M.Tech (Instrumentation and Control Engineering) – R19

Course Structure

I Semester

S.No	Course Code	Course Name	Category	L	T	P	Credits
1	PC	Transducers and Sensors		3	0	0	3
2	PC	Digital Control Systems		3	0	0	3
3	PE	1. Adaptive Control Systems 2. Soft computing Techniques 3. Fuzzy Based Control Systems 4. Artificial intelligence		3	0	0	3
4	PE	1. Fiber optic sensors and devices 2. VLSI Technology and design 3. Advanced digital signal processing 4. Digital system design		3	0	0	3
5		Research methodology and IPR		2	0	0	2
6		Transducers & Instrumentation Lab		0	0	4	2
7		Digital control system simulation Lab		0	0	4	2
8		Audit course-1		2	0	0	0
			Total				18

II Semester

S.No	Course Code	Course Name	Category	L	T	P	Credits
1		Bio-Medical Engineering	PC	3	0	0	3
2		Process Control Instrumentation	PC	3	0	0	3
3		1.Non Linear and Optimal Control Systems 2. Control and guidance systems 3. Data Acquisition systems 4. Machine learning	PE	3	0	0	3
4		1. DSP Processors & Architecture 2. Analytical Instrumentation 3. Robotics 4. EMI / EMC	PE	3	0	0	3
5		Bio-Medical Engineering Lab		0	0	4	2
6		Process Control Instrumentation Lab		0	0	4	2
7		Mini Project with Seminar		0	0	4	2
8		Audit Course – 2		2	0	0	0
			Total				18

*Students be encouraged to go to Industrial Training/Internship for at least 2-3weeks during semester break.

Audit Course 1& 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education

5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

III Semester*

S.No	Course Code	Course Name	Category	L	T	P	Credits
1		1. MEMS & Nano Technology 2. Internet of Things 3. Embedded System Design 4. Intelligent and Smart Instrumentation 5. MOOCs-1 (NPTEL/SWAYAM)	PE	3	0	0	3
2		1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy 7. MOOCs-2 (NPTEL/SWAYAM)- Any 12 Week Course on Engineering/ Management/ Mathematics offered by other than parent department	OE	3	0	0	3
3		Dissertation Phase -I /Industrial Project **(to be continued and evaluated next semester)**		0	0	20	10[#]
			Total				16

[#]Evaluated and Displayed in IV Sem Marks list.

*Students going for Industrial Project/Thesis will complete these courses through MOOCs

IV Semester

S.No	Course Code	Course Name	Category	L	T	P	Credits
1		Project/ Dissertation Phase-II **(continued from III semester)**		0	0	32	16
			Total				16

M. Tech I Year I Semester I&CE - 2019

L	T	P	C
3	0	0	3

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)

Course Outcomes:

At the end of the course, a student will be able to:

1. Use concepts in common methods for converting a physical parameter into an electrical quantity
2. Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light
3. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc
4. Predict correctly the expected performance of various sensors
5. Locate different type of sensors used in real life applications and paraphrase their importance

M. Tech I Year I Semester I&CE - 2019

L	T	P	C
3	0	0	3

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”.

Course outcomes:

1. Design a pure, two-pole system that satisfies specified performance specifications like percent overshoot, peak time, settling time, and DC gain.
2. Calculate the z-plane location of a pair of dominant poles given time-domain performance information like percent overshoot, settling time, and peak time.
3. Create discrete equivalents from given continuous-time systems,
4. Able to Construct a discrete-time difference equation containing input variables and output variables at particular time instances from a system’s discrete-time transfer function.
5. Numerically compute the value of any system variable (e.g., state variable or output variable) at any discrete, time instant given initial conditions and input waveforms.

M. Tech I Year I Semester I&CE - 2019

L	T	P	C
3	0	0	3

ADAPTIVE CONTROL SYSTEMS
(ELECTIVE-I)

Unit-I

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-II:

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-III.

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-IV:

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 V:

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

Course Outcomes:

CO1: Design identifiers and adaptive controllers for linear systems
CO2: Design Adaptive feedback linearizing control systems for nonlinear systems
CO3: Apply the concept of different types of optimal control for solving problems
CO 4 : Apply the concept of Linear Quadratic method for solving problems
CO 5: Apply the concept of adaptive control technique for solving problems

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M. Tech I Year I Semester I&CE - 2019				
	3	**0**	**0**	**3**

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.

