ANNA UNIVERSITY COIMBATORE

FACULTY OF

ELECTRONICS & COMMUNICATION

ENGINEERING

BOARD OF STUDIES -ECE

M.E. MEDICAL ELECTRONICS

CURRICULUM AND SYLLABI

I –IV SEMESTERS

REGULATIONS - 2007

ANNA UNIVERSITY COIMBATORE

M.E. MEDICAL ELECTRONICS

CURRICULUM 2007 - FULL TIME MODE

SEMESTER – I

Code No.	Course Title	L	T	P	M
Theory					
	Applied Mathematics	3	1	0	100
	Advanced Bio signal processing	3	1	0	100
	Modeling of Physiological Systems	3	1	0	100
	VLSI Design Techniques	3	0	0	100
	Clinical Engineering	3	1	0	100
	Biomaterials and Biomechanics	3	0	0	100
Practical					
	Medical Electronics Lab I	0	0	4	100
	Total	18	4	4	-

SEMESTER – II

Code No.	Course Title	L	T	P	M
Theory					
	Bio-Medical Imaging Techniques	3	1	0	100
	Pattern Recognition &AI Techniques	3	1	0	100
	Theraputic Equipments	3	1	0	100
	Elective I	3	0	0	100
	Elective II	3	0	0	100
	Elective III	3	0	0	100
Practical					
	Electronics Design Lab	0	0	4	100
	Total	18	3	4	-

SEMESTER – III

Code No.	Course Title	L	T	P	M
Theory					
	Elective IV	3	0	0	100
	Elective V	3	0	0	100
	Elective VI	3	0	0	100
Practical					
	Project Work (Phase I)	0	0	12	200
	Total	9	0	12	-

SEMESTER – IV

Code No.	Course Title	L	T	P	M
	Project Work (Phase II)	0	0	24	400
	Total	0	0	24	-

LIST OF ELECTIVES
M.E. MEDICAL ELECTRONICS
SEMESTER II

Code No.	Course Title	L	T	P	M
	Cell Biology and Tissue Engineering	3	0	0	100
	Principles of Telemedicine	3	0	0	100
	Soft Computing	3	0	0	100
	Bio –Informatics	3	0	0	100
	Data mining for clinical engineering	3	0	0	100
	Reliability Engineering	3	0	0	100
	MEMS	3	0	0	100
	Digital Signal Processing Integrated Circuits				
	Multimedia Compression Techniques				

LIST OF ELECTIVES
M.E. MEDICAL ELECTRONICS
SEMESTER III

Code No.	Course Title	L	T	P	M
	BIO MEMS	3	0	0	100
	Multimedia Databases				
	Design of Embedded Systems	3	0	0	100
	Low Power VLSI Design	3	0	0	100
	Genetic Algorithm and its Applications	3	0	0	100
	DSP Processor Architecture and Programming	3	0	0	100
	ASIC Design				
	Wavelets and Multi-resolution Processing				
	Wireless Communication Networks				
	Wireless Sensor Networks				
	Special Elective	3	0	0	100

07ML101 APPLIED MATHEMATICS 3 1 0 100

Unit-I:
LINEAR ALGEBRAIC EQUATION AND EIGEN VALUE PROBLEMS 9+3
System of equations- Solution by Gauss Elimination, Gauss-Jordan and LU decomposition method- Jacobi, Gauss-Seidal iteration method- Eigen values of a matrix by Jacobi and Power method.

Unit-II: WAVE EQUATION 9+3
Solution of initial and boundary value problems- Characteristics- D'Alembert's Solution - Significance of characteristic curves - Laplace transform solutions for displacement in a long string - a long string under its weight - a bar with prescribed force on one end- free vibrations of a string.

Unit-III: SPECIAL FUNCTIONS 9+3
Bessel's equation - Bessel Functions- Legendre's equation - Legendre polynomials -Rodrigue's formula - Recurrence relations- generating functions and orthogonal property for Bessel functions - Legendre polynomials.

Unit-IV: RANDOM VARIABLES 9+3
One dimensional Random Variable - Moments and MGF – Binomial, Poisson, Geometrical, Normal Distributions- Two dimensional Random Variables – Marginal and Conditional Distributions – Covariance and Correlation Coefficient - Functions of Two dimensional random variable

Unit-V: QUEUEING THEORY 9+3
Single and Multiple server Markovian queueing models - Steady state system size probabilities – Little's formula - Priority queues - M/G/1 queueing system – P.K. formula.

L + T = 45 + 15 = 60

REFERENCES:

1. Sankara Rao.K. "Introduction to Partial Differential Equation ", PHI, 1995.
2. Taha. H.A., "Operations Research- An Introduction " 6th Edition, PHI, 1997.
3. Jain M.K. Iyengar, S.R.K. & Jain R.K., "International Methods for Scientific and Engineering Computation", New Age International (P) Ltd, Publlishers 2003..
4. Kanpur J.N. & Saxena. H.C. "Mathematical Statistics", S.Chand & Co.,New Delhi, 2003.
5. Greweal B.S. "Higher Engineering Mathematics", Khanna Publishers, 2005.

07ML102 ADVANCED BIO SIGNAL PROCESSING 3 1 0 100

Prerequisite: Digital Signal Processing**.**

Unit-I: Bio Signal Wave shapes and Waveform complexity: 9
Introduction to Biomedical signals-overview and characteristics of ECG,ENG,EMG,EEG,ERPs,EGG,PCG,Carotid pulse,EOG, VMG,VAG, and Otto acoustic emission signals-Bio signal acquisition-conversion and analysis.Morpholigical analysis of ECG-Envelope extraction and analysis of PCG-Correlation and Cross spectral analysis of EEG Channels.

Unit-II: Time Series Analysis and Spectral Estimation: 9
Time series analysis-linear prediction models-Time variant systems- Adaptive segmentation-Spectral Estimation-Blackman Tuckey method-Periodogram and model based estimation.

Unit-III: Removal of Artifacts: 9
Noise sources in biomedical signals-Review of optimal filtering-adaptive filters- LMS&RLS Adaptive filters-Removal of Artifacts in ECG-Maternal-Fetal ECG-Muscle contraction interference-use of adaptive filters for segmentation in ECG and PCG Signals.

Unit-IV: Bio Signal Pattern Classification and Diagnostic Decision: 9
Pattern classification as applied to Bio signals-supervised pattern classification-unsupervised pattern classification-Probabilistic models and statistical training and test steps-Neural networks-measures of diagnostic accuracy and cost-Reliability of classifiers and decisions.

Unit-V: Special Topics on Bio signal processing: 9
Application of wavelet transform-TFR representation-ECG Characterization- wavelet networks-data compression of ECG and EEG signals-Application of chaos theory on Bio signals.

