BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

COMPUTER SCIENCE & ENGINEERING (CSE)

7th Semester				8th Semester			
Theory		Contact Hours		Theory		Contact Hours	
Code	Subject	L-T-P	Credit	Code	Subject	L-T-P	Credit
HSSM3401	Entrepreneurship Development	3-0-0	3	HSSM3402	Environmental Engineering	3-0-0	3
PCCS4401	Computer Graphics	3-0-0	3				
PCCS4402	Principles and Practices in Software Engineering	3-0-0	3				
	Professional Elective-III (Any one)	3-0-0	3		Professional Elective-V (Any one	3-0-0	3
PECS5401	Artificial Intelligence			PECS5406	Digital Image Processing		
PECS5402	Cryptography & Network Security			PECS5407	Wireless Sensor Networks		
PECS5403	Real Time Systems			PECS5408	Embedded System Development		
	Professional Elective-IV (Any one)	3-0-0	3		Professional Elective-VI (Any one)	3-0-0	3
PECS5404	Advanced Computer Architecture			PECS5409	Data and Web Mining		
PCIT4401	Principles of Soft Computing			PECS5410	Algorithms for Bio-Informatics		
PCIT4402	Software Project Management			PECS5411	Parallel & Distributed Systems		
	Free Elective-III (Any one)	3-0-0	3		Free Elective-IV (Any One)	3-0-0	3
PCEC4401	VLSI Design			PEEC5418	Satelite Communication Systems		
PEEC5416	Biomedical Instrumentation			PEEI5405	MEMS		
PEEC5417	Digital Switching & Telecommunication Network			PCBM4402	Medical Imaging Techniques		
FECS6401	Introduction to Digital Signal Processing			PEEI5404 PEME5407 PEEI5403	Free Elective-V (Any One) Analog VLSI Design Mechatronics Industrial Instrumentation	3-0-0	3
Theory Credits			18	Theory Credits			15
	Practical/Sessional				Practical/Sessional		
PCCS7402	Minor Project		3	PCCS7403	Major Project		6
PCCS7401	Software Engineering Lab	0-0-3	2	PCCS7404	Comprehensive Viva voce		2
Practical / Sessional Credits			5	Practical / Sessional Credits			8
TOTAL SEMESTER CREDITS			23	TOTAL SEMESTER CREDITS			23
TOTAL CUMULATIVE CREDITS			181	TOTAL CUMULATIVE CREDITS			204

ENTREPRENEURSHIP DEVELOPMENT

Module I: Understanding Entrepreneurship 10Hrs

Concept of Entrepreneurship, Motivation for Economic Development and Entrepreneurial Achievement, Enterprise and Society

Why and how to start Business – Entrepreneurial traits and skills, Mind Vrs Money in Commencing New Ventures, Entrepreneurial success and failures, Environmental dynamics and change.

Entrepreneurial Process

Step by step approach to entrepreneurial start up

Decision for Entrepreneurial start up.

Module II: Setting up of a small Business Enterprise. 10Hrs

Identifying the Business opportunity - Business opportunities in various sectors, formalities for setting up small enterprises in manufacturing and services, Environmental pollution and allied regulatory and non-regulatory clearances for new venture promotion in SME sector.

Writing a Business plan, components of a B-Plan, determining Bankability of the project.

Module III: Institutional Support for SME. 10Hrs

Central / State level Institution promoting SME.

Financial Management in small business.

Marketing Management, problems & strategies

Problems of HRM – Relevant Labour – laws.

Sickness in Small Enterprises.

Causes and symptoms of sickness – cures of sickness.

Govt. policies on revival of sickness and remedial measures.

Reference Books:

1. Entrepreneurship Development, Small Business Enterprises, Chavantimath, Pearson.
2. Entrepreneurial Development, S.S. Khanka, S Chand
3. Entrepreneurship, Barringer BR, Ireland R.D., Pearson
4. Entrepreneurship, David H Holt, PHI
5. Entrepreneurship, Kurilko, D.F. and Attodgets RM, Cengage
6. The Dynamics of Entrepreneurial Development & Management, Vasant Desai, HPH.
7. Entrepreneurship, Roy, Oxford
8. Entrepreneurship, Hisrich, Peters, Shepherd, TMH

COMPUTER GRAPHICS

Module – I (10 hours)

Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices.

Output Primitives: Line drawing Algorithms: DDA and Bresenham's Line Algorithm, Circle drawing Algorithms: Midpoint Circle Algorithm and Bresenham's Circle drawing Algorithm.

Two Dimensional Geometric Transformation: Basic Transformation (Translation, rotation, Scaling) Matrix Representation, Composite Transformations, Reflection, Shear, Transformation between coordinate systems.

Two Dimensional Viewing: Window-to- View port Coordinate Transformation.

Module –II (12 hours)

Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm).

Aliasing and Antialiasing, Half toning, Thresholding and Dithering, Scan conversion of Character.

Polygon Filling: Seed Fill Algorithm, Scan line Algorithm.

Two Dimensional Object Representation: Spline Representation, Bezier Curves and B-Spline Curves.

Fractal Geometry: Fractal Classification and Fractal Dimension.

Three Dimensional Geometric and Modeling Transformations: Translation Rotation, Scaling, Reflections, shear, Composite Transformation.

Projections: Parallel Projection and Perspective Projection.

Module –III (8 hours)

Visible Surface Detection Methods: Back-face Detection, Depth Buffer, A- Buffer, Scan- line Algorithm and Painters Algorithm.

Illumination Models: Basic Models, Displaying Light Intensities.

Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading and Phong Shading.

Computer Animation: Types of Animation, Key frame Vs. Procedural Animation, methods of controlling Animation, Morphing.

Virtual Reality: Types of Virtual reality systems, Input and Output Virtual Reality devices.

Textbook

1. Computer Graphics with Virtual Reality System, Rajesh K.Maurya, Wiley-Dreamtech.
2. Computer Graphics, D. Hearn and M.P. Baker (C Version), Pearson Education

Reference Books

1. Computer Graphics Principle and Practice , J.D. Foley, A.Dam, S.K. Feiner, Addison, Wesley
2. Procedural Elements of Computer Graphics- David Rogers (TMH)
3. Computer Graphics: Algorithms and Implementations – D.P Mukherjee & Debasish Jana (PHI)
4. Introduction to Computer Graphics & Multimedia – Anirban Mukhopadhyay & Arup Chattopadhyay (Vikas)

PRINCIPLES & PRACTICES OF SOFTWARE ENGINEERING

Module –I **8Hrs**

Evolution and impact of Software engineering, software life cycle models; Feasibility study, Functional and Non-functional requirements, Requirement analysis and specification.