Course Outcomes:

1. Develop intelligent systems leveraging the paradigm of soft computing techniques.
2. Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.
3. Recognize the feasibility of applying a soft computing methodology for a particular problem
4. Design the methodology to solve optimization problems using fuzzy logic, genetic algorithms and neural networks.
5. Design hybrid system to revise the principles of soft computing in various application

M. Tech I Year I Semester I&CE - 2019

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FUZZY BASED CONTROL SYSTEMS
(ELECTIVE-I)

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.

Course Outcomes:

1. Utilize the state of the art topics of fuzzy control in their research activities.
2. Design fuzzy systems and fuzzy controllers. exhibit familiarity with the fundamental concepts of fuzzy set theory and fuzzy logic
3. Recognize the feasibility and applicability of the design and implementation of intelligent systems (that employ fuzzy logic) for specific application areas
4. Understand fuzzy system design methodology and how it impacts system design and performance.

M. Tech I Year I Semester I&CE - 2019

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ARTIFICIAL INTELLIGENCE

(ELECTIVE-I)

Syllabus Contents:

Unit I

What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI

Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final

WordProblems, State Space Search & Heuristic Search Techniques: Defining The Problems As A

State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

Unit II

Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

Unit III

Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Certainty Model Curriculum of Engineering & Technology PG Courses [Volume -II]

289

Factors And Rule-Base Systems, Bayesian Networks, DempsterShafer Theory

Unit IV

Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC

Unit V

Game Playing: Overview, And Example Domain: Overview, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic

Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.

References:

1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

Course Outcomes:

At the end of this course, students will be able to

- Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues
- Understanding reasoning and fuzzy logic for artificial intelligence
- Understanding game playing and natural language processing.

M. Tech I Year I Semester I&CE - 2019

L	T	P	C
3	0	0	3

FIBRE OPTIC SENSORS AND DEVICES

(ELECTIVE-II)

Unit –I

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 – II

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 – III

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-IV

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 – V

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.

Course outcomes:

After going through this course the student will be able to

1. Choose necessary components required in modern optical communications systems .
2. Design and build optical fiber experiments in the laboratory, and learn how to calculate electromagnetic modes in waveguides, the amount of light lost going through an optical system, dispersion of optical fibers.
3. Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems.
4. Choose the optical cables for better communication with minimum losses
5. Design, build, and demonstrate optical fiber experiments in the laboratory

M. Tech I Year I Semester I&CE - 2019

L	T	P	C
3	0	0	3

VLSI Technology and design
(ELECTIVE-II)

UNIT I: MOS Transistors

Introduction, The Structure of MOS Transistors, The Fluid Model, The MOS Capacitor, The MOS Transistor, Modes of Operation of MOS Transistors, Electrical Characteristics of MOS Transistors, Threshold Voltage, Transistor Transconductance g_m, Figure of Merit, Body Effect, Channel-Length Modulation, MOS Transistors as a Switch, Transmission Gate

UNIT II: MOS Fabrication Technology

Introduction, Basic Fabrication Processes, Wafer Fabrication, Oxidation, Mask Generation, Photolithography, Diffusion, Deposition. N-MOS Fabrication Steps, CMOS Fabrication Steps,n-Well Process,p-Well Process, Twin-Tub Process, Latch-Up Problem and Its Prevention, Use of Guard Rings, Use of Trenches, Short-Channel Effects-Channel Length Modulation Effect. Drain-Induced Barrier Lowering, Channel Punch Through, Hot carrier effect, Velocity Saturation Effect

UNIT III:Layout Design Rules

Design Rule Background, Scribe Line and Other Structures MOSIS Scalable CMOS Design Rules, Micron Design Rules, CMOS Process Enhancements, Transistors, Interconnect, Circuit Elements, Beyond Conventional CMOS

UNITIV: MOS Combinational Circuits

Pass-Transistor Logic, Realizing Pass-Transistor Logic, Advantages and Disadvantages, Pass-Transistor Logic Families, Gate Logic, Fan-In and Fan-Out, n-MOS NAND and NOR Gates, CMOS Realization, Switching Characteristics, CMOS NOR Gate, CMOS Complex Logic Gates, MOS Dynamic Circuits, Single-Phase Dynamic Circuits, Two-Phase Dynamic Circuits, CMOS Dynamic Circuits, Advantages andDisadvantages Domino CMOS Circuits, NORA Logic

UNIT V: Sequential MOS Logic Circuits

Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

TEXT BOOKS

1.Principals of CMOS VLSI Design-N.H.EWeste, K. Eshraghian, 2nd Edition, Addison Wesley.
2.CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.
3.Low-Power VLSI Circuits and Systems,Ajit Pal, SPRINGER PUBLISHERS

REFERENCE BOOKS:

1. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.

2. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, AnanthaChandrakasan, BorivojeNikolic, 2nd Ed., PHI.

Course outcomes

At the end of the course the student able to

1. Understand the basics of MOS transistors and also the characteristics of MOS transistors.
2. Learn about the MOS fabrication process and short channel effects.
3. Learn about the basic rules in layout designing.
4. Analyse various combinational logic networks and sequential systems.

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M. Tech I Year I Semester I&CE - 2019				
	3	**0**	**0**	**3**

ADVANCED DIGITAL SIGNAL PROCESSING
(ELECTIVE-II)

SYLLABUS:

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, Subband

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, 4thEd., 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

Course outcomes:

At the end of this course the student can able to:

1. Know the concept of multi rate signal processing and derive the Expression for sampling rate conversion by a rational factor I/D.
2. Know the conditions for perfect reconstruction of 2 channels QMF.
3. Know the classifications of non-parametric methods and compare the performance of non-parametric methods.
4. Know the advantages and disadvantages of non-parametric methods.
5. Derive the reflection coefficients of Lattice realization.

M. Tech I Year I Semester I&CE - 2019

L	T	P	C
3	0	0	3

DIGITAL SYSTEM DESIGN
(ELECTIVE-II)

SYLLABUS:

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, CAMPalgorithm,

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, Hamming 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 , 2ndEdition, 2001, TMH
3. Digital system Design using PLDd-Lala

REFERENCE BOOKS:

1. Fundamentals of Logic Design – Charles H. Roth, 5thEd., Cengage Learning.
2. Digital Systems Testing and Testable Design – MironAbramovici, Melvin A.

Breuer and Arthur D. Friedman- John Wiley & Sons Inc.

OUTCOMES:

At the end of this course the student can able to:

1. Perform the minimization of a Boolean function using tabular method, QM algorithm and CAMP algorithm and determine the Adjacencies, DA, CSC, SSMs, EPCs and SPCs.
2. Draw the block diagram of PLA and identify the size of PLA and PLA design aspects.
3. Perform the minimization of PLA using IISc algorithm and folding using COMPACT algorithm.
4. Can design a digital circuit by steps involving ASM chart.
5. Understand the digital system design approaches using CPLDs, FPGAs and ASICs.
6. Rectify a single fault and multiple faults in combinational circuits using Path sensitization method, Boolean difference method and Kohavi algorithm.

M. Tech I Year I Semester I&CE - 2019

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Research Methodology and IPR

Syllabus Contents:

Unit I: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit II: Effective literature studies approaches, analysis Plagiarism, Research ethics.Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit III: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit IV: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit V: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

- Mayall , “Industrial Design”, McGraw Hill, 1992.
- Niebel , “Product Design”, McGraw Hill, 1974.
- Asimov , “Introduction to Design”, Prentice Hall, 1962.
- Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New
- Technological Age”, 2016.
- T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

Course Outcomes:

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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M. Tech I Year I Semester I&CE - 2019				
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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 Year I Semester I&CE - 2019				
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Digital control system simulation Lab

1.To study

a. Conversion of a transfer function from continuous domain to discrete domain.

b. Conversion of a transfer function from the continuous domain to the digital domain.

c. Pole Zero Map of a discrete transfer function

2. To determine

a. Z transform of a discrete-time signal

b. Inverse Z transform of a discrete-time signal

c. Factored form and partial fraction form of a rational z function d. Pole zero map of a digital system

3. To study

a. Closed loop response of a discrete-time system

b. Comparison of time responses of continuous time and discrete time systems

c. Effect of sampling time on system response and system parameters

4. To design a lead compensator to obtain system response with the desired accuracy, and less overshoot.

5. To design a lag compensator to meet performance specification parameters

6. To study a. The effect of variation in controller parameters on system response

7. To obtain

a. Transfer function model from a state model

b. State model from transfer function model

c. Step response of a system represented by its state model

8.To determine

a. Eigenvalues from state model

b. Eigenvalues from transfer function model

c. Stability of a system

9.To study the effect of common nonlinearities such as relay, dead zone, and saturation on the response of a 2nd order control system