Total: 45

Text Books:

1. Rangaraj. M.Rangayyan, "Biomedical Signal Analysis-A Case Study Approach," IEEE Press- John Wiley &Sons Inc, New York-2002.

References:

1. Arnon-Cohen, "Bio-Medical Signal Processing," Vol I&II, CRC Press.1995.
2. W.J.Tompkins, "Biomedical Digital signal processing," Prentice Hall, New Jersey-1993.
3. IEEE Transaction on Bio Medical Engineering.
4. IEEE Engineering Medicine and Biology Magazine.

07ML103 MODELING OF PHYSIOLOGICAL SYSTEMS 3 1 0 100

UNIT I: Technological Control System 9
Introduction to Technological Control System, Transfer functions, Mathematical Approaches, System Stability, Feedback Concept and Stability Analysis.

UNIT II: Biological Control System 9
Introduction to Biological Control System, similarities and differences, Transfer of substances between compartments, Biological receptors, characteristics, Transfer function model, Bio feedback.

UNIT III: Regulation of Biological Systems 9

Regulation of acid-base balance, Endocrine Control, Regulation of Extra cellular Water and Electrolyte. Introduction to Various Process Controls like Cardiac Rate, Blood Pressure, Respiratory Rate and Blood Glucose Regulation. Pharmaco Modelling- Drug distribution System, Regulation of Interstitial Fluid Volume and Precontrol in Material Exchange. Co_2 regulations.

UNIT IV: Modeling of Human Thermal System 9
Modelling of Human Thermal Regulatory System, Parameters Involved, Control System Models etc. Biochemistry of Digestion. Type of Heat Loss from the Body, Model of Heat Transfer between Subsystems of Human Body like Skin, Core, etc., and System within Body, Body Environment etc.

UNIT V: Respiratory and Vision System 9
Respiratory control system, Modelling of O_2 Uptake, Mass Balancing by Lungs, Gas Transport Mechanism of Lungs, O_2 and CO_2 Transport in Blood and Tissue. Introduction to Eye Tracking and Control. Cardio Vascular Control system, Servo mechanism, pupil control system.Matlab in Control Applications. Design of Biomedical Control Systems, few Case Studies.

Total: 45

Reference Books:

1. Suresh R.Devasahayam, Signals and Systems in Biomedical Engineering: Signal Processing and Physiological Systems Modeling Kluwer Academic / Plenum Publishers, June 2000.
2. Ibrell and Guyton, "Regulation and Control in Physiological System" CRC Press, 2002.
3. Milhorn, "The Applications of Control Theory to Physiological System" , Kluwer Academic,2000.
4. Matlab, "Users Manual" 2004..

07ML104 VLSI DESIGN TECHNIQUES 3 0 0 100

UNIT I 9

MOS TRANSISTOR THEORY AND PROCESS TECHNOLOGY.

NMOS and PMOS transistors, Threshold voltage- Body effect- Design equations- Second order effects. MOS models and small signal AC characteristics. Basic CMOS technology.

UNIT II 9

INVERTERS AND LOGIC GATES.

NMOS and CMOS Inverters, Stick diagram, Inverter ratio, DC and transient characteristics , switching times, Super buffers, Driving large capacitance loads, CMOS logic structures , Transmission gates, Static CMOS design, dynamic CMOS design.

UNIT III 9

CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION

Resistance estimation, Capacitance estimation, Inductance, switching characteristics, transistor sizing, power dissipation and design margining. Charge sharing .Scaling.

UNIT IV 9

VLSI SYSTEM COMPONENTS CIRCUITS AND SYSTEM LEVEL PHYSICAL DESIGN.

Multiplexers, Decoders, comparators, priority encoders, Shift registers.
Arithmetic circuits – Ripple carry adders, Carry look ahead adders, High-speed adders, Multipliers. Physical design – Delay modelling ,cross talk, floor planning, power distribution. Clock distribution. Basics of CMOS testing.

UNIT V 9

VERILOG HARDWARE DESCRIPTION LANGUAGE

Overview of digital design with Verilog HDL, hierarchical modelling concepts, modules and port definitions, gate level modelling, data flow modelling, behavioral modelling, task & functions, Test Bench.

Total: 45

REFERENCES:

1. Neil H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education ASIA, 2nd edition, 2000.
2. John P.Uyemura “Introduction to VLSI Circuits and Systems”, John Wiley & Sons, Inc., 2002.
3. Samir Palnitkar, “Verilog HDL”, Pearson Education, 2nd Edition, 2004.
4. Eugene D. Fabricius, Introduction to VLSI Design McGraw Hill International Editions, 1990.
5. J.Bhasker, B.S.Publications, “A Verilog HDL Primer”, 2nd Edition, 2001.
6. Pucknell, “Basic VLSI Design”, Prentice Hall of India Publication, 1995.
7. Wayne Wolf “Modern VLSI Design System on chip. Pearson Education.2002.

07ML105 CLINICAL ENGINEERING 3 1 0 100

UNIT I: INTRODUCTION TO BIOCHEMISTRY 10

The cell and its components. The plasma membrane. Membrane transport (diffusional processes, active transport systems, ion channels and gates). Mitochondrial function (ATP generation; metabolism). The nervous system. The nerve cells - neurons, glia. Functions and geometry including myelinations, giant neurones, dendrites, synapses. The brain - summary of anatomy and function. The resting potential – ionic, distribution, Na+ K+ pump. Generation of an action potential (Na+, K+ channels, hyper-polarisation

depolarisation, threshold potential, signal transduction). Muscle structure and the mechanism of muscle contraction (interaction between Ca2+ and actin/myosin; Ca2+ pump).

UNIT II: INTRODUCTION TO ANATOMY 6

Surface and regional anatomy, cells, tissues and organs. Terminology

UNIT III: PHYSIOLOGICAL MEASUREMENT 9

Introduction to physiological measurement. Common parameters to be measured. Special considerations for measurement. Measurement examples: Electro-cardiology, audiology.

UNIT IV: MEASUREMENT SYSTEM AND APPLICATIONS 9

The heart's specialised conduction system. Use of the electrocardiogram in the diagnosis of various conditions of the cardiovascular system. Human hearing. Audiological testing in diagnosis and remediation.

UNIT V: MANUFACTURE, MANAGEMENT AND SAFETY OF MEDICAL EQUIPMENT – 11

An introduction to the requirement for the manufacture, management and safety of medical equipment. The Medical Devices Regulations and Medical Devices Directive. The General Safety Standard: EN 60601.1 for electromedical equipment. Routine safety checking: procedure for acceptance testing of electromedical equipment and guidelines for the management of equipment – DB9801, including selection ordering, training, servicing, replacement and revenue consequences. Consumer Protection Act & Product Liability, Quality Assurance and EN ISO 9000.

