19MA605  COMPUTATIONAL LINEAR ALGEBRA, DIFFERENTIAL EQUATIONS AND PROBABILITY THEORY  3-1-0-4


TEXT BOOKS/REFERENCES


19EM602  DIGITAL SIGNAL CONTROLLERS  3-0-2-4

TEXT BOOKS/ REFERENCES:

5. PICmicrocontroller, PIC16F87XA Data Sheet 28/40/44-Pin Enhanced Flash Microcontrollers, 2003 Microchip Technology Inc., DS39582B.

19EM601 DYNAMICS OF LINEAR AND NONLINEAR SYSTEMS


TEXTBOOKS/ REFERENCES:


19EM611 MODELLING AND IDENTIFICATION OF DYNAMICSYSTEMS

Modelling by first principle approach of simple mechanical, electrical, thermal, chemical systems. Modelling by energy approach using Lagrangian and Hamiltonian, bond graph modelling of dynamical systems. Classical methods of system identification:

TEXT BOOKS/ REFERENCES:


EMBEDDED CONTROL SYSTEM 3-0-2-4

Review of control system design: closed loop control, analysis of control loops, time and frequency domain specifications, stability. Approaches for controller design. Practical realization of a control loop. Controller Implementation: architecture of embedded controllers and description of various components. Design and implementation of control loops, choice of embedded computing platforms- Real-time Operating Systems, Tiny Operating systems, I/O and communication, scheduling algorithms and their performance analysis, real-time issues in co-design implementation. Validation techniques for embedded control systems. Model Based Control System Design: discrete systems, notion of state, Finite State Machines, Extended State Machines, Model based design, code generation, verification and validation, HIL, MIL, SIL, PIL. Performance assessment of control algorithms on the target implementation architectures. Case studies from automotive, aerospace, process control and other application domains.

TEXT BOOKS/ REFERENCES:


19EM613 PROCESS CONTROL AND AUTOMATION 3-0-2-4


TEXT BOOKS/ REFERENCES:


19EM614 DIGITAL CONTROL FOR AUTOMATION 3-0-2-4


TEXT BOOKS/ REFERENCES:


19EM615 OPTIMAL AND ADAPTIVE CONTROL


TEXT BOOKS/ REFERENCES:

19EM616  
SMART SENSING AND SIGNAL PROCESSING 3-0-2-4


TEXT BOOK/REFERENCES:


19EM603  
APPLICATION DEVELOPMENT LABORATORY 1-0-2-2

The student in consultation with the faculty advisor has to select a topic related to Control and Instrumentation area, write a paper and present it. Lab training sessions in commonly used ICs and kits (Microcontrollers, FPGA kits etc) to prepare students for project phase.

19RM600  
RESEARCH METHODOLOGY 2-0-0-2

Unit I:
Meaning of Research, Types of Research, Research Process, Problem definition, Objectives of Research, Research Questions, Research design, Approaches to Research, Quantitative vs. Qualitative Approach, Understanding Theory, Building and Validating Theoretical Models,
Exploratory vs. Confirmatory Research, Experimental vs Theoretical Research, Importance of reasoning in research.

**Unit II:**
Problem Formulation, Understanding Modeling & Simulation, Conducting Literature Review, Referencing, Information Sources, Information Retrieval, Role of libraries in Information Retrieval, Tools for identifying literatures, Indexing and abstracting services, Citation indexes

**Unit III:**
Experimental Research: Cause effect relationship, Development of Hypothesis, Measurement Systems Analysis, Error Propagation, Validity of experiments, Statistical Design of Experiments, Field Experiments, Data/Variable Types & Classification, Data collection, Numerical and Graphical Data Analysis: Sampling, Observation, Surveys, Inferential Statistics, and Interpretation of Results

**Unit IV:**
Preparation of Dissertation and Research Papers, Tables and illustrations, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript. References, Citation and listing system of documents

**Unit V:**

**TEXT BOOKS/ REFERENCES:**

**19EM701 INTELLIGENT CONTROL SYSTEMS3-0-0-3**

Geneticalgorithm: basics of Genetic Algorithms, design issues in Genetic Algorithm, geneticmodelling, hybrid approach, GA based fuzzy model identification, Particle SwarmOptimization: concept, algorithm, PSO variations and applications. Ant colonyoptimization. Mathematical modelling of intelligent robotic systems. Lab Practice:Simulation/ Hardware experiments in Neural control, Fuzzy logic control and Comparison of optimization algorithms in a selected case study.