Module – II **10Hrs**

Basic issues in software design, modularity, cohesion, coupling and layering, function-oriented software design, object modeling using UML, Object-oriented software development, user interface design. Coding standards and Code review techniques.

Module III **12Hrs**

Fundamentals of testing, White-box, and black-box testing, Test coverage analysis and test case design techniques, mutation testing, Static and dynamic analysis, Reliability and Quality management, ISO and SEI CMMI, PSP and Six Sigma. Computer aided software engineering, software maintenance, software reuse, Component-based software development.

Text Book :

Fundamentals of Software Engineering – Rajib Mall. (PHI-3rd Edition), 2009.

References:

1. Ian **Sommerville**, "*Software Engineering*", 8th Edition, 2007, Pearson Education Inc., New Delhi.
2. Roger S. **Pressman**, "*Software Engineering: A Practitioner's Approach*", 7th International Edition, McGraw-Hill Education (Asia), Singapore.
3. Shari Lawrence **Pfleeger,** Joanne M. **Atlee**, "*Software Engineering*", 3rd Edition (2006) , Pearson Education, Inc. New Delhi.
4. Pankaj **Jalote**, "*Software Engineering*", First Edition, 2009, Wiley India Pvt. Ltd., New Delhi.

ARTIFICIAL INTELLIGENCE

Module 1 **12Hrs**

What is Artificial Intelligence? AI Technique, Level of the Model,Problem Spaces, and Search: Defining the Problem as a State Space Search, Production Systems, Problem Characteristics, Production System Characteristics, Issues in the Design of Search Programs.Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Best-first Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis,**Knowledge Representation:** Representations and Mappings, Approaches to Knowledge Representation, **Using Predicate Logic**: Representing Simple Facts in Logic, Representing Instance and ISA Relationships, Computable Functions and Predicates, Resolution, Natural Deduction.**Using Rules**: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning, Matching, Control Knowledge.**Symbolic Reasoning Under Uncertainty**: Introduction to Nonmonotonic Reasoning, Logics for Nonmonotonic Reasoning, Implementation Issues, Augmenting a Problem-solver, Depth-first Search, Breadth-first Search.**Weak and Strong Slot-and-Filler Structures**: Semantic Nets, Frames, Conceptual DependencyScripts, CYC.

Module 2 **10Hrs**

Game Playing: The Minimax Search Procedure, Adding Alpha-beta Cutoffs, Iterative Deepening.**Planning**: The Blocks World, Components of a Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical PlanningOther Planning Techniques.**Understanding**: What is Understanding, What Makes Understanding Hard?, Understanding as Constraint Satisfaction.**Natural Language Processing**: Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking.

Module 3 **8Hrs**

Learning: Rote Learning, Learning by Taking Advice, Learning in Problem-solving, Learning from Examples: Induction, Explanation-based Learning, Discovery, Analogy, Formal Learning Theory, Neural Net Learning and Genetic Learning. **Expert Systems**: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Text Book:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009

References:

1) Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010
2) S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011

CRYPTOGRAPHY AND NETWORK SECURITY

Module 1 **10Hrs**

Introduction to Information Security: Security Goals, Attacks, Security Services and Mechanisms, **Mathematical Background**: Integer and Modular Arithmetic, Matrices, Linear Congruence. Groups, Rings, and Fields, GF(p), Euclidean and Extended Euclidean Algorithms, Polynomial Arithmetic, GF(2n). Random Number Generation, Prime Numbers, Fermat's and Euler's Theorems, Primality Testing Methods, Factorization, Chinese Remainder Theorem, Quadratic Congruence, Discrete Logarithms.

Module 2 **10Hrs**

Traditional Encryption Methods: Symmetric Cipher Model, Substitution Ciphers, Transposition Ciphers, Block and Stream Ciphers, Rotor Cipher, Steganography. **Symmetric Key Ciphers**: Data Encryption Standard, Advanced Encryption Standard. **Asymmetric Key Ciphers**: RSA Cryptosystem, ElGamal Cryptosystem, Elliptic Curve Cryptosystem.**Message Integrity, Authentication**: Message Integrity, Random Oracle Model, Message Authentication, MAC Algorithms. Cryptographic Hash Functions: MD Hash Family, Whirlpool, Secure Hash Algorithm. Digital Signature and Authentication: Digital Signature Schemes, Variations and Applications, Entity Authentication.Key Management: Diffie-Hellman Key Exchange.

Module 3 **10Hrs**

Network and System Security:Security at the Application Layer: e-mail security, PGP and S/MIME. Security at the Transport Layer: Secure Socket Layer (SSL) and Transport Layer Security (TLS). Security at the Network Layer: IP Security. **System Security**: Malicious Software, Malicious Programs, Viruses, Worms, Malware, Intrusion Detection System, Firewalls.

Text Books:

1. B. A. Forouzan & D Mukhopadhyay ,Cryptography and Network Security., McGraw Hill, 2nd ed.2010

References:

1. B. Menezes ,Network Security and Cryptography., Cengage Learning, 1st ed.2010
2. Stallings ,Cryptography and Network Security., PHI, 4th ed.2010

REAL-TIME SYSTEMS

MODULE-1 10Hrs

Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteistics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints

Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations.

MODULE-2 10Hrs

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP.Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies.

Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

MODULE-3 10Hrs

Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system,POSIX-RT, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real-time Communication: Basic concepts, Examples of applications, Real-time communication in a LAN and Real-time communication over packet switched networks.

Text Book:

1. Real-time Systems Theory and Practice by Rajib Mall, Pearson Publication, 2008.

References:

1. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.
2. C.M. Krishna and K.G. Shin, Real-Time Systems, TMH.

ADVANCED COMPUTER ARCHITECTURE

Module 1: Processor Architecture 10Hrs

Evolution of Microprocessors, Instruction set processor design, Principles of processor performance, Instruction-level Parallelism, RISC and CISC architectures, Pipelining fundamentals, Arithmetic and instruction pipelining, Pipeline hazards, Minimizing pipeline stalls, Branch Prediction, superscalar and superpipelined architectures.

Module 2: Memory and I/O Architecture 10Hrs

Hierarchical memory technology; Multi-level caches, Data and Instruction caches, Cache optimizations, Memory Management hardware, I/O systems: Peripheral and Processor-Memory buses, Split transaction buses , USB.