Total: 45

References

1. Ross & Wilson , Churchill Livingstone, Anatomy and Physiology in Health and Illness, ISBN0-443-04243-8
2. Haughton, Adam Hilger, Physical Principles of Audiology, Journal of Medical Physics, 8, 3, 1981.
3. Code of Practice for Acceptance Testing of Medical Electrical Equipment, DB9801 Suppl 2. DoH
4. Specifications for the Safety of Medical Electrical Equipment, Pt.1, General Requirements, EN 60601.1, British Standards Institution.

07ML106 BIOMATERIALS AND BIOMECHANICS 3 0 0 100

UNIT I: Material Properties 9

Introduction - Material Science and Classes of Materials used in Medicine: Polymers, Metals and Plastics, Ceramics. Treated Natural Materials, Tissue Reaction. Sterilization of Biomaterials. Steam Sterilization. Ethylene Oxide Treatment, Gamma Irradiation, Formaldehyde Treatment. Mechanical Properties of Materials - Experimental Stress Analysis and Material Testing.

UNIT II: Reaction and Treatment 9

Tissue Reactions and Blood Compatibility. Practical Aspects of Biomaterials Cardio Vascular Implants. Implants and Device Failure. Product Development and Regulations

UNIT III: Biomechanics Principles 9

Scope of Mechanics in Medicine - Orthopaedics, Cardiology, Exercise Physiology, Surgery, Biomechanics in Orthopaedics - Principles, Joints, Fracture, Internal and External Fixation, Prosthetic Design.

UNIT IV: Biomechanics System 9

Biomechanics of Degenerative Disorders, Gait Analysis, Biofluid Mechanics, Mathematical Models. Biomechanics and Accident Investigation.

UNIT V: Rehabitation Engineering **9**

Introduction to Rehabilitation Engineering: Artificial Limb, Myoelcctric hand, Finite Element Analysis and its Application to Problems in Biomechanics.

Total: 45

References:

1. J.B.Park, "Bio-materials - Science and Engineering" Plenum Press, 1984.
2. Hench and Etheridge. "Bio-materials" Vol. 1,2,3,4 Academic Press, 2002.
3. Sahay and Saxena , "Biomechanics" John Wiley and Sons,2000.
4. D.N. Ghista and Roaf, "Orthopedic Mechanics" Academic Press, 2002.

07ML107 MEDICAL ELECTRONICS LABORATORY 0 0 4 100

A. Measurement, Study and Testing Modules:

1 Measurement of differential temperature -Thermometer,
2 Study and testing of ECG Equipment, (Signal analysis and vector cardio graph, abnormality)
3 Study and waveform analysis -Electronic Stethoscope,
4 Study (Arterial) Blood gas Analyzer (non -Invasive),
5 Study and testing of Endoscopes (non -Invasive),
6 Study and testing of Human Body Vibration Simulator,

B. Project Modules:

1 Mini project- Pulse Oximeter (Under different BP conditions/exercise/ respiratory disorders / vaso dilation /vaso constriction),
2 Min project using ultra sonic images-Ultrasound – 4 MHz,
3 Mini project using X-Ray digitizer,
4 Design and simulation of controller (PID + FUZZY) Infusion Pumps ,
5 Insulin Pumps, Drug Delivery Testing System-PC Based.

SEMESTER II

07ML201 BIO-MEDICAL IMAGING TECHNIQUES 3 1 0 100

Prerequisite course: Medical electronics

Unit-I: Introduction **9**

Introduction to imaging modalities-Image quality X-rays in Diagnostic imaging-X-ray production-X-ray interactions-X-ray spectra-X-ray dosimetry-X-ray detection-radiography-mammography-fluoroscopy. Computed tomography systems- Scanner design-reconstruction techniques-image quality artifacts-multi slice imaging-scanner performance.

Unit-II: Magnetic Resonance Imaging **9**

Basic principles of nuclear magnetic resonance-Image creation- Slice selection, Frequency encoding, Phase Encoding, pulse sequence, Image characteristics and artifacts, Hardware and software components.

Unit-III: Ultrasound Imaging **9**

The wave equation-Impedance, Power and reflection-Acoustic properties of Biological tissues-Transducers, beam patterns and resolution-Diagnostic imaging modes –Doppler principles.

Unit-IV: Segmentation **9**

Image preprocessing-Thersholding-Edge based techniques-Region based segmentation-Classification-deformable models-Image Registration-Geometrical Transformations-Point based methods-Surface based methods-Intensity based methods.

Unit-V: 3D Visualization **9**

Pre processing-Scene-based visualization-object based visualization-Manipulation. **Medical Applications and Systems–** Diagnostics-Therapeutics- Interventions.

Total: 45

Reference books:

1. Isaac Bankman, I. N. Bankman , Handbook of Medical Imaging: Processing and Analysis (Biomedical Engineering),Academic Press,2000
2. K.Krish Shung,Micheal B. Smith, Benjamin Tsui, Principles of Medical Imaging, Academic Press Inc; London 1992.
3. Jacob Beutel (Editor), M. Sonka (Editor), Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis , SPIE Press 2000
4. Albert Macowski, Medical Imaging Systems, Prentice hall New Jersy-1983.
5. Avinash C.Kak, Malcolm Shaney, Principles of Computerized Tomographic Imaging, IEEE Press, New york-1998.

07ML202 PATTERN RECOGNITION &AI TECHNIQUES **3 1 0 100**

Unit-I: PATTERN CLASSIFIER **10**

Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation - Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm -Problems with Bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.

Unit-II. UNSUPERVISED CLASSIFICATION **8**

Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm – Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.

Unit-III. STRUCTURAL PATTERN RECOGNITION **8**

Elements of formal grammars - String generation as pattern description - Recognition of syntactic description -Parsing - Stochastic grammars and applications - Graph based structural representation.

Unit-IV. FEATURE EXTRACTION AND SELECTION **7**

Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation -Binary feature selection.

Unit-V RECENT ADVANCES **12**

Neural network structures for Pattern Recognition - Neural network based Pattern associators – Unsupervised learning in neural Pattern Recognition - Self organizing networks - Fuzzy logic - Fuzzy pattern classifiers -Pattern classification using Genetic Algorithms.

Total: 45

References:

1. Robert J.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley &Sons Inc., New York, 1992.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
3. Duda R.O., Hart.P.E., and Strok, Pattern Classification, second Edition Wiley, New York, 2001.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

07ML203 THERAPUTIC EQUIPMENTS **3 1 0 100**

Unit-I: Review of Recording and Monitoring Instruments: **9**

The origin of Bio electric signals ECG,EEG,EMG,PCG and EOG, lead systems and recording methods, typical waveforms and signal characteristics-Electrodes- Medical display systems- Patient monitoring systems.

