the Z-Plane, Jury stablility test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion, Stability analysis using Liapunov theorems.

UNIT –IV:

Design of Discrete Time Control System by Conventional Methods:

Design of digital control based on the frequency response method – Bilinear Transformation and Design procedure in the W-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers. Design digital control through deadbeat response method.

UNIT –V:

State Feedback Controllers and Observers:

Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula, State Observers – Full order and Reduced order observers.

Introduction to Kalman filters, State estimation through Kalman filters, introduction to adaptive controls.

TEXT BOOKS:

1. K. Ogata - "Discrete-Time Control systems" - Pearson Education/PHI, 2nd Edition.
2. M.Gopal - "Digital Control and State Variable Methods"- TMH

REFERENCE BOOKS:

1. Kuo - "Digital Control Systems"- Oxford University Press, 2nd Edition, 2003.
2. M. Gopal - "Digital Control Engineering".

FIBRE OPTIC SENSORS AND DEVICES

Unit –1

Optical Sources and Detectors: Light-emitting diode: Principles, Structures, LED characteristics, Modulation of LED.

Lasers: Principles, Laser diode structures and radiation pattern, Laser characteristics, Modulation of Semiconductor Laser. Photo detectors: Principles, Quantum efficiency, Responsitivity of P.I.N photodiode, and Avalanche photodiode.

Unit – 2

Optical Fiber Sensors and Devices: Overview of fibre optic sensors - advantages over conventional sensors, broadband classification.

Intensity Modulated Optical Fibre Sensors: Introduction, intensity modulation through light interruption shutter/ schlieren multimode fibre optic sensors - reflective fibre optic sensors, evanescent wave fibre sensors -microbend optical fibre sensors - fibre optic refractometers, intensity modulated fibre optic thermometers, distributed sensing with fibre optics.

Unit – 3

Interferometric Optical Fibre Sensors: Introduction, basic principles of interferometric optical fibre sensors, components and applications of interferometric sensors.

Fused Single Mode Optical Fibre Couplers: Introduction, physical principles(coupling coefficient) polarization effect, experimental properties, theoretical modelling, and comparison with experiment.

Unit-4

Single Mode All Fibre Components: Introduction, directional couplers, polarizes, polarization splitters polarization controllers, optical isolators, single mode fibre filters wave length multiplexers and demultiplexers, switches and intensity modulators, phase and frequency modulators.

Fibre Optic Sensor Multiplexing: Introduction, general topological configuration, and incoherent and coherent detection.

Unit – 5

Signal Processing in MonomodeFibre Optic Sensor Systems: Introduction, Transduction mechanisms, Optical Signal Processing, Electronic Processing.

Text Books:

1. Optical Fiber Communications – Gerd Keiser, 3 rd Ed. McGraw Hill.

2. Fundamentals of Fibre Optics in Telecommunication and Sensor Systems - Bishnu P PAL Wiley Eastern Ltd. (1994).

Reference:

Optical Fiber Communications and Sensors – Dr. M. Arumugam.

DIGITAL SYSTEM DESIGN

UNIT-I: Minimization Procedures and CAMP Algorithm:

Review on minimization of switching functions using tabular methods, k-map, QM algorithm, CAMP-I algorithm, Phase-I: Determination of Adjacencies, DA, CSC, SSMs and EPCs,, CAMP-I algorithm, Phase-II: Passport checking, Determination of SPC, CAMP-II algorithm: Determination of solution cube, Cube based operations, determination of selected cubes are wholly within the given switching function or not, Introduction to cube based algorithms.

UNIT-II: PLA Design, Minimization and Folding Algorithms:

Introduction to PLDs, basic configurations and advantages of PLDs, PLA-Introduction, Block diagram of PLA, size of PLA, PLA design aspects, PLA minimization algorithm(IISc algorithm), PLA folding algorithm(COMPACT algorithm)-Illustration of algorithms with suitable examples.

UNIT -III: Design of Large Scale Digital Systems:

Algorithmic state machine charts-Introduction, Derivation of SM Charts, Realization of SM Chart, control implementation, control unit design, data processor design, ROM design, PAL design aspects, digital system design approaches using CPLDs, FPGAs and ASICs.

UNIT-IV: Fault Diagnosis in Combinational Circuits:

Faults classes and models, fault diagnosis and testing, fault detection test, test generation, testing process, obtaining a minimal complete test set, circuit under test methods- Path sensitization method, Boolean difference method, properties of Boolean differences, Kohavi algorithm, faults in PLAs, DFT schemes, built in self-test.