Module 3: Multiprocessor Architecture 10Hrs

Basic multiprocessor architecture, Cache coherence, multithreaded processors, VLIW processor architectures. Array and vector processors. Case studies :MIPS architecture, Intel Series of processors, Pentium's Internally RISC and externally CISC, Hyper threading, SPARC and ARM processors.

Text Book

1. David A. Patterson and John L. Hennessy, Computer Organization and Design, Elsevier, Fourth Edition
2. John Paul Shen and Mikko Lipasti, Modern Processor Design, Tata McGraw Hill.

References:

1. Dezso *Sima*, Terence Fountain, and Peter Kacsuk, *Advanced Computer Architecture*: A Design Space Approach, by Addison Wesley
2. John L. Hennessy & David A. Patterson, Computer Architecture, A Quantitative Approach 4th Edition, Morgan Kaufmann.
3. Hwang & Jotwani, Advance Computer Architecture, TMH

PRINCIPLES OF SOFT COMPUTING (3-0-0)

Module - I (12 Hrs.)

Introduction to Soft Computing**,** Artificial Neural Network(ANN) **:** Fundamentals of ANN, Basic Models of an artificial Neuron, Neural Network Architecture, Learning methods, Terminologies of ANN, Hebb network, Supervised Learning Networks: Perceptron, MLP, Architecture of a Back propagation Network : back propagation, Learning Effect of Tunning parameters of the Back propagation, Adaline, Madaline, RBF Network, Associative memory: Auto, hetero and linear associative memory, network, Adaptive Resonance Theory

ART1, ART2, Applications

Module –II (12 Hrs)

FUZZY LOGIC

Fuzzy set theory: crisp sets, fuzzy sets, crisp relations, fuzzy relations, Fuzzy Systems: Crisp logic predicate logic, fuzzy logic, fuzzy Rule based system, Defuzzification Methods, Fuzzy rule based reasoning

GENETIC ALGORITHMS

Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction. Genetic Modeling :

Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA. Convergence of Genetic algorithm. Applications , Real life Problems.

Module – III (6 Hrs.)

Hybrid Soft Computing Techniques Hybrid system, neural Networks, fuzzy logic and Genetic algorithms hybrids. Genetic Algorithm based Back propagation Networks: GA based weight determination applications: Fuzzy logic controlled genetic Algorithms soft computing tools, Applications.

Text Book :

Principles of Soft Computing- S.N.Sivanandan and S.N.Deepa, Wiley India, 2nd Edition,2011

Reference Book :

1. Neuro Fuzzy and Soft Computing, J. S. R. JANG,C.T. Sun, E. Mitzutani, PHI
2. Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application) S.Rajasekaran, G.A. Vijayalakshmi Pai, PHI

SOFTWARE PROJECT MANAGEMENT

Module I: Project Evaluation and Planning (12Hrs)

Activities in Software Project Management, Overview Of Project Planning, Stepwise planning, contract management, Software processes and process models. Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

Module 2: Monitoring And Control (8Hrs)

Collecting Data, Visualizing Progress, Cost Monitoring, review techniques, project termination review, Earned Value analysis, Change Control, Software Configuration Management (SCM), Managing Contracts, Types Of Contracts, Stages In Contract Placement, Typical Terms of A Contract, Contract Management and Acceptance.

Module 3: Quality Management and People Management (10Hrs)

Introduction, Understanding Behavior, Organizational Behaviour, Selecting The Right Person For The Job, Motivation, The Oldman – Hackman Job Characteristics Model , Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety. ISO and CMMI models, Testing, and Software reliability, test automation, Overview of project management tools.

Text Book

1. Bob Hughes, Mike Cotterell, "Software Project Management", Fifth Edition, Tata McGraw Hill, 2011.

References:

1. Royce, "Software Project Management", Pearson Education, 1999.
2. Robert K. Wysocki, Effective Software Project Management, Wiley, 2009.

VLSI DESIGN

Module – I **08 Hours**

Introduction: Historical Perspective, VLSI Design Methodologies, VLSI Design Flow, Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI Design Styles, Computer-Aided Design Technology.

Fabrication of MOSFETs: Introduction, Fabrication Processes Flow – Basic Concepts, The CMOS n-Well Process, Layout Design Rules, Stick Diagrams, Full-Customs Mask Layout Design.

MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitance.

(Chapter 1 to 3 of Text Book 1 and for Stick Diagram Text Book 2)

Module – II **14 Hours**

MOS Inverters – Static Characteristics: Introduction, Resistive-Load Inverters, Inverters with n-Type MOSFET Load, CMOS Inverter.

MOS Inverters – Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definitions, Calculation of Delay-Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

Combinational MOS Logic Circuits: Introduction, MOS Logic Circuits with Depletion nMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates (Pass Gates).

(Chapter 5 to 7 of Text Book 1)

Module – III **18 Hours**

Sequential MOS Logic Circuits: Introduction, Behaviour of Bistable Elements, SR Latch Circuits, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop.

Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits.

Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM), Static Random Access Memory (SRAM), Non-volatile Memory, Flash Memory.

Design for Testability: Introduction, Fault Types and Models, Ad Hoc Testable Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring I_{DDQ} Test.

Text Books:

1. Sung-Mo Kang and Yusuf Leblebici, *CMOS Digital Integrated Circuits: Analysis and Design*, 3rd Edn., Tata McGraw-Hill Publishing Company Limited, 2003.
2. K. Eshraghian and N.H.E. Weste, *Principles of CMOS VLSI Design – a Systems Perspective*, 2nd Edn., Addison Wesley, 1993.

Reference Books:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, *Digital Integrated Circuits – A Design Perspective*, 2nd Edn., PHI.
2. Wayne Wolf, *Modern VLSI Design System – on – Chip Design*, 3rd Edn., PHI
3. Debaprasad Das, *VLSI Design*, Oxford University Press, New Delhi, 2010.
4. John P. Uyemura, *CMOS Logic Circuit Design*, Springer (Kluwer Academic Publishers), 2001.
5. Ken Martin, *Digital Integrated Circuit Design*, Oxford University Press, 2000.