Unit-II: Diagnostic Techniques: **9**

$pH, pO_2, pCO_2, pHCO_3$ –Electrophoresis-Auto analyzers- Blood flow meters-Cardiac output measurement-Blood cell counters- pulmonary function analyzers.

Unit-III: Therapeutic Equipment: **9**

Cardiac pacemakers-Cardiac defibrillators-Dialysers-Surgical Diathermy-LASER-Physiotherapy and Electrotherapy equipments-Oxygenators-Heart-Lung Machines-Hearing aids.

Unit-IV: Medical Imaging: **9**

X-Ray and Computer Axial Tomography-Positron Emission Tomography-MRI and NMR-Ultrasonic Imaging systems-Medical Thermograph.

Unit-V: Computer applications in Medical field: **9**

Bio medical Telemetry-Radio pill-Tele stimulation-Physiological parameter monitoring in space station-Arrhythmia monitoring system-EEG signal analysis-Role of Expert Systems(Cadiag,Mycin)-Pattern recognition techniques-E-health- Concepts of Bio technology, Bio Informatics and Genetic Engineering - Application of model sim VLSI design tool for diagnostic fuzzy processor.

Total: 45

References:

1. Leslie Cromwel, Fred. J. Weibel, Erich.A.Pferffer, “Biomedical Instrumentation and Measurements,” Prentice Hall India, NewDelhi-2001.

2. R.S.Khandpur, “Hand book of Biomedical Instrumentation,”Tata McGraw Hill, NewDelhi-1998.

3. Rangaraj.M.Rangayyan, “Biomedical Signal Analysis-A Case Study Approach,”IEEE Press- John Wiley&Sons Inc, New York-2002.

4. Joseph .J.Carr and John .M.Brown, “Introduction to Biomedical Equipment Technology,” John Wiley&Sons Inc, New York-2002.

5. Arnon-Cohen, “Bio-Medical Signal Processing,” Vol I&II, CRC Press.1995.

6. R.D.Lele, “Computers in Medicine,” Tata McGraw Hill, NewDelhi-1989.

7. John.C.Webster (Ed), "Medical Instrumentation Application and Design,"3rd Edition, John Wiley&Sons Inc, New York-1998.

07ML204 ELECTRONIC DESIGN LAB 0 0 4 100

1. System design using PLL
2. System design using CPLD
3. Alarm clock using embedded micro controller
4. Model train controller using embedded micro controller
5. Elevator controller using embedded micro controller
6. Design and Simulation of Non adaptive Digital Control System using MAT LAB control system toolbox
7. Design and Simulation of Adaptive Digital Control System using MAT LAB control system toolbox for biological system.
8. Design and Simulation of ARMA model for ECG Signals.

LIST OF ELECTIVES
SEMESTER II

07ML11 CELL BIOLOGY AND TISSUE ENGINEERING 3 0 0 100

UNIT I: BASIC CELL BIOLOGY: 9

Cells – DNA/RNA and proteins – Tissue Culture – Antibodies – Tools for Protein Analysis – Tools for DNA Analysis – Recombinant DNA and Protein Engineering – Gene Theraphy – DNA – Antisense Technology – Viruses.

UNIT II: CELL ENGINEERING: 9

Principles of Cell Adhesion – Adhesion Molecules – Immobilisation of Adhesion Ligands for Investigation of Cell – Substrate Interactions – Mechanics of Cell Adhesion. Example: Platelet Adhesion – Principles of Cell Migration – Intracellular Signaling Pathways.

UNIT III: CELL MECHANICS: 9

Cells under Stress, Strain, Pressure and Flow Fields – The Role of Mass Transfer in Tissue Function – Selected Examples of Mass Transfer Between Blood and Tissue – Cell Motility – Chemotaxis – Angiogenesis- Other Examples.

UNIT IV: BASIC TISSUE ENGINEERING TAXIS: 9

Basic Definition – Current Scope of Development – Use in Therapeutics and Invitro testing – Structure and Organization of Tissues – Transport Properties of Tissues – Introduction to Mass Transfer – Diffusion of Simple Metabolities - Diffusion and Reaction of Proteins – Hormone and Growth Factor scaling.

UNIT V: ORGAN TISSUE ENGINEERING : 9

Seaffolds and Tissue Engineering – Basic Properties – Tissue Engineering of Bone Marrow – Liver Nervous System – Engineering of Vascular Grafts – Regional Patency-Thrombosis – Tissue Engineering of Cartilage – Kidney.

Total: 45

TEXT BOOKS:

1. Lanza R P, Langer R S and Chick W L, "Principles of Tissues Engineering", Academic Press, 1997.

REFERENCES:

1 Bruce Alberts and Alexander Johnson, "Molecular Biology of the Cell", Garland Publishing Inc., Newyork, Forth Edition, 2002.
2 Joseph D Bronzino, "The Biomedical Engineering Handbook", Volume II, CRC Press, Boca Raton, Second Edition, 2000.

07 ML12 PRINCIPLES OF TELE MEDICINE 3 0 0 100

UNIT I: 9

History and advances in telemedicine. Benefits of telemedicine

UNIT II: 9

Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication. Mobile hand held devices and mobile communication.

UNIT III: 9

Internet technology and telemedicine using world wide web (www.) Video and audio conferencing.

UNIT IV 9

Medical information storage and management for telemedicine- patient information medical history, test reports, medical images diagnosis and treatment. Hospital information- Doctors, paramedics, facilities available. Pharmaceutical information.

UNIT V 9

Security and confidentially of medical and access control. Cyber laws related to telemedicine. Telemedicine access to health care services – health education and self care. Introduction to robotics and telesurgery.

TOTAL: 45

References:

1. H.D.Covveyet At, "Computer in the practical of Medicine" Addisson Wesley,1999.
2. Edward Shortliffe, "Computer Based Medical Consultation" Elsevier Scientific,2000.
3. John Zimmerman, "Computer for the Physicians Office" Research Studies Press,2001.
4. Date C.J. "An Introduction to Database Systems" Addission Wesley, 2003.
5. J.D.Ullman "Principles of Database systems" Galgotia Publications, 1990.
6. Joseph Bronzino, "Computer Applications in Patient Care" Addisson Wesley,1992.

07ML13 SOFTCOMPUTING 3 0 0 100

Unit-I: Fuzzy Systems: 9

Fuzzy set theory-fuzzy rules and fuzzy reasoning-fuzzy inference systems-decomposition-fuzzy automata and languages-fuzzy control methods.

Unit-II: Neural Networks: 9

Basic concepts-knowledge based processing-single layer perceptron-multilayer perceptron-supervised and unsupervised learning-feed forward and back propagation and counter propagation networks-kohens self organizing networks-Hopfield networks.

