

**AFFILIATED INSTITUTIONS**  
**ANNA UNIVERSITY, CHENNAI**  
**REGULATIONS - 2009**  
**CURRICULUM I SEMESTER (FULL TIME)**

**M.E. MEDICAL ELECTRONICS**

**SEMESTER I**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	MA9217	<a href="#">Applied Mathematics for Electronics Engineers</a>	3	1	0	4
2	MX9311	<a href="#">Anatomy and physiology</a>	3	0	0	3
3	MX9312	<a href="#">Bio signal processing</a>	3	0	0	3
4	MX9313	<a href="#">Biomedical equipment</a>	3	0	0	3
5	MX9314	<a href="#">Biomedical instrumentation</a>	3	0	0	3
6	E1	Elective I	3	0	0	3
<b>PRACTICAL</b>						
7	MX9316	<a href="#">Bio medical Instrumentation lab</a>	0	0	4	2
<b>TOTAL</b>			<b>18</b>	<b>1</b>	<b>4</b>	<b>21</b>

## ELECTIVES LIST

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	MX9001	<a href="#">Medical informatics</a>	3	0	0	3
2	MX9002	<a href="#">Advances in Electronics applied to Hospital Engineering</a>	3	0	0	3
3	MX9003	<a href="#">Human assist devices</a>	3	0	0	3
4	MX9004	<a href="#">Computer based medical Instrumentation.</a>	3	0	0	3
5	MX9005	<a href="#">Advanced Neural computing.</a>	3	0	0	3
6	MX9006	<a href="#">Health Hospital and Equipment management.</a>	3	0	0	3
7	MX9007	<a href="#">Rehabilitation Engineering.</a>	3	0	0	3
8	MX9008	<a href="#">Physiological modeling</a>	3	0	0	3
9	MX9009	<a href="#">Pattern recognition Techniques and Applications</a>	3	0	0	3
10	MX9010	<a href="#">Tissue Engineering.</a>	3	0	0	3
11	MX9011	<a href="#">Bio MEMS</a>	3	0	0	3
12	MX9012	<a href="#">Principles of Genetic Analysis</a>	3	0	0	3
13	MX9013	<a href="#">Wavelet transforms and its application</a>	3	0	0	3
14	MX9014	<a href="#">Tele Health technology</a>	3	0	0	3
15	MX9015	<a href="#">DSP Integrated Circuits</a>	3	0	0	3
16	MX9016	<a href="#">Bio Mechanics</a>	3	0	0	3
17	MX9017	<a href="#">Brain Control Interfaces</a>	3	0	0	3

<b>MA9217</b>	<b>APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS</b>	<b>L T P C 3 1 0 4</b>
<b>UNIT I</b>	<b>FUZZY LOGIC</b>	<b>9</b>
Classical logic – Multivalued logics – Fuzzy propositions – Fuzzy quantifiers.		
<b>UNIT II</b>	<b>MATRIX THEORY</b>	<b>9</b>
Some important matrix factorizations – The Cholesky decomposition – QR factorization – Least squares method – Singular value decomposition - Toeplitz matrices and some applications.		
<b>UNIT III</b>	<b>ONE DIMENSIONAL RANDOM VARIABLES</b>	<b>9</b>
Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.		
<b>UNIT IV</b>	<b>DYNAMIC PROGRAMMING</b>	<b>9</b>
Dynamic programming – Principle of optimality – Forward and backward recursion – Applications of dynamic programming – Problem of dimensionality.		
<b>UNIT V</b>	<b>QUEUEING MODELS</b>	<b>9</b>
Poisson Process – Markovian queues – Single and Multi-server Models – Little's formula - Machine Interference Model – Steady State analysis – Self Service queue.		

**L = 45: T=15; TOTAL: 45 PERIODS**

#### **BOOKS FOR REFERENCES**

1. George J. Klir and Yuan, B., Fuzzy sets and fuzzy logic, Theory and applications, Prentice Hall of India Pvt. Ltd., 1997.
2. Moon, T.K., Sterling, W.C., Mathematical methods and algorithms for signal processing, Pearson Education, 2000.
3. Richard Johnson, Miller & Freund's Probability and Statistics for Engineers, 7<sup>th</sup> Edition, Prentice – Hall of India, Private Ltd., New Delhi (2007).
4. Taha, H.A., Operations Research, An introduction, 7<sup>th</sup> edition, Pearson education editions, Asia, New Delhi, 2002.
5. Donald Gross and Carl M. Harris, Fundamentals of Queuing theory, 2<sup>nd</sup> edition, John Wiley and Sons, New York (1985).

<b>MX9311</b>	<b>ANATOMY AND PHYSIOLOGY</b>	<b>L T P C 3 0 0 3</b>
<b>UNIT I</b>	<b>CELL PHYSIOLOGY</b>	<b>9</b>
Cell structure, Cell membrane Transport, Resting membrane potential and ionic basis of potentials, Recording of Action potentials, patch clamp, Action potential in nerve, Muscle and Heart.		
<b>UNIT II</b>	<b>GASTROINTESTINAL AND RESPIRATORY SYSTEM</b>	<b>9</b>
Structure of gastrointestinal system, layers in Gastro-intestinal System (deglutition, Peristalsis) movement in stomach, small intestine and movements in GI tract and factors regulating the movement. Respiratory pathway, volumes capacities and measurement, respiratory centers and its regulation of respiration, Artificial Respiration.		

**UNIT III ENDOCRINE AND NEURAL REFLEXES 9**

Mention of Endocrine glands general hormonal action, Second messengers, anterior and posterior pituitary hormones. Components in a Simple reflex. Structure of kidney and micturition reflex, Cystometerogram.

**UNIT IV CARDIOVASCULAR AND SPECIAL SENSES 9**

Structure of Heart, conducting pathway and ECG, BP and its measurements. Structure of Eye and Ear, errors of refraction, photochemistry of vision and visual pathway, Middle Ear mechanics, organ of Corti and Auditory pathway, Audiometers.

**UNIT V NERVOUS SYSTEM 9**

Neuron, properties of Synapse, Cross section of spinal cord, ascending and descending tracts, EEG, Automatic nervous system, body temperature regulation. Cortical functions.

**L = 45 TOTAL: 45 PERIODS**

**REFERENCES**

1. Guyton 'Text book of Medical Physiology – WB Jaunder company Philadelphia - 10 edition 2002
2. Cyrul A Keele and Eric Neil – Samsons Wrights Applied physiology – Oxford University press New Delhi – 1991
3. Ranganathan T S, Text Book of human Anatomy S. Chand and company New Delhi – 1994
4. Best and Taylor, The livery Body – BC publication New Delhi 1980

**MX9312 BIOSIGNAL PROCESSING L T P C  
3 0 0 3**

**UNIT I SIGNAL, SYSTEM AND SPECTRUM 9**

Characteristics of some dynamic biomedical signals, Noises- random, structured and physiological noises. Filters- IIR and FIR filters. Spectrum – power spectral density function, cross-spectral density and coherence function, cepstrum and homomorphic filtering. Estimation of mean of finite time signals.