BIOMEDICAL INSTRUMENTATION (3-0-0)

Module – I (10 Hours)

Fundamentals of Biomedical Instrumentation: Sources of Biomedical Signals, Basic Medical Instrumentation System, Intelligent Medical Instrumentation Systems, PC Based Medical Instrumentation Systems, General Constraints & Regulations of Medical Devices

Biomedical Signals & Electrodes: Origin of Bioelectric Signals-Repolarization, Depolarization, Resting Potential Recording Electrodes – Ag-AgCl Electrodes, Electrodes for ECG, EEG, EMG, Microelectrodes, Skin Contact Impedance, Motion Artifacts

Module – II (13 Hours)

Physiological Transducers: Introduction to Physiological Transducers, Classification of Transducers, Pressure Transducers, Transducers for Body Temperature Measurement, Biosensors, Smart Sensors

Biomedical Recording Systems: Basic Recording Systems, General Considerations for Signal Conditioners, Biomedical Signal Analysis Techniques, Signal Processing Techniques, Writing Systems: Direct Writing Recorders, Inkjet Recorder, Potentiometric Recorders, Digital Recorders

Biomedical Recorders: Electrocardiograph (ECG), Phonocardiograph, Electroencephalograph (EEG), Electromayograph (EMG)

Module – III (14 Hours)

Patient Monitoring Systems: System Concepts, Measurement of Heart Rate, Blood Pressure Measurement, Measurement of Respiration Rate

Blood Flow meters: Electromagnetic Blood Flow meter, Ultrasonic Blood Flow meter, NMR Blood Flow meter, Laser-Doppler Blood Flow meter

Patient Safety: Electric Shock Hazards, Leakage Currents, Safety Codes for Biomedical Equipment

Text Books:

1. Hand Book of Biomedical Instrumentation-2nd Edition by R.S.Khandpur, Tata McGraw Hill 2003 (Chapters 1-6,11,18)
2. Biomedical Instrumentation and Measurements-2nd Edition by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, PHI learning Pvt Ltd 2nd Edition

Reference Books:

1. Introduction to Biomedical Equipment Technology-4th Edition by Joseph J. Carr, John M. Brown, Pearson Education 2007

DIGITAL SWITCHING AND TELECOMUNICATION NETWORKS

MODULE – I **(16 hours)**

Introduction: Fundamentals of switching system, telecommunication networks.

Electronic space division switching: Stored program control, centralized and distributed SPC, application software architecture, enhanced services, two and three stage & n stage networks.

Time Division Switching: Basic time division space switching, time division time switching, time multiplexed space and time switching, combination switching, three-stage & n stge combination switching. (Chapter 1, 4 and 6)

MODULE – II **(12 hours)**

Traffic Engineering: Network traffic load and parameters, Grade of services & blocking probability, modeling of switching systems, incoming traffic & service time characterization, blocking models and loss estimates, Delay systems (Chapter 8)

Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, Signaling techniques : in channel & common channel signaling (Chapter 9)

MODULE – III **(12 hours)**

Data Networks: Data transmission in PSTN, switching techniques, Data communication architecture, link-to-link layers, end-to-end layers, satellite based data networks, an overview of data network standards. (Chapter 10)

Integrated Service Digital Network: Motivation, new services, transmission channels, signalling, service characterization, ISDN standards, broad band ISDN, voice data integration (Chapter 11)

Text Books :

1. Thiagarajan Viswanathan, Telecommunication Switching Systems and Networks
   by, PHI Learning Pvt. Ltd., New Delhi.

References:

1. Communication Networks, A Leon-Garcia and Indra Widiaja, TMH, New Delhi
2. Data and Computer Communications by W Stallings, Pearson Education

INTRODUCTION TO DIGITAL SIGNAL PROCESSING (3-0-0)

Module – I (10 hours)

Discrete Time Signals and System

Discrete Time Signals (Elementary examples, classification : periodic and a periodic Signals energy and Power signals, Even and Odd Signals) .

Discrete Time System :

Block diagram representation of discrete time systems, classification of discrete time systems –static and dynamic, time variant and time – invariant, linear and non-linear, casual and anti-casual, stable and unstable.

Analysis and response (convolution sum) of discrete - time linear LTI system, Recursive and Non-recursive discrete time system. Constant coefficient differences equations and their solutions, impulse response of LTI system , structures of LTI systems Recursive and Non-recursive realization of FIR system. Correlation of dispute time Signal.

Selected portions from Chapter 2 (2.1, 2.2,2.3,2.4,2.5, 2.6.1) of Textbook – I

Chapter 1 of Textbook- 2.

Module – II (10 hours)

The Z transform

The Z-transform and one-sided Z-transform, properties of Z-transform , inverse of the Z-transform , Solution of difference equations.

Selected portions from Chapters 3 (3.1, 3.2,3.5) of Textbook – I

Selected portion of chapter 4 of Textbook - 2

The Discrete Fourier Transform

The DFT and IDFT, relationship , DFT with Z- transform , the DFT as a linear transformation Relationship of DFT with Z-transform , properties of DFT: periodicity, linearity, summery and time reversal of a sequence. Circular convolution, circular correlation, circular correction by convolution, method linear convolution by overlap save methods and by overlap add method, Circular convolution and correlation by DFT method, Overlap add and save filtering by DFT method.

Selected portion from Chapter – 5 (5.1.2,5.1.3,5.1.4,5.2,5.2.1,5.2.2, 5.2.3, 5.3.2) of textbook –1.

Selected portion of chapter 6 of textbook - 2.

Module- III (10 hours)

Fast Fourier Transform :

Operation counts by direct copulation of DFT, Radix – 2 FFT algorithm- Decimation –in-time (DIT) and Decimation – in frequency (DIF) algorithm, Efficient computation DFT of Two real sequences , Efficient Computation of DFT of a 2 N-pt real sequences.

Selected portions from chapter 6 (6.1.1,6.1.3, 6.2.1, 6.2.2) of Text book –I

Selected portions from chapter 7 and 8 of Text book – 2.

Design and Digital Filters:

Casually and its implication, Design of linear phase FIR filters using different windows. Design of IIR filters – Impulse Invariance Method and Bilinear transformation method.

Selected portions from chapter 8 (8.1.1, 8.2.1, 8.2.2., 8.3.2,8.3.3.) of Text book – I

Text Books

1. Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.

Reference Book :

SOFTWARE ENGINEERING LABORATORY

Experiment 1: Develop requirements specification for a given problem
(The requirements specification should include both functional and non-functional requirements.
For a set of about 20 sample problems, see the questions section of Chap 6 of Software Engineering book of Rajib Mall)

Experiment 2: Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem
(Use of a CASE tool required)

Experiment 3: Develop Structured design for the DFD model developed

Experiment 4: Develop UML Use case model for a problem
(Use of a CASE tool any of Rational rose, Argo UML, or Visual Paradigm etc. is required)

Experiment 5: Develop Sequence Diagrams

Experiment 6: Develop Class diagrams

Experiment 7: Develop code for the developed class model using Java

Experiment 8: Use testing tool such as Junit

Experiment 9: Use a configuration management tool

Experiment 10: Use any one project management tool such as Microsoft Project or Gantt Project, etc.