UNIT-V: Fault Diagnosis in Sequential Circuits:

Fault detection and location in sequential circuits, circuit test approach, initial state identification, Haming experiments, synchronizing experiments, machine identification, distinguishing experiment, adaptive distinguishing experiments.

TEXT BOOKS:

1. Logic Design Theory-N. N. Biswas, PHI
2. Switching and Finite Automata Theory-Z. Kohavi , 2nd Edition, 2001, TMH
3. Digital system Design using PLDd-Lala

REFERENCE BOOKS:

1. Fundamentals of Logic Design – Charles H. Roth, 5th Ed., Cengage Learning.
2. Digital Systems Testing and Testable Design – MironAbramovici, Melvin A. Breuer and Arthur D. Friedman- John Wiley & Sons Inc.

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Adaptive Control Systems

(Elective-I)

Unit-1.

Introduction: Definitions, History of adaptive Control, Essential aspects of adaptive control, Classification of adaptive control system: Feedback adaptive controllers, Feed forward adaptive controllers, Why adaptive control?

Unit-2:

Model Reference Adaptive System: Different configuration of model reference adaptive systems; classification of MRAS, Mathematical description, and Equivalent representation as a nonlinear time-varying system, direct and indirect MRAS.

Unit-3.

Analysis and Design of Model Reference Adaptive Systems: Model reference control with local parametric optimization (Gradient method), MIT rule, MRAS for a first order system, MRAS based on Lyapunov stability theory, Design of a first order MRAS based on stability theory, Hyperstability approach, Monopoli's augmented error approach.

Unit-4:

Self Tuning Regulators: Introduction: The basic idea; process models, disturbance models, General linear difference equation models, model simplification, Different approaches to self-tuning, Recursive Parameter Estimation Methods: The RLS method, extended Least squares, Recursive instrumental variable method; U-D factorization, Covariance resulting, variable data forgetting. Estimation accuracy, Direct and Indirect Self-tuning regulators, Clarke and Gawthrop's Self tuning Controller, Pole Placement approach to self tuning control; Connection between MRAS and STR.

Unit 5:

Gain Scheduling: Introduction, The Principal, Design of Gain Scheduling Regulators, Nonlinear transformations, Applications of gain scheduling.

Alternatives to Adaptive Control: Why not Adaptive Control? Robust High gain feedback control, Variable Structure schemes,Practical aspects, application and Perspectives on adaptive control.

References Books

1. I. B Landau, Adaptive Control - The Model Reference Approach, New York; Marcel Dekker, 1979.

2. K. J. Astrom and B. Wittenmark, Adaptive Control, Addison Wesley Publication Company, 1989.

3. B. Roffel, P. J. Vermeer, P. A. Chin, Simulation and Implementation of self Tuning

Controllers, Prentice-Hall, Englewood cliffs, NJ, 1989.

4. R. Isermann, K. Lashmann and D. Marko, Adaptive Control Systems, Printice-Hall International (UK) Ltd. 1992.

5. K. S. Narendra and A. M. Annaswamy, Stable Adaptive Systems

SOFT COMPUTING TECHNIQUES

(ELECTIVE -I)

UNIT –I:

Introduction:

Approaches to intelligent control, Architecture for intelligent control, Symbolic reasoning system, Rule-based systems, the AI approach, Knowledge representation - Expert systems.

UNIT –II:

Artificial Neural Networks:

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron, Learning and Training the neural network, Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations, Hopfield network, Self-organizing network and Recurrent network, Neural Network based controller.

UNIT –III:

Fuzzy Logic System:

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning, Introduction to fuzzy logic modeling and control, Fuzzification, inferencing and defuzzification, Fuzzy knowledge and rule bases, Fuzzy modeling and control schemes for nonlinear systems, Self-organizing fuzzy logic control, Fuzzy logic control for nonlinear time delay system.

UNIT –IV:

Genetic Algorithm:

Basic concept of Genetic algorithm and detail algorithmic steps, Adjustment of free parameters, Solution of typical control problems using genetic algorithm, Concept on some other search techniques like Tabu search and anD-colony search techniques for solving optimization problems.

UNIT –V:

Applications:

GA application to power system optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using MATLAB-Neural Network toolbox, Stability analysis of Neural-Network interconnection systems, Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, Stability analysis of fuzzy control systems.

TEXT BOOKS:

1. Introduction to Artificial Neural Systems - Jacek.M.Zurada, Jaico Publishing House, 1999.
2. Neural Networks and Fuzzy Systems - Kosko, B., Prentice-Hall of India Pvt. Ltd., 1994.

