JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.TECH IN BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION
EFFECTIVE FROM ACADEMIC YEAR 2017- 18 ADMITTED BATCH

COURSE STRUCTURE AND SYLLABUS

I Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-1	Physiology for Engineers	25	75	4	0	0	4
PC-2	Medical Instrumentation	25	75	4	0	0	4
PC-3	Analytical Instrumentation	25	75	4	0	0	4
PE-1	Medical Sensors Bioinformatics and Applications Transform Techniques	25	75	**3**	0	0	3
PE-2	Bio-MEMS and Nanotechnology Robotics in Medical Applications Electronic System Design	25	75	**3**	0	0	3
OE-1	***Open Elective – I**	25	75	3	0	0	3
Laboratory I	Biomedical Instrumentation Laboratory	25	75	0	0	3	2
Seminar I	Seminar	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

II Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-4	Advanced Biomedical Signal Processing	25	75	4	0	0	4
PC-5	Medical Image Processing	25	75	4	0	0	4
PC-6	Sensors and Actuators	25	75	4	0	0	4
PE-3	Medical Optics Telemedicine Digital Signal Processors and Architectures	25	75	**3**	0	0	3
PE4	Physiological Control Systems Rehabilitation Engineering Adaptive Signal Processing	25	75	**3**	0	0	3
OE-2	***Open Elective – II**	25	75	3	0	0	3
Laboratory II	Advanced Medical Signal & Image Processing Laboratory	25	75	0	0	3	2
Seminar II	Seminar	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

III Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Technical Paper Writing	100	0	0	3	0	2
Comprehensive Viva-Voce	0	100	0	0	0	4
Project work Review II	100	0	0	0	22	8
Total	**200**	**100**	0	**3**	22	**14**

IV Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Project work Review III	100	0	0	0	24	8
Project Evaluation (Viva-Voce)	0	100	0	0	0	16
Total	**100**	**100**	**0**	**0**	**24**	**24**

***Open Elective subjects must be chosen from the list of open electives offered by OTHER departments.**

 # For Project review I, please refer 7.10 in R17 Academic Regulations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

PHYSIOLOGY FOR ENGINEERS (PC-1)

UNIT -I

General Physiology & Respiratory System Physiology: Cell, Cell junctions, Transport through cell membrane, Homeostasis, Acid base balance. Physiological anatomy of respiratory tract, Pulmonary circulation, Mechanics of respiration, Pulmonary function tests, Ventilation, Exchange of respiratory gases, Transport of respiratory gases, Regulation of respiration, Artificial respiration.

UNIT -II

Renal Physiology: Kidney, Nephron, Juxtaglomerular apparatus, Renal circulation, Urine formation, Concentration of urine, Acidification of urine, Renal function tests, Renal disorders, Micturition, Uro flow studies, Dialysis.

UNIT -III

Cardiovascular System: Introduction to cardiovascular system, Properties of cardiac muscle, Cardiac cycle, Heart sounds, Cardiac murmurs, Electrocardiogram, Vector, Arrhythmia, Cardiac output, Regulation of heart rate, Hemodynamics, Arterial blood pressure, Hemorrhage.

UNIT -IV

GIS & Nervous System: GIS, Functions of stomach, pancreas, liver, intestine, function tests: endoscopies.

Introduction to nervous system, Neuron, Classification of nerve fibers, Properties of nerve fibers, Degeneration & regeneration of nerve fibers, Neuroglia, Receptors, Synapse, Neurotransmitters, Reflex activity, Physiology of pain, Hypothalamus, Electroencephalogram, Physiology of sleep, Epilepsy, cerebrospinal fluid, Autonomic nervous system and ANS tests. Evoked potentials. Cerebral circulation and tests.

UNIT -V

Muscle Physiology: Classification of muscles, Structure of skeletal muscles, Properties of skeletal muscles, Changes during muscular contraction, Neuromuscular junction, Electromyogram & disorders of skeletal muscles. Types of joint- Fibrous, Cartilaginous, Synovial, characteristics of synovial joints, shoulder joint, elbow joint, radioulnar joint, wrist joint, joints of hands and fingers, Hip joint, Knee joint, ankle joint, joints of foot and toes.