Unit-III: Neuro Fuzzy Modeling: 9

Adaptive neuro fuzzy inference systems-classification and regression trees- data clustering-rule base structure identification-neuro fuzzy controls.

Unit-IV: Genetic Algorithms: 9

Basics of GA- choice of encoding-selection probability-mutation and crossover-fitness evaluation– improving convergence rate-a simplex GA Hybrid approach.

Unit-V: Applications of Soft Computing: 9

Fuzzy techniques for inverted pendulum case-MIMO fuzzy systems-MCDM for weather forecasting and financial marketing-Neural networks for pattern recognition-TS problems-Routers-GA application to metabolic modeling.

TOTAL: 45 hrs

Text Book:

1. Jang.J.S.R.Sun.C.T.and Mizutami.E, "Neuro fuzzy and Soft computing, "Prentice Hall, New Jersey-2000.

References:

1. Timithy.J.Ross,"Fuzzylogic Engineering Applications," McGraw Hill,NewYork-1997.

2. Laurence Fauselt," Fundamentals of Neural Networks," Prentice Hall India, New Delhi-1997..

3. George .J.Klir and BoYaun, "Fuzzy sets and fuzzy logic," Prentice Hall, New Jersey-1997.

4. John Yen and Rezalangari, "Fuzzy logic intelligence, control and information," Pearson Education, Inc., Singapore-2000.

5. Mitchell, "Introduction to Genetic Algorithms," Pearson Education, Inc., Singapore-2003.

6. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Wiley India Pvt Ltd.

07ML14 BIO INFORMATICS **3 0 0 100**

UNIT I: Data Structures **9**

Overview: Introduction to Data Structures: Elements, Arrays, Records, sets, Tables singly and doubly Linked Data, Stacks, Queues, Trees Etc. Need for a Database, Architecture of a DBMS, Representation of Data, Physical Record Interface, Data Models, Relational, Hierarchical and network Approach.

UNIT II: Data Modeling **9**

Data Modeling Techniques: Relational, Hierarchical and network Normalization techniques for Data handling, Relational, Distributed and other types of Databases.

UNIT II: Indexing and Structuring **9**

Data Indexing and Structuring Techniques, Integrity and Security of Databases, Searching and Retrieval of information. Relational Operators use of Parenthesis, Logical Operators, boolean Sets, etc.

UNIT IV: Hospital Management Systems: **9**

Structuring Medical Records to carry out Functions like Admissions, Discharges, Treatment History, etc. Computerization in Pharmacy and Billing, Automated Clinical lab System and Radiology Information system.

UNIT V: Case Study **9**

Detailed Study of picture Archival and communication System (PACS)Case Study of any one of Application areas like Pharmacology System Or Biochemistry Lab Analysis System. Students to take up one Development Assignment and Demonstrate the Utility of the Software.

Reference Books:

1. H.D.Covveyet At, "Computer in the Practice of Medicine" Addisson Wesley, 1997.
2. Edward Shortliffe, "Computer Based Medical Consultation" Elsevier Scientific,2000.
3. John Zimmerman, "Computer for the Physicians Office" Research Studies Press,2002.
4. Date C.J. "An Introduction to Database Systems" Addisson Wesley,2004.
5. J.D.Ullman, "Principles of Database systems" Galgotia Publications, 1990.
6. Joseph Bronzino, "Computer Applications in Patient Care" Addisson Wesley,2004.

07 ML15 DATA MINING FOR CLINICAL ENGINEERING 3 0 0 100

UNIT I: DATAMINING-INTRODUCTION 9

Data mining- introduction – information and production factor – Data mining Vs Query tools-Data mining in marketing-self learning in computer systems-concept learning-data learning- data mining and data ware house.

UNIT II: KNOWELEDGE DISCOVERY PROCESS 9

Knowledge discovery process- data selection –cleaning – enrichment-coding- preliminary analysis of the data set using traditional query tools – Visualization techniques-OLAP tools- Decision trees – Association rules – Neutral networks – Genetics algorithms-KDD(knowledge Discover in Database) environment.

UNIT III: DATA WARE HOUSE 9

Data warehouse – system process- Process architecture – design – database schema- Partitioning strategy – aggregations – data marting – meta data - system and data warehouse process managers.

UNIT IV: DATA MINING IN MEDICAL ELECTRONICS 9

Analysis of descriptive mining of complex data objects, text database,-time series and sequence data-applications to medical data.

UNIT V: RECENT TRENDS 9

Spatial database , multimedia databases, mining of medical electronics records, world wide web application and trends in data mining

TOTAL : 45

Reference:

1. J.Han,M.Kambe, “data mining: concepts and techniques”,Harcourt India / Morgan Kauffman, 2001.
2. Margaret H.Dunham, “Data mining: Introductory and Advanced Topics”, Pearson Education 2004.
3. Sam Anahory, Dennis Muury, “Data warehousing in the real world”,Pearson Education 2003.

07ML16 RELIABILITY ENGINEERING 3 0 0 100

UNIT I 9
PROBABILITY PLOTTING AND LOAD-STRENGTH INTERFERENCE

Statistical distribution , statistical confidence and hypothesis testing ,probability plotting techniques – Weibull, extreme value ,hazard, binomial data; Analysis of load – strength interference , Safety margin and loading roughness on reliability.

UNIT II 9
RELIABILITY PREDICTION, MODELLING AND DESIGN

Statistical design of experiments and analysis of variance Taguchi method, Reliability prediction, Reliability modeling, Block diagram and Fault tree Analysis ,petric Nets, State space Analysis, Monte carlo simulation, Design analysis methods – quality function deployment, load strength analysis, failure modes, effects and criticality analysis.

UNIT III 9
ELECTRONICS AND SOFTWARE SYSTEMS RELIABILITY

Reliability of electronic components, component types and failure mechanisms, Electronic system reliability prediction, Reliability in electronic system design; software errors, software structure and modularity, fault tolerance, software reliability, prediction and measurement, hardware/software interfaces.

UNIT IV 9
RELIABILITY TESTING AND ANALYSIS

Test environments, testing for reliability and durability, failure reporting, Pareto analysis, Accelerated test data analysis, CUSUM charts, Exploratory data analysis and proportional hazards modeling, reliability demonstration, reliability growth monitoring.

UNIT V **9**
MANUFACTURE AND RELIABILITY MAQNAGEMENT

Control of production variability, Acceptance sampling, Quality control and stress screening, Production failure reporting; preventive maintenance strategy, Maintenance schedules, Design for maintainability, Integrated reliability programmes , reliability and costs, standard for reliability, quality and safety, specifying reliability, organization for reliability.