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M. Tech I Year II Semester I&CE - 2019	**3**	**0**	**0**	3

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)

Course outcomes:

1. Apply principles and concepts of electronics to analyze input and output signals in medical electronics
2. Apply principles and concepts of electronics to design filters for de-noising of medical measurements
3. Recognize different types of transducers, ongoing progress in improving their design, and their application in medical measurements
4. Apply principles and concepts of engineering to quantify and model measurements of biopotentials
5. Apply principles and concepts of sensing and engineering to (i) design diagnostic devices for detection of markers in biofluids, and (ii) be able to evaluate quality of diagnostic devices

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M. Tech I Year II Semester I&CE - 2019				
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PROCESS CONTOL INSTRUMENTATION

UNIT-I

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-II

Electronic Controller mode implementation: Designing of P, PI, PD, PID using OPamplifiers.

UNIT-III

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

UNIT-IV

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-V

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.

Course Outcomes:

- Understand the popular process automation technologies.
- Design and development of different PLC programming for simple process applications.
- Understand the different security design approaches, Engineering and operator interface issues for designing Distributed control system.
- Know the latest communication technologies like HART and Field bus protocol. Mapping of Course Outcome with Programme Outcomes:

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M. Tech I Year II Semester I&CE - 2019

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

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.

Course Outcomes:

- insight in the basic differences between nonlinear and linear dynamical systems
- be able to analyse the influence of common nonlinearities (saturation, backlash, deadzone etc) in control loops and how these should handled from a control point of view
- to derive mathematical models for and simulate simple nonlinear systems
- evaluate dominating nonlinearities and dynamics
- able to derive mathematical models for and simulate simple nonlinear systems

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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.

Course Outcomes:

- Analyse the concept of Tracking servo and self optimising servo
- Understand the concept of Missile control Methods
- Apply the Aerodynamic concept to real time applications
- Analyze the concept of LOS
- Discuss about Stability Problems and Proportional Navigation and Homing Guidance Loops

M. Tech I Year II Semester I&CE - 2019

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DATA ACQUISITION SYSTEMS
(ELECTIVE-III)

UNIT-I

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

UNIT-II

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-III

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-IV

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

UNIT-V

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

Course Outcomes:

1. Be able to identity a data acquisition system.
2. Be able to prescribe a sensor type to measure a specific environmental change.
3. Be familiar with different forms of signal conditioning.
4. Be familiar with different methods of Analog-to-Digital conversion.
5. Be able to identify the type of interface used to get a digital signal into a microprocessor.

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M. Tech I Year II Semester I&CE - 2019

Machine learning

(ELECTIVE-III)

UNIT - I

Introduction

Well-posed learning problems, designing a learning system Perspectives and issues in machine learning

Concept learning and the general to specific ordering

Introduction, A concept learning task, concept learning as search, Find-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination algorithm, Remarks on Version Spaces and Candidate Elimination, Inductive Bias.

Decision Tree Learning

Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.

UNIT - II

Artificial Neural Networks

Introduction, Neural Network Representation, Appropriate Problems for Neural Network Learning, Perceptions, Multilayer Networks and the Back propagation Algorithm.

Discussion on the Back Propagation Algorithm, An illustrative Example: Face Recognition Evaluation Hypotheses

Motivation, Estimation Hypothesis Accuracy, Basics of Sampling Theory, A General Approach for Deriving Confidence Intervals, Difference in Error of Two Hypotheses, Comparing Learning Algorithms.

UNIT - III

Bayesian learning

Introduction, Bayes Theorem, Bayes Theorem and Concept Learning Maximum Likelihood and Least Squared Error Hypotheses, Maximum Likelihood Hypotheses for Predicting Probabilities, Minimum Description Length Principle , Bayes Optimal Classifier, Gibs Algorithm, Naïve Bayes Classifier, An Example: Learning to Classify Text, Bayesian Belief Networks, EM Algorithm.