REFERENCE BOOKS:

1. Fuzzy Sets, Uncertainty and Information - Klir G.J. &Folger T.A., Prentice-Hall of India Pvt. Ltd., 1993.
2. Fuzzy Set Theory and Its Applications - Zimmerman H.J. Kluwer Academic Publishers, 1994.
3. Introduction to Fuzzy Control - Driankov, Hellendroon, Narosa Publishers.
4. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
5. Elements of Artificial Neural Networks - KishanMehrotra, Chelkuri K. Mohan, Sanjay Ranka, Penram International.
6. Artificial Neural Network –Simon Haykin, 2nd Ed., Pearson Education.
7. Introduction Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N. Deepa,1/e, TMH, New Delhi.

CYBER SECURITY

M. Tech – I&CS **I Year – I Semester - 2016**

Object Oriented Programming
(Elective-I)

Objective: Implementing programs for user interface and application development using core java principles

UNIT I:
Objective: Focus on object oriented concepts and java program structure and its installation

Introduction to OOP
Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Installation of JDK1.6

UNIT II:
Objective: Comprehension of java programming constructs, control structures in Java

Programming Constructs
Variables , Primitive Datatypes, Identifiers- Naming Coventions, Keywords, Literals, Operators-Binary,Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control-Branching,Conditional, loops.,
Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments

UNIT III:
Objective: Implementing Object oriented constructs such as various class hierarchies, interfaces and exception handling

Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class
Interfaces, Packages and Enumeration: Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages , using Packages, Access protection, java.lang package
Exceptions & Assertions - Introduction, Exception handling techniques-try...catch, throw, throws, finally block, user defined exception, Assertions

UNIT IV:
Objective: Understanding of Thread concepts and I/O in Java

MultiThreading :java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading, Syncronization, suspending and Resuming threads, Communication between Threads
Input/Output: reading and writing data, java.io package

UNIT V:
Objective: Being able to build dynamic user interfaces using applets and Event handling in java

Applets- Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint(),update() and repaint()
Event Handling -Introduction, Event Delegation Model, java.awt.event Description, Event Listeners, Adapter classes, Inner classes

UNIT VI:

Objective: Understanding of various components of Java AWT and Swing and writing code snippets using them

Abstract Window Toolkit

Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar

Swing:

Introduction , JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box

Text Books:

1. The Complete Refernce Java, 8ed, Herbert Schildt, TMH
2. Programming in JAVA, Sachin Malhotra, Saurabhchoudhary, Oxford.
3. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
4. Object oriented programming with JAVA, Essentials and Applications, Raj Kumar Bhuyya, Selvi, Chu TMH
5. Introduction to Java rogramming, 7thed, Y Daniel Liang, Pearson

Reference Books:

1. JAVA Programming, K.Rajkumar.Pearson
2. Core JAVA, Black Book, NageswaraRao, Wiley, Dream Tech
3. Core JAVA for Beginners, RashmiKanta Das, Vikas.
4. Object Oriented Programming through JAVA , P Radha Krishna , University Press.

M. Tech – I&CS **I Year – II Semester - 2016**

Fuzzy Based Control Systems

(ELECTIVE-II)

Unit -1

Introduction: Motivation, Fuzzy Systems, Fuzzy control from an industrial perspective, Uncertainty and Imprecision, Uncertainty in information, Chance Versus Ambiguity, The mathematics of fuzzy control.

Unit -II

Classical sets and fuzzy sets: Vagueness, Fuzzy set theory versus Probability theory, Operation and properties of classical and fuzzy sets.Classical relations and fuzzy relations: Cartesian Product, Crisp relations, Fuzzy relations,Operations on fuzzy relations, Various types of binary fuzzy relations, Fuzzy relationequations, The extension principle and its applications, Tolerance and equivalence relations,Crisp equivalence relation, Crisp tolerance relation, Fuzzy tolerance and equivalencerelation, Value assignments.

Unit -III

Fuzzy logic and Approximate reasoning: Introduction, Linguistic variables, Fuzzy logic: Truth-values and truth tables in fuzzy logic, Fuzzy propositions. Approximate reasoning: Categorical, qualitative, syllogistic, dispositional reasoning, fuzzy If - then statements, Inference rules, The compositional rule of inference, representing a set of rule, Properties of a set of rule.

