M.Tech –Biomedical Instrumentation (Full Time)

Curriculum and Syllabus
2018 Regulation

I SEMESTER						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MMA18007	Applied Mathematics For Instrumentation Engineers	3	1	0	4
2	MBM18B001	Advanced Biomedical Instrumentation	3	0	0	3
3	MBM18B002	Anatomy and Physiology	3	0	0	3
4	MBM18B003	Bio Signal Processing	3	1	0	4
5	MBM18B004	Radiological equipments	3	0	0	3
6	MBM18B005	Health, Hospital and Equipment Management	3	0	0	3
7	MBM18BL01	Biomedical Engineering Laboratory	0	0	2	1
8	MBM18BL02	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	MBM18B006	Medical Image Processing	3	1	0	4
2	MBM18B007	IoT Based Biomedical Engineer	3	0	0	3
3	MBM18B008	Computer based Medical Instrumentation	3	1	0	4
4	MBM18B009	Laser & ultrasonic Applications in medicine	3	1	0	4
5	MBM18BEXX	Elective – I	3	0	0	3
6	MBM18BEXX	Elective – II	3	0	0	3
7	MBM18BL03	Computer Based Medical Instrumentation Laboratory	0	0	2	1
8	MEE18PL04	Scholarly writing skills	0	0	2	1
		TOTAL	**18**	**3**	**4**	**23**

III SEMESTER						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM18B010	Biological effects of Radiation	3	1	0	4
2	MBM18B011	Recent advances applied to Hospital engineering	3	1	0	4
3	MBM18BEXX	Elective – III	3	0	0	3
4	MBM18BEXX	Elective – IV	3	0	0	3
5	MBM18BL04	Medical Image processing Laboratory	0	0	2	1
6	MBM18BL05	Project Phase - 1	0	0	12	3
		TOTAL	**12**	**2**	**14**	**18**

M.Tech –Biomedical Instrumentation (Full Time)

IV SEMESTER						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM18BL06	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**

ELECTIVE - I						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM18BE01	Human Assist Devices	3	0	0	3
2	MBM18BE02	Advanced Neural Computing	3	0	0	3
3	MBM18BE03	Health, Hospital and Equipment Management	3	0	0	3

ELECTIVE - II						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM18BE04	Medical Informatics	3	0	0	3
2	MBM18BE05	Rehabilitation Engineering	3	0	0	3
3	MBM18BE06	Fuzzy System applied to Bio-Medical Engineering	3	0	0	3

ELECTIVE - III						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MBM18BE07	Patter Recognition and AI Application	3	0	0	3
2	MBM18BE08	Special transducers and Instrumentation	3	0	0	3
3	MEE18PE10	Research Methodology	3	0	0	3

ELECTIVE - IV						
S.No	**Subject Code**	**Title of Subject**	**L**	**T**	**P**	**C**
1	MEE18PE15	Advanced Digital Signal Processing	3	0	0	3
2	MEE18PD006	Micro controller based System Design	3	0	0	3
3	MEE18PE05	MEMS Technology	3	0	0	3

MMA18007 APPLIED MATHEMATICS FOR INSTRUMENTATION ENGINEERS 3 1 0 4

OBJECTIVES:

- Understand the concept of advanced matrix and calculus
- Understand the concept of Linear Programming etc
- The student will be capable of understanding transportation, assignment and queuing concepts

UNIT I: ADVANCED MATRIX THEORY **12 hours**

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

UNIT II: CALCULUS OF VARIATIONS **12 hours**

Variation and its properties- Euler's equations- Functionals dependent on First and higher order derivatives- Functionals depend on functions of several independent variables- Problems with moving boundaries- Direct methods- Ritz and Kantorovich methods.

UNIT III: LINEAR PROGRAMMING **12 hours**

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

UNIT IV: TRANSPORTATION AND ASSIGNMENT **12 hours**

Formulation of Transportation problem- North West corner method- Least cost method- Vogel's approximation method- Optimality test- MODI method- Degeneracy- Assignment problem: Hungarian method- Travelling salesman problem.