Computational Learning Theory

Introduction, Probably Learning an Approximately Correct Hypothesis, Sample Complexity for Finite Hypothesis Space, Sample Complexity for Infinite Hypothesis Spaces, The Mistake Bound Model of Learning.

Instance-Based Learning

Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

UNIT - IV

Pattern Comparison Techniques

Temporal patterns, Dynamic Time Warping Methods, Clustering, Codebook Generation, Vector Quantization

Pattern Classification
Introduction to HMMS, Training and Testing of Discrete Hidden Markov Models and Continuous Hidden Markov Models, Viterbi Algorithm, Different Case Studies in Speech recognition and Image Processing

UNIT - V

Analytical Learning
Introduction, Learning with Perfect Domain Theories : PROLOG-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operations.
Combining Inductive and Analytical Learning
Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis.

Text Books

1. Machine Learning – Tom M.Mitchell,-MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.

References

1. Machine Learning : An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

Course Outcomes:

At the end of this course, students will be able to

1. Study the parametric and linear models for classification
2. Design neural network and SVM for classification
3. Develop machine independent and unsupervised learning techniques.

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M. Tech I Year II Semester I&CE - 2019				
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DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES (ELECTIVE-IV)

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

Course Outcomes:

1. Understand the basics of Digital Signal Processing and transforms.
2. Able to distinguish between the architectural features of general purpose processors and DSP processors.
3. Understand the architectures of TMS320C54xx devices and ADSP 2100 DSP devices.
4. Able to write simple assembly language programs using instruction set of TMS320C54xx.
5. Can interface various devices to DSP Processors.

M. Tech I Year II Semester I&CE - 2019

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Analytical Instrumentation
(ELECTIVE-IV)

UNIT–I:

FUNDAMENTALS OF ANALYTICAL INSTRUMENTS: Elements of an Analytical Instrument, Signal conditioning in Analytical Instruments, and instrumental methods of chemical analysis.

pH AND CONDUCTIVITY & DISSOLVED COMPONENT ANALYSER: Conductivity meters –pH meters – Dissolved oxygen analyser – Sodium analyser – Silica analyser and sampling systems.

UNIT-II:

GAS ANALYSERS: Thermal conductivity types – CO_2analyser, Oxygen gas Analyser, NOX analyser, H_2S analyser and Industrial gas analyser circuits: Paramagnetic Oxygen analyser, Magnetic wind instruments, and Infrared Gas analyser

UNIT-III:

SPECTROSCOPY: Beer – Lambert's Law, Sources and detectors, Ultraviolet – Visible (UV-Vis Spectroscopy – Single beam and double beam spectrophotometer, Infrared (IR) Spectrophotometry, Sources and detectors, Fourier Transform Infrared (FT IR) Spectroscopy.

Flamespectroscopy -atomic absorption Spectrophotometer, Atomic emission Spectrophotometer

UNIT-IV:

Nuclear Magnetic Resonance (NMR),Electron Spin Resonance (ESR), and Mass SPECTROMETERS: Principles and Instrumentation associated with NMR Spectroscopy, ESR Spectrometry, and Mass Spectrometry and their applications

UNIT-V:

CHROMATOGRAPHY&NUCLEAR RADIATION DETECTORS: Classification of Gas and liquidchromatography, Principles and Instrumentation associated with Gas and liquid chromatography – sample injection systems, columns, isothermal operation, different detectors, Ionization chamber, Geiger Muller counter, Proportional Counter, Scintillation counter and Solid-state detectors.

TEXT BOOKS:

1. Handbook of Analytical Instruments – by R S Khandpur. TMH
2. Introduction to instrumental analysis by Robert D. Braun
3. Instrumental Methods of Analysis – by Willard H.H., Merrit L.L., Dean J.A. and Seattle F.L.,CBS Publishing and Distributors, 6/e, 1995.

REFERENCES:

1. Analytical Instrumentation by Bela G. Lipkat
2. Analytical Instrumentation by Graham Currel

Course Outcomes:

- Understand the concept of FUNDAMENTALS OF ANALYTICAL INSTRUMENTS
- Analyze the concept of GAS ANALYSERS
- Apply SPECTROSCOPY in real time applications
- Discuss the concepts of MMR and ESR
- Understand the concept of CHROMATOGRAPHY&NUCLEAR RADIATION DETECTORS

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M. Tech I Year II Semester I&CE - 2019				
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Robotics(drafted from MECHANICAL AICTE syllabus)

(ELECTIVE-IV)

Syllabus Contents

Unit I Introduction:

Basic Concepts such as Definition, three laws, DOF, Misunderstood devices etc., Elements of Robotic Systems i.e. Robot anatomy, Classification, Associated parameters i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device, etc. Automation - Concept, Need, Automation in Production System, Principles and Strategies of Automation, Basic Elements of an

Automated System, Advanced Automation Functions, Levels of Automations, introduction to automation productivity.