TOTAL: 45

REFERENCES

1. Patrick D.T. O'Connor, David Newton and Richard Bromley, Practical Reliability Engineering, Fourth edition, John Wiley & Sons, 2002
2. David J. Klinger, Yoshinao Nakada and Maria A. Menendez, Von Nostrand Reinhold, New York, "AT & T Reliability Manual", 5th Edition, 1998.
3. Gregg K. Hobbs, "Accelerated Reliability Engineering - HALT and HASS", John Wiley & Sons, New York, 2000.
4. Lewis, "Introduction to Reliability Engineering", 2nd Edition, Wiley International, 1996.

07ML17 MEMS **3 0 0 100**

UNIT I: SWITCHING **9**
RF MEMS relays and switches: Switch parameters, Actuation mechanisms, Bistable relays and micro actuators, Dynamics of switching operation.

UNIT II: COMPONENTS – I **9**
MEMS inductors and capacitors: Micromachined inductor, Effect of inductor layout, Modeling and design issues of planar inductor, Gap tuning and area tuning capacitors, Dielectric tunable capacitors.

UNIT III: COMPONENTS - II **9**
MEMS phase shifters: Types. Limitations, Switched delay lines, Micromachined transmission lines, coplanar lines, Micromachined directional coupler and mixer.

UNIT IV: FILTERS **9**
Micromachined RF filters: Modeling of mechanical filters, Electrostatic comb drive, Micromechanical filters using comb drives, Electrostatic coupled beam structures.

UNIT V: ANTENNAS **9**
Micromachined antennas: Microstrip antennas – design parameters, Micromachining to improve performance, Reconfigurable antennas.

TOTAL: 45

TEXT BOOK:

1. V.K.Varadan etal, RFMEMS and their Applications, Wiley, 2003.
2. H.J.DELOS SANTOS : RF MEMS circuit Design for Wireless Communications, Artech House, 2002.
1. G.M.REBEIZ : RF MEMS Theory, Design and Technology, John Wiley, 2003

07ML18 DIGITAL SIGNAL PROCESSING INTEGRATED CIRCUITS **3 1 0 100**

UNIT I **9**
DSP INTEGARTED CIRCUITS AND VLSI CIRCUIT TECHNOLOGIES

Standard digital signal processors, Application specific IC's for DSP, DSP systems, DSP system design, Integrated circuit design. MOS transistors, MOS logic, VLSI process technologies, Trends in CMOS technologies.

UNIT II **9**
DIGITAL SIGNAL PROCESSING

Digital signal processing, Sampling of analog signals, Selection of sample frequency, Signal-processing systems, Frequency response, Transfer functions, Signal flow graphs, Filter structures, Adaptive DSP algorithms, DFT-The Discrete Fourier Transform, FFT-The Fast Fourier Transform Algorithm, Image coding, Discrete cosine transforms.

UNIT III **9**
DIGITAL FILTERS AND FINITE WORD LENGTH EFFECTS

FIR filters, FIR filter structures, FIR chips, IIR filters, Specifications of IIR filters, Mapping of analog transfer functions, Mapping of analog filter structures, Multirate systems, Interpolation with an integer factor L, Sampling rate change with a ratio L/M, Multirate filters. Finite word length effects -Parasitic oscillations, Scaling of signal levels, Round-off noise, Measuring round-off noise, Coefficient sensitivity, Sensitivity and noise.

UNIT IV **9**
DSP ARCHITECTURES AND SYNTHESIS OF DSP ARCHITECTURES

DSP system architectures, Standard DSP architecture, Ideal DSP architectures, Multiprocessors and multicomputers, Systolic and Wave front arrays, Shared memory architectures. Mapping of DSP algorithms onto hardware, Implementation based on complex PEs, Shared memory architecture with Bit – serial PEs.

UNIT V **9**
ARITHMETIC UNITS AND INTEGRATED CIRCUIT DESIGN

Conventional number system, Redundant Number system, Residue Number System .Bit-parallel and Bit-Serial arithmetic, Basic shift accumulator, Reducing the memory size, Complex multipliers, Improved shift-accumulator. Layout of VLSI circuits, FFT processor, DCT processor and Interpolator as case studies

L : 45, T:15 Total 60

REFERENCES:

1. Lars Wanhammer, **"**DSP Integrated Circuits**"**, Academic press, New York 1999.
2. A.V.Oppenheim et.al, 'Discrete-time Signal Processing' Pearson education, 2000.
3. Emmanuel C. Ifeachor, Barrie W. Jervis, **"** Digital signal processing – A practical approach**",** Second edition, Pearson education, Asia 2001.
4. Keshab K.Parhi, 'VLSI digital Signal Processing Systems design and Implementation' John Wiley & Sons, 1999.
5. Bayoumi & Magdy A., " VLSI Design Methodologies for Digital Signal Processing Architectures", BS Publications, 2005.

07ML19 MULTIMEDIA COMPRESSION TECHNIQUES 3 0 0 100

UNIT I **9**
INTRODUCTION

Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

UNIT II **9**
TEXT COMPRESSION

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmetic coding – Dictionary techniques – LZW family algorithms.

UNIT III **9**

AUDIO COMPRESSION

Audio compression techniques - µ- Law and A- Law companding. Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders

UNIT IV **9**

IMAGE COMPRESSION

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization– Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards.

UNIT V **9**

VIDEO COMPRESSION

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard.

Total: 45

REFERENCES:

1. Khalid Sayood : Introduction to Data Compression, Morgan Kauffman Harcourt India, 2nd Edition, 2000.
2. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001.
3. Yun Q.Shi, Huifang Sun : Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
4. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
5. Mark Nelson : Data compression, BPB Publishers, New Delhi,1998.
6. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2003.
7. Watkinson,J : Compression in Video and Audio, Focal press,London.1995.
8. Jan Vozer : Video Compression for Multimedia, AP Profes, NewYork, 1995

LIST OF ELECTIVES
SEMESTER III

07ML20 BIO-MEMS **3 0 0 100**

UNIT I: Introduction **9**

Microstructures and Applications in Microfluidi and Optical Components- The LIGA Process: A Brief History and Introduction **Nano imprinting Technology for Biological Applications I**ntroduction Overview of NIL Technology

UNIT II: Micropump Applications in Bio-MEMS **9**

Introduction , Basic Mechanisms, Fabrication Processes-.**Micromixers :**Introduction - Some Basic Considerations-Pressure driven Passive Micro Mixers- Electrically Driven-Multiphase Micro Mixers.