TEXT BOOKS:

1. Gerard J. Tortora and Bryan H. Derrickson, “Principles of Anatomy and Physiology”, Wiley 13th Edition
2. J Gibson, “Modern Physiology & Anatomy for Nurses”, Black-well Scientific Publishers, 1981.

REFERENCE BOOKS:

1. Best and Taylor, “Physiological basis of Medical practice, *The Living Body”*, B.I. Publication, 1980.
2. Walter Boron, “Textbook of Medical Physiology”, W.B. Saunders Company, 2008
3. Sujit K. Chaudhuri, “Concise Medical Physiology”, 5th Edition, New Central Book Agency Pvt. Ltd.

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M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

MEDICAL INSTRUMENTATION (PC-2)

UNIT -I

Bioelectric Signals and Electrodes: Sources of biomedical signals, basic medical instrumentation system, PC based medical instruments, General constraints in design of medical instrumentation systems, origin of bioelectric signals, Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG), Electroretinogram (ERG), Recording Electrodes – Electrode-tissue interface, polarization, skin contact impedance, motion artifacts, Silver-Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes.

UNIT -II

Biomedical Recording Systems & Recorders: Electrocardiograph-block diagram, ECG leads, effects of artifacts, multi-channel, ECG machine, Vectorcardiograph, Phonocardiograph-origin of heart sounds, microphones and amplifiers for PCG, Electroencephalograph- block diagram, computerized analysis of EEG, Electromyograph, biofeedback instrumentation.

UNIT -III

Oximeters, Blood Flow & Cardiac Output Measurement: Oximetry- In-vitro & in-vivo, ear oximetry, pulse oximetry, skin reflectance oximeters, intravascular oximeter. Electromagnetic blood flowmeter-principle, square wave electromagnetic flowmeter, Doppler shift ultrasonic flowmeter, flow measurement by Doppler imaging, NMR & Laser Doppler flowmeter, Cardiac output measurement-Indicator & dye dilution technique, impedance method, ultrasound method.

UNIT -IV

Pacemakers & Defibrillator: Need for cardiac pacemaker, external pacemaker, implantable pacemakers-types, ventricular synchronous demand pacemaker, programmable pacemaker, power sources for implantable pacemakers. Need for defibrillator, DC defibrillator, automatic external defibrillator, implantable defibrillators

UNIT -V

Advanced Diagnostic & Therapeutic Instruments: Principle of surgical diathermy & surgical diathermy machine, Electrodiagnosis-Electrotherapy-functional block diagram and working, interferential current therapy. Artificial kidney-Principle and haemodialysis machine. Anesthesia-Need for anesthesia, delivery of anesthesia, anesthesia machine.

TEXT BOOKS:

1. R.S. Khandpur, " Handbook of Biomedical Instrumentation", 2nd Edition, Tata McGraw Hill, 2003
2. John G. Webster, "Medical Instrumentation Application and Design", Willey, 4th edition.

REFERENCE BOOKS:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology" 4th Edition, Prentice Hall, 2001.
2. L. A. Geddes, L. E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition. Willey, 2008
3. Tatsuo Togawa, Toshiyo Tamura and P. Ake Oberg, "Biomedical Transducers and Instruments" 1st Edition, CRC Press, 1997.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

ANALYTICAL INSTRUMENTATION (PC-3)

UNIT -I

Electrochemical Instruments: Basic concepts of Analytical instrumentation, Electro chemical instruments- pH meter, Conductivity meter, Dissolved oxygen analyzers using Polarographic principle, Sodium analyzer, Silica analyzers, Polarographic Instruments.

UNIT -II

Absorption Spectrophotometers-I: UV, VIS spectrophotometers – single beam and double beam instruments, Instrumentation associated with the above spectrophotometers, Sources and detectors,IR SPM-Sources and detectors for IR spectrophotometers, FTIR.

Emission Spectrophotometers-II: Flame emission and atomic absorption spectrophotometer, Atomic emission spectrophotometer, Sources for Flame Photometers and online calorific value measurements.

UNIT -III

Gas and Liquid Chromatographs: Basic principle of gas chromatography, Liquid chromatography, HPLC different types of columns, Detectors, Recorders and associated equipment, Salient features of liquid chromatography, Detectors used, Applications of high pressure liquid chromatography.