8th Semester

ENVIRONMENTAL ENGINEERING (3-0-0)

Objective: This course introduces the students to the environmental consequences of Industries, development actions etc. and the methods of minimizing their impact through technology and legal systems.

Module – I

Ecological Concepts and Natural Resources: Ecological perspective and value of environment. Environmental auditing, Biotic components, Ecosystem Process: Energy, Food Chain, Water cycle, Oxygen cycle, Nitrogen cycle etc., Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law, Global Perspective.

Chemistry in Environmental Engineering: Atmospheric chemistry, Soil chemistry, Material balances and Reactor configurations.

Module – II

Water Pollution: water quality standards and parameters, Assessment of water quality, Aquatic pollution, Estuarine water quality, Marine pollution, Organic content parameters, Ground water Contamination, Water table and Aquifer, Ground water recharge. Water quality parameter and standards.

Water Treatment: Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.

Waste Water Treatment: DO and BOD of Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion and its microbiology, Reactor configurations and methane production. Application of anaerobic digestion.

Air Pollution : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –green house gases, non-criteria pollutants, emission standard form industrial sources, air pollution metereology, Atmospheric dispersion.

Industrial Air Emission Control:

Characterization of air stream, Equipment selection, Equipment design, Special Methods: Flue gas desulphurization, NOx removal, Fugitive emissions.

Module – III

Solid Waste Management Source classification and composition of MSW: properties and separation, storage and transportation, MSW Management, Waste minimization of MSW, Reuse and recycling,

Hazardous Waste Management, Hazardous waste and their generation, Transportation and treatment of hazardous waste: Incinerators, Inorganic waste treatment, handling of treatment plant residue. Waste minimization techniques.

Noise Pollution: Physical Properties of sound, Noise criteria, Noise Standards, Noise measurement, Noise control.

Environment impact Assessment, Origin and procedure of EIA, Project Screening for EIA, Scope studies, Preparation and review of EIS.

Text Book

1. Environmental Engineering Irwin/ McGraw Hill International Edition, 1997, G. Kiely,

2.Environmental Engineering & Safety by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack

Reference Books

1. Environmental Engineering by Arcadio P. Sincero & Gergoria A.Sincero PHI Publication

2. Principles of Environmental Engineering and Science, M. L. Davis and S. J. Masen, McGraw Hill International Edition, 2004

3. Environmental Science, Curringham & Saigo, TMH,

4. Man and Environment by Dash & Mishra

5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.

DIGITAL IMAGE PROCESSING

Module: 1 (12 hours)

Introduction: Digital Image fundamentals: Image sampling and quantization, relationship between pixels, Intensity transformations and spatial filtering, some basic intensity transformation functions, Histogram processing, spatial filters for smoothing and sharpening (Chapt: 2 & 3 of Text book 1)

Module: 2 (12 hours)

Filtering in the Frequency Domain: preliminary concepts, 2D DFT and its properties, basic filtering in the frequency domain, image smoothing and sharpening (Chapt: 4 of Text book 1)

Image Restoration and Reconstruction: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function (Chapt: 5 of Text Book 1)

Module: 3 (12 hours)

Color Image Processing: color models, Color transformation (Chapt: 6 of Text book 1)

Wavelets and Multi-resolution Processing: multiresolution expansions, wavelet transforms in one and two dimension (Chapt: 7 of Text book 1)

Image Compression: Fundamentals, Some basic compression methods (Chapt: 8 of Text book 1)

Morphological Image Processing: Erosion and Dilation, opening and closing (Chapt: 9 of Text book 1)

Text Books:

1. R.C. Gonzalez, R.E. Woods, *Digital Image Processing*, 3rd Edition, Pearson Education
2. R C Gonzalez, Woods and Eddins, *Digital Image Processing using Matlab*, 2nd Edition, Tata McGraw Hill

Reference Books:

1. S.Sridhar, *Digital Image Processing*, Oxford University Press, 2011

WIRELESS SENSOR NETWORK

Unit I **8Hrs**

Sensor Network Concept: Introduction, Networked wireless sensor devices, Advantages of Sensor networks, Applications, Key design challenges.

Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, Mobile deployment.

Unit II **8Hrs**

Localization and Tracking: Issues and approaches, Problem formulations: Sensing model, collaborative localization. Coarse-grained and Fine-grained node localization. Tracking multiple objects: State space decomposition.

Synchronization: Issues and Traditional approaches, Fine-grained clock synchronization, and Coarse-grained data synchronization.

Unit III **14Hrs**

Wireless Communications: Link quality, shadowing and fading effects

Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols.

Routing: Metric-based approaches, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing.

Sensor network Databases: Data-centric routing, Data-gathering with compression, Querying, Data-centric storage and retrieval, the database perspective on sensor networks.

Security: Privacy issues, Attacks and countermeasures.

Text Books:

1. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking 2004.

References Books:

1. Networking Wireless Sensors: Bhaskar Krismachari, Cambridge University Press
2. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati , Springer.
3. Wireless Sensor Networks: Technology, Protocols, and Applications: Kazem Sohraby, Daniel Minoli, Taieb Znati , Wiley Inter Science.

EMBEDDED SYSTEM DEVELOPMENT

Module I Hardware Concepts 10Hrs

Application and characteristics of embedded systems, Overview of Processors and hardware units in an embedded system, General purpose processors, Microcontrollers, ARM-based Systems on a Chip (SoC), Application-Specific Circuits (ASICs), Levels of hardware modelling, VHDL, Sensors, A/D-D/A converters, Actuators, Interfacing using UART, USB, CAN bus, SRAM and DRAM, Flash memory.

Module II Real-Time Operating Systems 12Hrs

Real-Time Task Scheduling: Some important concepts, Types of real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix-based Real-time operating systems, POSIX-RT, A survey of contemporary Real-time operating systems, Microkernel-based systems.

Module III Embedded Application Development 8Hrs

Embedded system development life cycle, State charts, General language characteristics , Features of MISRA C for embedded programming, Hardware/Software Co-design**,** Hardware/software partitioning, Testing embedded systems, Design for testability and Self-test.