**UNIT II TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION 9**

Time series analysis – linear prediction models, process order estimation, lattice representation, non stationary process, fixed segmentation, adaptive segmentation, application in EEG, PCG signals, Time varying analysis of Heart-rate variability, model based ECG simulator. Spectral estimation – Blackman Tukey method, periodogram, and model based estimation. Application in Heart rate variability, PCG signals,

**UNIT III ADAPTIVE FILTERING AND WAVELET DETECTION 9**

Filtering – LMS adaptive filter, adaptive noise canceling in ECG, improved adaptive filtering in FECCG, Wavelet detection in ECG – structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets.

**UNIT IV            BIOSIGNAL CLASSIFICATION AND RECOGNITION            9**

Signal classification and recognition – Statistical signal classification, linear discriminate function, direct feature selection and ordering, Back propagation neural network based classification. Application in Normal versus Ectopic ECG beats.

**UNIT V            TIME FREQUENCY AND MULTIVARIATE ANALYSIS            9**

Time frequency representation, spectrogram, Wigner distribution, Time-scale representation, scalogram, wavelet analysis – Data reduction techniques, ECG data compression, ECG characterization, Feature extraction- Wavelet packets, Multivariate component analysis-PCA,ICA

**L = 45 TOTAL: 45 PERIODS**

**REFERNCES**

1. Arnon Cohen, Bio-Medical Signal Processing Vol I and Vol II, CRC Press Inc., Boca Rato, Florida 1999.
2. Rangaraj M. Rangayyan, 'Biomedical Signal Analysis-A case study approach', Wiley- Interscience/IEEE Press, 2002
3. Willis J. Tompkins, Biomedical Digital Signal Processing, Prentice Hall of India, New Delhi, 2003.
4. Emmanuel C. Ifeakor, Barrie W.Jervis, 'Digital Signal processing- A Practical Approach' Pearson education Ltd., 2002
5. Raghuvver M. Rao and Ajith S.Bopardikar, Wavelets transform – Introduction to theory and its applications, Pearson Education, India 2000.
6. K.P.Soman,K.I Ramachandran,"Insight into wavelet from theory to practice", PHI, New Delhi,2004
7. John L.Semmlow," Biosignal and Biomedical Image Processing Matlab Based applications" Marcel Dekker Inc.,New York,2004
8. Kavyan Najarian and Robert Splerstor," Biomedical signals and Image processing", CRC – Taylor and Francis,New York,2006
9. D.C.Reddy,"Biomedical Signal Processing – Principles and Techniques",TMH,New Delhi,2005
10. Gari D.Clifford,Francisco Azuaje and Patrick E.McSharry," Advanced Methods and Tech for ECG Data Analysis", ARTECH House,Boston,2006.

**MX9313**

**BIOMEDICAL EQUIPMENT**

**L T P C**  
**3 0 0 3**

**UNIT I            CARDIAC CARE UNIT            9**

Pacemakers - different types, batteries for pacemakers. AC defibrillators, asynchronous and synchronous DC defibrillators, patient monitoring system.

**UNIT II            NEUROLOGY EQUIPMENT            9**

Evoked response - Auditory, Visual and Somato sensory Depth recording, Stereotaxy , EEG controlled Anesthetic monitor, Biofeedback equipments, Spinal reflex Measurement, Transcutaneous nerve stimulator

**UNIT III            PHYSIOTHERAPY AND DIATHERMY EQUIPMENT            9**

Physiological effects of HF radiation, Depth of Penetration, short wave, Ultrasonic and microwave diathermy, Surgical diathermy, Galvanic, Faradic Stimulators, Interferential therapy, Electrical safety- Leakage current, Micro and macro electric shock, GFI units, Earthing Scheme, Electrical safety Analyser

**UNIT IV            LASER AND ULTRASONIC APPLICATION            9**

Principles of Laser action, Different types and clinical applications of laser, ultrasonic frequency for medical application, different modes of Display A, B, and C ultrasonic probes, Real time echo and 2D scanner, Application of Ultrasonic for diagnosis.

**UNIT V RECENT TRENDS 9**

Principles and application of thermography, Detection circuits, Principles of cryogenic Technique and application , principles of Fibre optics cables, Endoscopy, Laparoscopy, ophthalmic equipments- slit Lamp, Tonometer, Retinal response Plotter, principles of Bio telemetry, principles of Lithotripsy.

**L = 45 TOTAL: 45 PERIODS**

**REFERENCES**

1. Albert M Cook and Webster J G – Therapeutic medical devices Prentice Hall Nee York 1982
2. Khandpur R.S Hand Book of Biomedical Instrumentation – Tata Mc Graw Hill publication , New Delhi 2<sup>nd</sup> edition 2003
3. Leslie Cromwell , Fred J.Weibell and Erich A.Pfeiffer - Biomedical Instrumentation Prentice Hall New Delhi 2000
4. Jacobson B and Webster J G Medical and Clinical Engineering – Prentice Hall of India New Delhi 1999
5. Wolbarsht . M. L, Laser Application in Medicine and Biology plenum press NewYork 1989.
6. Heinz Kresse – Handbook of Electro medicine. John Wiely & Sons – Chrchester - 1985

**MX9314 BIOMEDICAL INSTRUMENTATION L T P C  
3 0 0 3**

**UNIT I BIOMEDICAL TRANSDUCERS AND AMPLIFIERS 9**

Categories and Characteristics of Transducer, Signal conditioning units, Multichannel data acquisition system, various types recorders, necessity for low noise pre amplifiers, Difference amplifier, Chopper amplifier, Different types of electrode and its equivalent circuits.

**UNIT II BIOPOTENTIAL RECORDING 9**

ECG, EEG, EMG, PCG, EOG, ERG lead system and recording methods, typical waveform, frequency spectrum, abnormal waveform.

**UNIT III NON ELECTRICAL PARAMETER MEASUREMENTS 9**

Respiration rate, Pulse rate, Temperature, Blood Pressure, O<sub>2</sub> , CO<sub>2</sub> measurements, Respiratory volume measurement, BMR measurement, Plethysmography technique, Impedance technique- Bipolar and Tetra polar circuits, Detection of various physiological parameters using impedance technique,

**UNIT IV BLOOD FLOW METER AND BLOOD CELL COUNTER 9**

EM and ultrasonic blood flow meters, indicator dilution method, Thermodilution method, Manual and Automatic Counting of RBC, WBC and Platelets.

**UNIT V                    BIO-CHEMICAL MEASUREMENTS & BIOSENSORS                    9**

pH, pCO<sub>2</sub>, pO<sub>2</sub>, pHCO<sub>3</sub> and electrophoresis, colorimeter, spectrophotometer, flame photometer, autoanalyser, Biosensors.

**L = 45 : TOTAL =45 PERIODS**

**REFERENCES**

1. Geddes LA and Baker L.E Principals of Applied Biomedical Instrumentation , John Wiley and sons Newyork 1975
2. Webster J.G Medical Instrumentation application and design – John Wiley and sons New York 3<sup>rd</sup> edition 1999
3. Khandpur R.S Hand Book of Biomedical Instrumentation – Tata Mc Graw Hill publication , New Delhi 2<sup>nd</sup> edition 2003
4. Joseph J Carr and John m Brown – Introduction to Biomedical equipment Technology - Pearson Education 4<sup>th</sup> edition New Delhi 2001.
5. Richard S.Cobbold Transducers for Biomedical Measurements; Principle and applications- John Wiley and sons,1992.

**MX9316**

**BIO MEDICAL INSTRUMENTATION LAB**

**L T P C  
0 0 4 2**

**LIST OF EXPERIMENTS**

1. Construction and testing of Instrumentation amplifier
2. Design of Instrumentation amplifier using Single IC and Single supply
3. Patient monitoring system and Bio-telemetry.
4. Plotting of Human auditory response using audiometer.
5. Performance and testing of Surgical Diathermy unit using Diathermy analyzer.
6. Recording of Electromyogram.
7. Construction and testing of nerve stimulator.
8. Study of ECG machine.
9. Study of EEG machine.

**MX9001**

**MEDICAL INFORMATICS**

**L T P C  
3 0 0 3**

**UNIR I                    HEALTH INFORMATICS                    9**

Historical highlights and Evolution, Hospital Information System – its characteristics and functional online and offline modules, e – health services, Medical Standards – HL7 – DICOM – PACS, Medical data formats – Bioethics.

**UNIT II MEDICAL INFORMATICS 9**  
Medical Informatics and its six levels of interfaces, Electronic Patient Record (EPR), Medical data storage and retrieval techniques – Steganography, Evidence based Medicine- Virtual Hospital

**UNIT III SOFT COMPUTING 9**  
Fuzzy logic – its applications in Medicine, Physiological System Modeling and Simulation, Virtual Reality and Multimedia Applications in Medicine, Surgical Simulation, Clinical Expert Systems, Issues related to Web based Health Care Systems design, development and implementation.

**UNIT IV JAVA PROGRAMMING 9**  
Genesis of JAVA, Data types, Operators, Control statements, Classes – Inheritance – packages and interfaces – I/O applets, String handling Applet Classes – AWT and Swing classes - Java applets, Java servlets, Java script programming, Creating events, interactive forms, frames, documents, spread sheets and windows- Client – Server programming

**UNIT V INTERNET AND WEB 9**  
Web Design and programming, HTTP protocol, Web browsers Netscape, Internet explorer, Web site and web page design, HTML,XHTML, XML, CSS, Dynamic HTML, CGI. Data base design and programming, SQL introduction – Queries – Tables – RDBMS, Macromedia Dream Weaver, Web Servers, Databases – SQL, MYSQL, DBI and ADO.NET, Web based Medical Information Systems.

**L = 45 TOTAL : 45 PERIODS**

#### **REFERENCES**

1. Ramachandra Lele, Computers in Medicine Progress in Medical Informatics, Tata McGraw Hill Publishing Company, New Delhi, 2005
2. Herbert Schildt, The Complete Reference – JAVA, Tata McGraw Hill Publishing Company, New Delhi, 2005
3. Mohan Bansal M S, Medical Informatics, Tata McGraw Hill Publishing Company, New Delhi, 2005
4. H M Dietel, Internet and World Wide Web, AB Goldberg publishers, New Delhi, 2007
5. Ranjan Parekh, Principles of Multimedia, Tata McGraw Hill Publishing Company, New Delhi, 2006
6. Tay Vaughan, Multimedia – Making it Work, Tata McGraw Hill Publishing Company, New Delhi, 2006
7. Raif Steinmetz, Multimedia – Computing, Communications and Applications, Pearson Education, New Delhi, 2007
8. Deitel, “Java How to Program”, Pearson Education / PHI, 2006.
9. A S Godbole A Kahate, “Web Technologies, TCP/IP to Internet Application Architectures”, TMH 2007



<b>MX9002</b>	<b>ADVANCES IN ELECTRONICS APPLIED TO HOSPITAL ENGINEERING</b>	<b>L T P C 3 0 0 3</b>
<b>UNIT I</b>	<b>CLINICAL ENGINEERING</b>	<b>9</b>
	Need for Standardization, Medical standards and recalibration ,Hospital design, Hospital safety Regulations, hospital Management and Legal aspects.	
<b>UNIT II</b>	<b>NETWORKING</b>	<b>9</b>
	Importance of networking, types of networking, LAN features, network topologies, LAN components, network operating system, basic data communication concept, application, LAN and multi-user system, planning and installing LAN in hospital set up.	
<b>UNIT III</b>	<b>FIBRE OPTIC SENSORS FOR MEASURING PHYSIOLOGICAL PARAMETERS</b>	<b>9</b>
	Different optical sources, optical detectors, principle of fiber optic cables, single mode, multi mode, step index and graded index type, sensors based on polarisation, interferometer principle, magnetic sensors, application of the sensors in measuring pressure, temperature, flow, rotation and chemical activities, principles of smart sensors.	
<b>UNIT IV</b>	<b>EMI AND EMC APPLIED TO HOSPITAL EQUIPMENTS</b>	<b>9</b>
	Principles of EMI, computation Of EMI, measuring techniques to quantify the level of interference, method of suppressing and isolating this unit from interference	
<b>UNIT VI</b>	<b>VIRTUAL REALITY APPLICATION</b>	<b>9</b>
	Basic concepts of Virtual Environment , Human Factors and Human Perception, Computer graphics principles used in VR, Modeling of a Virtual Environment ,Existing tools, Avadars, Sensors for Perception, Tracking, Camera, Head mount display used in VR, Applications of Virtual Reality in Medicine	

**TOTAL = 45 PERIODS**

#### REFERENCES

1. Syed Amin Tabish “Hospital and Health services Administration Principles and Practices Oxford Press New Delhi 2001
2. Jacob Kline – Handbook of Biomedical Engineering Academe press INC Sandiego 1981.
3. Bernhard Keiser, Principles of Electromagnetic Compatibility, Artech House 3rd Edition, 1986.
4. Eric Udd, Fibre Optic Sensors and introduction for engineers and scientists,Wiley Interscience Publication, New Delhi, 1991.
5. SK Basandia, Local Area Network,Golgotia Publishing Pvt. Ltd., New Delhi, 1995

<b>MX9003</b>	<b>HUMAN ASSIST DEVICES</b>	<b>L T P C 3 0 0 3</b>
<b>UNIT I</b>	<b>HEART LUNG MACHINE AND ARTIFICIAL HEART</b>	<b>9</b>
	Condition to be satisfied by the H/L System. Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, The Indication for Cardiac Transplant, Driving Mechanism, Blood Handling System, Functioning and different types of Artificial Heart, Mock test setup for assessing its Functions	

<b>UNIT II</b>	<b>CARDIAC ASSIST DEVICES</b>	<b>9</b>
Synchronous Counter pulsation, Assisted through Respiration Right Ventricular Bypass Pump, Left Ventricular Bypass Pump, Open Chest and closed Chest type, Intra Aortic Balloon Pumping Venous Arterial Pumping, Prosthetic Cardio Valves, Principle and problem, Biomaterials for implantable purposes, its characteristics and testing.		
<b>UNIT III</b>	<b>ARTIFICIAL KIDNEY</b>	<b>9</b>
Indication and Principle of Haemodialysis, Membrane, Dialysate, Different types of haemodialysers, Monitoring Systems, Wearable Artificial Kidney, Implanting Type.		
<b>UNIT IV</b>	<b>PROSTHETIC AND ORTHODIC DEVICES</b>	<b>9</b>
Hand and Arm Replacement - Different Types of Models Externally Powered Limb Prosthesis Feedback in Orthodic System, Functional Electrical Stimulation, Sensory Assist Devices, Materials for Prosthetic and orthodic devices, Haptic Devices		
<b>UNIT V</b>	<b>RESPIRATORY AND HEARING AIDS.</b>	<b>9</b>
Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters. Types of Deafness, Hearing Aids, Construction and Functional Characteristics.		

**L = 45 TOTAL = 45 PERIODS**

**REFERENCES**

1. Kolff W.J., Artificial Organs, John Wiley and Sons, New York, 1979.
2. Andreas.F.Von racum, Hand book of bio material evaluation, Mc-Millan publishers, 1980.
3. Albert M.Cook and Webster J.G., Therapeutic Medical Devices, Prentice Hall Inc., New Jersey, 1982
4. Gray E Wnek, Gray L Browlin – Encyclopedia of Biomaterials and Biomedical Engineering – Marcel Dekker Inc New York 2004.
5. John. G . Webster – Bioinstrumentation - John Wiley & Sons (Asia) Pvt Ltd - 2004.

<b>MX9004</b>	<b>COMPUTER BASED MEDICAL INSTRUMENTATION</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

<b>UNIT I</b>	<b>PC HARDWARE AND OVERVIEW</b>	<b>9</b>
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Hardware – BIOS – DOS interaction, POST, Functional and Architecture Block diagram of a PC, Mother Board – I / O slots – Mother Board logics- Memory and I/O map, Peripheral interfacing and controllers- Serial and Parallel interface – CRT Display Adapter – FDC – HDC – PC buses

<b>UNIT II</b>	<b>80186, 80286, 80386 AND 80486 MICROPROCESSORS</b>	<b>9</b>
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80186 Architecture, Enhancements of 80186 – 80286 Architecture – Real and Virtual Addressing Modes – 80386 Architecture – Special Registers – Memory Management – Memory Paging Mechanism – 80486 Architecture – Enhancements – Cache Memory Techniques – Exception Handling – Comparison of Microprocessors (8086 – 80186 – 80286 – 80386 – 80486).

**UNIT III PENTIUM MICROPROCESSORS 9**

Pentium Microprocessor Architecture – Special Pentium Registers – Pentium Memory Management – New Pentium Instructions – Pentium Pro Microprocessor Architecture – Special features – Pentium II Microprocessor Architecture – Pentium III Microprocessor Architecture – Pentium III Architecture – Pentium IV Architecture – Comparison of Pentium Processors.

**UNIT IV COMPUTERISED DATA ACQUISITION AND PROGRAMMING 9**

Plug-in-data acquisition and Control Boards, Data acquisition using GPIB and Serial Interfaces and Programming in C, Virtual reality – Multimedia - Telemedicine – Computers in Critically Care Units and radiological centres

**UNIT V BIOMETRICS FOR NETWORK SECURITY 9**

Introduction to Biometrics and its characteristics, Finger print technology, feature extraction and classification, Face recognition and hand geometry - feature extraction and classification, Biometric authentication system

**L = 45 TOTAL = 45 PERIODS**

**REFERENCES**

1. Ramachandra Lele, Computers in Medicine Progress in Medical Informatics, Tata McGraw Hill Publishing Company, New Delhi, 2005
2. N.Mathivanan, PC Based Instrumentation: Concepts and Practice, Prentice Hall of India, New Delhi 2007.
3. B.Govindarajalu, IBM PC and Clones: Hardware, Trouble shooting and Maintenance, Tata McGraw Hill Publishing Company, New Delhi, 2005
4. Herbert Schildt, The Complete Reference – JAVA, Tata McGraw Hill Publishing Company, New Delhi, 2005
5. John P Woodward, Biometrics – The Ultimate Reference, Dreamtech Publishers, New Delhi, 2003
6. Ranjan Parekh, Principles of Multimedia, Tata McGraw Hill Publishing Company, New Delhi, 2006
7. Stephen J Bigelow, Trouble shooting, Maintaining and Repairing of PCs, Tata McGraw Hill Publishing Company, New Delhi, 2005
8. H M Dietel, Internet and World Wide Web, AB Goldberg publishers, New Delhi, 2007
9. Atul Khate, Cryptography and network security, Tata McGraw Hill Publishing Company, New Delhi, 2008

**MX9005 ADVANCED NEURAL COMPUTING L T P C  
3 0 0 3**

**UNIT I FUNDAMENTAL CONCEPTS AND MODELS  
OF ARTIFICIAL NEURAL SYSTEMS 9**

Biological Neurons and their Artificial models, Models of Artificial Neural Networks, Learning and Adaptation, Neural Network Learning Rules, Single Layer Perceptron Classifiers.

<b>UNIT II</b>	<b>BPN AND BAM</b>	<b>9</b>
Back Propagation Network, Generalised Delta Rule, BPN Application, Associative Memory Definition, BAM, Hopfield Memory, Simulated Annealing-Boltzmann Machine.		
<b>UNIT III</b>	<b>OTHER NETWORKS</b>	<b>9</b>
Counter Propagation Network, Feature Mapping, Self Organising Feature Maps, Adaptive Resonance Theory (ART) Network Descriptions,		
<b>UNIT IV</b>	<b>GENETIC ALGORITHMS &amp; IMPLEMENTATION TECHNIQUES</b>	<b>10</b>
The Appeal of Evolution, Search Spaces and Fitness Landscapes, Elements of Genetic Algorithms, Data Structures, Adaptive Encoding. Selective Methods, Genetic Operators, Fitness Scaling		
<b>UNIT V</b>	<b>ADVANCES AND APPLICATIONS</b>	<b>8</b>
Support Vector Machines, R B F Network, Neocognitron		
Evolving neural networks using GA, Applications of ANN in biomedical signal analysis and Medical image analysis		

**L = 45 TOTAL = 45 PERIODS**

**REFERENCES**

1. Philip D.Wasermann, Advanced Methods in neural Computing, Van Nostrand Reinhold, New York 1993.
2. David Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison - Wesley USA, 1997.
3. Melanie Mitchell, An Introduction to Genetic Algorithms: Prentice Hall of India, New Delhi 1998. .
4. Simon Haykins, Neural Networks ,Prentice Hall international Inc, 1999.
5. James A Freeman and David M. Skapura, Neural Networks, Addison - Wesley, India 1999.

<b>MX9006</b>	<b>HEALTH HOSPITAL AND EQUIPMENT MANAGEMENT</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

<b>UNIT I</b>	<b>HEALTH SYSTEM</b>	<b>9</b>
Health organisation of the country, the State, the Cities and the Region, Health Financing System, Organisation of Technical Section		
<b>UNIT II</b>	<b>HOSPITAL ORGANISATION AND MANAGEMENT</b>	<b>9</b>
Management of Hospital Organisation, Nursing Sector, Medical Sector, Central Services, Technical Department, Definition and Practice of Management by Objective, Transactional Analysis Human Relation in Hospital, Importance of Team Work, Legal aspect in Hospital Management.		
<b>UNIT III</b>	<b>REGULATORY REQUIREMENT AND HEALTH CARE CODES</b>	<b>9</b>
FDA Regulation, Joint Commission of Accreditation for Hospitals, National Fire Protection Association Standard, IRPQ.		

**UNIT IV EQUIPMENT MAINTENANCE MANAGEMENT 9**

Organising Maintenance Operations, Paper Work Control, Maintenance Job Planning, Maintenance Work Measurement and Standards, Preventive Maintenance, Maintenance Budgeting and Forecasting, Maintenance Training, Contract Maintenance.

**UNIT V TRAINED TECHNICAL PERSONNEL 9**

Function of Clinical Engineer, Role to be performed in Hospital, Manpower Market, Professional Registration, Structure in Hospital.

**L = 45 TOTAL = 45 PERIODS**

**REFERENCES**

1. Cesar A.Caceres and Albert Zara, The Practice of Clinical Engineering, Academic Press, New York, 1977.
2. Webster.J.G. and Albert M.Cook, Clinical Engineering Principles and Practices Prentice Hall Inc. ,Englewood Cliffs, New Jersey, 1979.
3. Hans Pfeiff, Vera Dammann (Ed.), Hospital Engineering in Developing Countries, Z Report, Eschbom, 1986
4. Jacob Kline, Handbook of Bio Medical Engineering, Academic Press Inc. SanDeigo 1988 .
5. R.C.Goyal, Human Resource Management in Hospital, Prentice Hall of India, 3<sup>rd</sup> edition, 2000.
6. Syed Amin Tabish "Hospital and Health services Administration Principles and Practices Oxford Press New Delhi 2001

**MX9007 REHABILITATION ENGINEERING L T P C  
3 0 0 3**

**UNIT I REHABILITATION TECHNOLOGY 9**

Selection, design or manufacturing of augmentive or assistive devices appropriate for individual with disability.

**UNIT II REHABILITATION SCIENCE 9**

Knowledge about the basic and clinical research about the variation in the physiological functioning and anatomical structure.

**UNIT III REHABILITATION ADVOCACY 9**

Legal aspect helps the handicapped people in choosing the device, the provisions available to them in this regard.

**UNIT IV REHABILITATION MEDICINE 9**

Physiological aspects of functional recovery, neurological and psychological aspects, rehabilitation therapies, training to restore vision auditory and speech

**L =45 Total = 45 PERIODS**

**REFERENCES**

1. Reswick.J. What is Rehabilitation Engineering? ,Annual Review of rehabilitation Volume 2 Springer - Vorlage, New York, 1982.
2. Robinson.C.J, Rehabilitation Engineering, Handbook of electrical engineering, CRC Press, Bocaraton, 1993

<b>MX9008</b>	<b>PHYSIOLOGICAL MODELING</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
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System Concept, System Properties, Piece-Wise Linear Approximation, Electrical Analog for Compliance, Thermal Storage, Mechanical Systems, Step response of a Resistance/Compliant Systems, Pulse Response of First Order System.

<b>UNIT II</b>	<b>TRANSFER FUNCTION</b>	<b>9</b>
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System as an Operator use of Transfer Function, Bio Engineering of a Coupled System, Example of Transformed Signals and Circuits for the Transfer Function with Impedance Concept, Prediction of Performance.

<b>UNIT III</b>	<b>PERIODIC SIGNALS</b>	<b>9</b>
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Sinusoidal Functions, Sinusoidal Analysis of Instrumentation System, Evaluation of Transfer Function s from Frequency Response, Relationship between Phase Lag and Time Delay Transient Response of an Undamped Second Order system, General Description of Natural Frequency Damping, Physical Significance of Under Damped Responses.

<b>UNIT IV</b>	<b>FEEDBACK</b>	<b>9</b>
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Characterization of Physiological Feedback. Systems, Uses and Testing of System Stability.

<b>UNIT V</b>	<b>SIMULATION OF BIOLOGICAL SYSTEMS</b>	<b>9</b>
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Simulation of Skeletal muscle servomechanism, thermo Regulation, cardiovascular control System, Respiration controls, Occulo Motor System, Endocrine control system and Modeling of receptors.

**L =45 TOTAL = 45 PERIODS**

**REFERENCES**

1. William B. Blesser, A System Approach to Biomedicine, McGraw Hill Book Co, New York, 1969.
2. Manfredo Clynes and John H. Milsum, Biomedical Engineering System, McGraw Hill and Co, New York, 1970.
3. Douglas S. Rigg, Control Theory and Physiological Feedback Mechanism, The William and Wilkins Co, Baltimore, 1970 .
4. Richard Skalak and Shu Chien, Hand Book of Biomedical Engineering, McGraw Hill and Co, New York, 1987.
5. Michael C.K. Khoo, "Physiological Control System" - Analysis, Simulation and Estimation"- Prentice Hall of India, New Delhi, 2001

<b>MX9009</b>	<b>PATTERN RECOGNITION TECHNIQUES AND APPLICATIONS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

<b>UNIT I</b>	<b>OVERVIEW OF PATTERN RECOGNITION</b>	<b>9</b>
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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 9**

Clustering for unsupervised learning and classification ,clustering concepts C- means algorithm - hierarchical clustering - Graph theoretic approach to pattern clustering- Validity of clustering solutions.

**UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 9**

KL Transforms - feature selection through functional approximation - Binary selection Elements of formal grammars, syntactic description, stochastic grammars, Structural representation.

**UNIT IV FUZZY SYSTEMS 9**

Fuzzy sets and fuzzy reasoning- fuzzy matrices-fuzzy functions-decomposition – fuzzy automata and languages- fuzzy control method- fuzzy decision making.

**UNIT V RECENT ADVANCES AND APPLICATIONS 9**

Principle of neuro fuzzy techniques, Application of PR in image segmentation - Credit scoring - Techniques for colon endoscopy - Target classification of Cancer cells - Cell cytology classification

**L = 45 TOTAL = 45 PERIODS**

**REFERENCES**

1. Duda R.O., and Hart P.G.,Pattern Classification and scene analysis, JohnWiley, New York, 1973.
2. Robert J. Schalkoff , Pattern recognition: Statistical, Structural and Neural approaches, John Wiley and SonsInc, New York, 1992.
3. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley and sons, New York, 1993.
4. Andrew Webb, Statistical Pattern Recognition, Arnold publishers, London,1999.
5. Donna L. Hudson, Maunee E. Cohan, Neural Networks & Artificial Intelligence for Biomedical Engineering, Prentice Hall of India, New Delhi - 2001.
6. Timothy Ross, Fuzzy Logic with Engineering applications,2<sup>nd</sup> Edition John Wiley and sons,West Sussex,2004.

**MX9010 TISSUE ENGINEERING L T P C  
3 0 0 3**

**UNIT I FUNDAMENTAL OF TISSUE ENGINEERING 9**

Tissue Exchange and Tissue Development, objectives of Tissue engineering, Element of Tissue development.

**UNIT II CELLULAR STUDIES 9**

Cell growth and differentiation, Cell and tissue mechanism, cell adhesion, cell migration, cell aggregation and tissue equivalent.

**UNIT III TISSUE BARRIERS TO MOLECULAR AND CELLULAR TRANSPORT 9**

Cell delivery and recirculation, Delivery molecular agents in tissue engineering, control releaser agents in time and space.

**UNIT IV INTRODUCTION TO POLYMERS 9**  
 Non degrade polymer, Bio degradable polymer, cell interaction with polymer cell, cell interaction with polymer in suspension, cell interaction with gels.

**UNIT V APPLICATION OF TISSUE ENGINEERING 9**  
 Artificial organs, synthetic components, Replacement in Tissue structure or Functional Tissue engineering cartilage, Skin, and nerve regeneration.

**L = 45 TOTAL = 45 PERIODS**

**REFERENCES**

1. W Mark Saltzman Tissue Engineering – Engineering principles for design of replacement organs and tissue – Oxford University Press inc New York 2004
2. Gray E Wnek, Gray L Browlin – Encyclopaedia of Biomaterials and Biomedical Engineering – Marcel Dekker Inc New York 2004.

**MX9011 BIO MEMS L T P C**  
**3 0 0 3**

**UNIT I MEMS AND MICROSYSTEMS 9**  
 Working principle of Microsystems, materials for MEMS and Microsystems, micromachining, System modeling and properties of materials

**UNIT II MICROSENSORS AND ACUATORS 9**  
 Mechanical sensors and actuators – beam and cantilever, piezoelectric materials, thermal sensors and actuators- micromachined thermocouple probe, Peltier effect heat pumps, thermal flow sensors, Magnetic sensors and actuators- Magnetic Materials for MEMS, Devices

**UNIT III MICRO OPTO ELECTRO MECHANICAL SYSTEMS 9**  
 Fundamental principle of MOEMS technology, light modulators, beam splitter, microlens, digital micromirror devices, light detectors, optical switch

**UNIT IV MICROFLUIDIC SYSTEMS 9**  
 Microscale fluid, expression for liquid flow in a channel, fluid actuation methods, dielectrophoresis, microfluid dispenser, microneedle, micropumps-continuous flow system

**UNIT V BIOMEMS 9**  
 Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR), DNA hybridization, Electronic nose, Bio chip

**L = 45 TOTAL = 45 PERIODS**

**REFERENCES**

1. Tai Ran Hsu , “ MEMS and Microsystems design and manufacture”, Tata McGraw Hill Publishing Company, New Delhi, 2002
2. Nitaigour Premchand Mahalik, “ MEMS”, Tata McGraw Hill Publishing Company, New Delhi, 2007
3. Wanjun Wang, Steven A.Soper “ BioMEMS- Technologies and applications”, CRC Press,Boca Raton,2007
4. Abraham P. Lee and James L. Lee, BioMEMS and Biomedical Nano Technology, Volume I, Springer 2006.



<b>MX9012</b>	<b>PRINCIPLES OF GENETIC ANALYSIS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>
<b>UNIT I</b>	<b>INHERITANCE - GENETIC ANALYSIS</b>	<b>9</b>
Pattern of inheritance, Chromosomal basis of inheritance, Chromosome mapping by recombination, Genetics of Bacteria and viruses.		
<b>UNIT II</b>	<b>DNA AND PHENOTYPE</b>	<b>9</b>
From Gene to Phenotype, DNA structure and replication- DNA sequencing, DNA Amplification, DNA Hybridisation and DNA Polymorphism, RNA transcription and processing, Protein synthesis and regulation of gene expression.		
<b>UNIT III</b>	<b>GENOME STRUCTURE AND GENETIC ENGINEERING</b>	<b>9</b>
Gene isolation and manipulation, Genomics, mutations, repair and recombination, site directed mutagenesis, large-scale chromosomal changes and genetic polymorphism.		
<b>UNIT IV</b>	<b>GENETIC PROCESSES</b>	<b>9</b>
Gene function, Genetic organization, Genetic regulation, normal and cancer cells, Genetic basis of development		
<b>UNIT V</b>	<b>IMPACT OF GENETIC VARIATION</b>	<b>9</b>
Population Genetics, Quantitative Genetics, Evolution Genetics.		

**L =45 TOTAL = 45 PERIODS**

#### **REFERENCES**

1. Watson. J. etal, “ Molecular Biology of the Gene “, 5<sup>th</sup> Edition, Pearson Publication, 2004.
2. Griffiths, Wesslers, Lewontin, Bart Gel, Suzuki, Miller “Introduction to Genetics Analysis”, – W.H Freeman & company, New York 8<sup>th</sup> Edition - 2005.
3. Glick, B.R and J.J Pasternak “Molecular Biotechnology”, Principles and application of Recombinant DNA” 3<sup>rd</sup> Edition ASM Press, 2003
4. Karp, Gerald.“ Cell and Molecular Biology”. Concepts and Experiments, 4<sup>th</sup> Edition, John Wiley Sons, 2005.
5. Weaver. R.F. “ Molecular Biology “ 3<sup>rd</sup> Edition, McGraw – Hill, 2005.
6. Tom Strachan, Andrew P Read “Human molecular Genetics” 3<sup>rd</sup> Edition, Garland Publishing – 2004.

<b>MX9013</b>	<b>WAVELET TRANSFORMS AND ITS APPLICATIONS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>
<b>UNIT I</b>	<b>FUNDAMENTALS OF SIGNAL DECOMPOSITIONS</b>	<b>9</b>
Series expansion of signals, Multi resolution concepts – Hilbert spaces – Vectors space and inner products, complete inner product spaces, orthogonal and general basis. Fourier theory and sampling – Fourier transform, Fourier series, direct function, Impulse trains and Poisson sum formula, DFT, DTFT, DTFS. Signal Processing – Continuous, Discrete and Multi rate discrete time signal processing. Time frequency representation.		

**UNIT II DISCRETE TIME BASIS AND FILTER BANKS 9**

Series expansion of DTS – DTFS, Haar expansion of DTS, Sinc expansion of DTS. Tree – Structured filter banks – Octave-band filter bank, Discrete time Wavelet series and properties, Multi resolution, Interpretation, Wavelet packets. Multi channel filter banks – Block and lapped orthogonal transforms, Analysis of multi channel and modulated filter banks. Multi dimensional filter banks – Analysis and Synthesis.

**UNIT III MULTI RESOLUTION CONCEPT AND MODULATED BASES 9**

Multi resolution analysis – Wavelet function, DWT. bases, orthogonal basis and biorthogonal bases. Scaling function, scaling coefficients, Wavelet and wavelet coefficients – Scaling function and wavelet. Properties of scaling function and wavelet. Parameterization of scaling coefficients. Calculating the basic scaling function and wavelet. Local cosine bases – Rectangular window, smooth window and general window.

**UNIT IV WAVELET SYSTEM DESIGN 9**

Daubechie’s method for zero wavelet moment design. Non-maximal regularity wavelet design. Relation of zero wavelet moments to smoothness, Approximation of scaling coefficients by sample of the signal and by scaling function projection. Tiling the time frequency and time scale plane.

**UNIT V APPLICATIONS 9**

Wavelet, wavelet packets and matching pursuits with bio medical applications – analysis of phono cardiogram signals, feature extraction for neuro physiological signals, speech enhancements for hearing aids. Wavelets in medical imaging – wavelets applied to mammograms, adapted wavelet encoding in fMRI, wavelet compression of medical images. Video compression, denoising, edge detection, and discrete wavelength multi tone modulation.

**L =45 TOTAL = 45 PERIODS**

**REFERENCES**

1. M.Vetterli and J. Kovacevic, ‘Wavelets and sub band coding’, Prentice Hall, 1995.
2. C.Sidney Burrus, Ramesh Gopinath & Haito Guo, ‘Introduction to wavelets and wavelet transform’, Prentice Hall, 1998.
3. Metin Akay, ‘Time frequency and wavelets in biomedical signal processing’, Wiley-IEEE Press, October 1997.
4. Raguveer m Rao & Ajith S. Bopardikar, ‘Wavelet transforms – Introduction to theory and applications’, Addison Wesley, 1998
5. S.Mallet, ‘A Wavelet tour of signal processing’, Academic Press 1998
6. G.Strang and T.Nguyen, ‘Wavelet and filter banks’, Wesley and Cambridge Press.
7. P.P.Vaidyanathan, ‘Multi rate systems and filter banks’, Prentice Hall 1993.

**MX9014 TELEHEALTH TECHNOLOGY L T P C**  
**3 0 0 3**

**UNIT I TELEMEDICINE AND HEALTH 9**

History and Evolution of telemedicine, Functional diagram of telemedicine system, Telemedicine, Tele health, Tele care, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine.

**UNIT II TELEMEDICAL TECHNOLOGY 9**

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN, POTS, ANT, ISDN, Internet, Air/ wireless communications: GSM satellite, and Micro wave, Modulation techniques, Types of Antenna, Integration and operational issues, Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication. Mobile hand held devices and mobile communication. Internet technology and telemedicine using world wide web (www). Video and audio conferencing. clinical data– local and centralized,

**UNIT III TELEMEDICAL STANDARDS 9**

Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, phases of Encryption. Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7, H. 320 series (Video phone based ISBN) T. 120, H.324 (Video phone based PSTN), Video Conferencing, Real-time Telemedicine integrating doctors / Hospitals, Clinical laboratory data, Radiological data, and other clinically significant biomedical data, Administration of centralized medical data, security and confidentiality of medical records and access control, Cyber laws related to telemedicine.

**UNIT IV MOBILE TELEMEDICINE 9**

Tele radiology: Definition, Basic parts of teleradiology system: Image Acquisition system Display system, Tele pathology, multimedia databases, color images of sufficient resolution, Dynamic range, spatial resolution, compression methods, Interactive control of color, Medical information storage and management for telemedicine- patient information medical history, test reports, medical images diagnosis and treatment. Hospital information system - Doctors, paramedics, facilities available. Pharmaceutical information system.

**UNIT V TELEMEDICAL APPLICATIONS 9**

Telemedicine access to health care services – health education and self care. . Introduction to robotics surgery, telesurgery. Telecardiology, Teleoncology, Telemedicine in neurosciences, Electronic Documentation, e-health services security and interoperability., Telemedicine access to health care services – health education and self care, Business aspects - Project planning and costing, Usage of telemedicine.

**L =45 TOTAL = 45 PERIODS**

**REFERENCES**

1. Norris, A.C. Essentials of Telemedicine and Telecare. Wiley (ISBN 0-471-53151-0), 2002
2. Wootton, R., Craig, J., Patterson, V. (Eds.), Introduction to Telemedicine. Royal Society of Medicine Press Ltd (ISBN 1853156779), 2006
3. O'Carroll, P.W., Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), Public Health Informatics and Information Systems. Springer (ISBN 0-387-95474-0), 2003
4. Ferrer-Roca, O., Sosa-Iudicissa, M. (editors), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54). (ISBN 90-5199-413-3), 2002.
5. Simpson, W. 2006. Video over IP. A practical guide to technology and applications. Focal Press (Elsevier). ISBN-10: 0-240-80557-7
6. Bommel, J.H. van, Musen, M.A. (Eds.) (1997). Handbook of Medical Informatics. Heidelberg, Germany: Springer. (ISBN 3-540-63351-0)

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

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            DIGITAL SIGNAL PROCESSING            9**

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            DIGITAL FILTERS AND FINITE WORD LENGTH EFFECTS            9**

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            DSP ARCHITECTURES AND SYNTHESIS OF DSP ARCHITECTURES            9**

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            ARITHMETIC UNITS AND INTEGRATED CIRCUIT DESIGN            9**

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. Cordic algorithm.

**L = 45 TOTAL = 45 PERIODS**

**REFERENCES**

1. Lars Wanhammer, "DSP Integrated Circuits", 1999 Academic press, New York
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.
4. Keshab K.Parhi, "VLSI Digital Signal Processing Systems design and Implementation", John Wiley & Sons, 1999.

**MX9016**

**BIO-MECHANICS**

**L T P C**  
**3 0 0 3**

**UNIT I INTRODUCTION 9**

Introduction to bio-mechanics, relation between mechanics and Medicine, Newton's laws, biofluid mechanics, soft tissue mechanics, stress, strain, shear rate, viscosity, visco elasticity, non Newtonian viscosity, mechanical properties of soft biological tissues.

**UNIT II MECHANICS OF CIRCULATION 9**

Flow properties of blood, effect of shear rate, hematocrit, temperature and protein Content of blood, rheology of blood and micro vessels, dynamics of circulatory system, turbulence flow around prosthetic heart valves.

**UNIT III MECHANICS APPLIED TO ORTHOPAEDICS 9**

Orthopedic biomechanics, mechanical properties of bones, stress induced bone growth, kinematics and kinetics of joints, lubrication of joints, analysis of force in orthopedic implants.

**UNIT IV MECHANISM OF BIOLOGICAL SYSTEMS 9**

Skeletal muscles servo mechanism, Cardio vascular control mechanism, respiratory control mechanism

**UNIT V BIO MECHANICAL ASPECT OF ACCIDENT INVESTIGATION 9**

Experimental and Analytical method of analysis, Clinical evaluation, Head Injury tolerance, rotational injury, spine injury – Accident reconstruction, Analysis of impact, skid analysis – Damage analysis.

**L = 45 TOTAL = 45 PERIODS**

**REFERENCES**

1. Y.C.Fung, Biomechanics : Mechanical properties in living tissues, Springer Verlag, Newyork1981.
2. D.Dawson and Right, Introduction to Bio-mechanics of joints and joint replacement, Mechanical Engineering publications Ltd. 1989.
3. Jacob clime, Head book of Bio Medical Engineering, Academic Press in, Sandiego, 1988.
4. Susan J.Hall , Basics Bio Mechanics 4<sup>th</sup> Edition, McGrawHill Publishing Co,2002.

**MX9017**

**BRAIN CONTROL INTERFACES**

**L T P C**  
**3 0 0 3**

**UNIT I INTRODUCTION TO BCI 8**

Concept of BCI – Invasive and Non-invasive Types – EEG Standards – Signal Features – Spectral Components – EEG Data Acquisition – Pre-processing – Hardware and Software – Artifacts – Methods to Remove – Near Infrared BCI.

<b>UNIT II</b>	<b>BCI APPROACHES</b>	<b>7</b>
Mu Rhythm – Movement Related EEG Potentials – Mental States – Visual Evoked Potential Based – P300 component.		
<b>UNIT III</b>	<b>EEG FEATURE EXTRACTION METHODS</b>	<b>10</b>
Time/Space Methods – Fourier Transform – Wavelets – AR models – Band pass filtering – PCA – Laplacian Filters – Linear and Non-linear Features.		
<b>UNIT IV</b>	<b>EEG FEATURE TRANSLATION METHODS</b>	<b>10</b>
LDA – Regression – Memory Based – Vector Quantization – Gaussian Mixture Modeling – Hidden Markov Modeling.		
<b>UNIT V</b>	<b>CASE STUDY</b>	<b>10</b>
Case Study of Problems in BCI Competition III(2005) – Dataset I, II, III, IV and V – Solutions. Case Study of Brain Actuated Control of Khepera Mobile Robot.		

**L = 45 TOTAL = 45 PERIODS**

#### **REFERENCES:**

1. Special Issue on Brain Control Interfaces, IEEE Transactions on Neural Systems and Rehabilitation Engineering, Vol 14, June 2006.
2. Andrew Webb, "Statistical Pattern Recognition", Wiley International, Second Edition, 2002.
3. R.Spehlmann, "EEG Primer", Elsevier Biomedical Press, 1981. Arnon Kohen, "Biomedical Signal Processing", Vol I and II, CRC Press Inc, Boca Raton, Florida.
4. Bishop C.M, "Neural Networks for Pattern Recognition", Oxford, Clarendon Press, 1995.
5. Torsten Felzer, "On the possibility of Developing a Brain Computer Interface", Technical Report, Technical University of Darmstadt, Germany, 2001.
6. Wolpaw J.R, N.Birbaumer et al, "Brain control interface for Communication and control", Clinical Neurophysiology, 113, 2002.
7. Jose del R.Millan et al, "Non-invasive brain actuated control of a mobile robot by human EEG", IEEE Transactions on biomedical Engineering, Vol 51, No.6, 2004 June.
9. S.Coyle, T.Ward et al, "On the suitability of near infra red systems for next generation Brain Computer interfaces", Physiological Measurement, 25, 2004.
10. Carlo Tomasi, "Estimating Gaussian Mixture Densities with EM – A Tutorial", Duke University, 2000.
11. R.Dugad, U.B Desai, "A Tutorial on Hidden Markov Modeling", Signal Processing and Artificial Neural Networks Laboratory, IIT Bombay, 1996.
12. [http://ida.first.fhg.de/projects/bci/competition\\_iii](http://ida.first.fhg.de/projects/bci/competition_iii)