UNIT V: QUEUING **12 hours**

Elementary concepts- Pure Birth and Death process- Single server Markovian models with infinite and finite capacity- Multi server Markovian models with infinite and finite capacity.

Tutorials: 15
Total no. of Hours: 60

References:

1. Bronson R., Theory and problems of Matrix operations (Schaum's outline series), MCGraw Hill, (1989).
2. Lewis D.W., Matrix Theory, Allied Publishers, (1995)
3. Venkataraman M.K>, Higher Mathematics for Engineering and Science, The National Publishing Co., (2006)
4. Gupta A.S., Calculus of variations with applications, Prentice Hall of India, (2004).
5. Hamdy A. Taha, Operations Research: An Introduction (9^{th} ed.), Pearson (2010).
6. Paneerselvam R., Operations Research (2^{nd} ed.), Prentice Hall of India, (2011).
7. Hillier, Lieberman, Introduction to operations Research (8^{th} ed.) (IAE), Tata McGraw Hill Publishing Co., (2005).

MBM18B001 ADVANCED 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- Electrodes –Limb electrodes –floating electrodes – pre-gelled disposable electrodes

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

Blood pH measurement- Blood pCO2 measurement- Blood pO2 measurement- intra arterial - complete blood gas analyzer – Oximetry - Principle, ear, pulse, skin reflectance, intravascular oximeter.

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

Introduction-medical diagnosis with chemical test – Spectrophotometer – Colorimeter - Auto analyzers - clinical flame photometer - selective ion based electrolytes - Electrical safety in medical environment - shock hazards – leakage current-safety codes-electrical safety analyzer - testing of biomedical equipments.

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.

MBM18B002 **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.

MBM18B003 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.

MBM18B004 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.

MBM18B005 HEALTH, HOSPITAL AND EQUIPMENT 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- INTRODUCTION TO HEALTH CARE MANAGEMENT 9 hours

Overview of health care Management: Management definition-Function and competence-Management position control in the organization HierarchyFocus of management- Role of manager in ensuring high performance- Role of manager in successive planning- Role of manager in health care policyLeadership: Leadership vs Management, Followership- Contemporary model- Leadership style- Leadership competencies- Leadership protocolEthical responsibility.

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: EQUIPMENT MANAGEMENT 9 hours

Maintenance equipment and Tools, failure analysis, spare parts and maintenance materials. Reliability fundamentals- Principles of EMI, computation of EMI, Method of suppressing and isolating the unit from interference.

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).

MBM18BL01 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

MBM18BL02 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

MBM18B006 **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.

MBM18B007 **IOT BASED BIOMEDICAL ENGINEER** **3 0 0 3**

OBJECTIVES:

- Understands the concepts of IoT
- Students will learn about Processors, Communication and Storage
- To be familiar with recent trends of IoT in Hospital

UNIT- I: INTRODUCTION TO IOT & ITS OVERVIEW **9 hours**

Evolution of IOT – Block Diagram – Architecture of IOT – Challenges – IOT in hospitals – configuration and scalability – Efficiency – Quality of service- Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards

UNIT -II: BIOSENSORS **9 hours**

General features of biosensors – biological material – detection device or transducer - types of biosensors – calorimetric biosensors – potentiometric biosensors – acoustic wave biosensors – amperometric biosensors –optical biosensors- e-Health Body Area Networks - Bio Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

UNIT -III: PROCESSORS, COMMUNICATION AND STORAGE **9 hours**

Processors – audrino, raspberry pi – communication techniques in IOT – cloud storage in IOT – data storage in IOT- Application Protocols: MQTT, REST/HTTP, CoAP, MySQL.

