MEDI – 301(A) DSP PROCESSORS

UNIT- I

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- II

Execution Control and Pipelining

Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

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

Implementation of Basic DSP Algorithms

The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters.

UNIT- V

Implementation of FFT Algorithms

An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX.

TEXT BOOKS

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.
3. Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M. Bhaskar, TMH, 2004.
4. Digital Signal Processing – Jonathan Stein, John Wiley, 2005.

MEDI – 301(B) NUCLEAR INSTRUMENTATION

UNIT- I

General Introduction to Properties of Nuclear Systems and Radiation, Interaction of radiation with matter, Radioactive sources-Choice of isotopes.

Radiation detectors-Ionization chambers, Geiger-Muller counters, Scintillation counters, Semiconductor devices, Neutron detectors based on recoil, Measuring circuits including modulators, converters and stabilizers, Synchronous detectors.

Counting Statistics, Correlation sets, Standard deviation of rate meters, Error propagation, Effect of background, Statistical distribution of pulse height distribution, Detector efficiency.

UNIT- II

Nuclear Reactor Instrumentation

Diffusion, moderation, absorption and delay processes, Neutron flux measurement, Control rod calibration, Nuclear fuel inspection and testing including poisoning, Radiation energy measurement, Remote control instrumentation, Nuclear instrument maintenance.

UNIT -III

Application to industrial System

Radioactive Tracer technique, Gas and Liquid flow measurement, Leak detection, Residence time and its distribution, application to blending corrosion and wear studies

Thickness and density measurement by beta rays, Gammaray absorption technique, measurement of thickness of surface material by back scattering.

UNIT -IV

Level detection by radioactive devices, interface detection by neutron moderation technique.Measurement of gas pressure and gas analysers, Speceros-copic and frequency methods.Void detection, a idity meter, moisture meter, smoke detection, Ozonizer, Radiochromatography and interferometry.

Portable instruments, Source activity for dynamic properties of instruments.

UNIT -V

Safety

Hazards of ionization radiation, physiological effect of radiation, Dose and Risk, Radiological protection (Plpha, beta and Gamma, X, Neutron), Shielding material and effectiveness.

Operational safety instruments, emergency schemes, effluent disposal, Application to medical diagnosis and treatment.

References:

- Ed. Noltingk, B.E., "Instrumentation Reference Book, Butterworth Heinemenn.
- Boltan W., Newness, "Instrumentation and Measurement., Newness.
- Jones, "Instrumentation Series",

MEDI – 301(C) INDUSTRIAL STANDARDS

UNIT- I

Plant wide Control Systems and Automation Strategy

Evolution of instrumentation and control, Role of automation in industries, Benefits of automation, Introduction to automation tools PLC, DCS, SCADA, Hybrid DCS/PLC, Automation strategy evolution, Control system audit, performance criteria, Safety systems.

UNIT- II

Advance Applications of PLC and SCADA

PLC programming methods as per IEC 61131, PLC applications for batch process using SFC, Analog Control using PLC, PLC interface to SCADA/DCS using communication links (RS232, RS485) and protocols (Modbus ASCII/RTU)

UNIT- III

Instrumentation Standard Protocols

HART Protocol introduction, frame structure, programming, implementation examples, Benefits, Advantages and Limitations. Foundation Fieldbus H1 introduction, structure, programming, FDS configuration, implementation examples, Benefits, Advantages and Limitations. Comparison with other fieldbus standards including Device net, Profibus, Controlnet, CAN, Industrial Ethernet etc.

UNIT- IV

Distributed Control Systems Basics

DCS introduction, functions, advantages and limitations, DCS as an automation tool to support Enterprise Resources Planning, DCS Architecture of different makes, Latest trends and developments.DCS detail engineering, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface control, display etc. Enhanced function viz. Advance process Control, Batch application, Historical Data Management, OPC support, Security and Access Control etc. Performance Criteria for DCS and other automation tools.

UNIT- V

Application development and Automation for Industry verticals.

Application development and automation for following Industries- Power, Water and Waste water Treatment, Food and Beverages, Cement, Pharmaceuticals, Automobile and Building Automation.