UNIT -IV

Gas Analyzers-I: Flue gas analysis using thermal conductivity principle, Katharometer– Oxygen analysers using paramagnetic principle, Zirconium oxide cells, Pollution Monitoring Instruments.

Gas Analyzers-II: CO monitors – NO_x analyser – H_2S analyser system – Industrial analyzer circuits.

UNIT -V

Principle of Nuclear Magnetic Resonance: Instrumentation associated with NMR spectrophotometer– Introduction to mass spectrophotometers, Principle and brief discussion on Electron Spin Resonance (ESR).

Nuclear Radiation Detectors, GM counter, Scintillation counter, Ionization chamber– Solid state detector, Gamma Spectrometry, Industrial application of radiation measurement.

TEXT BOOKS:

1. R.S. Khandpur ,"Analytical Instrumentation", McGraw Hill, 2nd Edition.
2. Willard. Merrit, Dean, D. Van. Nostrand, "Instrumental Method of Analysis", Journal of Chemical Education.

REFERENCE BOOKS:

1. Skoog D.M and West D.M, "Principles of Instrumental Analysis", Helt Saunder Publication
2. B.G. Liptak, "Process Measurement and Analysis", CRC Press.
3. E.B. Jones, "Instrument Technology", Butterworth Scientific Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

MEDICAL SENSORS (PE-1)

UNIT -I

Principles of Transduction and Measurement: Sensor Classification, Medically significant measurands- strain, force, pressure, acceleration, flow, volume, temperature and biopotentials. Functional specifications of medical sensors; static and dynamic characteristics of measurement systems. Primary sensors.

UNIT – II

Resistive Sensors: Potentiometers, Strain gages, RTDs, Thermistors, LDR. Signal conditioning. Wheatstone bridge, balance and deflection measurements. Instrumentation amplifier. Interference types and reduction. Shield grounding. Isolation amplifiers.

UNIT -III

Reaction Variation and Electromagnetic Sensors: Capacitive sensors, inductive sensors, LVDT, electromagnetic sensors. Signal conditioning, AC bridges, AC amplifiers, electrostatic shields, carrier amplifiers, phase-sensitive detectors.

UNIT -IV

Self-Generating Sensors: Thermoelectric sensors, thermocouples, piezoelectric sensors, photovoltaic sensors. Signal conditioning. Chopper and low-drift amplifiers, Noise in op-amps. Digital sensors. Telemetry and data acquisition.

UNIT -V

Bio Micro Electro Mechanical Systems (BioMEMS): Principles, design, fabrication and application of micro- and nano-devices to instrument and control biological molecules, living cells, and small organisms. Development of micro fabricated systems, lab-on-a-chip, and micro- and nano-biosensors.

TEXT BOOKS:

1. Ramon Pallas-Areny and John G. Webster, “Sensors and signal conditioning”, John Wiley and Sons, 1991.
2. DVS Murthy, “Transducers for Instrumentation Systems”, 2nd Edition, Prentice Hall of India Ltd, 2004

REFERENCE BOOKS:

1. John G. Webster, “Medical Instrumentation-Application, and Design”, John Wiley and Sons Inc., 3rd Edition. 2003.
2. Rangan C.S., Sarma G.R., and Mani V.S.V., “Instrumentation devices and system”, Tata McGraw Hill Publishing Company limited, New Delhi, 2006.
3. A.P.F. Turner, I. Karube & G.S. Wilson, “Biosensors: Fundamentals & Applications”, Oxford University Press, Oxford, 1987.
4. L.A. Geddes, L.E. Baker, ”Principles of Applied Biomedical Instrumentation”, 3rd Edition, Wiley, 2008

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M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

BIOINFORMATICS AND APPLICATIONS (PE-1)

UNIT -I

The Central Dogma & XML (Bio XML) for Bioinformatics: Watson's definition, information flow, from data to knowledge, Convergence, the organization of DNA, the organization of Proteins, Introduction, Differences between HTML and XML, fundamentals of XML, fundamentals of XML namespaces. Introduction to DTDs, Document type Declarations, Declaring elements, declaring attributes, working with entities XML Schemas, Essential Concepts, working with simple types, working with complex types, Basic namespaces issues.

UNIT -II

Perl (Bioperl) for Bioinformatics: Representing sequence data, program to store a DNA sequence, concatenating DNA fragments, Transcription, Calculating the reverse complement in Perl, Proteins, files, reading proteins in files, Arrays, Flow control, finding motifs, counting Nucleotides, exploding strings into arrays, operating on strings, writing to files, subroutines and bugs.

UNIT -III

Databases: Flat file, Relational, object oriented databases, object Relational and Hypertext, Data life cycle, Database Technology, Database Architecture, Database Management Systems and Interfaces.

UNIT -IV

Sequence Alignment Algorithms: Biological motivations of sequence analysis, the models for sequence analysis and their biological motivation, global alignment, local alignment, End free-space alignment and gap penalty, Sequence Analysis tools and techniques.

UNIT -V

Phylogenetic Analysis: Introduction, methods of Phylogenetic analysis, distance methods, the neighbor- Joining (NJ) method, The Fitch/ Margoliash method, character-based methods, Other methods, Tree evaluation and problems in phylogenetic analysis, Clustering, Protein structure visualization and Protein structure prediction.

TEXT BOOKS:

1. S.C.Rastogi, N. Mendiratta, "Bioinformatics Methods and Applications", CBS publications, 2004
2. James D. Tisdall, "Beginning Perl for Bioinformatics" O'Reilly media, 1st Edition, 2001

REFERENCE BOOKS:

1. D.R. Westhead, J.H. Parish, "Bioinformatics" Viva books private limited, New Delhi (2003)
2. Att Wood, "Bioinformatics" Pearson Education, 2004
3. Bryan Bergeron, M.D, "Bioinformatics Computing" Pearson Education, 2003

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M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

TRANSFORM TECHNIQUES (PE-1)

UNIT -I

Fourier Analysis: Vector space, Hilbert spaces, Fourier basis, FT- Limitations of Fourier Analysis, Need for time-frequency analysis, DFT, 2D-DFT: Definition, Properties and Applications, IDFT, Hilbert Transform, STFT.

UNIT -II

Transforms: Walsh, Hadamard, Haar and Slant Transforms, DCT, DST, KLT,– definition, properties and applications

UNIT -III

Continuous Wavelet Transform (CWT): Short comings of STFT, Need for wavelets, Wavelet Basis- Concept of Scale and its relation with frequency, Continuous time wavelet Transform Equation- Series Expansion using Wavelets- CWT- Tiling of time scale plane for CWT. Important Wavelets: Haar, Mexican Hat, Meyer, Shannon, Daubechies.

UNIT -IV

Multi Rate Analysis and DWT: Need for Scaling function – Multi Resolution Analysis, Two-Channel Filter Banks, Perfect Reconstruction Condition, Relationship between Filter Banks and Wavelet Basis, DWT, Structure of DWT Filter Banks, Daubechies Wavelet Function, Applications of DWT.

UNIT -V

Special Topics: Wavelet Packet Transform, Multidimensional Wavelets, Bi-orthogonal basis- B-Splines, Lifting Scheme of Wavelet Generation, Multi Wavelets

TEXT BOOKS:

1. Raghuveer M.Rao and Ajit S. Bopardikar, “Wavelet Transforms-Introduction theory and applications” Pearson Edu, Asia, New Delhi, 2003.
2. Soman. K. P, Ramachandran. K.I, “Insight into Wavelets from Theory to Practice” Printice Hall India, 1st Edition, 2004.

REFERENCE BOOKS:

1. Jaideva C Goswami, Andrew K Chan, “Fundamentals of Wavelets- Theory, Algorithms and Applications” John Wiley & Sons, Inc, Singapore, 1999.
2. Vetterli M. Kovacevic, “Wavelets and Sub-band Coding”, PJI, 1995.
3. C. Sydney Burrus, “Introduction to Wavelets and Wavelet Transforms”, PHI, 1st Edition, 1997.
4. Stephen G. Mallat,v, ”A Wavelet Tour of Signal Processing” , Academic Press, 2nd Edition
5. S.Jayaraman, S.Esakkirajan, T.Veera Kumar, “Digital Image Processing” , TMH, 2009

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M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

BIO-MEMS AND NANOTECHNOLOGY (PE-2)

UNIT -I

Mems and Microsystems: Mems and Microsystems-General principles, advantages, materials used-properties, Technology involved in MEMS. Fabrication techniques- Lithography- etching- Ion implantation- wafer bonding. Integrated processing- Bulk Micro machining- Surface micro machining-coating technology and CVD- LIGA process.