UNIT -IV: IOT IN HOSPITAL MANAGEMENT **9 hours**

IOT for inventory management – healthcare work flow optimization - medical device integration – handling of datas from IOT – IOT medical device security – management of virtual devices – remote monitoring of patient's health statistics – remote device configuration and tuning – hospital asset management – predictive device maintenance

UNIT -V: PATIENT MONITORING USING IOT **9 hours**

Blood Analyzers - Immuno-assays - Breast Biopsy Equipment - HIV Detection Systems - Weighing scales - Pulse Oximeter - BP Meter - ECG Ventilators - Blood Glucose Meters - Heart Rate Monitors – Medication Adherence Systems - Dosage Calculation Systems - Activity Tracker - Pedometer - Sleep Apnea Detector - Implants Prostheses MRI/CT/ Ultrasound Scanners- Physiological monitor - Smart-phone based interface of HeartSense- The telemetry system for bio-signal communication

Total no. of Hours: 45

TEXT BOOKS:

1. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, 2017
2. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning

REFERENCES:

1. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , Arshdeep Bahga
2. https://www.journals.elsevier.com/.../special-issue- on-internet- of-things- for-biomedical
3. Designing The Internet of Things : Adrian Mcewen, Hakin Cassimally , WileyIndia, 2013

MBM18B008 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 Processors - Architectures and Memory management - Overview of 8086 based Mother boards.

UNIT- II: MICROCONTROLLERS **12 hours**

Introduction – 8051 architecture and programming, micro controller based medical systems – TMS 320 series – architecture and programming – BIOS – DOS interaction- POST- Functional and Architecture Block diagram of a PC- Memory and I/O map.

UNIT- III: PERIPHERAL INTERFACING AND 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 – Keyboard and Mouse Interfaces - Memory types - RAM - SDRAM and RDRAM, Cache memory, ROM and its types, Flash memory, CMOS semiconductor memory - Adapter Cards - Sound Card, Modem card, Video card Moderns and computer networking in the hospital.

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

Plug-in-data acquisition and Control Boards, - Data acquisition using GPIB and Serial Interfaces and Programming in C -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**

FPGA Design Logics - Virtual Bio- Instrumentation in LABview - Multisim Simulation with bioamplifiers - Mixed signal SoC applications in biomedical applications -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.

MBM18B009 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 FUNDAMENTALS **12 Hours**

Absorption and Emission of Radiation by atoms, Ions and Molecules, Properties of laser –Mono-chromaticity, Coherence, Directionality, Brightness, Pumping mechanism- Optical pumping, Electrical pumping, Laser pumping, Resonators, Q-switching and its methods, Gain switching, Mode locking and its types, Cavity damping, Dosimeter-optical and thermal.

UNIT -II: LASERS IN MEDICINE **12 Hours**

Photo Dynamic Therapy, LASER in Ophthalmology, Dermatology, Neurosurgery, Dentistry, Gynecology, Urology, Angioplasty and Cardiology, Orthopedics, Gastroenterology, Pulmonology- Other advanced applications of LASER

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

Characteristics of sound, properties of ultrasound, sources, wave propagation of ultrasound, generation of ultrasound- Interaction of ultrasound with matter, Transducers matching layer, Non-resonance multi-frequency transducers..

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

Ultrasonic waves – generation and detection of ultrasound –Beam characteristics—attenuation of ultrasound – specific acoustic impedance—reflection at body interfaces---Coupling medium --- interaction ultrasound with tissues-—deleterious effects of Ultrasound- Safety levels of Ultrasound- real time scanners image clarity---Resolution ---axial and lateral resolution ---- Artifacts---Pulse echo imaging ----Obsterics abdominal investigations-Echo cardiograph (UCG) – The Doppler Effect-Doppler Shift---continuous wave Doppler system ---Pulsed wave Doppler systems---duplex scanning-display devices for ultrasonic imaging -Effects due to High energy ultrasonics applications in Surgery, Cell destruction, Cleaners.

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

Applications in medicine: Eco-cardiography, Obstetrics and Gynaecology, Breast imaging and Musculoskeletal structures 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.