Text Books

- Distributed Computer Control for Industrial Automation, Poppovik Bhatkar, Dekkar Publications.
- Programmable logic controllers: Principles and Applications, Webb and Reis, PHI.
- Computer Aided Process Control, S.K. Singh, PHI
- Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning

Reference Books

- The Management of Control System; Justification and Technical Auditing, N.E. Battikha , ISA
- Computer Based Process Control, Krishna kant, PHI

MEDI – 302(A) ROBOTICS

UNIT- I

Introduction: Definition, Classification of Robots, Geometric classification and control classification.

UNIT- II

Robot Elements: Drive systems, Control systems, sensors, End effectors, Gripper actuators and gripper design.

UNIT- III

Robot Coordinate Systems and Manipulator Kinematics: Robot co-ordinate system representation, Transformation, Homogeneous transforms and its inverse, Relating the robot to its world. Manipulators Kinematics, Parameters of links and joints, Kinematic chains, Dynamics of kinematic chains, Trajectory planning and control, Advanced techniques of kinematics and dynamics of mechanical systems, Parallel actuated and closed loop manipulators.

UNIT- IV

Robot Control: Fundamental principles, Classification, Position, path and speed control systems, adaptive control.

UNIT-V

Robot Programming: Level of robot programming, Language based programming, task level programming, Robot programming synthesis, robot programming for foundry, press work and heat treatment, welding, machine tools, material handling, warehousing assembly, etc., automatic storage and retrieval system, Robot economics and safety, Robot integration with CAD/CAM/CIM, Collision free motion planning

Books:

1. Robotic Technology (Vol. I-V) Phillipe Collet Prentice Hall

2. An Introduction to Robot Technology Coiffet and Chirooza Kogan Page

3. Robotics for Engineers Y. Koren McGraw Hill

4. Robotics K.S. Fu, R.C. Gonzalez & CSG Lee McGraw Hill International

5. Robotics J.J. Craig Addison-Wesley

6. Industrial Robots Groover, Mitchell Weiss, Nagel Octrey McGraw Hill

7. Robots & Manufacturing Automation Asfahl Wiley Eastern

MEDI – 302(B) FUZZY SYSTEMS

UNIT- I

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.

UNIT- III

Classical relations and fuzzy relations: Cartesian Product, Crisp relations, Fuzzy relations, Operations on fuzzy relations, Various types of binary fuzzy relations, Fuzzy relation equations, The extension principle and its applications, Tolerance and equivalence relations, Crisp equivalence relation, Crisp tolerance relation, Fuzzy tolerance and equivalence relation, Value assignments.

UNIT- IV

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- V

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.

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. COURSES OF STUDY (Syllabus) M. Tech. (Instrumentation) for the batch registering in 2012-13
5. G. J. Klir and B. Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall of India, New Delhi, 1997.

MEDI – 302(C) SAFETY & RELIABILITY

UNIT- I

Reliability and safety definitions, Risk factor, Classification of failures and protective measures. Safety measurement, Preliminary hazard analysis, Subsystem fault hazard analysis, Common mode failures, codes and standards for safety.

UNIT- I

Reliability improvement

Redundancy element, Unit, and stand by optimization-cost trade off- Fault tree analysis-Constructions of Fault tree-Calculations of reliability from fault tree-reliability allocation-evaluation of reliability-test-O.C. curve specifying reliability acceptance test.

UNIT- III

Definition of Quality-Quality control design-Product development cycle-Quality planning of manufacturing process-Process selection and control-Inspection and testing-Quality audit-Organizing for quality-Quality function-Quality engineering and quality control-Typical organization for quality : Small scale, Medium scale and Large scale organization.

UNIT- IV

Distribution, Markov modeling, Stress-strength approach to reliability design, Relationship between MTBF, hazard rate, failure rate, reliability.

UNIT- V

Redundancy techniques, examples from Electrical, Nuclear, Chemical and Process Engineering, Elementary Analysis and Estimation techniques.

References:

- Jurian J.M., “Quality V Control Handbook”, McGraw Hill.
- Grant E.L., & Levenworth, “Statistical Quality Control”, McGraw Hill.
- Geedenko B.V., “Mathematical Methods of Reliability Theory”, Academic.
- Mann, Schafer R.E., & Singapurvala N.D., “Mehods for Statistical Analysis of Reliability and Life Date”
- Reigenbaum V., “Total Quality Control”, McGraw Hill.
- Trylot J.R., “Quality Control Systems-Procedures for Planning Quality Programs”.