TEXTBOOKS

1. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware /Software Introduction, John Wiley, 2002. **(For Module 1)**

2. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000. **(For Modules 2 and 3)**

REFERENCES

1. S. Chattopadhyay, Embedded System Design, PHI
2. Shibu KV, Introduction to Embedded Systems, TMH
3. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, 2001
4. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, 2003

DATA & WEB MINING

Module 1 **15Hrs**

Introduction to Data mining: Role Data in Data Mining, Data Mining functionalities, patterns in data mining, Type of patterns, Classification of Data Mining Systems, Major issues in Data Mining; **Mining Association Rules in Large Databases** : Association Rule Mining, Mining Single-Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Transaction Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-Based Association Mining. **Classification and Prediction:** Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Backpropagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods, Prediction, and Classifier Accuracy.**Cluster Analysis Introduction** : Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis.

Module 2 **10Hrs**

Introduction to WWW, Information Retrieval and Web Search: Basic Concepts, IR models, Relevance Feedback, Evaluation Measures, Text and Web Page Pre-Processing, Link Analysis: Graph Mining, Social Network Analysis, Co-Citation and Bibliographic Coupling, Page Rank, HITS, Community Discovery, Web Crawling: Basic and Universal Crawlers, Structured Data Extraction: Wrapper Generation: Wrapper Induction, Automatic Wrapper Generation: Problems, String Matching and Tree Matching, Information Integration: Pre-Processing for Schema Matching, Domain and Instance-Level Matching.

Module 3 **5Hrs**

Opinion Mining: Sentiment Classification, Feature-Based Opinion Mining and Summarization, Opinion Search, Opinion Spam, Web Usage Mining: Data Collection and Pre-Processing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web Usage Patterns, Privacy Preserving Data Mining: Issues and Solutions.

Text Books:

1. J. Han & M. Kamber, *Data Mining: Concepts and Techniques*, Morgan Kaufmann, 2nd ed, 2006. (Module 1)
2. Bing Liu. Web Data Mining, Exploring Hyperlinks, Contents and Usage Data, Springer Publishers (Module 2 and Module 3)

References:

1. Margret H Dunham,Data Mining Introductory and advanced topics, Pearson Education, 6th ed,2009,
2. Shawkat Ali and Saleh Wasimi,Data Mining: Methods and Techniques, Cengage Learning, Indian Edition,2009,

ALGORITHMS FOR BIOINFORMATICS

Module 1 **8Hrs**

Introduction, Algorithms and Complexity: Biological Algorithms versus Computer Algorithms, Notations, Algorithm Design Techniques, Tractable versus Intractable Problems.

Molecular Biology Primer: Genes, Molecules, Structure of DNA, Proteins, Analysis.

Exhaustive Search: Restriction Mapping, Impractical Restriction Mapping Algorithms, A Practical Restriction Mapping Algorithm, Regulatory Motifs in DNA Sequences, Profiles, The Motif Finding Problem, Search Trees, Finding Motifs, Finding a Median String.

Module 2 **8Hrs**

Greedy Algorithms: Genome Rearrangements, Sorting by Reversals, Approximation Algorithms, Breakpoints: A Different Face of Greed, A Greedy Approach to Motif Finding. **Dynamic Programming Algorithms**: The Power of DNA Sequence Comparison, The Change Problem Revisited, The Manhattan Tourist Problem, Edit Distance and Alignments, Longest Common Subsequences, Global Sequence Alignment, Scoring Alignments, Local Sequence Alignment, Alignment with Gap Penalties, Multiple Alignment, Gene Prediction, Statistical Approaches to Gene Prediction, Similarity-Based Approaches to Gene Prediction, Spliced Alignment. **Divide-and-Conquer Algorithms**: Divide-and-Conquer Approach to Sorting, Space-Efficient Sequence Alignment, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Subquadratic Time.

Module 3: **10Hrs**

Graph Algorithms: Graphs and Genetics, DNA Sequencing, Shortest Superstring Problem, DNA Arrays as an Alternative Sequencing Technique, Sequencing by Hybridization, SBH as a Hamiltonian Path Problem, SBH as an Eulerian Path Problem, Fragment Assembly in DNA Sequencing, Protein Sequencing and Identification, The Peptide Sequencing Problem, Spectrum Graphs, Protein Identification via Database Search, Spectral Convolution, Spectral Alignment.

Combinatorial Pattern Matching: Repeat Finding, Hash Tables, Exact Pattern Matching, Keyword Trees, Suffix Trees, Heuristic Similarity Search Algorithms, Approximate Pattern Matching, BLAST: Comparing a Sequence against a Database.

Text Book: No Indian Print is available.

References:

1) Neil C. Jones and Pavel A. Pevzner, An Introduction to Bioinformatics Algorithms, MIT Press, 2004.
2) Bioinformatics Algorithms, Techniques & Applications – Wiley Inter Science
3) Wing-Kin Sung, "Algorithms in Bioinformatics: A Practical Introduction", CRC Press (Taylor & Francis Group), 2009.
4) Ion Mandoiu, Alexander Zelikovsky, Bioinformatics Algorithms: Techniques and Applications Wiley, 2008.

PARALLEL AND DISTRIBUTED SYSTEM

Module – I 8Hrs.

Introduction to parallel computing.

Parallel programming platforms: Trends in microprocessor Architectures, Limitations of memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, communication costs in parallel machines, Routing mechanisms for interconnection network, Impact of process processors mapping and mapping techniques.

Module – II 10Hrs.

Principles of parallel algorithm design: Preliminaries, Decomposition techniques, Characteristics of tasks and interactions, Mapping techniques for load balancing, Methods for containing. Interactions overheads, Parallel algorithm models. Basic communication operations: One-to-All Broadcast and All-to-One Reduction, All-to-All broadcast and reduction All-Reduce and prefix sum operations, scatter and gather, All-to-All personalized communication, circular shift, Improving the speed of some communication operation.

Module – III 12Hrs.

Analytical modeling of parallel programs: Performance metrics for parallel systems, Effect of granularity of performance, scalability of parallel system, Minimum execution time and minimum cost-optimal execution time, Asymptotic analysis of parallel programs, other scalability metrics. Programming using the message passing paradigm:

Principle of message – Passing programming, Send and receive operations, The message passing interface, Topologies and embedding, Overlapping communication with computation, collective communication and computation operations, Groups and communicators.

Dense matrix algorithm:

Matrix-vector multiplication, Matrix-matrix algorithm, Solving a system of linear equations.

Text Book:

1) Introduction to Parallel Computing, Second Edition, Ananth Gram, Anshul Gupta, George Karypis, Vipin Kumar Person Education.
2) Parallel computing Theory and Practice, Second Edition, Michael J. Quinn, TMH.