Unit -IV

Fuzzy knowledge based controllers (FKBC) design parameters: Introduction, Structure of a FKBC, Fuzzification and defuzzification module, Rule base, Choice of variable and contents of rules, derivation of rules, data base, choice of membership function and scaling factors, choice of fuzzification and defuzzification procedure, various methods.

Unit -V

Adaptive fuzzy control: Introduction, Design and performance evaluation, the main approaches to design self-organizing controller, Model based controllers.

Neuro-fuzzy and fuzzy-neural control systems: Adaptive fuzzy systems, optimising the membership functions and the rule base of fuzzy logic controllers using neural networks, fuzzy transfer functions in neural networks, elements of evolutionary computation, case studies.

Reference Books

1. D. Drainkov, H. Hellendoorn and M. Reinfrank, An Introduction to Fuzzy Control, Narosa Publishing House, 1993.

2. T. J. Ross, Fuzzy Logic with Engineering Applications, McGraw Hill, Inc 1995.

3. H. J. Zimmermann, Fuzzy set theory and its applications, second edition, Allied Publishers limited, New Delhi, 1996.
4. T. Terano, K. Asai and M. Sugeno, Fuzzy systems theory and its application, Academic Press, 1992.

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VLSI TECHNOLOGY AND DESIGN

(Elective-II)

UNIT-I:

VLSI Technology: Fundamentals and applications, IC production process, semiconductor processes, design rules and process parameters, layout techniques and process parameters.

VLSI Design: Electronic design automation concept, ASIC and FPGA design flows, SOC designs, design technologies: combinational design techniques, sequential design techniques, state machine logic design techniques and design issues.

UNIT-II:

CMOS VLSI Design: MOSTechnology and fabrication process of pMOS, nMOS, CMOS and BiCMOS technologies**,** comparison of different processes.

Building Blocks of a VLSI circuit: Computer architecture, memory architectures, communication interfaces, mixed signal interfaces.

VLSI Design Issues: Design process, design for testability, technology options, power calculations, package selection, clock mechanisms, mixed signal design.

UNIT-III:

Basic electrical properties of MOS and BiCMOS circuits, MOS and BiCMOS circuit design processes, Basic circuit concepts, scaling of MOS circuits-qualitatitive and quantitative analysis with proper illustrations and necessary derivations of expressions.

UNIT-IV:

Subsystem Design and Layout: Some architectural issues, switch logic, gate logic, examples of structured design (combinational logic), some clocked sequential circuits, other system considerations.

Subsystem Design Processes: Some general considerations and an illustration of design processes, design of an ALU subsystem.

UNIT-V:

Floor Planning: Introduction**,** Floor planning methods, off-chip connections.

Architecture Design: Introduction, Register-Transfer design, high-level synthesis, architectures for low power, architecture testing.

Chip Design: Introduction and design methodologies.

TEXT BOOKS:

1. Essentials of VLSI Circuits and Systems, K. Eshraghian, Douglas A. Pucknell, SholehEshraghian, 2005, PHI Publications.
2. Modern VLSI Design-Wayne Wolf, 3rd Ed., 1997, Pearson Education.
3. VLSI Design-Dr.K.V.K.K.Prasad, KattulaShyamala, Kogent Learning Solutions Inc., 2012.

REFERENCE BOOKS:

1. VLSI Design Technologies for Analog and Digital Circuits, Randall L.Geiger, Phillip E.Allen, Noel R.Strader, TMH Publications, 2010.
2. Introduction to VLSI Systems: A Logic, Circuit and System Perspective- Ming-BO Lin, CRC Press, 2011.
3. Principals of CMOS VLSI Design-N.H.E Weste, K. Eshraghian, 2nd Edition, Addison Wesley.

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ADVANCED DIGITAL SIGNAL PROCESSING

UNIT –I:

Review of DFT, FFT, IIR Filters and FIR Filters:

Multi Rate Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion.

UNIT –II:

Applications of Multi Rate Signal Processing:

Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Sub-band Coding of Speech Signals, Quadrature Mirror Filters, Trans-multiplexers, Over Sampling A/D and D/A Conversion.

UNIT -III:

Non-Parametric Methods of Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods, Comparison of all Non-Parametric methods

UNIT –IV:

Implementation of Digital Filters:

Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures.

UNIT –V:

Parametric Methods of Power Spectrum Estimation: Autocorrelation & Its Properties,Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation, Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

TEXT BOOKS:

1. Digital Signal Processing: Principles, Algorithms & Applications - J.G.Proakis& D. G. Manolakis, 4th Ed., PHI.
2. Discrete Time Signal Processing - Alan V Oppenheim & R. W Schaffer, PHI.
3. DSP – A Practical Approach – Emmanuel C. Ifeacher, Barrie. W. Jervis, 2 Ed., Pearson Education.

