

**M.Tech (BME), Two Year (Four Semesters)**  
Scheme to be valid with effect from the admitted batch of 2019 – 2020

**I SEMESTER**

Code	Name of the Subject	Periods/Week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTBM-1.1	Bio Medical Signal Processing	3	-	70	30	100	3
MTBM-1.2	Bio-Medical Instrumentation -I	3	-	70	30	100	3
MTBM-1.3	Elective – I Anatomy & Physiology/EMI/EMC / Bio-Mechanics	3	-	70	30	100	3
MTBM-1.4	Elective – II Principles of Electrotherapy/ Electronic Devices and Circuits / Mathematical methods for Engineers	3	-	70	30	100	3
MTBM-1.5	Research Methodology & IPR	3	-	70	30	100	2
MTBM-1.6	Audit Course	3	-	70	30	100	0
MTBM-1.7	Bio-Medical Signal processing LAB	-	3	-	100	100	2
MTBM-1.8	Bio Instrumentation LAB-I	-	3	-	100	100	2
	Total	18	6	420	380	800	18

**II SEMESTER**

Code	Name of the Subject	Periods/Week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTBM-2.1	Bio-Medical Instrumentation -II	3	-	70	30	100	3
MTBM-2.2	Principles of Radiology	3	-	70	30	100	3
MTBM-2.3	Elective – III Orthopedics & Rehabilitation / Biological Effects of Radiation/ Bio- MEMS and Bio-Sensors	3	-	70	30	100	3
MTBM-2.4	Elective – IV Medical Image Processing/ Nano Technologies and Applications/ Robotics and Artificial intelligence	3	-	70	30	100	3
MTBM-2.5	Audit Course	3	-	70	30	100	0
MTBM-2.6	Bio-Medical Image Processing LAB	-	3	-	100	100	2
MTBM-2.7	Bio Instrumentation LAB-II	-	3	-	100	100	2
MTBM-2.8	Mini Project With Seminar	-	3	-	100	100	2
	Total	15	9	350	450	800	18

**III SEMESTER**

Code	Name of the Subject	Periods/Week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTBM-3.1	Elective – V Clinical Medicine /Electrocardiography Signal Analysis/ Bio-Materials and Artificial Organs	3	-	70	30	100	3
MTBM-3.2	Open Elective Hospital Management and Supporting System/ Business Analytics/Industrial Safety/Operational Research/Cost Management of Engineering Projects	3	-	70	30	100	3
MTBM-3.3	Dissertation- I / Industrial Project	-	-	-	100	100	10
	Total	6	-	140	160	300	16

#### IV SEMESTER

Code	Name of the Subject	Periods/Week		Max. Marks		Total	Credits
		Theory	Lab	Ext.	Int.		
MTBM-4.1	Dissertation- II	-	-	70	30	100	16
	Total	-	-	70	30	100	16

#### **Note:**

1. **At the end of 3<sup>rd</sup> semester project review is conducted by HOD with the committee consisting of the HOD, Chair Person of BOS and the Guide. In the Affiliated Colleges, Project (Preliminary) will be evaluated by concerned HOD and the thesis Guide of their respective colleges.**
2. **At the end of the 4<sup>th</sup> semester there will be a final viva voce for the project work conducted by the HOD with the committee consisting of HOD, Chair Person of BOS, the Guide and an External examiner nominated by the university.**

#### **Audit Course 1 & 2**

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

## BIO-MEDICAL SIGNAL PROCESSING

**Credits: 3**

**Subject Code: MTBM – 1.1**

**Max. Marks: 70**

**Sessionals: 30**

### 1. Discrete-time Signals and Systems

Characterization, classification and time-domain representation of discrete-time signals, Typical sequences and their representation, Classification of sequences, Basic operations on sequences, Discrete-time systems.