SATELLITE COMMUNICATION SYSTEMS

Module – I (12 Hours)

Introduction to state of satellite communication: Orbital mechanics and parameters, look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system(AOCS), TT&C , Description of spacecraft System – Transponders,

Equipment reliability and space qualification.

Satellite Link Design: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

Module – II (10 Hours)

Analog telephone and television transmission: Energy dispersal, digital transmission

Multiple Access: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA. Spread Spectrum Transmission and Reception. Estimating Channel requirements, SPADE, Random access

Application of Satellite communication: Network distribution and direct broad casting TV, fundamentals of mobile communication satellite

Module – III (12 Hours)

Propagation on satellite: Earth paths and influence on link design: Quantifying attenuation and depolarization, hydrometric & non hydrometric effects, ionosphere effects, rain and ice effects

Satellite Antennas: Types of antenna and relationships , Basic Antennas Theory – linear, rectangular & circular aperture. Gain, pointing loss,

Earth station Technology: Earth station design, Design of large antennas – Cassegrain antennas, optimizing gain of large antenna, antenna temperature, feed system for large cassegrain antennas,

Design of small earth station antennas: Front fed paraboloid reflector antennas, offset fed antennas, beam steering, Global Beam Antenna, equipment for earth station

Text Books:

1. Satellite Communication by T. Pratt, C. Bostian. 2nd Edition, John Wiley Co.

Reference Books:

1. Digital Communication with Satellite and Fiber Optic Application, Harlod Kolimbins, PHI
2. Satellite Communication by Robert M. Gagliardi, CBS Publishers

MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS)

Module-I **14 Lectures**

Overview of MEMS and Microsystems. (Chapter 1 of Text Book 1)

Micromachining Techniques: Silicon as material for micromachining, Photolithography, thin film deposition, doping, wet and dry etching, surface and bulk micromachining, Wafer bonding, packaging. (Chapter 3 and Section 8.2 of Text Book 1, Chapter 2 of Text Book 2)

Module II **10 lectures**

Microsystem Modeling and Design: Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage. (Section 4.1 to 4.3 and 6.2.2 of Text Book 1, Section 3.4 of Text Book 2)

Module III **15 Lectures**

MEMS Applications: Mechanical sensors and actuators: Piezoresistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, Piezoelectric actuators. (Section 8.3 of Text Book 1 and Section 5.3 and 5.11 of Text Book 2)

Optical: Micro-lens, Micro-mirror, Optical switch (Section 7.5 to 7.7 of Text Book 2)

Radio frequency MEMS: Inductor, Varactor, Filter, Resonator. (Section 9.3 to 9.7 of Text Book 2)

Microfluidics: Capillary action, Micropumping, Electrowetting, Lab-on-a-chip. (Section 10.1 to 10.8 of Text Book 2)

Text Books:

1. G.K. Ananthsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Atre: Micro and Smart Systems, Wiley India, New Delhi, 2010.
2. N.P. Mahalik: MEMS, Tata McGraw-Hill, New Delhi, 2007.

Reference Book:

1. T. Hsu: MEMS and Microsystems: Design and Manufacture, Tata McGraw-Hill, New Delhi, 2002.

MEDICAL IMAGING TECHNIQUES (3-0-0)

Module I (15 Hours)

X-Ray Machines:

Basis of Diagnostic Radiology, Nature of X-rays, Properties of X-rays, Units of X-radiation, Production of X-rays : stationary anode tube & rotating anode tube.

X-Ray Machine: High Voltage Generation, High frequency Generator, High Tension Cable, Collimators & Grids, Exposure Time Systems, and Automatic Control.

Visualization of X-rays & Digital Radiography:

X-ray Films, X-ray Image Intensifier Television System, Dental X-ray machines, portable & mobile X-ray units, Digital Radiography, Flat Panel detector for Digital Radiography.

Module II (15 Hours)

Ultrasonic Imaging System: Physics of Ultrasonic waves, generation & detection of ultrasound, basic pulse-echo apparatus, brief description of different modes of scans like A-scan, M-mode, B-scan with its applications in medicine.

Computed Tomography Machine (CT):

Basic Principle of CT, System components: scanning system, Detector, Processing system, Viewing system, storing & documentation, Gantry geometry, Patient dose in CT Scan & Advantages of CT Scanning.

Module III (10 Hours)

MRI Machine & Gamma Camera:

Principles of NMR Imaging System, Basic NMR Components – Block Diagram Description, Advantages of NMR Imaging, The Gamma Camera – Block Diagram Description. Study of Working Principle of Emission CT, SPECT & PET scanners and Introduction to recent developments like Infrared Imaging, Ophthalmic Imaging, and Double headed CT & PET scanner.

Text Book:

Hand Book of Biomedical Instrumentation – 2nd Ed, R.S.Khandpur, Tata McGraw Hill- 2003.

Reference Books:

1) Introduction to Biomedical equipment technology, 4e. By JOSEPH.J.CAAR & JOHN.M.BROWN (Pearson education publication)

(2) Medical Instrumentation-application & design. 3e – By JOHN.G.WEBSTER John Wiley & sons publications

(3) Leslie. Cromwell – Biomedical instrumentation & measurements, 2e PHI

(4) Dr. M. Arumugam – Biomedical instrumentations, Anuradha Publishers

ANALOG VLSI DESIGN

Module – I **10 Hours**

Introduction to Analog Design: General Concepts, Levels of Abstraction, Robust Analog Design

Single-Stage Amplifiers: Basic Concepts, Common-Source Stage, Common-Source Stage with Resistive Load, CS Stage with Diode-Connected Load, CS Stage with Current-Source Load, CS Stage with Triode Load, CS Stage with Source Degeneration, Source Follower, Common-Gate Stage, Cascode Stage, Folded Cascode.

Differential Amplifiers: Single-Ended and Differential Operation, Basic Differential Pair, Qualitative Analysis, Quantitative Analysis, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell.

(Chapters 1, 3 and 4 of Text Book)

Module – II **12 Hours**

Passive and Active Current Mirrors: Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties.

Bandgap References: General Considerations, Supply-Independent Biasing, Temperature-Independent References, Negative-TC Voltage, Positive-TC Voltage, Bandgap Reference.

Operational Amplifiers: General Considerations, Performance Parameters, One-Stage Op Amps, Two-Stage Op Amps, Gain Boosting, Comparison, Common-Mode Feedback, Input Range Limitations, Slew Rate, Power Supply Rejection.

