MTDE – 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.

MTDE – 301(B) INFORMATION THEORY & CODING

Introduction and Preview: Basic applications of Information Theory and its relationship with other fields.

Entropy, Relative Entropy and Mutual Information: Entropy, Joint entropy and conditional entropy, Relative, Mutual Information, Chain Rules, Some Inequalities, Jensen's, Log Sum, Data Processing and Fano's inequality, Channel models, channel capacity, Shannon's channel capacity theorem.

The Asymptotic Equipartition Property and Data Compression: Entropy Rates of a Stochastic Process: Markov Chains, Entropy Rate of a Random Walk.

Data Compression: Uniquely decodable codes, Kraft Inequality, McMillan Inequality, Huffman Code, The channel coding theorem, converse of coding theorem.

Error Control Coding: Coding for reliable digital transmission and storage, Types of codes, Modulation and coding, ML decoding, Performance measures.

Algebra Background: Groups, Fields, Binary field arithmetic, Vector Spaces over GF(2).

Linear Block Codes: Generator and parity check matrices, Syndrome and error detection, Standard array and syndrome decoding, Hamming codes.

Cyclic Codes: Polynomial representation, Systematic encoding, Cyclic encoding, Syndrome decoding.

References:

1. T. Cover & J. Thomas, Elements of Information Theory, J. Wiley, 1999.
2. Shu Lin & D. J. Costello, Error Control Coding (2^{nd} Edn), Pearson, 2004.
3. T. K. Moon, Error Correction Coding (WSE), Wiley- Interscience, 2006.

MTDE – 301(C) OPTOELECTRONICS

Optical process in semiconductors: Electron-hole pair formation and recombination, Absorption in semiconductors, Stark effects, Absorption and emission spectra, Stokes shift in optical transitions, Excitation, recombination, Band to Band recombination, Auger recombination.

Optical sources and modulators:
Heterostructure LED & LASER sources, Quantum well lasers, Laser rate equations,Laser modes, Q-switching, Mode locking, Electro- optic modulator, Magneto-optic,modulator, Acousto-optic modulator.

Optical Detectors:
Hetero-junction photodiodes, Photoconductors, MSM photodiodes, Phototransistors,OPFET.

Solar cells, Spectral response, conversion efficiency, Charge couple devices, SCCDS, BCCDS, JCCDS, Characteristics and applications.

Optical Computing- I:
Analog optical arithmetic, Half tone processing, Nonlinear optical processing, Arithmetic operations.

Optical Computing II:
Digital optical computing: Nonlinear devices, optical bistable devices, SEED devices , Optical phase conjugate devices, Integrated devices, spatial light modulators (SLM), Shadow casting system , POSC multiprocessor , Free space PLA, Fiber optic PLA.

Photonics switching and interconnects:
Kerr gats, Nonlinear Directional couplers, Nonlinear optical loop mirror (NOLM), Soliton,logic gats, Free-space optical interconnects, waveguide interconnects.

Text Books:
1. Semiconductor Optoelectronic Devices, P. Bhattacharya, PHI.
2. Physics of Semiconductor Devices, S. M. Sze , Wiley Eastern
3. Optical Computing, an Introduction, Mohammad A. Karim and Abdul A.S. Awwal,John Wiley & Sons, Inc.

Reference Books:
1. Optoelectronics and Photonics, Principles and Practices, S. O. Kasap, PrenticeHall
2. Essentials of optoelectronics, Alan Rogers, 1st Ed., Chapman & Hall.
3. Optical Fiber Communications, G.Keiser, 3rd Ed., McGraw Hill
4. Introduction to Fiber Optics, Ghatak &Thyagarajan, Cambridge University press.
5. Photonic switching and Interconnects Abdellatif Marrakchi, Marcel Dekker, Inc

MTDE – 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

MTDE – 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.

MTDE – 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”.