REFERENCE BOOKS:

1. Modern Spectral Estimation: Theory & Application – S. M .Kay, 1988, PHI.
2. Multi Rate Systems and Filter Banks – P.P.Vaidyanathan – Pearson Education.
3. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C.Gnanapriya, 2000,TMH
4. Digital Spectral Analysis – Jr. Marple

M. Tech – I&CS **I Year – I Semester - 2016**

TRANSDUCERS & INSTRUMENTATION LABORATORY

- **The students are required to perform the following experiments using necessary software tools and hardware equipment.**
- **The simulated results should be analyzed with appropriate procedures.**
- **The students are required to develop the necessary algorithms, flow diagrams, source code and result description in case of software experiments.**
- **The students are required to analyze the hardware experiments with relevant applications.**

List of Experiments:

PART-A

1. To determine the variation of Percent error of potentiometer using MATLAB.
2. To find the step response, Impulse response, Frequency response of First order and second order Instruments using MATLAB.
3. To find the variation of Gauge factor of a strain gauge with Poisson's Ratio using MATLAB.
4. Simulation of PID Controller using Simulink.
5. Simulation of a digital control system using Simulink.

PART-B

1. LVDT Characteristics
2. Measurement of weight using Load cell
3. Measurement of Pressure using Strain Gauge
4. Temperature measurement using Thermistor, Thermocouple, RTD.
5. Study of PID Controller Characteristics using **Temperature Process Controller**
6. Study of PID Controller Characteristics using **Level Process Controller**
7. Study of PID Controller Characteristics using **PressureProcess Controller**
8. Study of PLC based controllers

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M. Tech – I&CS **I Year – II Semester - 2016**

DATA ACQUISITION SYSTEMS

UNIT-1

INTRODUCTION: Objective of a DAS, single channel DAS, Multi-channel DAS,Components used in DAS– Converter Characteristics-Resolution-Non-linearity,settling time, Monotonicity.

UNIT-2

ANALOG TO DIGITAL CONVERTERS (ADCS): Classification of A/D converters.Parallelfeed back – Successive approximation – Ramp comparison – Dual slope integration – Voltage to frequency – Voltage to Time – Logarithmic types of ADCS.

NON-LINEAR DATA CONVERTERS (NDC): Basic NDC configurations – Some common NDACS and NADCS – Programmable non-linear ADCS – NADC using optimal sized ROM – High speed hybrid NADC – PLS based NADC – Switched capacitor NDCS.

ADC APPLICATIONS: Data Acquisition systems – Digital signal processing systems – PCM voice communication systems – Test and measurement instruments – Electronic weighing machines.

UNIT-3

DIGITAL TO ANALOG CONVERTERS (DACS): Principles and design of – Parallel R– 2R, Weighted resistor, inverted ladder, D/A decoding – Codes other than ordinary binary.

DATA CONVERTER APPLICATIONS: DAC applications – Digitally programmable V/I sources – Arbitrary waveform generators – Digitally programmable gain amplifiers – Analog multipliers/ dividers – Analog delay lines.

UNIT-4

Monolithic data converters: typical study of monolithic DACS and ADCS. Interfacing of DACS and ADCS to a μP.

UNIT-5

Error budget of DACS and ADCS: Error sources, error reduction and noise reduction techniques in DAS. Error budget analysis of DAS, case study of a DAC and an ADC.

TEXT BOOKS:

1. Electronic data converters fundamentals and applications – Dinesh K. Anvekar, B.S. Sonde – Tata McGraw Hill.

REFERENCES:

1. Electronic Analog/ Digital conversions – Hermann Schmid – Tata McGraw Hill.

2. E.R. Hanateck, User's Handbook of D/A and A/D converters - Wiley

3. Electronic instrumentation by HS Kalsi- TMH 2 ndEdition, 2004.

4. Data converters by G.B. Clayton

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BIO-MEDICAL INSTRUMENTATION

UNIT-I

Sources of Bioelectric potentials and Electrodes: Resisting and Action Potentials, Propagation of Action Potentials, The Bioelectric Potentials. Electrodes: Electrode theory, Bio Potential Electrodes, Biochemical Transducers, introduction to bio-medical signals.