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UNIT -II

Microsensors and Microactuators: Microsensors and Microactuators –working principle, types-pressure sensors, thermal sensors and actuators, piezoelectric crystals-Intelligent materials and structures, Magnetic sensors and actuators- magnetic materials used for MEMS.

UNIT -III

Mems and Microfluidic System: Principle of MOEMS- light modulator, beam splitter, digital micro mirror device, light detectors and optical switch. Micro fluidic System- Fluid actuation method, dielectrophoresis, micro fluid dispenser, micro needle, micro pumps. Application of BioMEMS: Healthcare, drug delivery, micrototal analysis system detection and measurement methods, electronic nose, biochip.

UNIT -IV

Introduction to Nanotechnology: Essence of Nanotech, Nanofying electronics, Properties of nanomaterials, metal nano clusters, semiconductor nanoparticles, nano composites. Introduction to carbon nanostructure, carbon molecules, carbon clusters, nanotubes application.

UNIT -V

Medical Applications of Nanotechnology: Nanotechnology and Biomedicine-Drug synthesis and delivery – Nanobiomedicine and diagnostic-nano fabrication methods-nanomaterials in human body-toxicity in nanomaterials.

TEXT BOOKS:

1. Tai Ram Hsu, “Mems and Microsystems, Design and Manufacture”, McGraw Hill, 2002.
2. Mohamed Gad-el-Hak, “MEMS: Introduction and Fundamentals”, CRC Press, 2005.
3. Neelina H. Malsch, “Biomedical Nanotechnology”, CRC Press, 2005

REFERENCE BOOKS:

1. Marc J Madou, “Fundamentals of Microfabrication and Nanotechnology”, CRC Press, 2011.
2. Hari Singh Nalwa, “Encyclopedia of Nanoscience and Nanotechnology”, American Scientific Publishers, 2004.
3. ELLIS MENG, “Biomedical Microsystems”, CRC Press, 2011

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M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

ROBOTICS IN MEDICAL APPLICATIONS (PE-2)

UNIT -I

Robotics Foundation: Definition and origin of robotics – different types of robotics -various generations of robots– degrees of freedom, Kinematics: position and orientation representation -joint kinematics-inverse kinematics-forward. Instantaneous kinematics- inverse instantaneous kinematics-Dynamic: Spatial vector notation, dynamic model of rigid body system, kinematic tree, and kinematic loop.

UNIT -II

Motion Planning and Control: Motion planning: Motion planning concept- sampling based planning-Motion control: Introduction to motion control- join spaces verses operational space control-independent join control- PID control- tracking control- computed torque control- Adaptive control-optimal and robust control- digital implementation- learning control- indirect force control- hybrid force control.

UNIT -III

Sensor Based Planning and Control: Force and tactile sensor- Inertial sensor- GPS and Odometry: Odometry, gyroscopic system, GPS, IMU integration- Sonar sensor: CTFM sonar- Multipulse sonar-sonar ring- Bio-mimetric sonar- Range sensor- Visual servoing and visual tracking: Basic component of visual servoing- Image based visual servo- Position based visual servo- Performance optimization and planning- Estimation of 3D parameters.

UNIT- IV

Mobile and Distributed Robotics: Motion control of wheeled mobile robots- Motion planning and obstacle avoidance: Non-holonomic mobile robots-Motion planning and obstacle avoidance- Definition of Obstacle avoidance- Obstacle avoidance technique. Distributed and cellular robots: Modularity for locomotion-Modularity for manipulation- modularity for geometric configuration and robot system. Multiple mobile robot system: Architecture for multi robot system-swarm robot- heterogeneity- task allocation-learning.

UNIT -V

Automation and Medical Robotics: Introduction of medical automation-Application of automation: Bar coding- RFID and wireless tracking- Human factor issue with automation- Medical robotics and computer integrated surgery, Rehabilitation and health care robotics: Physical therapy and training robots- Aids for people with 28disability- Smart prosthesis and orthosis- Augmentation for diagnosis and monitoring safety ethics.

TEXT BOOKS:

1. Brunosciliano, Oussama Khatib, “Springer Handbook of Robotics”, Springer-verlag berlin Heidelberg, 1st Edition, 2008.
2. Robin felder, “System Engineering Approch to automation”, Artech House Inc, 1st Edition, 2008.
3. Mikell P. Weiss G.M., Nagel R.N, Odraj N.G., “ Industrial Robotics”, McGraw-Hill Singapore, 1st Edition,1996.

REFERENCE BOOKS:

1. Ghosh, “Control in Robotics and Automation: Sensor Based Integration”, Allied Publishers, Chennai, 1st Edition, 1998.
2. Nagrath and Mittal, “Robotics and Control”, Tata McGraw-Hill, 1st Edition 2003.
3. Fu. K.S, Gonzalez, R.C., Lee, C.S.G, “Robotics, control, sensing, Vision and Intelligence”, McGraw Hill International, 1st Edition, 2008.
4. Hannes Bleuler, M. Bouri, Doina Pisla, Aleksandar Rodic, Calin Vaida, Adrian Pisla, “New Trends in Medical and Service Robots: Theory and Integrated Applications” Springer link, 2014

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

ELECTRONIC SYSTEM DESIGN (PE-2)

UNIT -I

Analog and Digital Circuit Design of Circuits: Analog and digital circuit design of circuits for biomedical applications using operational amplifiers, data acquisition, conversion, and interface to microcomputers. Patient safety, patient isolation circuits. Operating principles of various types of patient isolation circuitry. Most suitable isolation circuit for a given application. Test isolation circuits.

UNIT -II

Data Acquisition: Sample and Hold Conversion, Multi-Channel acquisition, High speed sampling in ADC, Selection of drive amplifier for ADC performance, Gain setting and level shifting, ADC input protection, Multichannel channel applications for data acquisition systems, External protection of amplifiers, High speed ADC architectures.

UNIT -III

Interference and Noise Reduction Techniques: Types of noise-Thermal noise, shot noise, excess noise, Burst, Internal noise in OPAMPs, Noise issues in high speed applications, Causes of noise and interference encountered in medical equipment. Manifestation of noise or interference. Techniques for minimizing the impact of noise or interference when using various types of medical equipment.

UNIT -IV

Hardware Approach to Digital Signal Processing: Coherent and non-coherent sampling, Digital signal processing techniques, DSP hardware, ALU, Multipliers, accumulators, data address generators, serial ports, system interfacing ADC's and DAC's to DSPs. Interfacing IO ports to DSPs.

UNIT -V

Use of Telemetry in A Medical Environment: Available frequency bands and licensing requirements for RF telemetry environments. Typical telemetry methods used in medical applications. Common problems with telemetry installations. Battery management procedures. Types of batteries used in medical equipment. Typical shelf life of common batteries. Applications for common batteries. Techniques to improve life of batteries. Test equipment for correct function after battery replacement.

TEXT BOOKS:

1. Halit Eren, "Electronic portable instruments-Design and applications", CRC Press, 2004.
2. Robert B. Northrop, "Analysis and application of analog electronic circuits to biomedical instrumentation", CRC Press, 2004.

REFERENCE BOOKS:

1. Reinaldo J. Perez, "Design of medical electronic devices", Academic Press, 2002.

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M. TECH. I YEAR I SEMESTER
BIOMEDICAL SIGNAL PROCESSING AND INSTRUMENTATION

BIOMEDICAL INSTRUMENTATION LAB

Note: A minimum of 10 experiments to be done

1. Design of ECG Amplifier using Instrumentation Amplifier
2. ECG Recording and Heart rate measurement
3. Study of Electrical activities of Skeletal Muscles
4. Design of Respiration Rate Measurement.
5. Demonstration of Defibrillator, Pacemaker and Short wave Diathermy.
6. Design an instrument for temperature measurement to control and maintenance at constant temperature.
7. Demonstration of Blood Pressure measurement and phonocardiogram
8. Study of brain waves using EEG machine
9. Study of Patient monitoring system.
10. Demonstration of ultrasound machine using various modes
11. Demonstration of Heart lung machine and Hemodialysis
12. Demonstration of X-Ray, CT Scan, MRI, Gamma camera, SPECT and PET Imaging (by visiting to a Hospital)