### 2. The Discrete Fourier Transform

The discrete -time Fourier transform (DTFT), The discrete Fourier Transform (DFT), Computation of the DFT

### 3. Theory of Z-Transform

Mathematical derivation of the unilateral z-transform, Properties of the z-transform, the inverse-z-transform, The bilateral z-transform, Power series, Region of convergence (RoC) and its impedance

### 4. Neurological Signal Processing

The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis, Linear prediction theory,

### 5. Neurological Signal Processing

The autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination – the case of epileptic patients, Overall performance.

### 6. Cardiological Signal Processing

Basic electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation,

### 7. Cardiological Signal Processing

The use of multi-scale analysis for parameters estimation of ECG waveforms, Arrhythmia analysis monitoring, Long-term continuous ECG recording.

### 8. ECG Data Reduction Techniques

Direct data compression techniques, Direct ECG data compression techniques, Transformation compression technique, Other data compression techniques, The PRD index

### **Textbook**

1. Biomedical Signal Processing, Principles and Techniques by D.C. Reddy, Tata McGraw Hill, 2005.

## BIO-MEDICAL INSTRUMENTATION-I

**Subject Code: MTBM – 1.2**

**Credits: 3**

**Max. Marks: 70**

**Sessionals: 30**

1. Introduction to Biomedical Instrumentation

The age of biomedical engineering, Development of biomedical instrumentation, Biometrics, Introduction to the man-instrument system, Components of the man-instrument system, Physiological Systems of the body, Problems encountered in measuring a living system

2. Basic Transducer Principles

The transducer and transduction principles, Active transducers, Passive transducers, Transducers for biomedical applications

3. Sources of Bioelectric Potentials

Resting and action potentials, Propagation of action potentials, The bioelectric potentials.

4. Electrodes

Electrode theory, Biopotential electrodes, Biochemical transducers

5. The Cardiovascular System

The heart and cardiovascular system, The heart, Blood pressure, Characteristics of blood flow, Heart sounds.

6. Cardiovascular Measurements

Electrocardiography, Measurement of blood pressure, Measurement of blood flow and cardiac output, Plethysmography, Measurement of heart sounds.

7. Patient Care and Monitoring

The elements of intensive-care monitoring, Diagnosis, Calibration and repairability of patient-monitoring equipment, Other instrumentation for monitoring patients, The organization of the hospital for patient-care monitoring, Pacemakers, Defibrillators.

8. Measurements in the Respiratory System

The physiology of the respiratory system, Tests and instrumentation for the mechanics of breathing, Gas exchange and distribution, Respiratory therapy equipment.

**TEXT BOOK :**

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A. Pfeiffer – Pearson education.

**Reference Book**

1. Bio-Medical Instrumentation – Dr. M. Arumugam, Anuradha Agencies, 2005.

# Elective-I: ANATOMY AND PHYSIOLOGY

Credits: 3

Subject Code: MTBM – 1.3

Max. Marks: 70

Sessionals : 30

## 1. Introduction

- Cell and its constituents,
- Functional characteristics of cell organelles,
- Cell division : Mitosis and Meiosis,
- Tissue structure and overview of organ systems

## 2. Nervous System

- Structure of brain, spinal cord
- Neuromuscular junction
- Motor pathways : Pyramidal and extra pyramidal
- Sensory pathway
- Sensory end organs
- Special sensors
  - Auditory pathway
  - Visual pathway
  - Olfactory pathway
  - Gustatory pathway

## 3. Energy balance, metabolism and nutrition

- Energy metabolism
- Intermediary metabolism
- Nutrition

## 4. Respiratory System

- Anatomy of lungs
- Properties of gases
- Gas exchange in the lungs
- Mechanics of respiration
- Hypoxia, effect of exercise

## 5. Kidney

- Functional anatomy
- Glomerular filtration
- Tubular function
- Effects of disordered renal function

## 6. Muscular System

- Anatomy and structure of skeletal and smooth muscle
- Process of contraction of skeletal and smooth muscle
- Exercise physiology