UNIT III: Microfabricated Devices for Sample Extraction, Concentrations and Related Sample Processing Technologies – **9**

Introduction- Sample Extraction and Concentrations-Microfabricated Single stage and Dual stage Micro dialysis Device

UNIT IV: Sensing Technologies for Bio-MEMS applications **9**

Introduction-Laboratory on – a chip (LOC)- Micro total Analysis-Microfluidic Culture based Chip-challenging Biochip Mycobacteria –MEMS for Drug Delivaery-Human skin and Microneedles

UNIT V: Pharmaceutical Analysis Using Bio-MEMS **9**

Advantages of the Microworld for Pharamaceutical and Biomedical Analysis- Basic Components of Bio-MEMS and Lab-on-a-Chip Devices for Pharmaceutical Analysis.

TOTAL: 45

References:

1. Wanjun Wang. Steven A.Soper (Editors), Bio-MEMS- Technologies and Applications, CRC Press,1999.

07ML21 MULTIMEDIA DATABASES

3 0 0 100

UNIT I **9**
INTRODUCTION

Overview of Database Management – Threshold Architecture – Informal look at the Relational Model – SQL.

UNIT II **9**
NORMAL FORM

Functional Dependencies – Basic Definition and Some Examples – 1NF, 2NF, 3NF, BCNF – Multivalued Dependencies – Definition and Examples – 4NF – Join Dependencies : Definitions and Examples – 5NF.

UNIT III **9**
OODB AND ADVANCED DATA STRUCTURES

Introduction to OODBMS – K-D trees – Point Quad Trees – R-trees

UNIT IV **9**
IMAGE AND TEXT DATABASES

Similarity Based Retrieved – Representing Image DBs with Relation – Representing Image DBs with R-Trees – Stop Lists – Words Term and Frequency Tables – Latent Semantic Indexing – TV Trees.

UNIT V **9**
VIDEO AND AUDIO DATABASES

Organizing content of a Single Video – Querying content of Video Libraries – General Model of Audio Data – Indexing Audio Data.

TOTAL : 45

REFERENCES

1. Elmasri and Navathe, Fundamentals of Database System, 3rd Edition, Pearson Education, 2002.
2. V. S. Subramanian, "Principles of Multimedia Database System", Morgan Kaufmann Publishers, Inc, 1998.
3. C. J. Date, "An Introduction to Database Systems", Seventh Edition, Pearson Education, 2000.
4. S. Khoshafian and A. B. Bakor, "Multimedia and Imaging Databases", Morgan Kaufmann, 1996.

07ML22 DESIGN OF EMBEDDED SYSTEMS **3 0 0 100**

UNIT I: EMBEDDED PRODUCT &PROCESS **9**

Embedded Design life cycle – Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Selection Processes – Microprocessor Vs

Micro Controller – Performance tools – Bench marking – RTOS Micro Controller – Performance tools – Bench marking – RTOS availability – Tool chain availability – Other issues in selection processes.

UNIT II: COMPONENTS **9**

Partitioning decision – Hardware / Software duality – coding Hardware – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization – System startup – Hardware manipulation – memory – mapped access – speed and code density.

UNIT III: SERVICES&DEBUGGING **9**

Interrupt Service routines – Watch dog timers – Flash memory Basic toolset – Host ased debugging – Remote debugging – ROM emulators – logic Analyzer – Caches – Computer optimization – Statistical profiling.

UNIT IV: EMULATORS & ISSUES **9**

In circuit emulators – Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers.

UNIT V: RELIABLITY **9**

Testing – Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

Total = 45

REFERENCE

1. Arnold S. Berger – Embedded System Design CMP books, USA 2002

07ML23 LOW POWER VLSI DESIGN **3 0 0 100**

UNIT I **9**

POWER DISSIPATION IN CMOS

Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices- Basic principle of low power design.

UNIT II **9**

POWER OPTIMIZATION

Logical level power optimization – Circuit level low power design – Circuit techniques for reducing power consumption in adders and multipliers.

UNIT III **9**

DESIGN OF LOW POWER CMOS CIRCUITS

Computer Arithmetic techniques for low power systems – Reducing power consumption in memories – Low power clock, Interconnect and layout design – Advanced techniques – Special techniques

UNIT IV **9**

POWER ESTIMATION

Power estimation techniques – Logic level power estimation – Simulation power analysis – Probabilistic power analysis.

UNIT V **9**

SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER

Synthesis for low power –Behavioral level transforms- Software design for low power -

Total: 45

REFERENCES:

1. K.Roy and S.C. Prasad , LOW POWER CMOS VLSI circuit design, Wiley,2000

2. Dimitrios Soudris, Chirstian Pignet, Costas Goutis, Designing CMOS Circuits For Low Power, Kluwer,2002
3. J.B. Kuo and J.H Lou, Low voltage CMOS VLSI Circuits,Wiley 1999.
4. A.P.Chandrakasan and R.W. Broadersen, Low power digital CMOS design, Kluwer,1995.
5. Gary Yeap, Practical low power digital VLSI design, Kluwer,1998.
6. Abdellatif Bellaouar,Mohamed.I. Elmasry, Low power digital VLSI design,s Kluwer, 1995.
7. James B. Kuo, Shin – chia Lin, Low voltage SOI CMOS VLSI Devices and Circuits. John Wiley&Sons, Inc 2001

07ML24 GENETIC ALGORITHM AND ITS APPLICATIONS 3 0 0 100

UNIT I **9**

Fundamentals of genetic algorithm: A brief history of evolutionary computation-biological terminology-search space -encoding, reproduction-elements of genetic algorithm-genetic modeling-comparison of GA and traditional search methods.

UNIT II **9**

Genetic technology: steady state algorithm - fitness scaling - inversion. Genetic programming - Genetic Algorithm in problem solving

UNIT III **9**

Genetic Algorithm in engineering and optimization-natural evolution –Simulated annealing and Tabu search .Genetic Algorithm in scientific models and theoretical foundations.

UNIT IV **9**

Implementing a Genetic Algorithm – computer implementation - low level operator and knowledge based techniques in Genetic Algorithm.

UNIT V **9**

Applications of Genetic based machine learning-Genetic Algorithm and parallel processors, composite laminates, constraint optimization, multilevel optimization, real life problem.

TOTAL : 45

REFERENCES

1. Melanie Mitchell, 'An introduction to Genetic Algorithm', Prentice-Hall of India, New Delhi, Edition: 2004
2. David.E.Golberg, 'Genetic algorithms in search, optimization and machine learning', Addision-Wesley-1999
3. S.Rajasekaran and G.A Vijayalakshmi Pai,'Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and Applications', Prentice Hall of India, New Delhi-2003.
4. Nils.J.Nilsson,'Artificial Intelligence- A new synthesis', Morgan Kauffmann Publishers Inc, San Francisco,California,1998.