Unit II Robot Grippers:

Types of Grippers , Design aspect for gripper, Force analysis for various basic gripper system. Sensors for Robots:- Characteristics of sensing devices, Selections of sensors, Classification and applications of sensors. Types of Sensors, Need for sensors and vision system in the working and control of a robot.

Unit III Drives and control systems:

Types of Drives, Actuators and its selection while designing a robot system. Types of transmission

systems,

Control Systems -Types of Controllers, Introduction to closed loop control

Control Technologies in Automation:- Industrial Control Systems, Process Industries Verses Discrete-Manufacturing Industries, Continuous Verses Discrete Control, Computer Process and its

Forms. Control System Components such as Sensors, Actuators and others.

Unit IV Kinematics:

Transformation matrices and their arithmetic, link and joint description, Denavit - Hartenberg

parameters, frame assignment to links, direct kinematics, kinematics redundancy, kinematics calibration, inverse kinematics, solvability, algebraic and geometrical methods. Velocities and Static forces in manipulators:- Jacobians, singularities, static forces, Jacobian in force domain. Dynamics:- Introduction to Dynamics , Trajectory generations

Unit V Machine Vision System:

Vision System Devices, Image acquisition, Masking, Sampling and quantisation, Image

Processing Techniques , Noise reduction methods, Edge detection, Segmentation.
Robot Programming :- Methods of robot programming, lead through programming, motion interpolation, branching capabilities, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Introduction to various types such as RAIL and VAL II etc, Features of
type and development of languages for recent robot systems.

Unit 6 Modeling and Simulation for manufacturing Plant Automation:

Introduction, need for system Modeling, Building Mathematical Model of a manufacturing Plant, Modern Tools- Artificial neural networks in manufacturing automation, AI in manufacturing, Fuzzy decision and control, robots and application of robots for automation.
Artificial Intelligence:- Introduction to Artificial Intelligence, AI techniques, Need and application
of AI. Other Topics in Robotics:- Socio-Economic aspect of robotisation. Economical aspects for robot design, Safety for robot and associated mass, New Trends & recent updates in robotics

References:

Text Books:

1. John J. Craig, Introduction to Robotics (Mechanics and Control), Addison-Wesley, 2nd Edition, 04
2. Mikell P. Groover et. Al., Industrial Robotics: Technology, Programming and Applications, McGraw – Hill International, 1986.
3. Shimon Y. Nof , Handbook of Industrial Robotics , John Wiley Co, 01.
4. Automation, Production Systems and Computer Integrated Manufacturing, M.P. Groover, Pearson Education.
5. Industrial Automation: W.P. David, John Wiley and Sons.

Reference Books:

1. Richard D. Klafter , Thomas A. Chemielewski, Michael Negin, Robotic Engineering : An Integrated Approach , Prentice Hall India, 02.
2. Handbook of design, manufacturing & Automation: R.C. Dorf, John Wiley and Sons.

Course Outcomes:

At the end of the course students will be able to
1. understand basic terminologies and concepts associated with Robotics and Automation
2. demontrate comprehension of various Robotic sub-systems
3. understand kinematics and dynamics to explain exact working pattern of robots
4. aware of the associated recent updates in Robotics

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M. Tech I Year II Semester I&CE - 2019				
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ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY (EMI / EMC)
(ELECTIVE-IV)

SYLLABUS:

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-linearity's in circuits, passive intermediation, 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, opt isolators, 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 IMPACTseries,IIT – Delhi, Modules 1– 9.