### Reference Books:

1. R.J. Last: Human anatomy: Associated East West Press
2. Ross & Wilson: Anatomy and Physiology
3. Ganey Phydogy

## Elective-I: EMI/EMC

Subject Code: MTBM – 1.3

Credits: 3  
Max. Marks: 70  
Sessionals: 30

1. Introduction, Natural and Nuclear sources of EMI / EMC:  
Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI / EMC, Natural and Nuclear sources of EMI.
2. EMI from apparatus, circuits and open area test sites:  
Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive intermodulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.
3. Radiated and conducted interference measurements and ESD:  
Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment,  
Immunity to conducted EMI detectors and measurements. ESD, Electrical fast transients / bursts, electrical surges.
4. Grounding, shielding, bonding and EMI filters:  
Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design.
5. Cables, connectors, components and EMC standards:  
EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International EMC standards.

### Text Books:

1. Engineering Electromagnetic Compatibility by Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi, Modules 1 – 9. References:
  1. Introduction to Electromagnetic Compatibility, Ny, John Wiley, 1992, by C.R. Pal.

## Elective I: BIO-MECHANICS

**Credits: 3**

**Subject Code: MTBM – 1.3**

**Max. Marks : 70**

**Sessionals : 30**

1. BIO FLUID MECHANICS:Introduction: Newton's laws, Stress, Strain, Non Viscous fluid, Newtonian Viscous fluid, Viscoelasticity, Blood Characteristics, Mechanical Interaction of Red blood cells with solid wall, Thrombous formation and dissolution, Medical applications of blood rheology
2. BONE & ITS PROPERTIES:Bone structure and Composition, Blood Circulation in Bone, Viscoelastic properties of Bone, Electrical Properties of Bone, Fracture Mechanism and Crack Propagation in bones, Kinetics and Kinematics of Joints.
3. CARDIAC MECHANICS:Cardio vascular system, Mechanical properties of blood vessels- Arteries, Arterioles, Capillaries, Veins, Blood flow- Laminar & turbulent , Prosthetic Heart Valves & replacement.
4. BIOMECHANICS OF SPINE AND LOWER EXTREMITY:Biomechanics of Spine- Structure, Movements, Loads on Spine, Exoskeletal system for Paraplegics, Structure of Hip- Movements, Loads on Hip, Total Hip Prosthesis , Structure of Knee- Movements , loads on knee, Knee prosthesis , Powered wheel chair, Crutches and canes.
5. GAIT ANALYSIS:Human Locomotion- Gait Analysis, Foot Pressure measurements- Pedobarograph , Mechanics of Foot-Arthritis, Biomechanical treatment.

### TEXT BOOKS

1. Y.C. Fung, *Biomechanics-Circulation Springer Verlag*, 2<sup>nd</sup> Edition, 1997.
2. *Basic Biomechanics* , By Susan J. Hall

### REFERENCE BOOKS:

1. Alexander.R. Mc.Neill, *Biomechanics* , Chapman and Hall, 1975.
2. D.N.Ghista, *Biomechanics of Medical Devices*, Macel Dekker, 1982.
3. *An Introduction to Biomechanics*, By Jay D. Humphrey & Sherry L. Delance
4. *Fundamentals of Biomechanics* , By Duane Knudson.
5. VC Mow and W C Hayes, *Basic Orthopedic Biomechanics*, Lippincott – Raven Publishers.

## **Elective-II: PRINCIPLES OF ELECTROTHERAPY**

**Subject Code: MTBM-1.4**

**Credits: 3**

**Max. Marks: 70**

**Sessionals: 30**

1. Introduction  
Low Frequency Currents
2. Medium Frequency Currents  
High Frequency Currents
3. Radiation Therapy  
Laser Therapy
4. Superficial Heating Modalities  
Ultrasonic Therapy
5. Cryotherapy

### **Textbook**

1. Step by Step Practical Electrotherapy by Jagmohan Singh, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, 2006.



## Elective-II: ELECTRONICS DEVICES AND CIRCUITS

Credits: 3

Subject Code: MTBM – 1.4

Max. Marks: 70

Sessionals : 30

### 1. Diode Characteristics and Applications

Diode working, Basic applications of PN diode, Diode specifications, Diode equivalent circuits, Characteristics of a PN diode, Volt-ampere characteristics of PN diode, Diode resistances, Diode testing, Varactor diode, Zener diode, Tunnel diode Light Emitting Diode, Photo diode, Solar cells,

### 2. Rectifier Circuits

Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Comparative characteristics of rectifier circuits, Filter circuits

### 3. Transistor Characteristics and Applications

Operation of the transistor, Transistor configurations, Current amplification factor,  $\beta$ , Differences among the parameters of CE, CB and CC transistor configurations, The transistor equivalent circuits, The specification parameters correspondent to maximum ratings of BJT, Applications of transistors, Testing of transistors,

### 4. Biasing and Stability of Transistors

Biasing of amplifiers, Definition of operating point, Stability factors, Self-bias or emitter bias, Diode compensation, Thermistor compensation, Sensistor compensation, Thermal runaway, Thermal resistance,  $T_R$ , Thermal stability

### 5. Field Effect Transistors

Classification of field effect transistors, Junction field effect transistors (JFET), The salient features of JFET, Comparative characteristics of JFET and BJT, Merits of JFET

Demerits of JFET, Construction of JFET, JFET characteristics, JFET parameters, Transfer characteristics, Drain characteristics, Applications of JFETs, Metal oxide semiconductor field effect transistor (MOSFET), Enhancement type MOSFET, Depletion type MOSFET, Salient features of enhancement and depletion type of MOSFET

## **6. Feedback Amplifiers**

Expression gain with feedback, First classification of feedback amplifiers, Negative feedback amplifier, Positive feedback, Second classification of feedback amplifiers, Characteristics of negative feedback amplifier, Characteristics of positive feedback, Effect of negative feedback on gain stability, Effect of negative feedback on bandwidth, Effect of negative feedback on distortion, Effect of negative feedback on non-linear distortion, Effect of negative feedback on noise, Voltage-series feedback, Voltage-shunt feedback, Current-series feedback, Current-shunt feedback amplifier, The net effects of feedback circuits, Applications of negative feedback.

## **7. Oscillators**

Definition of oscillator, Definition of generator, Conditions for oscillators, Barkhausen criteria, The characteristics of oscillators, Classification of oscillators, Sinusoidal oscillators, Relaxation oscillators, RC phase shift oscillator, Salient features of RC phase oscillator, Wein bridge oscillator, Colpitts oscillator, Hartley oscillator, The crystal oscillator

## **8. Operational Amplifiers and Applications**

Introduction to integrated circuits, Salient features of op-amps, Symbol of op-amp, Classification of integrated circuits, Differences between linear and digital ICs, Characteristics of an ideal op-amp, Applications of operational amplifiers, The equivalent circuit of op-amp, The circuits inside an op-amp, Definitions of op-amp parameters, Frequency sensitive parameters of op-amp, Temperature sensitive parameters, Applications of linear ICs, Typical op-amps, Salient features of op-amp 741 series, Specifications of  $\mu\text{A}$  741, Virtual ground concept, Applications of op-amp, Typical pin designations of op-amp

### **Textbook**

1. G.S.N. Raju, "Electronic Devices and Circuits," IK International Publishing House Pvt. Ltd., 2006.
2. Boylestad, "Electronic Devices and Circuit Theory", Pearson Education Pvt. Ltd., 2006.

**Elective-II: MATHEMATICAL METHODS FOR ENGINEERS**

**Subject Code: MTBM – 1.4**

**Credits: 3**

**Max. Marks: 70**

**Sessionals : 30**

1. Mathematical modeling and solution of biomedical problems namely respiratory Rate, blood flow, cardiac output and impedance diffusion, ultra filtration etc.

2. Operational research applied to the description of physiological systems and Signals processing by interfacing instrumentation

3. Biomedical variability and probabilistic solution to medical decision making, Population dynamics perturbation technique in dealing with the problems of thermodynamics. Stochastic process. Finite- Difference method.