UNIT-II

The Cardiovascular System: The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristics of Blood Flow, Heart Sounds, Cardio Vascular Measurements, Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiac output, Plethysmography, Measurement of Heart Sounds, Event detection, PQRS & T-Waves in ECG, the first & second Heart beats, ECG rhythm analysis, the di-crotic notch in the carotid pulse detection of events and waves, analysis of exercise ECG, analysis of event related potentials, correlation analysis of EEG channels, correlation of muscular contraction.

UNIT- III

Patient Care & Monitory and Measurements in Respiratory System: The elements of Intensive Care Monitory, Diagnosis, Calibration and reparability of Patient Monitoring equipment, other instrumentation for monitoring patients, pace makers, defibrillators, the physiology of respiratory system, tests and instrumentation for mechanics of breathing, respiratory theory equipment, analysis of respiration.

UNIT-IV

Bio telemetry and Instrumentation for the clinical laboratory Introduction to bio telemetry, Physiological parameters adaptable to bio telemetry, the components of bio telemetry system, implantable units, applications of telemetry in patient care – The blood, tests on blood cells, chemical test, automation of chemical tests.

UNIT-V

X-ray and radioisotope instrumentation and electrical safety of medical equipment: Generation of Ionizing radiation, instrumentation for diagnostic X-rays, special techniques, instrumentation for the medical use of radioisotopes, radiation therapy - Physiological effects of electrical current, shock Hazards from electrical equipment, Methods of accident prevention, Modern Imaging Systems: Tomography, Magnetic resonance Imaging System, Ultrasonic Imaging System, Medical Thermography.

TEXT BOOK:

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A.Pfeiffer – Pearson education.
2. Biomedical signal analysis – Rangaraj, M. Rangayya – Wiley Inter science – John willey& Sons Inc.

Reference:

1. Hand Book of Bio-Medical Instrumentation – R.S. Khandpur, (TMH)
2. Introduction to Bio-Medical Engineering – Domach, (Pearson)
3. Introduction to Bio-Medical Equipment Technology – Cart, (Pearson)

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PROCESS CONTOL INSTRUMENTATION

UNIT-1

P & ID symbols. Process characteristics: Process load, Process lag, self-regulation.

Control system parameters: control lag, dead time, cycling.

Discontinuous controller modes: two position, multi position, floating control modes.

Continuous controller modes: Mathematical representation and description of P, I, D controller modes. Composite control modes: Mathematical representation and description of PI, PD, PID control modes. Response of control modes to linear, step and square wave error signals.

UNIT-2

Electronic Controller mode implementation: Designing of P, PI, PD, PID using OP-amplifiers.

UNIT-3

Pneumatic controller mode implementation: Implementation of P, PI, PD, PID using flapper – nozzle system.

UNIT-4

Final control: Actuators – Electrical & Pneumatic. Control Valves – Quick opening, linear and equal percentage control valves, valve sizing. I to P, P to I converters.

UNIT-5

Programmable controllers & Digital Controllers:

Programmable controllers:Ladder Diagram, Programmable controller program from the ladder diagram of simple applications.

Digital Controllers**:** Data logging, supervisory control, computer based controller.

Text Book:

1. Process control Instrumentation Technology by Curtis Johnson, 4 th Edition – PHI, Dec, 2000.

Reference Books:

1. Principles of Process control by D. Patranabis- TMH 2 nd Edition, 1996

2. P. Harriott, process control, Tata MoGraw – Hill publishing Co., Ltd., New Delhi, 1984.

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EMBEDDED SYSTEM DESIGN

UNIT-I: Introduction

An Embedded System-Definition, Examples, Current Technologies, Integration in system Design, Embedded system design flow, hardware design concepts, software development, processor in an embedded system and other hardware units, introduction to processor based embedded system design concepts.

UNIT-II: Embedded Hardware

Embedded hardware building blocks, Embedded Processors – ISA architecture models, Internal processor design, processor performance, Board Memory – ROM, RAM, Auxiliary Memory, Memory Management of External Memory, Board Memory and performance.

Embedded board Input / output – Serial versus Parallel I/O, interfacing the I/O components, I/O components and performance, Board buses – Bus arbitration and timing, Integrating the Bus with other board components, Bus performance.

UNIT-III: Embedded Software

Device drivers, Device Drivers for interrupt-Handling, Memory device drivers, On-board bus device drivers, Board I/O drivers, Explanation about above drivers with suitable examples.

Embedded operating systems – Multitasking and process Management, Memory Management, I/O and file system management, OS standards example – POSIX, OS performance guidelines, Board support packages, Middleware and Application Software – Middle ware, Middleware examples, Application layer software examples.