07ML25 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING 3 0 0 100

UNIT I **9**
FUNDAMENTALS OF PROGRAMMABLE DSPs

Multiplier and Multiplier accumulator (MAC) – Modified Bus Structures and Memory access in Programmable DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

UNIT II **9**
TMS320C3X PROCESSOR

Architecture – Data formats - Addressing modes – Groups of addressing modes- Instruction sets - Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals – Generating and finding the sum of series, Convolution of two sequences, Filter design

UNIT III **9**
ADSP PROCESSORS

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT IV **9**
ADVANCED PROCESSORS I

Architecture of TMS320C54X: Pipe line operation, Addressing modes and assembly language instructions Introduction to Code Composer studio

UNIT V **9**
ADVANCED PROCESSORS II

Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

TOTAL : 45

REFERENCES :

1. B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. User guides Texas Instrumentation, Analog Devices, Motorola.

07ML26 ASIC DESIGN 3 0 0 100

UNIT I **9**
INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN

Types of ASICs - Design flow - CMOS transistors CMOS Design rules - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort – Library cell design - Library architecture .

UNIT II **9**
PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS

Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA – Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

UNIT III **9**
PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN ENTRY

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX – Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools - EDIF- CFI design representation.

UNIT IV 9
LOGIC SYNTHESIS, SIMULATION AND TESTING

Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation.

UNIT V 9

ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING

System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow –global routing - detailed routing - special routing - circuit extraction - DRC.

TOTAL : 45

REFERENCES

1. M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc., 1997.
2. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.
3. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
4. R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers, 2000.
5. F. Nekoogar. Timing Verification of Application-Specific Integrated Circuits (ASICs). Prentice Hall PTR, 1999.
6. J.Bhaskar, " A VHDL Synthesis Primer" BS Publications , 2001.
7. J.Bhaskar "A Verilog HDL Primer" BS Publications, 2001.
8. J.Bhaskar " Verilog HDL Synthesis" BS Publications, 2001.
9. J.Bhaskar "VHDL Coding Styles and Methodologies" BS Publications,2005.

07ML27 WAVELETS AND MUTIRESOLUTION PROCESSING 3 0 0 100

UNIT I 9

INTRODUCTION

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence - Generalised Fourier Expansion**.**

UNIT II 9

MULTI RESOLUTION ANALYSIS

Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of general orthonormal MRA- Wavelet basis– Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PR-QMF filter banks

UNIT III 9

CONTINUOUS WAVELET TRANSFORM

Wavelet Transform - definition and properties - concept of scale and its relation with frequency - Continuous Wavelet Transform (CWT) - Scaling function and wavelet functions (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi-Orthogonal) - Tiling of time -scale plane for CWT**.**

UNIT IV 9

DISCRETE WAVELET TRANSFORM

Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation by Filter banks - Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets - Multi-band Wavelet transforms. Introduction to lifting Scheme

UNIT V 9

APPLICATIONS

Signal Compression – Image Compression techniques: EZW-SPHIT Coding - Image denoising techniques: Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detection and object Isolation, Image Fusion, and Object Detection.

TOTAL : 45

REFERENCES

1. Rao .R.M and A.S.Bopardikar, "Wavelet Transforms: Introduction to theory and Applications", Pearson Education Asia Pte. Ltd., 2000.
2. Strang G, Nguyen T, "Wavelets and Filter Banks," Wellesley Cambridge Press, 1996

3. Vetterli M, Kovacevic J., "Wavelets and Sub-band Coding," Prentice Hall, 1995
4. Mallat S., "Wavelet tour of Signal Processing", Academic Press, 1996
5. David C.Lay., "Linear Algebra and its applications" Pearson education, 2007.(Unit I only)

07ML28 WIRELESS COMMUNICATION NETWORKS 3 0 0 100

UNIT I **9**
WIRELESS MEDIUM:

Air Interface Design – Radio propagation mechanism – Pathloss modeling and Signal Coverage – Effect of Multipath and Doppler – Channel Measurement and Modelling – Simulation of Radio Channel.

UNIT II **9**
WIRELESS MEDIUM ACCESS:

Fixed Assignment Access for Voice Networks – Random Access for Data Networks – Integration of Voice and Data Traffic.

UNIT III **9**
WIRELESS NETWORK OPERATION:

Wireless Network Topologies – Cellular Topology – Cell fundamentals – Signal to Interference Ratio – Capacity Expansion – Mobility Management – Resources and Power Management – Security in Wireless Networks.

UNIT IV **9**
WIRELESS WAN:

GSM and TDMA Technology – Mobile Environment – Communication in the Infrastructure – CDMA Technology – IS95 – IMT2000 – Mobile Data Networks – CDPD Networks – GPRS – Mobile Application Protocol.

UNIT V **9**
WIRELESS LANS AND HIPERLANS:

Introduction to wireless LANs – IEEE 802.11 – WPAN IEEE 802.15 –Mobile AdHoc Networks(MANET)- Principle and operation - Wireless Home Networking – Concepts of Bluetooth Technology – Wireless Geolocation.

Total: 45

REFERENCES:

1. Kaveth Pahlavan, K.Prasanth Krishnamurthy, "Principles of Wireless Networks", Pearson Education Asia, 2002
2. Leon Garcia, Widjaja, "Communication Networks", Tata McGraw Hill, New Delhi, 2000.
3. William Stallings, "Wireless Communications and Networks",Second Edition Prentice Hall,India 2007
4. Jon W Mark , Weihua Zhuang,"Wireless communication and Networking",Prentice Hall India 2003

07ML29 WIRELESS SENSOR NETWORKS 3 0 0 100

UNIT I **9**
INTRODUCTION
Over view of sensor networks- Constraints and challenges – Advantages of sensor networks- Applications- Collaborative processing – Key definitions in sensor networks – Tracking scenario – Problem formulation – Distributed representation and interference of states – Tracking multiple objects – sensor models- Performance comparison and metrics.

UNIT II **9**
NETWORKING SENSORS

Key assumption - Medium access control – S-MAC protocol – IEEE 802.15.4 standard and ZigBee - General Issues - Geographic, Energy – Aware Routing - Attribute based routing.

UNIT III **9**

INFRASTRUCTURE ESTABLISHMENT

Topology control – Clustering -Time Synchronization – Localization – Task driven sensing – Role of sensor nodes – Information based tasking - Routing and aggregation.

UNIT IV **9**

SENSOR NETWORK DATABASE

Sensor Database Challenges – Querying the physical environment – Interfaces – In-network aggregation – Data centric storage – Data indices and range queries – Distributed Hierarchical aggregation – Temporal data.

UNIT V **9**

SENSOR NETWOR PLATFORMS AND TOOLS

Sensor Node Hardware – Sensor network programming challenges – Node level software platforms – Operating system TinyOS – Node level simulators – State centric programming – Applications and future directions.

Total: 45

REFERENCE:

1. Feng Zhao, Leonidas Guibas, “Wireless sensor networks an information processing approach”, Mogan kanufmann publishers, 2004