REFERENCE BOOKS:

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

OUTCOMES:

At the end of this course the student can able to:

1. Understand the electromagnetic environment the definitions of EMI and EMC, history of EMI some examples of practical experiences due to EMI such as mains power supply, switches and relays, radio astronomy, biological effects, aircraft navigation etc.
2. Understand the several sources of electromagnetic noise in electrical, electro mechanical and electronic apparatus.
3. Understand the methods to measure RE and RS in the open are test sites
4. Understand the measurement facilities and procedures using anechoic chamber, TEM cell, reverberating chamber GTEM cell.
5. Understand the conduction current /voltages, common mode and differential mode noises, and instrumentation for measuring conducted EMI
6. Understand the various standards for EMI/EMC such as MIL-STD-461/462, IEEE/ANSI, CASPR/IEC standards, FCC regulations, British standard etc.

M. Tech I Year II Semester I&CE - 2019

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Bio-Medical Engineering Lab

List of Experiments:

1. Measurement of Blood Pressure
2. study of blood flow monitoring system
3. Measurement of blood po1 and po2
4. Study of ECG
5. Study of EEG
6. Study of EMG
7. Study of Cardiac pacemaker
8. Study of Defibrillator
9. Measurement of Heart Sounds (PLG)
10. Study of blood cell counter

List of Equipments:

- Study of electrical safety analyzer,
- Study of ventilator and
- Study of pacemakers

M. Tech I Year II Semester I&CE - 2019

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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

M. Tech II Year I Semester I&CE - 2019

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MEMS & Nano Technology

(ELECTIVE-V)

UNIT I: Overview of MEMS and Microsystems: MEMS and Microsystems, Typical MEMS and Micro-system products, Evolution of Micro-fabrication, Micro-system and Microelectronics, The Multidisciplinary nature of micro-system design and manufacture, Micro-system and Miniaturization. Application of Microsystems in the automotive industry, Application of Microsystems in other industries: Health care industry, Aerospace industry, Industrial products, Consumer products, Telecommunications. Markets for Microsystems

UNIT II: Working Principles of Microsystems: Introduction, Micro-sensors: Acoustic Wave Sensors, Biomedical sensors and Biosensors, Chemical sensors, Pressure sensors, Thermal sensors. Micro actuation: Actuation using thermal forces, shaped memory alloys, Piezoelectric crystals, Electrostatic forces. MEMS with Micro actuators: Micro-grippers, Micro-motors, Micro-valves, Micro-pumps, Micro accelerators, Micro-fluidics.

UNIT III: Scaling Laws in Miniaturization: Introduction to scaling, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Electromagnetic Forces, Scaling in Electricity, Scaling in Fluid Mechanics, Scaling in Heat Transfer.
Materials for MEMS and Microsystems: Introduction, Substrates and wafers, Active substrate materials, Silicon as a substrate material. Silicon compounds, Silicon piezo resistors, Gallium Arsenide, Quartz, Piezoelectric crystals, Polymers, Packing materials.

UNIT IV: Micro system Fabrication Process: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition, Physical Vapour Deposition, Deposition by Epitaxy, Etching. Overview of Micro manufacturing and Applications: Bulk Micro manufacturing- any one example of application, Surface Micromachining- any one example of application. LIGA Process- any one example of application

UNIT V: Applications of MEMS-Switching: Introduction, Switch parameters, Basics of switching, Mechanical switches, Electronic switches for RF and microwave applications, Mechanical RF switches, PIN diode RF switches.

Text Books:

1. Tai-Ran Hsu, "MEMS and Microsystems: Design and Manufacture", Tata McGraw Hill, (2002).

2. Gabriel M. Rebeiz, "RF MEMS Theory, Design and Technology", Wiley India PvtLtd.

Reference Books:

1. Stephen D. Senturia, "Microsystem Design", Springer International Edition,(2010).

2. Mohamed Gad-el-Hak, "The MEMS Handbook", CRC Press,(2002).

3. Chang Liu, "Foundations of MEMS", Second Edition, PearsonPublication.

Course Outcomes:

1. Understand the basic overview of MEMS and Microsystems with broad category ofMEMS& Micro system applications.
2. Understanding the working principles of Microsystems
3. Understand the Scaling Laws in Miniaturization and Materials for MEMS andMicrosystems
4. Understand the Micro system Fabrication Process and Analyze the different Micro manufacturing process and Applications.
5. Study and Analyze the different types of RF switches, Various Switching Mechanismand their applications.