UNIT-IV: Embedded System Design, Development, Implementation and Testing

Embedded system design and development lifecycle model, creating an embedded system architecture, introduction to embedded software development process and tools- Host and Target machines, linking and locating software, Getting embedded software into the target system, issues in Hardware-Software design and co-design.

Implementing the design-The main software utility tool, CAD and the hardware, Translation tools, Debugging tools, testing on host machine, simulators, Laboratory tools, System Boot-Up.

UNIT-V: Embedded System Design-Case Studies

Case studies- Processor design approach of an embedded system –Power PC Processor based and Micro Blaze Processor based Embedded system design on Xilinx platform-NiosII Processor based Embedded system design on Altera platform-Respective Processor architectures should be taken into consideration while designing an Embedded System.

TEXT BOOKS:

1. Tammy Noergaard “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”, Elsevier(Singapore) Pvt.Ltd.Publications, 2005.

2. Frank Vahid, Tony D. Givargis, “Embedded system Design: A Unified Hardware/Software Introduction”, John Wily & Sons Inc.2002.

REFERENCE BOOKS:

1. Peter Marwedel, “Embedded System Design”, Science Publishers, 2007.

2. Arnold S Burger, “Embedded System Design”, CMP.

3. Rajkamal, “Embedded Systems: Architecture, Programming and Design”, TMH Publications, Second Edition, 2008.

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NON-LINEAR & OPTIMAL CONTROL SYSTEMS
(ELECTIVE-IV)

Non-linear control systems

Unit – I

Introduction to Non-Linear Control systems.

Describing Functions, Describing function Analysis of Non-Linear Control Systems.

Unit – II

Introduction to Phase plane analysis, Methods for constructing Trajectories, singular points, phase-plane analysis of linear control systems and Non-linear control systems.

Introduction to liapunov stability analysis, second method of liapunov, stability analysis of linear systems, stability analysis of nonlinear systems (Variable gradient method and Krosovskii's method)

Optimal Control systems

Unit –III

Introduction to optimal control system, Formulation of optimal Control problem – Characteristics of the plant, requirements made upon the plant, Nature of information about the plant supplied to the controller.

Calculus of variations – fixed end problem and variable end problems

Unit – IV

Pontragin's minimum/maximum principle, Hamilton Jacobii's approach, Matrix-Riccati equations..

Unit – V

Dynamic Programming,

Text Books:

1. Modern Control Engineering – Ogata.K. Prentice Hall of India, Eastern Economy Edition, 1986.

2. Modern Control System Theory – M. Gopal, Wiley Eastern, Second edition, 1993.

PC BASED INSTRUMENTATION

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DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES

(ELECTIVE-III)

UNIT-I:

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 filters, Decimation and interpolation.

Computational Accuracy in DSP Implementations

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT-II:

Architectures for Programmable DSP Devices

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT-III:

Programmable Digital Signal Processors

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX Instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54XX Processors.

UNIT-IV:

Analog Devices Family of DSP Devices

Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor.

Introduction to Black fin Processor - The Black fin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.

UNIT-V:

Interfacing Memory and I/O Peripherals to Programmable DSP Devices

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

TEXT BOOKS:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. A Practical Approach To Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009
3. Embedded Signal Processing with the Micro Signal Architecture: Woon-SengGan, Sen M. Kuo, Wiley-IEEE Press, 2007

REFERENCE BOOKS:

1. Digital Signal Processors, Architecture, Programming and Applications-B. Venkataramani and M. Bhaskar, 2002, TMH.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
3. Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI
4. The Scientist and Engineer's Guide to Digital Signal Processing by Steven W. Smith, Ph.D., California Technical Publishing, ISBN 0-9660176-3-3, 1997

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M. Tech – I&CS **I Year – II Semester - 2016**

ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY (EMI / EMC)

(ELECTIVE-IV)

UNIT -I:

Introduction, Natural and Nuclear Sources of EMI / EMC:

Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations, An overview of EMI / EMC, Natural and Nuclear sources of EMI.

UNIT -II:

EMI from Apparatus, Circuits and Open Area Test Sites:

Electromagnetic emissions, Noise from relays and switches, Non-linearities in circuits, passive intermodulation, Cross talk in transmission lines, Transients in power supply lines, Electromagnetic interference (EMI), Open area test sites and measurements.

UNIT -III:

Radiated and Conducted Interference Measurements and ESD:

Anechoic chamber, TEM cell, GH TEM Cell, Characterization of conduction currents / voltages, Conducted EM noise on power lines, Conducted EMI from equipment, Immunity to conducted EMI detectors and measurements, ESD, Electrical fast transients / bursts, Electrical surges.