TEXT BOOKS/ REFERENCES:


19EM702 ROBOTICS AND CONTROL 3-0-0-3

19EM703  FLIGHT DYNAMICS AND CONTROL  3-0-0-3


TEXT BOOKS / REFERENCES:


19EM704  VIRTUAL INSTRUMENTATION 3-0-0-3

Virtual Instrumentation: Historical perspective, advantages, block diagram and architecture of a virtual instrument, data flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming. VI programming techniques: VIS and sub - VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web. Data acquisition basics: Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses, ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements. VI Chassis

TEXTBOOKS/ REFERENCES:

4. www.ni.com

19EM705 LOGIC AND DISTRIBUTED CONTROL SYSTEMS 3-0-0-3

TEXT BOOKS/ REFERENCES:


19EM706 ROBUST CONTROL 3-0-0-3


TEXT BOOKS/ REFERENCES:


19EM707 ADVANCED DIGITAL SIGNAL CONTROLLERS AND APPLICATIONS 3-0-0-3

Applications using dsPIC30F: Generating SPWM, generating PWM's for power converters, PID based control loops, signal processing based on FIR and IIR filter structures, developing single and multi-point communications with dsPIC and other IC's. Lab Practice: FIR/IIR Filters, FFT, PID control loops and communication systems using dsPIC30F2010.

TEXT BOOKS/ REFERENCES:

1. dsPIC30F Family Reference manual, Microchip, 2008

19EM708 ESTIMATION THEORY AND STOCHASTIC CONTROL 3-0-0-3


TEXT BOOKS/ REFERENCES:


19EM709 MULTI AGENT SYSTEMS 3-0-0-3


TEXT BOOKS / REFERENCES:

3. M. Mesbahi and M. Egerstedt, “Graph Theoretic Methods in Multiagent Networks.”

19EM710 POWER PLANT INSTRUMENTATION

TEXT BOOKS/ REFERENCES:

5. “Nuclear power plant instrumentation and control”, A guidebook, International atomic energy agency Vienna, 1984 (online resource).

19EM711 ELECTRIC DRIVES AND CONTROL 3-0-0-3


TEXT BOOKS/REFERENCES:


19EM712 MODERN OPTIMIZATION TECHNIQUES 3-0-0-3

Historical Development, Engineering applications of Optimization. Art of Modelling: Objective function, Constraints and Constraint surface, Formulation of design problems as mathematical programming problems. Classification of optimization problems: Optimization techniques, classical and advanced techniques, Functions of single and two variables, Stationary points, Global Optimum, Convexity and concavity of functions of one and two variables, optimization of function of one variable and multiple variables,

TEXT BOOKS/ REFERENCES:


19EM713 GUIDANCE AND CONTROL OF AUTONOMOUS SYSTEMS 3-0-0-3


TEXT BOOKS/ REFERENCES:


**TEXTBOOKS/REFERENCES:**


**19EM715 SMART ELECTRICAL NETWORKS AND INTELLIGENT COMMUNICATION SYSTEMS 3-0-3**


TEXT BOOKS / REFERENCES:


19EM716 VARIABLE STRUCTURE AND SLIDING MODE CONTROL

Notion of variable structure systems and sliding mode control, Existence conditions of sliding mode, sliding surface, Design of continuous sliding mode control, Chattering reduction methods, Discrete sliding mode control, sliding mode observer, Uncertainty estimation using sliding mode, Discrete output feedback SMC using multiratesampling, Introduction to higher order sliding mode control, twisting and super twisting algorithms. Lab Practice: Simulation experiments in sliding mode control, continuous sliding mode control and so on.

TEXTBOOKS/ REFERENCES:


19EM717 CLOUD COMPUTING 3-0-0-3


TEXTBOOKS/ REFERENCES:


19EM718 CYBER PHYSICAL SYSTEMS3-0-0-3

TEXTBOOKS/ REFERENCES:


19EM719 AUTOMOTIVE CONTROL SYSTEM DESIGN 3-0-0-3


TEXT BOOKS/ REFERENCES:


19EM720 BIOLOGICAL CONTROL SYSTEMS 3-0-0-3


TEXT BOOKS/ REFERENCES:


19EM721 NONLINEAR SYSTEM ANALYSIS AND CONTROL 3-0-0-3


TEXT BOOKS/ REFERENCES:


**19EM722 ADVANCED DIGITAL SIGNAL PROCESSING 3-0-0-3**


**TEXT BOOKS/ REFERENCES**

1. Proakis J G and Manolakis DG Digital Signal Processing Principles, Algorithms and Application, PHI.
2. Openheim AV & Schafer RW, Discrete Time Signal Processing PHI.

**19EM723 ROBOTICS FOR INDUSTRIAL AUTOMATION 3-0-0-3**


TEXT BOOKS/REFERENCES:


19EM724 ARTIFICIAL INTELLIGENCE IN AUTOMATION 3-0-0-3


TEXT BOOKS/REFERENCES: