M.Tech –Biomedical Instrumentation (Full Time)

Curriculum and Syllabus
2016 Regulation

I SEMESTER						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MMA16016	Random Process and Optimization Techniques	3	1	0	4
2	MBM16B001	Biomedical Instrumentation	3	0	0	3
3	MBM16B002	Anatomy and Physiology	3	0	0	3
4	MBM16B003	Bio Signal Processing	3	1	0	4
5	MBM16B004	Radiological equipments	3	0	0	3
6	MBM16B005	Hospital Management	3	0	0	3
7	MBM16BL01	Biomedical Engineering Laboratory	0	0	2	1
8	MBM16BL02	Biomedical Simulation Laboratory	0	0	2	1
		TOTAL	**18**	**2**	**4**	**22**

II SEMESTER						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM16B006	Medical Image Processing	3	1	0	4
2	MBM16B007	Bio-Medical Equipments & Devices	3	0	0	3
3	MBM16B008	Computer based Medical Instrumentation	3	1	0	4
4	MBM16B009	Laser & ultrasonic Applications in medicine	3	1	0	4
5	MBM16BEX X	Elective – I	3	0	0	3
6	MBM16BEX X	Elective – II	3	0	0	3
7	MBM16BL03	Computer Based Medical Instrumentation Laboratory	0	0	2	1
8	MEE16PL04	Scholarly writing skills	0	0	2	1
		TOTAL	**18**	**3**	**4**	**23**

M.Tech –Biomedical Instrumentation (Full Time)

III SEMESTER						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM16B010	Biological effects of Radiation	3	1	0	4
2	MBM16B011	Recent advances applied to Hospital engineering	3	1	0	4
3	MBM16BEX X	Elective – III	3	0	0	3
4	MBM16BEX X	Elective – IV	3	0	0	3
5	MBM16BL04	Medical Image processing Laboratory	0	0	2	1
6	MBM16BL05	Project Phase - 1	0	0	12	3
		TOTAL	**12**	**2**	**14**	**18**

IV SEMESTER						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM16BL06	Project Phase – II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

Summary of Credits:

1st Semester Credits	**22**
2nd Semester Credits	**23**
3rd Semester Credits	**18**
4th Semester Credits	**12**
Total	**75**

M.Tech –Biomedical Instrumentation (Full Time)

ELECTIVE - I						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM16BE01	Human Assist Devices	3	0	0	3
2	MBM16BE02	Advanced Neural Computing	3	0	0	3
3	MBM16BE03	Health, Hospital and Equipment Management	3	0	0	3

ELECTIVE - II						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM16BE04	Medical Informatics	3	0	0	3
2	MBM16BE05	Rehabilitation Engineering	3	0	0	3
3	MBM16BE06	System theory applied to Bio-Medical Engineering	3	0	0	3

ELECTIVE - III						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM16BE07	Patter Recognition and AI Application	3	0	0	3
2	MBM16BE08	Special transducers and Instrumentation	3	0	0	3
3	MEE16PE10	Research Methodology	3	0	0	3

ELECTIVE - IV						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MEE16PE15	Advanced Digital Signal Processing	3	0	0	3
2	MEE16PE18	Micro controller based System Design	3	0	0	3
3	MEE16PE05	MEMS Technology	3	0	0	3

M.Tech –Biomedical Instrumentation (Full Time)

MMA16016 RANDOM PROCESS AND OPTIMIZATION TECHNIQUES 3 1 0 4

OBJECTIVES:

- Capable to solve the problems arises in Power System, Control System etc
- Understand the concept of interpolation like least square method etc
- The student will be capable of solving Eigen value problems

UNIT I: Random Variables **12 hours**

Random variables – Distribution functions – Moments – Moment generating functions – Two dimensional Random variables – Marginal and conditional distributions

UNIT II: Random Process **12 hours**

Classification of Random Process – Stationary Process – Ergodic Process – Markov Process – Markov Chains – Auto Correlation – Auto Covariance – Cross Correlation – Cross Covariance – Spectral Density

UNIT III: Solution of Equations **12 hours**

Solution of Algebraic and Transcendental equations – Method of false position – Iteration method – Newton-Raphson method – Solution of Linear system of equations – Gauss Elimination method – Gauss-Jordan method Iterative methods – Gauss-Jacobi method – Gauss-Seidel method – Matrix Inversion by Gauss-Jordan method

UNIT IV: Advanced Matrix Theory **12 hours**

Generalized Eigen vectors – Jordan canonical form – Matrix norms – QR algorithm – Pseudo inverse – Singular value decomposition – Least square solutions

UNIT V: Linear Programming **12 hours**

Formulation of LPP – Standard form of LPP – Graphical method – Simplex method – Big M method – Two phase method

Tutorials: 15
Total no. of Hours: 60

References:

1. Richard Johnson, A.(2009) *Miller & Freund's Probability and statistics for Engineers* 8th Ed. Prentice Hall of India
2. Veerarajan, T.(2008) *Probability, Statistics and Random Processes*. Tata McGraw Hill Publishing Co
3. Gupta,S.C. Kapoor, V.K. (2007) *Fundamentals of Mathematical Statistics*, Chand S. & Co
4. Veerarajan, T.(2005) *Numerical Methods*. Tata McGraw Hill Publishing Co
5. Sastry, S.S.(2003) *Introductory Methods of Numerical Analysis*. Prentice Hall of India
6. Bronson, R.(1989) *Theory and problems of Matrix operations (Schaum's outline series)*.McGraw Hill
7. Lewis,D.W.(1995) *Matrix theory*. Allied publishers
8. Hamdy A. Taha, (2010) *Operations Research: An Introduction.*9th Ed. Pearson
9. Panneerselvam, R.(2011) *Operations Research* .2nd Ed. Prentice Hall of India

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B001 BIOMEDICAL INSTRUMENTATION 3 0 0 3

OBJECTIVES

- To study about bio-amplifiers and electrodes
- Understand the concept non – electrical parameters and resipratory measurements
- The student will be capable of understanding blood flowmeters and blood cell counting & bio-chemical measurements

Unit – I: BIO-AMPLIFIERS AND ELECTRODES **9 Hours**

Necessity for low – noise pre-amplifiers, differences amplifiers, chopper amplifiers. Different types of electrodes, equivalent circuits of micro electrode.

Unit – II: BIO-POTENTIAL RECORDING **9 Hours**

ECG, EEG, EMG, PCG, EOG –lead system and recording methods, typical waveforms, frequency spectrum, abnormal waveforms, evoked response.

Unit – III: IMPEDANCE TECHINQUES **9 Hours**

Bipolar and tetra polar circuits, detection of physiological activities using impedance techniques, GSR., cardiac output, neural activities, respiratory activity, impedance plethysmograohy – resistance and capacitance type.

Unit – IV: NON – ELECTRICAL PARAMETERS AND RESIPRATORY MEASUREMENTS **9 Hours**

Respiration, heart rate, temperature, blood pressure, O_2, CO_2 measurements, Spiro meter, BMR apparatus.

Unit – V: 5. BLOOD FLOWMETERS AND BLOOD CELL COUNTING & BIO-CHEMICAL MEASUREMENTS **9 Hours**

EM and ultrasonic blood flow meters indicator dilution method, Thermo dilution method, Manual and Automatic Counting of RBC, WBC and Platelets – Auto analyzer-pH, pCO_2, pO_2, $pHCO_3$ electrophoresis, colorimeter, spectrophotometer, flame photometer.

Total no. of Hours: 45

References:

1. Geddes L.A. and Baker L.E., Principles of applied biomedical Instrumentation, John Wiley and Sons, New York, 1975.
2. Harry E. Thomas, Handbook of Automated Electronic Clinical Analysis, Reston Publishing Company, Virginia, 1979.
3. Heinx Kresse, Handbook of Electro medicine, John Wiley and Sons, Chichester, 1985.
4. Richard A. Normann, Principle of Bio Instrumentation, John Wiley and Sons New York, 1988.
5. Khandpur R.S., Handbook of Biomedical Instrumentation, Tata McGraw Hill Publishing Company, New Delhi, 1999.
6. Webster J.G., Medical Instrumentation, John Widly and sons, New York, 3rd edition, 1999.
7. John Enderle Susan M. Blancharad, Joseph Brozino, Introduction to Biomedical Engineering, Academic press, Sandiego, 1999.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B002 ANATOMY AND PHYSIOLOGY 3 0 0 3

OBJECTIVES

- To study about circulatory and respiratory systems
- Understand the concept nervous and sensory system
- The student will understand about excretory systems & endocrine system

Unit – I: BASICS **9 Hours**

Basic Embryology, Osteology and Myology.

Unit – II: CIRCULATORY AND RESPIRATORY SYSTEMS **9 Hours**

Structure and Functioning of heart, structure and functioning of lungs, trachea and its branches, General circulation, capillary circulation, Venous return, neural control of cardio vascular system, regulation of breathing, carrier of oxygen and carbon dio-oxide, dysponea.

Unit – III: NERVOUS AND SENSORY SYSTEM **9 Hours**

Structure and function of nervous tissues, reflex action afferent nervous system, regulation of posture, physiology of emotion, regulation of temperature, cerebro spinal fluid, Sensory end organs, tongue, mechanism of sight, hearing and smelling.

Unit – IV: DIGESTIVE SYSTEM **9 Hours**

Structure of alimentary canal, related digestive glands, and liver, mechanism of alimentary canal, secretion of digestive fluids, function of liver.

Unit – V: EXCRETORY SYSTEMS & ENDOCRINE SYSTEM **9 Hours**

Structure of kidney, Bladder and colon, Physiology of Perspiration, Physiology of urine formation, Physiology of micturation, Physiology of defascation. Pituitary gland, thyroid and parathyroid glands, pancreas, ovary and testis.

Total No of Hours: 45

References:

1. Best and Tayler, The living body, Bi publications, New Delhi, 1980.
2. J.Gibson, Modern Physiology and Anatomy for nurses, Black Well scientific Publications, 1981.
3. Cyril A. Keele and Eric Neil, Samsons Wright's Applied Physiology, Oxford University Press, Hond Kong, 1983.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B003 BIO SIGNAL PROCESSING 3 1 0 4

OBJECTIVES:

- Understand the basics of signal, system and spectrum
- Capable to understand the concepts of time series analysis and spectral estimation
- The student will be capable of understanding biosignal classification and recognition

UNIT-I: SIGNAL, SYSTEM AND SPECTRUM **12 Hours**

Characteristics of some dynamic biomedical signals – bioelectric signals, impedance., acoustic signals, mechanical signals biomagnetic signals, biochemical signals. Signal conversion-simple signal conversion systems, conversion requirements for bio-medical signals. Basics of digital filtering – FIR and IIR filters. Spectral analysis – power spectral densities function, cross-spectral density and coherence function, cepstral analysis and homomorphic filtering. Estimation of Mean of finite time signal

UNIT-II: TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION **12 Hours**

Time series analysis – linear predication models, process order estimation, lattice representation, non-stationary process, adaptive segmentation, model based ECG simulator. Spectral estimation – Blackman Tukey method, periodogram, and model simulator.

UNIT-III: ADAPTIVE FILTERING AND WAVELET DETECTION **12 Hours**

Filtering – LMS adaptive noise canceling in ECG, improve adaptive filtering in FECG. Wavelet detection in ECG-structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets.

UNIT-IV: BIOSIGNAL CLASSIFICATION AND RECOGNITION **12 Hours**

Signal classification and recognition – statistical signal classification, linear discriminate function, direct features selection and ordering, Back Propagation Neural network based classification.

UNIT-V: SELECTED TOP[ICS IN BIOSINGAL PROCESSING **12 Hours**

Application of wavelet transform on Biosignal –TFR representation, ECG data compression, ECG characterization. Application of Chaos theory on Biomedical signals. Software implementation of signal processing algorithms on biomedical signals

Tutorial hours: 15
Total no. of Hours: 60

References:

1. Wills J Tompkins, Biomedical Digital Signal Processing Prentice Hall, New Jersery, 1993.
2. Samuel D. Steams Ruth A. David, Signal Processing algorithms using Forton and C, Prentice Hall, New Jersery, 1993.
3. Vallaru Rao and Hayagriva Rao, C++ Neural Networks and fuzzy logic, BPS Publicaion, New Delhi, 1996.
4. Special topics on The applications of chaos theory on Biosignal, Journal of IEEE Engg., in Medicine and Biology Magazine, October, 1996.
5. Amon Cohen, Bio-Medical Signal Processing Vol I and II, CRC Press Inc., Boca Raton, Florida 1999.
6. Raghuveer M. Rao and Ajit S. Bopardikar, Wavelets transform – Introduction to Theoryand its Applications, Addision – Wesley, India, 2000.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B004 RADIOLOGICAL EQUIPMENTS 3 0 0 3

OBJECTIVES:

- Understands the concepts of X-Rays
- Capable to analyse tomography and NMR techniques
- Capable to understand Therapy Using X-Rays And Isotopes & Radiation Safety

UNIT-I: X – RAYS **9 hours**

Principle and production of soft X-Rays, Selection of anodes, heel pattern, Scattered radiation, porter-Bucky systems, Cooling System, Testing of various parameters of the unit, principles of Angiography and Fluoroscopic Techniques, Image Intensifiers, single plane and bi plane recording units, digital subtraction angiography, dental X-ray units.

UNIT-II: TOMOGRAPHY **9 hours**

Principle, plane of Movement, Multisection Radiography, Computerised Axial Tomography, Type of detection, image reconstruction, Sprial CT, Transverse Tomography.

UNIT-III: NUCLEAR MAGNETIC RESONANT **9 hours**

Principle, NMR Scanners, Imaging Different Sections of the Body, Tissue Characterization, NMR Spectroscopy.

UNIT-IV: ISOTOPES **9 hours**

Alpa, Beta, Gamma Emission, different types of Radiation Detectors, G.M. & Proportional Counters, Pulse Height Analysers, Isotopic, Scanners, Isotopic Diagnosis of RBC Destruction Rate, GI Bleedings Iron Concentration, Liver Functions, Functions of Gamma camera, PET, SPECT.

UNIT-V: THERAPY USING X-RAYS AND ISOTOPES & RADIATION SAFETY **9 hours**

Direct and Indirect effects of high energy radiation, Units for radiation Exposer, Depth Dose curves, Linear Accelerator Betatron., Cobalt and Cesium Therapy, Computation of Absorbed Dose Level, Automatic Treatment Planning. Safety precautions Hazardous Effects of Radiations, Radiation measuring units, Allowed Levels, ICRP regulation Protection Methods, Radiological equipment specifications with respect to performances for RLE

Total No of Hours: 45

References:

1. Wagner H.N., Principles of Nuclear Medicine, W.B. Saunders Company, Philadelpia, 1969.
2. Chesney D.N. and Chesney M.O., X-Ray Equipments for students Radiographer for students Radiographer, Blackwell scientific Publications, Oxford, 1971
3. Jacobson B. and Webset J.G., Medicine and Clinical Engineering, Prentice Hall India. New Delhi 1979.
4. Alexander, Kalender and Linke, Computer tomography, John Wiley, Chichester, 1986.
5. Steve Webb, The physics of medical Imaging Adam Hilger, Philadelpia, 1988.
6. Peggy W. Roger.D.Ferimarch, MRI for Technologists, Mcgraw Hill Publications, New York, 1995.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B005 HOSPITAL MANAGEMENT 3 0 0 3

OBJECTIVES:

- To familiarize with need and scopes of clinical engineering
- Understand the national health policies
- To be familiar with training and management of technical staff in hospital

UNIT-I: NEED AND SCOPES OF CLINICAL ENGINEERING 9 hours

Clinical engineering program, educational responsibilities, role to be performed by them in hospital, staff structure in hospital

UNIT-II: NATIONAL HEALTH POLICIES 9 hours

Need for evolving health policy, health organization in state, health financing system, health education, health insurance, health legislation

UNIT-III: TRAINING AND MANAGEMENT OF TECHNICAL STAFF IN HOSPITAL 9 hours

Difference between hospital and industrial organization, levels of training, steps of training, developing training program, evaluation of training, wages and salary, employee appraisal method.

UNIT-IV: STANDARDS AND CODES IN HEALTH CARE 9 hours

Necessity for standardization, FDA, Joint Commission of Accreditation of hospitals, ICRP and other standard organization, methods to monitor the standards.

UNIT-V: COMPUTER IN MEDICINE 9hours

Computer application in ICU, X-Ray department, laboratory administration, patient data, medical records, communication, simulation.

Total No of Hours: 45

References:

1. Webster J.C. and Albert M.Cook, “Clinical Engineering Principle and Practice”,Prentice Hall Inc., Englewood Cliffs, New Jersey, 1979 (Unit I).
2. Goyal R.C., “Handbook of hospital personal management”, Prentice Hall of India, 1996 (Unit II – V).

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BL01 BIOMEDICAL ENGINEERING LABORATORY 0 0 2 1

OBJECTIVES: Student will be capable to analyse the patient monitoring system and diathermy

LIST OF EXPERIMENTS

1. Patient monitoring system and Bio-telemetry
2. Plotting of Human auditory response using audiometer.
3. Performance and testing of Surgical Diathermy unit using Diathermy analyzer.
4. Recording of Electromyogram.
5. Construction and testing of Instrumentation amplifier.
6. Electrical Safety testing of equipment using international safety analyzer.
7. Construction and testing of nerve stimulator.
8. Study of HP page writer ECT machine
9. Study of picker EEG machine
10. Bio-Signal processing workstation.
11. Study of magnetic recorder for recording and retrieval of bio-signals

Total no. of Hours: 45

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BL02 BIOMEDICAL SIMULATION LABORATORY 0 0 2 1

OBJECTIVES: Student will be capable to analyse various biomedical signals using simulation package

LIST OF EXPERIMENTS

1. To obtain response for unit step, ramp, impulse and parabolic input signals
2. To study the basic operation on discrete time signals
3. To perform the sampling rate conversion for any discrete signal.
4. To perform linear and discrete convolution
5. To obtain the response of I order low pass filter
6. To obtain the response of II order band pass filter
7. To analysis the ECG waveform using MATLAB
8. To analyze IIR digital filter for ECG using MATLAB
9. To perform Frequency domain analysis of the ECG using MATLAB
10. To perform EEG signal averaging using MATLAB

Total no. of Hours: 45

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B006 **MEDICAL IMAGE PROCESSING** **3 1 0 4**

OBJECTIVES:

- Understands the fundamentals of imaging
- Capable to process the images
- Understands the concept of reconstruction of images

UNIT-I: IMAGE FUNDAMENTALS **12 hours**

Image perception, MTF of the visual system, image fidelity criteria,image model, image sampling and quantization – two dimenstional sampling theory, image quantization, optimum mean square quantizer, image transforms –2D-DFT and other transforms.

UNIT- II: IMAGE PREPROCESSING **12 hours**

Image enhancement–point operation, histogram modeling, spatial operations, transforms operations. Image restoration-image degradation model, inverse and Wiener filtering.

UNIT- III: IMAGE ANALYSIS AND CLASSIFICATION **12 hours**

Image analysis – spatial feature extraction, edge detection, image segmentation classification techniques – statistical methods, neural network approaches.

UNIT- IV: RECONSTRUCTION OF CT AND MRI IMAGES. **12 hours**

Image reconstruction from projections – Radon transforms, filter back projection algorithm, algebraic methods, 3D tomography, imaging methods in CT images, imaging methods in magnetic resonance imagers, Fourier reconstruction of magnetic resonance images.

UNIT- V: TRANSMISSION OF MEDICAL **12 hours**

Medical image data compression and transmission – transform coding pixel coding, predictive coding, interframe coding. Application of image processing techniques in thermography, SPECT, PET, DSA, AI techniques in medical imaging. Biomagnetic diagnosis in connection with medical imaging of CT or MRI. Software implementation of image processing algorithms on medical images, Design consideration for RF cage

Tutorial hours: 15
Total no. of Hours: 60

References:

1. Albert Macouskl, Medical Imaging Systems, Prentice Hall New Jersery, 1983.
2. Gonzalez .R and Wintz .P, Digital Image Processing Addision Wesley Publishing Co. USA, 1987.
3. Eric Krestel Imaging Systems for Medical diagnosis, Siemens Aktlengesellschaft, FRG, 199.
4. Alfred Horowitz MRI Physics for Radiologists – A Visual Approach, Springer Verlag, New York, II Edition, 1991.
5. Anil K. Jain, Fundamental of Digital Image Processing, Prentice Hall of India Pvt Ltd., New Delhi, 1995.
6. M.A. Sid Ahmed, Image Processing, theory Algorithms and Architectures, Mcgraw Hill Book Company Siongapore, 1995.7.G.W. Awock and R. Thomas " Applied Image Processing", Mcgraw Hill book company, Singapore 1996.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B007 BIO-MEDICAL EQUIPMENTS & DEVICES 3 0 0 3

OBJECTIVES:

- Understands the concepts of Cardiac care units
- Students will lern about various equipments
- To be familiar with recent trends and electrical safety of biomedical equipments

UNIT- I: CARDIAC CARE UNITS **9 hours**

Pace makers – different types, batteries for pace makers, AC defibrillators, asynchronous and synchronous DC defibrillators, patient monitoring system.

UNIT- I: NEUROLOGICAL EQUIPMENTS **9 hours**

Stereo toxic unit, depth recording system, dot scanners, transcutaneous nerve stimulator, anesthesia Monitor, EEG controlled Anesthesia, Bio Feedback Equipments, Spinal Reflex Measurements, Front end devices for all Biomedical Equipments

UNIT- I: DIATHERMY AND STIMULATOR **9 hours**

Depth of penetration and physiological effects of H.F. radiation, short wave, Ultrasonics, and Micro Wave Diathermy, Surgical Diathermy, Physiological effects of stimulation, Galvanic, Farradical Surged types, Interfrantial Therapy.

UNIT- I: BIO-TELEMETRY **9 hours**

Principal, frequency selection for Telemetry, radio pills, multiplexing and tracking techniques, Telestimulation

UNIT- I: RECENT TRENDS & ELECTRICAL SAFETY **9 hours**

Principles of Thermography, detecting circuits, its application in medicine, principles of Cryogenic Techniques, its application in medicine, Principles of Fiber optic cable, Endoscopy, Laproscopy, Opthaimic Equipments. Micro and macro shock, sources of shock, monitoring and interrupting circuit from leakage current, Earthing scheme.

Total no. of Hours: 45

References:

1. Albert M. Cook and Webster J.G., Therapeutic Medical Devices, Prentice Hall Inc., New Jersery, 1982.
2. Feinberg B.N. Applied Clinical Engineering, Prentice Hall Inc., Engiewood Cliffs, New Jersery, 1986
3. Khandpur R.S. Handbook of Biomedical Instrumentation. Tata McGraw Hill Publishing company, New Delhi 1999.
4. Jacobson B. and Webster. J.G. Medicine and Clinical engineering, Prentice Hall of India, New Delhi, 1999
5. Leslie Cromwell, etal., Biomedical Instrumentation and measurements, Prentice Hall India, New Delhi, 2000

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B008 COMPUTER BASED MEDICAL INSTRUMENTATION 3 1 0 4

OBJECTIVES:

- To understand the concept of microcontrollers
- To be familiar with computers inpatient monitoring
- Students understands the concepts of medical equipments system

UNIT- I: INTRODUCTION **12 hours**

8086 Architecture – system connections and timing – Instruction set and assembly language programming. Macro assemblers – BIOS and DOS Services – memory and I/O interfacing – Advanced Intel 32 bit processors.

UNIT- II: MICROCONTROLLERS **12 hours**

Introduction – 8051 architecture and programming, micro controller based medical systems – TMS 320 series – architecture and programming – applications in bio-signal processing – IDE51 – C Cross Assemblers.

UNIT- III: SYSTEM DESIGN **12 hours**

Multichannel computerized ECG, EMG and EEG data acquisition –storage, analysis and retrieval techniques – Medical image acquisitions through video –card – storage and retrieval techniques – Moderns and computer networking in the hospital.

UNIT- IV: COMPUTERS IN PATIENT MONITORING **12 hours**

Physiological monitoring – automated intensive care units – computerized arrhythmia monitoring – information flow in a clinical lab – computerized concepts – interfacing to HIS.

UNIT- V: MEDICAL EQUIPMENTS SYSTEM **12 hours**

Microprocessor based medical system – pulmonary instrumentation – anesthesia machine –EEG system – microprocessor based blood pressure monitor – prosthetic systems – bio- chemical measuring systems and micro processor based medical devices – Radiological Information system.

Tutorial:15
Total no. of Hours: 60

References:

1. Kenneth J. Ayala, The 8051 Micro Controller – Architecture Programming And Applications, Second Edition, Penram International, 1996.
2. Douglas V. Hall, Microprocessors and Interfacing: Programming and hardware, Mcgrase Hill, Singapore, 1999.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B009 LASER & ULTRASONIC APPLICATIONS IN MEDICINE 3 1 0 4

OBJECTIVES:

- Able to understand about LASER
- Capable to analyze the concepts of ultrasonic
- To be familiar with holographic application in medicine

UNIT -I: LASER **12 Hours**

Principles of Laser action, different types and of lasers and its operation, Applications of Laser in Biology, Dentistry, Ophthalmology, Dermatology, Medicine, Surgery, Interferometer Applications, Flurorescence studies in cancer Diagnosis, Laser in Genetic Engineering, Low power applications in Medicine.

UNIT -II: ULTRASONICS **12 Hours**

Different Modes of Display, A B, C, scanning Techniques, Absorption in biological Tissues, Measurement of Ultrasonic Energy, Construction of Ultrasonic probe, Ultrasonic Imaging in Abdomen, Breast, Heart, Chest, Eye, Kidney, Skull, Pulsatile Motion, Pregnant and non-Pregnant uterus.

UNIT -III: ULTRASONIC SCANNERS **12 Hours**

Real Time Echo, 2-D Scanners, Colour Doppler.

UNIT -IV: HIGH ENERGY ULTRASONICS **12 Hours**

Effects due to High energy ultrasonics applications in Surgery, Cell destruction, Cleaners.

UNIT -V: HOLOGRAPHIC APPLICATION IN MEDCINE **12 Hours**

Wave front Recording and Reconstruction, Recording Media, Image forming application, Motion Induced Constrast, correlation filtering, Holograms using Ultrasonic signals and Hologram using Lasers.

Tutorials:15

Total no. of Hours: 60

References:

1. Leon Goldman, M.D., & R. Jamies Rockwell, Jr. Lasers in medicine Gordon and breach, science publishers Inc., New York, 1971.
2. Brown Y.H.V. and Dickson J.F. (Eds), Advances in Bio – Medical Engineering Volume II and V, Academic press, London, 1972.
3. Georg W. Stroke, Kock W.E., Ultrasonic Imaging and Holography, plenum press, New York, 1974.
4. Mertellucci S. S,. and Chester A.N. Laser Photo biology and photo medicine, plenum press, New York, 1989.
5. Wolbarsht M.L., Laser Application in Medicine and Biology, Plenum press, New York, 1989.

MBM16BL03 COMPUTER BASED MEDICAL INSTRUMENTATION LABORATORY 0 0 2 1

OBJECTIVES:

- Students will be capable to perform simulations of various biomedical signals

LIST OF EXPERIMENTS:

1. Representation of basic discrete time signals
2. Computation of convolution –linear convolution
3. Response of a difference equation to initial conditions; stability
4. DFT and FFT computation
5. FIR filter design using windowing techniques
6. IIR filters design-digital Butterworth filter and Chebyshev filter
7. Simulation of signals.
8. Simulation of ECG signals.
9. Simulation of EEG signals
10. Simulation of EMG signals

Total no. of Hours: 45

M.Tech –Biomedical Instrumentation (Full Time)

MEE16PL04 **SCHOLARLY WRITING SKILLS** **0 0 2 1**

OBJECTIVES:

- The student will be familiar with research articles
- The student will learn the nuances of writing a research article
- The student will be capable of paraphrasing and summarizing the research findings

TOPICS TO BE COVERED

- What is a research paper?
- Steps in writing research paper
- Structure of a research paper
- Choosing a Topic
- Narrowing and Limiting the Topic
- Finding and Selecting Sources (Book, Article, Other)
- Proposing a Working Thesis
- Note Taking
- Outlining
- Referencing
- Final Organization of Paper
- Final Drafting (Putting It All Together)
- Proof Reading

Total no. Hours 45

Evaluation Process:

The student needs to select any one of the core theory paper and draft a scholarly article on the same in IEEE template and submit the same for evaluation in the department at the end of the semester

Note: Technical English will also be play an important role in evaluation

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B010 BIOLOGICAL EFFECTS OF RADIATION 3 1 0 4

OBJECTIVES:

- To understand the effect of radiation in living cells
- To understand the somatic application and genetic effects of Radiation
- To understand the effect of microwave, RF & UV radiation

UNIT- I: ACTION OF RADIATION ON LIVING CELLS **12 hours**

Various theories related to radiation at cellular level, DNA and chromosomal damages, experiments on computation of various parameters related to this radiation exposure.

UNIT- II: SOMATIC APPLICATION OF RADIATION **12 hours**

Radiosensitivity protocols of different issues of human, LA\D 50/30 effective radiation on skin, bone marrow, eye, endocrine glands, basis of radiotherapy.

UNIT- III: GENETIC EFFECTS OF RADIATION **12 hours**

Thresholds and linear dose, gene control hereditary diseases, effect of dose and I Infleneceson genetic Equilibrium.

UNIT- IV: EFFECT OF MICROWAVE AND RF WITH MATTERS **12 hours**

Effects on various human organs and systems, wavelength in tissues, nonthermal interaction, low frequency radiation, measurement devices used to compute the thermal effects, standards of protection, national and international standards and precautions.

UNIT- V: UV RADIATION **12 hours**

Classification of sources, measurement, photo medicine, UV radiation safety Visibleand infrared radiation, combined effect of UV and IR, dose measuring instruments sed safety standards for this radiation

Tutorials:15

Total no. of Hours: 45

References:

1. Glasser.O. Medical Physics, vol I, II, III, The year book Publishers Iinc., Chicago, 1980.
2. Baranski.S and Cherski.P, Biological effects of microwave, Hutchison and Ross Inc., Stroudsburg, 1980.
3. Moselly.H non-ionizing Radiation, Adam-Hilgar, Bristol, 1988.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16B011 RECENT ADVANCES APPLIED TO HOSPITAL ENGINEERING 3 1 0 4

OBJECTIVES:

- Understands the standardization of hospital equipments
- Familiarize with fibre optic sensors for measuring physiological parameters
- To understands the concept of EMI and EMC applied to hospital equipments

UNIT- I: STANDARDISATION OF HOSPITAL EQUIPMENTS 12 Hours

Need for standardization, classification of equipments, international standards, Experimental methods of testing standards, maintenance of standards and recalibration.

UNIT- II: CLINICAL ENGINEERING 12 Hours

Hospital design, electrical, air – conditioning, sanitation, ventilation, safety regulation to be incorporated in the hospital center, management and legal aspects, latest rug delivery systems for sustained delivery of medicines.

UNIT- III: NETWORKING 12 Hours

Importance 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.

UNIT- IV: FIBRE OPTIC SENSORS FOR MEASURING PHYSIOLOGICAL PARAMETERS 12 Hours

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 activites, principles of smart sensors.

UNIT- V: EMI AND EMC APPLIED TO HOSPITAL EQUIPMENTS 12 Hours

Principles of EMI, computation of EMI, measuring techniques to quantify the level of interference, method of suppressing and isolating this unit from interference.

Tutorials:15
Total no. of Hours: 45

References:

1. Donald R.J. White, A Handbook of electromagnetic Interference and Compatibility, Vol 4,5, Published by Donwhite Constant – Maryland, 1972.
2. Webster J.G. and Albert M. Cook, Clinical Engineering Principles and Practices Printice Hall Inc, Englewood Cliffs, New Jersery, 1979.
3. Bernhard Keiser, Principles of Eletromagnetic Compatibility, Artech House- 3rd Edition, 1986.
4. Eric Udd, Fiber Optic Sensors and introduction for engineers and scientists, Wiley Interscience Publication, New Delhi, 1991.
5. Bajbai, P.K. Ceramic – a novel device for sustained long term delivery of drugsBio Ceramic Vol III, Rose Heliman Institute of Technology, Terrahaute, Indian, 1992.
6. S.K. Basandia, Local Area Network, Golgotia Publishing Pvt Ltd., New Delhi, 1995.

M.Tech –Biomedical Instrumentation (Full Time)

MEE16PL05 **MEDICAL IMAGE PROCESSING LABORATORY** **0 0 2 1**

OBJECTIVES:

- Students are capable to process the various image processing using MATLAB software

LIST OF EXPERIMENTS

1. Analysis of Bio-signals.
2. Analysis of ECG signals.
3. Analysis of EEG signals
4. Analysis of EMG signals
5. To obtain the response of I order low pass filter
6. To obtain the response of II order band pass filter
7. To analysis the ECG waveform using MATLAB
8. To analyze IIR digital filter for ECG using MATLAB
9. To perform Frequency domain analysis of the ECG using MATLAB
10. To perform EEG signal averaging using MATLAB

Total no. of Hours: 45

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BE01 HUMAN ASSIST DEVICES 3 0 0 3

OBJECTIVES:

- Understand the concepts of heart lung machiesn and artificial heart
- To be familiar with cardiac assist devices
- To be able to analyse prosthetic and orthodic devices

UNIT- I: HEART LUNG MACHIESN AND ARTIFICIAL HEART **9 hours**

Condition to be satisfied by the H/L System. Different types of Oxygenerators, 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.

UNIT- II: CARDIAC ASSIST DEVICES **9 hours**

Synchronous Counter pulsation, Assisted through Respiration Right Ventricular Bypass Pump, Left Ventricular Bypass Pump, Open Chest and closed Chest type, Intra Aortica Veno Pumping, Prosthetic Vardio Valves, Principles and problem, Biomaterials for implantable purposes, its characteristics and testing

UNIT- III: ARTIFICIAL KIDNEY **9 hours**

Indication and Principles of heamodynalisis, Membrane, Dialasate, Different Types of hearmodialisers, Monitoring systems, Wearable Artificial Kidney, Implanting Type.

UNIT- IV: PROSTHETIC AND ORTHODIC DEVICES **9 hours**

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

UNIT- V: RESPIRATORY AIDS **9 hours**

Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters. Audiograms, Types of Deafness Conductive and Nervous, Hearing Aids, Construction and Functional Characteristics.

Total no of hours: 45

References:

1. Leving S.N.(Ed.), Advances in Bio Medical Engineering and Medical physics. Volumes I, II and IV, Inter University Publications, New York, 1968.
2. Kolff W.J., Artificial Organs, John Wiley and Sons, New York 1979.
3. Andreas, F.Von racum, Hand book of bio material evaluation, Mc-Millan publishers, 1980.
4. Albert M. Cook and Webster J.G., Therapeutic Medical Devices, Prentice Hall Inc., New Jersery, 1982.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BE02 ADVANCED NEURAL COMPUTING 3 0 0 3

OBJECTIVES:

- To understand the fundamental concepts and models of artificial neural systems
- To be familiar with bpn and bam
- Students will understand about genetics algorithm in problem solving and models

UNIT- I: FUNDAMENTAL CONCEPTS AND MODELS OF ARTIFICIAL NEURAL SYSTEMS 9 Hours

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

UNIT- II:BPN AND BAM 9 Hours

Back Propagation Network, Generalised Delta Rule, BPN Application, Back – propagation Simulator, Associative Memory Definition, BAM, Hopfield Memory, simulating the BAM, Simulated Annealing – Boltzmann Machine, Boltzmann Simulator.

UNIT- III:OTHER NETWORKS AND APPLICATIONS 9 Hours

Counter propagation Network, Feature Mapping, Self Organizing Feature Maps, Adaptive Resonance Theory (ART) Network Descriptions, Applications in Medical diagnosis.

UNIT- IV:OVERVIEW OF GENETIC ALGORITHMS & IMPLEMENTATION TECHNIQUES 9 Hours

The Appeal of Evolution, Search Spaces and Fitness Landscapes, Elements of Genetic Algorithms, Data Structures, Adaptive Encoding. Selective Methods, Genetic Operators, Fitness Scaling, Multiparameter mapping, Advanced Operators and Techniques

UNIT- V: GENETICS ALGORITHM IN PROBLEM SOLVING AND MODELS 9 Hours

Data Analysis and Prediction Evolving of Neural Networks, Modeling, Interactions between learning and evolution. Applications in biomedical signal analysis and Medical diagnosis

Total no. of Hours: 45

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. Skapra, Neural, Networks, Addison – Wesely, India 1999.
6. Jacek M. Zurada, Introduction to Artificial Neural Networks, Jaico Publishing House, India 1999.
7. Donna L. Hudson, Maunee E. Cohan, Neural Networks & Artificial Intelligence for Biomedical Engg., Prentice Hall of India, New Delhi, 2001.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BE03 HEALTH, HOSPITAL AND EQUIPMENT MANAGEMENT 3 0 0 3

OBJECTIVES:

- To understand the basics of health system
- Students understands the regulatory requirement and health care codes
- Capable to analyze equipment maintenance management

UNIT- I: HEALTH SYSTEM **9 hours**

Health organization of the country, the State the Cities and the Region, Health financing System, Organization of Technical Section.

UNIT- II: HOSPITAL ORGANISATION AND MANAGEMENT **9 hours**

Management of Hospital Organization, Nursing Sector, Medical Sector, Central Service, Technical Department, Definition and Practice of Management by Objective, Transactional Analysis Human Relation in Hospital, Importance of Team work, Legal aspect in Hospital Management.

UNIT- III: REGULATORY REQUIREMENT AND HEALTH CARE CODES **9 hours**

FDA Regulation, Joint Commission of Accreditation for Hospitals, National Fire Protection Association Standard, IRPC.

UNIT- IV: EQUIPMENT MAINTENANCE MANAGEMENT **9hours**

Organizing 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 PERSONEEL **9 hours**

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

Total no. of Hours: 45

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 Jersery, 1979.
3. Antony Kelly, Maintenance Planning and Control, Butterworths, London, 19804.
4. Hans Pfeiff, Vera Dammann (Ed.), Hospital Engineering in Developing Countries, Zreport, Eschborm, 1986.
5. Jacob Kline, Handbook of Bio Medical Engineering, Academic Press Inc., SanDeigo 1988.
6. R.C. Goyal, Handbook of Hospital Personnel Management, Prentice Hall of India, 1993.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BE04 MEDICAL INFORMATICS 3 0 0 3

OBJECTIVES:

- Familiarity to biomedical information technology
- Understands the concepts of hospitals information systems
- Capable to analyse visual programming and multimedia information systems of hospitals information systems

UNIT- I: BIOMEDICAL INFORMATION TECHNOLOGY **9 Hours**

Historical highlights of Healthcare Information systems – Biomedical Information systems – problems and pitfalls – History and evolution of Electric resources – Internet and Interactive Multimedia components.

UNIT- II: OVERVIEW OF COMPUTER HARDWARE **9 Hours**

Motherboard and its logic – memory and I/O interfacing, memory and I/O map, I/O peripherals and add-on cards, RS 232-C and various IEEE standards.

UNIT- III: HOSPITALS INFORMATION SYSTEMS **9 Hours**

Concept of HIS and its Position on the hospital – introduction of a computerized HIS-application of HIS in project management – Automation of Medical record – hospital Inventory data protection aspects – costs and benefits of HIS – transfer of information within the hospital – Modems and computer networking in Hospitals.

UNIT- IV: VISUAL PROGRAMMING AND MULTIMEDIA INFORMATION SYSTEMS **9 Hours**

Visuals Basic principles and programming – Design, Production and testing of multimedia based medical information systems.

UNIT- V: INTEGRATED MEDICAL INFORMATION SYSTEMS **9 Hours**

Integration of Intra and Inter hospital information systems – Role of expert systems and fuzzy logic in medical information systems – Physiological system modeling and simulation – Concepts of Virtual reality, web based multimedia information systems – video conferencing.

Total no. of Hours: 45

References:

1. S.K. Chauhan,. “PC Organisation”, S.K. Kataria and sons, Delhi.
2. Haroid sackman, “Biomedical Inforamtion Technology, Academic Press, New York, 1997.
3. Mary Beth Fecko, “Electronic Resources: Access and Issues, Bowker-saur, London, 1997.
4. R.D. Lele, “Computers in medicine”, Tata McGraw Hill, New Delhi, 1999.
5. Tay Vaughan, “Multimedia making it work”, Tata McGRaw Hill, New Yotk, 1999.
6. Mark Spenik, “Visual Basic 6, Iterative Course”, Techmedia, New Delhi, 1999.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BE05	**REHABILITATION ENGINEERING**	**3**	**0**	**0**	**3**

OBJECTIVES:

- Familiarity to rehabilitation technology
- To understand the concept of rehabilitation medicine
- Familiar with rehabilitation therapy

UNIT- I: REHABILITATION TECHNOLOGY **9 Hours**

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

UNIT- II: REHABILITATION SCIENCE **9 Hours**

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

UNIT- III: REHABILITATION ADVOCACY **9 Hours**

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

UNIT- IV: REHABILITATION MEDICINE **9 Hours**

Physiological aspects of functional recovery, neurological and physiological aspects,

UNIT- V: REHABILITATION THERAPY **9 Hours**

rehabilitation therapies training to restore vision auditory and speech.

Total no. of Hours: 45

References:

1. Reswick.J.What is Rehabilitation Engineering?, Annual Review of rehabilitation – volume 2 springer – verlag, New York, 1982.
2. Robinsion.C.J, Rehabilitation Engineering Handbook of electrical engineering, CRC Press, Bocaraton, 1993.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BE05 SYSTEM THEORY APPLIED TO BIO-MEDICAL ENGINEERING 3 0 0 3

OBJECTIVES:

- Familiarity to transfer function
- Understands impedance concept
- Capable to analyse feedback & simulation of biol,ogical systems

UNIT- I: INTRODUCTION **9 Hours**

System Concept, System Properties, Piece –Wiser Linear Approximation, Electrical Analog for Compliance, Thermal Storage, Mechanical Systems, Step response of a Resistance/Compliant Systems, Pulse Response of First Order System.

UNIT- II: TRANSFER FUNCTION **9 Hours**

System as an Operator use of Transfer Function, bioengineering of a Coupled System, Example of Transformed Signals.

UNIT- III: IMPEDANCE CONCEPT **9 Hours**

Circuits for the Transfer Function with Impedance Concept Prediction of Performance.

UNIT- IV: PERIODIC SIGNALS **9 Hours**

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.

UNIT- V: FEEDBACK & SIMULATION OF BIOL,OGICAL SYSTEMS **9 Hours**

Characterization of Physiological Feedback, System, Uses and Testing of System Stability. Simulation of Skeletal music servomechanism, thermo Regulation, Cardiovascular control System, Respiration controls, Occulo Motor System, Endocrine control system and Modeling of receptors.

Total no. of Hours: 45

References:

1. William B. Blesser, A System Approacg to Biomedicine , McGraw Hill Book Co., New York, 1969.
2. Manfreo Clynes and John H. Milsum, Biomedical Engineering System, McGraw Hill and Co, New York, 1970.
3. Douglas S. Rigg, Control Theory and Physiological Feedback Mechancism, The William and Wilkins Co., Baltimore, 1970.
4. Riechard Skalak and Shu Chien, Handbook of Biomedical Engineering, McGraw Hill and Co., New York, 1987.
5. Michael C.K. Kheo, “Physiological Control System”, Analysis, Simultaion and Estimation”, Prentice Hall of India, New Delhi, 2001.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BE07 PATTERN RECOGNITION AND AI APPLICATION 3 0 0 3

OBJECTIVES:

- Familiarity to pattern recognition
- Understands feature extraction and structural pattern recognition
- Understands recent advances and image applications

UNIT- I: OVERVIEW OF PATTERN RECOGNITION **9 Hours**

Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood estimation – Bavesian parameter estimation –Perceptron Alogorithm – Problems with Bayes Approach – Pattern Classification by distance functions – minimum distance pattern classifier.

UNIT- I: UNSUPERVISED CLASSIFICATION **9 Hours**

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

UNIT- I: FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION **9 Hours**

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

UNIT- I: AI TECHNIQUES **9 Hours**

Search and control strategies – Uniformed search – Informed search – searching AND graphs – Matching techniques – Knowledge for recognition and classification process – visual image understanding – Expert system architectures.

UNIT- I: RECENT ADVANCES AND IMAGE APPLICATIONS **9 Hours**

Learning of neural pattern recognition – Fuzzy logic – Fuzzy logic – Fuzzy pattern classifiers – image segmentation – Credit scoring – Techniques for colon Endoscopy – Target classification of cancer cells – Cancer cells – Cell cytology classification – Mixture modeling of excited and living ovine hearts – bacterial classification.

Total no. of Hours: 45

References:

1. Dudo R.O., and Hart P.g., Pattern Classification and scene analysis, Johnwiley New York, 1973.
2. Elaine Rich, Artificial Intelligence, McGraw Book company, Singapore, 198.
3. Robert Jchalkoff, Pattern recognition: Statistical Structural and Neural approaches, John Wiley and Sons Inc., New Yotk, 1992.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley and sons, New Yotk, 1993.
5. Dan Patterson, Introduction to artificial Intelligence and Expert Systems, Prentice Hall of India, 1997.
6. Andrew Webb, Statiscal Pattern Recognition, Amoid publishers, London, 1999.
7. Donna L Hudson, Maunee E. Cohan, Neural Networks & Artificial Intelligence for Biomedical Engineering, Prentice Hall of India, New Delhi – 2001.

M.Tech –Biomedical Instrumentation (Full Time)

MBM16BE08 SPECIAL TRANSDUCERS AND INSTRUMENTATION 3 0 0 3

OBJECTIVES:

- Familiarity to basic concepts of measurement
- Understands force, pressure and motion measurement concepts
- Capable to understand data acquisition recording

UNIT- I: BASIC CONCEPTS OF MEASUREMENT **9 hours**

Transducer Categories, Characteristics of Transducers Static and Dynamic Characteristics of Measurement.

UNIT- I: FORCE, PRESSURE AND MOTION MEASUREMENT **9 hours**

Various Transducers Capable of Measuring Low Pressure and Force, Its measuring System, External and Catheter tip Transducers, Transducer to Measure Single Movement and Differential Movements, Velocity Transducer, Seismic Pick Up, Accelerometer.

UNIT- I: FLOW MEASUREMENT & CHEMICAL AND OPTICAL TRANSDUCER **9 hours**

Transducer to Measure Velocity, Magnitude and Direction Flow various Methods of measuring these Parameter. Invivo and Invitro Type of Measurements.Ion Sensor, Anion and Cation Sensor, Liquid and solid Ion Exchange Membrance Electrodes, Enzyme Electrodes, Molecular Electrode, Fiber Optic Sensor, Photo Acoustic Sensors, PPG Sensors.

UNIT- I: TEMPERATURE AND RADIATION MEASUREMENT **9 hours**

Various Thermal Sensors Including Integrated Circuit Thermal Sensors, Radiation Thermometry and Chemical Thermometry, Scintillation technique, Gas ionization type films.

UNIT- I: DATA ACQUISITION RECORDING **9 hours**

Signal Conditioners, Single and Multi Channel data acquistion System, DATa Transmission system, Various Types of recorders, Multichannel column display oscilloscope, Multi colour dot scanner, Magentic recorder.

Total no. of Hours: 45

References:

1. Michael R. Newman, David G. Flemming, Physical Sensors for Bio Medical Applications, CRC Press Inc, Flordia, 1980.
2. Rangan C.S., Sarma G.R., And Mani V.S.V., Instrumentation Devices and System, Tata McGraw Hill Publication Company Limited, New Delhi, 1983.
3. Jacob Kline., Handbook of Bio Medical Engineering, Avademic Press Inc., San Diego 1988.
4. George C. Barney, Intelligent Instrumentation, Prentice Hall of India, New Delhi, 1988.
5. Earnest O.Doebelin., Measurement System Application and Design., McGraw Hill, New York, 1990.

M.Tech –Biomedical Instrumentation (Full Time)

MEE16PE10 **RESEARCH METHODOLOGY** **3 0 0 3**

OBJECTIVES:

- Understands the fundamentals of Research
- Attains knowledge to collect Data
- Ability to write Reports & Research Papers

UNIT I: Fundamentals of Research **9 Hours**

Basic principles of research, theory building, facts, concepts, constructs and definitions, Valuable and its attributes, Ethics in research, Preparation of proposal, Review of literature, formation and types of hypothesis and testing of the hypothesis, Research designs, sampling designs, methods, techniques and tools of research

UNIT II: Analysis of Existing Empirical Research **9 Hours**

Needs assessment and program evaluation, including formative and summative assessment-Evidence-based practice-Practice-based evidence-Research methods such as qualitative, quantitative, mixed method, single-case design, action research and outcome-based research- Descriptive and inferential statistical analysis-Ethical and cultural issues in research

UNIT III: Data Collection and Processing **9 Hours**

Types of data and sources – Primary and Secondary data sources - Data analysis for specific type of data - Methods of collection of primary data- Experimental Field – Experimental Laboratory

UNIT- IV: Quantitative Method **9 Hours**

Use of quantitative method in research- Tabulation and graphical representation - Central tendency-Dispersion-Correlation-Regression-Use of chi square-Steps involved in applying chi—square test-Non parametric or free distribution tests-Testing of hypothesis for non parametric data

UNIT V: Communication and Evaluation of Research **9 Hours**

Report writing and the writing of research papers-Presentation of research proposals-Evaluation of research report-Presentation of research-Oral and Written (abstracts/synopsis)- Word processing-Data processing-Graphical processing-Use of web-2 tools for research-Use of excel-Use of SPSS-Use of graphical software- Use of multimedia tools

Total no. of Hours: 45

References:

1. Kothari C R, *Research Methodology : Methods and Techniques* , New age international publishers, 3rd edition, 2014
2. Yogesh Kumar Singh(2006), *Fundamentals of Research Methodology and Statistics*, New age international publishers
3. David Targett(1990), *Quantitative Methods*, Heriot-Watt University
4. Sinha P.K. (2004), *Computer Fundamentals*, BPB Publications, 3rd edition, New Delhi

M.Tech –Biomedical Instrumentation (Full Time)

MEE16PE15 ADVANCED DIGITAL SIGNAL PROCESSING 3 0 0 3

OBJECTIVES:

- To enable the students to get the fundamentals of parametric and non-parametric analysis
- To enable the students to design adaptive filters using different methodologies

UNIT –I: Discrete Random Signal Processing **9 Hours**

Discrete Random Process, Expectation, Variance, Co-Variance, Scalar Product, Energy of Discrete Signal-Parseval's Theorem, Wiener Khintchine Relation-Power Spectral Density –Periodogram – Sample Autocorrelation-Sum Decomposition Theorem, Spectral Factorization Theorem – Discrete Random Signal Processing by Linear Systems-Simulation of White Noise – Low Pass Filtering of White Noise

UNIT – II: Spectrum Estimation **9 Hours**

Non-Parametric Methods-Correlation Method – Co-Variance Estimator – Performance Analysis of Estimators – Unbiased, Consistent Estimators – Periodogram Estimator – Bartlett Spectrum Estimation – Welch Estimation – Model based Approach – AR, MA, and ARMA Signal Modeling – Parameter Estimation using Yule-Walker Method

UNIT – III: Linear Estimation and Prediction **9 Hours**

Maximum likelihood criterion-efficiency f estimator – Least mean squared error criterion – Wiener filter – Discrete Wiener Hoff equations – Recursive estimators-Kalman filter – Linear prediction, prediction error-whitening filter, inverse filter – Levinson recursion, Lattice realization, and Levinson recursion algorithm for solving Teoplitz system of equations

UNIT – IV: Adaptive Filters **9 Hours**

FIR adaptive filters – Newton's steepest descent method-adaptive filter based on steepest descent method – Widrow Hoff LMS adaptive algorithm – Adaptive channel equalizations – Adaptive echo chancellor – Adaptive noise cancellation – RLS adaptive filters –Exponentially weighted RLS – sliding window RLS – Simplified IIR LMs adaptive filter

UNIT – V: Multi Rate Digital Signal Processing **9 Hours**

Mathematical description of change of sampling rate – Interpolation and Decimation –continuous time model – Direct digital domain approach -Decimation by an integer factor – Interpolation by an integer factor – single and multistage realization - Poly phase realization – Application to sub band coding – Wavelet transform and filter bank implementation of wavelet expansion of signals

Total no. of Hours: 45

References:

1. Monson H. Hayes, *Statistical Digital Signal Processing and Modeling*, John Wiley and Sons, Inc., New York, 1996
2. John G. Proakis, Dimitris G. Manolais, *Digital Signal Processing Prentice Hall of India*, 1995
3. Sopocles J. Orfanidis, *Optimum Signal Processing*, McGraw Hill, 1990

M.Tech –Biomedical Instrumentation (Full Time)

MEE16PE018 MICROCONTROLLER BASED SYSTEM DESIGN 3 0 0 3

OBJECTIVES:

- To gain knowledge of the latest microcontrollers like RL78 and PIC16F877A
- To educate on the interrupts, timers, peripheral devices for data communication and transfer
- To gain knowledge to design and build a real-time system performing data-capture, communications, and user interface

UNIT I: Introduction of Rl78 **9 Hours**

Introduction about RENESAS Family of microcontrollers, RL78 Processor Core basics, Block Diagram, Data flow diagram within core, Instruction set, Addressing Modes, RL78 Pipeline structure, Implementation of C language statements in RL78Assembly language, Programming Examples, Software development tools for RL78

UNIT II: Rl78 Interrupts and Timer Peripherals **9 Hours**

RL78 Interrupt mechanism, Interrupt processing activities: both hardware and software with ISR examples, Interrupt Characteristics, RL78 Interrupt vector table, Concurrent Interrupt, External Interrupt. Timers: Timer Array Unit: Independent Channel Operation Modes, Simultaneous Channel Operation Modes - Using PWM Mode to Control a Servo Motor, Programming Examples

UNIT III: Serial Communication **9 Hours**

Basic Concepts: Synchronous, Asynchronous, Example Protocols: CSI, UART, I2C, Serial Array Unit Concept: CSI Mode, UART Mode, Simplified IIC Mode, Serial Communications Device Driver Code, Programming Examples for serial communication

UNIT IV: PIC Microcontroller **9 Hours**

Introduction to PIC Microcontroller, PIC16F877A Architecture, Pin Description, Peripheral Features, Analog Features, Pipelining, Program Memory considerations, Register File Structure, Instruction Set, Addressing modes, Advantages of PIC

UNIT V: Interfacing with PIC Microcontroller **9 Hours**

Interfacing: LCD Display, Keypad Interfacing, Generation of Gate signals for converters and Inverters, Motor Control, Controlling AC appliances, Measurement of frequency, Stand alone Data Acquisition System

Total no. of Hours: 45

References:

1. Alexander, G.,Conrad, M (2012),*Embedded Systems using Renesas RL78 Microcontroller*, Micrium Press
2. Ganssle, J.(2008),*The Art of Designing Embedded systems*, Newnes
3. *RL78 Family User" s Manual*: RENESAS Electronics, 2011
4. http://microcontrollerslab.com/pic16f877a
5. http://www.microchip.com
6. www.circuitstoday.com

M.Tech –Biomedical Instrumentation (Full Time)

MEE16PE05 MEMS TECHNOLOGY 3 0 0 3

OBJECTIVES:

- Understands the concept of MEMs Technology
- Knowledge of MEMs structures
- Ability to design a Microsystems

UNIT I: Introduction to MEMS **9 hours**

Introduction to Micromachining- Material for MEMS- Silicon Compatible Material System- Other materials and substrates – Important material properties and physical effects

UNIT II: MEMS Tools **9 hours**

Processes for Micromachining- Basic Process Tools – Advanced Process Tools – Non lithographic Microfabrication Technologies – Combining the Tools- Examples of Commercial Process

UNIT III: MEMS Structures **9 hours**

General Design Methodology- Techniques for sensing and Actuation –Passive Micromachines Mechanical Structures – Sensors and Analysis Systems – Actuators and Actuated Microsystems-Imaging & Displays- Fiber-Optic Communication Devices

UNIT IV: MEMS Application **9 hours**

Microfluidies for Biological Applications- DNA Analysis- Microelectrode Arrays- Signal Integrity in RF MEMS- Passive Electrical Components – Microelectromechanical Resonators – MEM Switches

UNIT V: Reliability consideration for MEMs **9 hours**

Key Design & Packaging Considerations- Die Attach Processes- Wiring and Interconnects – Types of Packaging Solutions- Quality Control, Reliability and failure Analysis

Total no. of Hours: 45

References:

6. Nadim Maluf, Kirt Williams , *An Introduction to Microelectro mechanical Systems Engineering* Second edition, Artech House, Inc British Library Cataloguing ISBN 1-58053-590-9
7. Stephen D. Senturia, *Microsystem Design* Springer Publisher ISBN 979-0792372462
8. Marc J. Madou, *Fundamentals of Microfabrication and Nanotechnology Volume –II*, CRC Press ISBN : 978-1420055191