M. Tech II Year I Semester I&CE - 2019

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INTERNET OF THINGS
(ELECTIVE-V)

Unit I

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models, Iot Communication APIs IoTenabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle(Chap 1 and 2)

Unit II

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANGNETCONF, YANG, SNMP NETOPEER(Chapter 3 and 4)

Unit III

IOT Platform design Methodology, Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib(Chapter 5 and 6)

Unit IV

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins., other IOT Devices(Chapter 7)

Unit V

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API, Amazon web services for IOT, Skynet IOT messaging platform(Chapter 8)

Text Books:

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD),2014, ISBN: 9789350239759

Reference Books:

1.The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).

2.. From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence, Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.

3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.

4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O'Reilly Media, 2011.

Course Outcomes:

- Understand the new computing technologies
- Able to apply the latest computing technologies like cloud computing technology and Big Data
- Ability to introduce the concept of M2M (machine to machine) with necessary protocols
- Get the skill to program using python scripting language which is used in many IoT devices

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EMBEDDED SYSTEM DESIGN
(ELECTIVE-V)

SYLLABUS:

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.

Course Outcomes:

At the end of this course the student can able to:

1. Understand the basic concepts of Current Technologies, Integration in system Design, Embedded system design flow, hardware design concepts, and software development.
2. Understand the Processor in an embedded system and other hardware units, introduction to processor based embedded system design concepts with examples.
3. Know the Embedded Hardware building blocks, Embedded Processors – ISA architecture models, internal processor design, and processor performance.
4. Know the introduction to Board Memory – ROM, RAM, Auxiliary Memory, Memory Management of External Memory, Board Memory and performance.
5. Know the importance and requirement of real time operating system to perform the task by an embedded system on real time environment.

M. Tech II Year I Semester I&CE - 2019

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Intelligent and Smart Instrumentation

(ELECTIVE-V)

UNIT I:

Introduction: Definition of intelligent instrumentation, types of instruments, Static Characteristics: Accuracy and Precision, Error, Correction, and Uncertainty, Repeatability, Reproducibility, and Hysteresis, Sensitivity, Offset, and Dead Band, Resolution and Linearity, Statistical Characteristics, Error Modeling, Dynamic Characteristics, Dynamic Error and Dynamic Sensitivity, Input-Output Impedances, Historical Perspective, Current status, software based instruments.

UNIT II:

Intelligent Sensors: Classification, Smart sensors , Cogent Sensors, Soft or Virtual sensors, Self-Adaptive Sensors, Self-Validating Sensors, VLSI Sensors, Temperature Compensating Intelligent Sensors, Pressure Sensor,Indirect Sensing

UNIT III:

Linearization, Calibration, and Compensation:

Analog Linearization of Positive and Negative Coefficient Resistive Sensors, Higher-Order Linearization, Nonlinear ADC- and Amplifier-Based Linearization, Interpolation, Piecewise Linearization, Microcontroller-Based Linearization, Artificial Neural Network–Based Linearization, Nonlinear Adaptive Filter–Based Linearization, Sensor Calibration, Conventional Calibration Circuits, Offset Compensation, Error and Drift Compensation, Lead Wire Compensation

UNIT IV:

Sensors with Artificial Intelligence:

Artificial Intelligence, Sensors with Artificial Intelligence, Multidimensional Intelligent Sensors, AI for Prognostic Instrumentation, ANN-Based Intelligent Sensors, Fuzzy Logic–Based Intelligent Sensors

UNIT V:

Intelligent Sensor Standards and Protocols:

IEEE 1451 Standard, STIM, TEDS, NCAP, Network Technologies, LonTalk, CEBUS, J1850 Bus, 1 Signal Logic and Format, MI Bus, Plug-n-Play Smart Sensor Protocol

Text Books:

1. ManabendraBhuyan, ―Intelligent Instrumentation: Principles and Applications‖ CRC Press,2011.
2. G. C. Barney, ―Intelligent Instrumentation‖, Prentice Hall, 1995.
3. J.B DIXIT, A. yadavLaxmi Publications, Ltd., 01-Sep-2011

Course Outcomes:

1:To develop the design methodologies for measurement and instrumentation of real world problems.
2: To be study the concepts of intelligent sensor devices, their performance characteristics and signal and system dynamics.
3: To address the issues in dealing signal conditioning operations such as calibration, linearization and compensation
4:To use artificial intelligence in sensor signal processing to solve real world problems
5:To deal with interfacing protocols in wireless networking platform.