MBM18BL03 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

MEE18PL04 **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

MBM18B010 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 & X- RAY RADIATION 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- Dual energy x-ray absortiometry (DXA)- Scanner design and operation- Radiation detectors- Total body composition.

UNIT- II: RADIATION DOSE 12 hours

Radisation dose measurement- dose considerations in helical scanning- Dose in computed 38 tomographic fluoroscopy

UNIT- III: RADIOACTIVITY DETECTORS 12 hours

Radionuclide detection and measurement - Type of detectors – pulsed and current mode - spectroscopy, Gas Filled detectors, Scintillation detectors, Semiconductor detectors, Pulse height spectroscopy, Non– imaging detector applications, Counting statistics

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: BIOLOGICAL EFFECTS OF ULTRASOUND AND ULTRSOUND APPLICATIONS 12 hours

Ultrasound quality assurance, Acoustic power and bio-effects: Acoustic power and intensity of pulsed ultrasound, Biological mechanisms and effects - Applications in medicine: Eco-cardiography, Obstetrics and Gynaecology, Breast imaging and Musculoskeletal structures.

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.

MBM18B011 RECENT ADVANCES APPLIED TO HOSPITAL ENGINEERING 3 1 0 4

OBJECTIVES:

- Understands the standardization of hospital equipments
- Familiarize with networking and hospital safety
- To understands the concept of EMI and EMC applied to hospital equipments

UNIT- I: STANDARDISATION OF HOSPITAL EQUIPMENTS 12 Hours

International and National level policy framework for healthcare facilities – Types of healthcare facilities based on public and private ownership, bed size and type of health care services based on outpatient ,inpatient and diagnostic care - Organizational, function and structure of the hospital- FDA regulations, Accreditation for hospitals - JCI, NABH and NABL, Other regulatory Codes.

UNIT- II: CLINICAL ENGINEERING 12 Hours

Historical highlights and Evolution, Hospital Information System – its characteristics and functional online and offline modules- Health Informatics- Bioinformatics- Medical Informatics- Clinical Informatics- Nursing Informatics- Public Health Informatics- e – health services- Evidence Based Medicine- Bioethics- Virtual Hospital.

UNIT- III: NETWORKING 12 Hours

Importance of networking- LAN features- network topologies- LAN components- network operating system- System Development life cycle- Reasons to use computers in hospital- main categories of information systems in hospitals.

UNIT- IV: HOSPITAL SAFETY 12 Hours

Security & Safety of Hospital -Property, Staff & Patients- Radiation safety- Safety precautions- hazardous effects of radiation- allowed levels of radiation- ICRP regulations for radiation safety- Disposal of Biological waste.

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- Sources of shocks- macro & micro shocks -Hazards, monitoring and interrupting the Operation from leakage current- Elements of fire- causes of fire- Action to be taken in case of fire in a Hospital.

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.

MEE18PL05 **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

MBM18BE01 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.

MBM18BE02 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.

MBM18BE03 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.

MBM18BE04	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 and Evolution-Historical highlights of Healthcare Information systems – Biomedical Information systems – problems and pitfalls – History and evolution of Electric resources – Internet and Interactive Multimedia components- Health Informatics, Bioinformatics, Medical Informatics.

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- Medical Standards for Vocabulary - ICD 10, DRGs, MeSH, UMLS, SNOMED - Healthcare Standards - JCAHO, HIPAA.

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

Bio-information technologies, Semantic web and Bioinformatics, Genome projects - Education and Training - Automation of Medical record – hospital Inventory data protection aspects – costs and benefits – transfer of information within the hospital – Modems and computer networking in Hospitals.

UNIT- IV: VISUAL PROGRAMMING AND JAVA PROGRAMMING **9 Hours**

Visuals Basic principles and programming – Design, Production and testing Design and Development of Hospital Information Systems – Developing front-end, back-end and Client – Server interface programs in Java Environment – SQL.