(Chapters 5, 11 and 9 of Text Book)

Module – III **14 Hours**

Frequency Response of Amplifiers: General Considerations, Miller Effect, Association of Poles with Nodes, Common-Source Stage, Source Followers, Common-Gate Stage, Cascode Stage, Differential Pair.

Feedback: General Considerations, Properties of Feedback Circuits, Types of Amplifiers, Feedback Topologies, Voltage-Voltage Feedback, Current-Voltage Feedback, Voltage-Current Feedback, Current-Current Feedback, Effect of Loading, Two-Port Network Models, Loading in Voltage-Voltage Feedback, Loading in Current-Voltage Feedback, Loading in Voltage-Current Feedback, Loading in Current-Current Feedback, Summary of Loading Effects, Effect of Feedback on Noise.

Oscillators: General Considerations, Ring Oscillators, LC Oscillators, Crossed-Coupled Oscillator, Colpitts Oscillator, One-Port Oscillators, Voltage-Controlled Oscillators, Tuning in Ring Oscillators, Tuning in LC Oscillators, Mathematical Model of VCOs.

(Chapters 6, 8 and 14 of Text Book)

Text Books:

1. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, Tata McGraw-Hill Publishing Company Limited, 2002.

Reference Books:

1. P. Gray, P. Hurst, S. Lewis, and R. Meyer, *Analysis and Design of Analog Integrated Circuits*, 4th Edition, John Wiley, 2001.
2. Behzad Razavi, *Fundamentals of Microelectronics*, 1st Edition, John Wiley, 2008.
3. D. Holberg and P. Allen, *CMOS Analog Circuit Design*, Oxford University Press, 2002.
4. D. Johns and K. Martin, *Analog Integrated Circuit Design*, John Wiley, 1997.
5. K.R. Laker and W.M.C. Sansen, *Design of Analog Integrated Circuits and Systems*, McGraw-Hill, Inc., 1994.
6. A. Sedra and K.C. Smith, *Microelectronic Circuits*, 5th Edition, Oxford University Press.

MECHATRONICS

Module – I:

Sensors and Transduceers:- Sensors and transducers, Performance terminology, Displacement, position and proximitry, Velocity and motion, Force, Fluid pressure, Liquid flow, Liquid level, Temperature, Light sensors, Selection of sensors, Inputting data by switches. Book – 1: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12.

Signal conditioning:- Signal conditioning, The operational amplifier, Protection, Filtering, Pulse modulation.

Book – 1: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6.

Digital Signals:- Digital signals, Analogue and digital signals, digital-to-analogue and analogue-to-digital converters, Multiplexers, Data acquisition, Digital signal processing. Book – 1: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6.

Pneumatic and Hydraulic Actuation Systems:- Actuation systems, Pneumatic and hydraulic systems, Directional control valves, Pressure control valves, Cylinders, Servo and proportional control valves, process control valves, Rotary actuators.

Book – 1: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8.

Module – II:-

Mechanical Actuation Systems:- Mechanical systems, Types of motion, Kinematic chains, Cams, GTears, Belt and chain drives, bearings, Mechanical aspects of motor selection. Book – 1: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9.

Electrical Actuation Systems:- Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. motors, A.C. motors, Stepper motors.

Book – 1: 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7.

Basic System Models:- Mathematical models, Mechanical system building blocks, Electrical system building blocks, Electrical system building blocks, Fluid system building blocks, Thermal system building blocks.Book – 1: 10.1, 10.2, 10.3, 10.4, 10.5.

Module – III:-

System Models:- Engineering systems, Rotational-translational systems, Electromechanical systems, Electromechanical systems, Linearity, Hydraulic-mechanical systems, Summary, Problems.

Book – 1: 11.1, 11.2, 11.3, 11.4, 11.5.

Closed-loop Controllers:- Continuous and discrete control processes, Terminology, Two-step mode, Proportional mode, Derivative control, Integral control, PID controller, Digital controllers, Control system performance, Controller tuning, Velocity control, Adaptive control, Summary, Problems.

Book – 1: 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 15.7, 15.8, 15.9, 15.10, 15.11, 15.12.

Programmable Logic Controllers:- Introduction to PLCs, Basic Structure of a PLC, Principles of Operation, PLCs versus Computers, Introduction to Internal Architecture and Hardware Components, PLC Programming, Analog I/O, Selecting a PLC for the Application, Application of PLCs for Control.

Book – 2: 13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8, 13.9.

Text Books:

1. Mechatronics Electronic Control Systems in Mechanical and Electrical Engg. Pearson Publication, 4th Edition by William Bolton, 2010.
2. Mechatronics Integrated Mechanical Electronic Systems by K. P. Ramachandran, G. K. Vijayaraghavan, M. S. Balasundaram, Wiley India Edition, Printed on 2008.

Reference Books:

1. Mechatronics integrated Technologies for Intelligent Machines by A. Smaili, F.Mrad, Oxford University Press, Printed on 2009.
2. Mechatronic Sources Book, Cengage Learning India Edition by Newton C Braga, 2nd Edition, 2010.

INDUSTRIAL INSTRUMENTATION

Module 1 **18 Hours**

Introduction: Functional Units, Classification, Performance characteristics, Dynamic Calibration, Errors: An Overview, Statistical Error Analysis, Reliability and Related Topics (Chapter 1 of Text book)

Instruments for Analysis: Introduction, Gas Analysers, Liquid Analysers, X-ray Methods, Chromatography (Chapter 8 of Text Book)

Module II: **10 Hours**

Telemetry: Introduction, Pneumatic Means, Electrical Means, Frequency Telemetring, Multiplexing, Modulation, Modulation of Digital Data, Transmission Channels, Briefing of a Telemetry System in Operation, Wireless I/O (Chapter 10 of Text Book)

Module III: **10 Hours**

Power Plant Instruments: Introduction, The Power Plant Scheme, Pressure, Temperature, Flow and Level, Vibration and Expansion, Analysis, Flue Gas Analysis (Chapter 12 of Text Book)

Hazard and Safety: Initial consideration, Enclosures, Intrinsic Safety, Prevention of Ignition, Methods of Production, Analysis Evaluation and Construction (Chapter 13 of Text Book)

Text Book:

1. Principles of Industrial Instrumentation, Third Edition, D Patranabis, Tata McGraw Hill Education Private Limited, New Delhi

Reference Books:

1. Process/Industrial Instruments and Controls Handbook, Gregory K. Mc Millian Editor-in-Chief, Douglas M. Considine Late Editor-in-Chief

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