UNIT -IV:

Grounding, Shielding, Bonding and EMI filters:

Principles and types of grounding, Shielding and bonding, Characterization of filters, Power lines filter design.

UNIT -V:

Cables, Connectors, Components and EMC Standards:

EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International EMC standards.

TEXT BOOKS:

1. Engineering Electromagnetic Compatibility - Dr. V.P. Kodali, IEEEPublication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi, Modules 1 – 9.

REFERENCE BOOKS:

1. Introduction to Electromagnetic Compatibility - Ny, John Wiley, 1992, by C.R. Pal.

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CONTROL AND GUIDANCE SYSTEMS

(ELECTIVE-III)

Unit – I

The Accuracy of Target Trackers: Introduction, some objectives with feedback, some general concepts on accuracy, A tracker servo, Tracking accuracy in the absence of noise, The effect of thermal noise, The effect of other inputs and disturbances, A self optimising servo.

Unit – II

Missile Servos & control Methods: Servo requirements, Stored cold gas servos, Hot gas servos, Ram air servos, Hydraulic servos, Electric servos with d.c. motors, Other electric servos, Some tentative conclusions.

Missile control Methods: Introduction, Why not manoeuvre by banking?, Roll control, Aerodynamic lateral control, Aerodynamic polar control versus cartesian control, Thrust vector control, Methods of thrust vectoring.

Unit – III

Aerodynamic Derivatives and Aerodynamic Transfer Functions: Notation and conventions, Euler's equations of motion for a rigid body, Trajectory considerations, Control surface conventions, Aerodynamic derivatives, Aerodynamic transfer functions, Altitude and speed conversion factors, Aerodynamic derivatives with TVC.

Unit – IV

Missile Instruments: Introduction, Elementary theory of gyroscopes, Free or position gyros, Rate or constrained gyros, Accelerometers, Resolvers, Altimeters.

Line of Sight Guidance Loops: The effect of target and missile motion on missile "g" requirements, Types of LOS systems, Kinematic closure and stability of the guidance loop, The concept of feed forward terms, Phasing error and orientation difficulties, The effect of a digital computer inside guidance loop, Some numerical examples on the estimation of guidance accuracy, Some general conclusions on accuracy.

Unit – V

Homing Heads and Some Associated Stability Problems: Introduction, Homing head requirements, Some electro-mechanical arrangements, The effect of radome aberration, Isolated sight line and missile compensation.

Proportional Navigation and Homing Guidance Loops: Introduction, A particular case, The mathematical model, A summary of previous work, The effect of a missile heading error, Miss distance due to a target lateral acceleration, Miss distance die to angular noise, Miss distance due to glint, Three dimensional homing, An integrated form of proportional navigation, Other homing guidance laws.

Text Book:

Guided Weapon Control Systems by P. Garnell, Brassey'sDefence Publishers, New York.

Reference Book:

Guided Weapons by R.G. Lee et al., Brassey'sDefence Publishers.

ANALYTYCAL INSTRUMENTATION

M. Tech – I&CS **I Year – II Semester - 2016**

PROCESS CONTROL INSTRUMENTATION LABORATORY

OBJECTIVES:

To experimentally verify the process control concepts on the selected process control loops using LabVIEW and Experimental Trainers.

OBJECTIVES:

Ability to understand and analyse process control engineering problems.

List of Experiments:

PART-A

Using Quanser DC Motor control hardware / Heating Ventilation & Airconditioning hardware and LabVIEW

1. Mathematical Modeling and simulation
2. Qualitative PD Control
3. PD Control to Specifications
4. Qualitative PI Control
5. PI Control to Specifications
6. PID Controller Design
7. Stability analysis
8. Time domain analysis
9. Frequency domain analysis
10. Fuzzy controller design
11. Special control design

PART-B

1. Study of Process Control Training Plant and Compact Flow Control Unit
2. Characteristics of Pneumatically Actuated Control Valve
3. Level Control and Pressure Control in Process Control Training Plant
4. Design of ON/OFF Controller for the Temperature Process
5. PID Implementation Issues
6. Tuning of PID Controller for mathematically described processes
7. PID Enhancements (Cascade and Feed-forward Control Schemes)
8. Design and Implementation of Multi-loop PI Controller on the Three-tank system
9. Analysis of Multi-input Multi-output system (Four-tank System)
10. Auto-tuning of PID Controller

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