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

Web Design and programming - Design of Web portal services in medicine-Integration of Intra and Inter medical information systems – Role of expert systems in medical information systems – Physiological system modeling and simulation – Concepts of Virtual reality– 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.

MBM18BE05 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 AND SCIENCE 9 Hours

Selection, design or manufacturing of augmentive or assistive devices appropriate for individual with disability- Knowledge about the basic and clinical research about the variation in the physiological functioning and anatomical structure.

UNIT- II: REHABILITATION MEDICINE AND ADVOCACY 9 Hours

Legal aspect helps the handicapped people in choosing the devices- the provisions available to them in this regard- Physiological aspects of functional recovery- neurological and physiological aspects.

UNIT- III: REHABILITATION THERAPY FOR PROSTHETIC AND ORTHOTIC 9 Hours

Hand and arm replacement- different types of models for externally powered limb prosthetics- Lower limb- Upper limb orthotics and material for prosthetic and orthotic devices- mobility aids.

UNIT- V: REHABILITATION THERAPY FOR AUDITORY AND SPEECH ASSIST 9 Hours

Types of deafness- hearing aids- application of DSP in hearing aids- Cochlear implants- Voice synthesizer- speech trainer.

UNIT- V: REHABILITATION THERAPY FOR VISUAL 9 Hours

Ultra sonic and laser canes- Intra ocular lens- Braille Reader- Tactile devices for visually challenged- Text voice converter- screen readers.

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.
3. Rory A Cooper, An Introduction to Rehabilitation Engineering, CRC press,2006.
4. Albert M.Cook and Webster J.G, Therapeutic Medical devices, Prentice Hall Inc., NewJersy, 1982

MBM18BE05 FUZZY SYSTEM APPLIED TO BIO-MEDICAL ENGINEERING 3 0 0 3

OBJECTIVES:

- Familiarity to Fuzzy System
- Understands fuzzy techniques
- Capable to analyse feedback & simulation of biol,ogical systems

UNIT- I: INTRODUCTION **9 Hours**

Fuzzy sets and fuzzy reasoning- fuzzy matrices-fuzzy functions-decomposition – Fuzzy inference systems Mamdani and Sugeno model,

UNIT- II: Fuzzy Clustering **9 Hours**

Fuzzy clustering- fuzzy c- means algorithm- fuzzy control method- fuzzy decision making.

UNIT- III: Fuzzy Techniques **9 Hours**

Fuzzy logic system and controller, Principle of neuro fuzzy techniques- Artificial neural networks (ANN)

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

Sinusoidal Functions- Sinusoidal Analysis of Instrumentation System- General Description of Natural Frequency Damping- Physical Significance of Under Damped Responses

UNIT- V: FEEDBACK & SIMULATION OF BIOLOGICAL 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. Timothy Ross, Fuzzy Logic with Engineering applications,2nd Edition John Wiley and sons,West Sussex,2004.
2. Manfreo Clynes and John H. Milsum, Biomedical Engineering System, McGraw Hill and Co, New York, 1970.
3. Riechard Skalak and Shu Chien, Handbook of Biomedical Engineering, McGraw Hill and Co., New York, 1987.
4. Michael C.K. Kheo, “Physiological Control System”, Analysis, Simultaion and Estimation”, Prentice Hall of India, New Delhi, 2001.

MBM18BE07 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.

MBM18BE08 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- Errors in the measurements- - Resistive, Capacitive, Inductive, Photoelectric, piezoelectric and mechanoelectronics transducers.

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 Direct and Indirect Methods of Radiation Measurement.

UNIT- I: DATA ACQUISITION RECORDING 9 hours

Signal Conditioners- Single and Multi Channel data acquisition System- DATA Transmission system- Types of recorders- Ink jet, heated stylus, Photographic recorder, Multicolor dot scanners, CRO, storage type, long persistence, digital scope, magnetic tape recorders.

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.

MEE18PE10 **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

MEE18PE15 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

MEE18PD006 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

MEE18PE05 **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