**TEXTBOOKS:**

1. Numerical Methods in Biomedical Engineering, By Stanley Dunn, Alkis Constantinides, Prabhas V. Moghe
2. Mathematical Models in Engineering, By Joseph M Powers, Mihir Sen.

**RESEARCH METHODOLOGY & IPR**

**Subject Code: MTBM – 1.5**

**Credits: 2**  
**Max. Marks: 70**  
**Sessionals : 30**

**AUDIT COURSE**

**Subject Code: MTBM – 1.6**

**Credits: 0**  
**Max. Marks: 70**  
**Sessionals : 30**

**BIO-MEDICAL SIGNAL PROCESSING LAB**

**Credits: 2**

**Subject Code: MTBM -1.7**

**Max. Marks: 100**

**BIO INSTRUMENTATION LAB-I**

**Subject Code: MTBM -1.8**

**Credits: 2**

**Max. Marks: 100**

## BIO-MEDICAL INSTRUMENTATION – II

**Subject Code: MTBM –2.1**

**Credits : 3**

**Max. Marks : 70**

**Sessionals : 30**

### **Chapter – I :** Sources of Bioelectric potentials and Electrodes

Resisting and Action Potentials, Propagation of Action Potentials, The Bioelectric Potentials Electrode theory, Bio Potential Electrodes, Biochemical Transducers

### **Chapter – II :** The Cardiovascular System and Cardiovascular Measurements,

The Heart and Cardiovascular System, The Heart, Blood Pressure, Characteristics of Blood Flow, Heart Sounds Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiac output, Plethysmography, Measurement of Heart Sounds,

### **Chapter – III :** Patient Care & Monitory and Measurements in Respiratory System

The elements of Intensive Care Monitory, Diagnosis, Calibration and repairability of Patient Monitoring equipment, other instrumentation for monitoring patients, pace makers, defibrillators

The Physiology of respiratory system, tests and instrumentation for mechanics of breathing, respiratory theory equipment

### **Chapter – IV :** Bio telemetry and Instrumentation for the clinical laboratory Introduction to biotelemetry, physiological parameters adaptable to biotelemetry, the components of biotelemetry system, implantable units, applications of telemetry in patient care

The blood, tests on blood cells, chemical test, automation of chemical tests

### **Chapter – V :** X – ray and radioisotope instrumentation and electrical safety of medical equipment.

Generation of Ionizing radiation, instrumentation for diagnostic X – rays, special techniques, instrumentation for the medical use of radioisotopes, radiation therapy.

Physiological effects of electrical current, shock Hazards from electrical equipment, Methods of accident prevention

### **TEXT BOOK :**

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A. Pfeiffer – Pearson education.



## PRINCIPLES OF RADIOLOGY

Subject Code: MTBM – 2.2

Credits: 3

Max. Marks: 70

Sessionals: 30

1. GI Tract Liver Gallbladder  
Pancreas Kidney  
Urinary Bladder
2. Female Genital Tract Chest  
Orthopaedics Nervous System  
Breast  
Thyroid
3. Helical CT Technique and Protocols Common Acute  
Abdominal Pathologies CT in Bowel Obstruction  
CT in the Evaluation of Intestinal Volvulus Abdominal Wall  
Hernias and Role of CT
4. CT in Inflammatory Bowel Diseases and Infectious Colitis Ischemic  
Bowel Disease  
Acute Intra-abdominal Vascular Emergencies and Hemorrhage  
Miscellaneous
5. Basic Principles  
Instrumentation MR Safety  
MR Contrast Media  
Principles of Interpretation : Neuroimaging Principles of  
Interpretation : Body Imaging MR Angiography  
Cardiac MRI

### Textbooks

1. Radiology Interpretation Made Easy by G. Balachandiran, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, 2007.
2. Step by Step Emergency Radiology by Arjun Kalyanpur and Jagdish Singh, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, 2006.
3. MRI Made Easy by Govind B Chavhan, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, 2006.

### Elective III: ORTHOPAEDICS AND REHABILITATION

Credits : 3

Subject Code: MTBM – 2.3

Max. Marks : 70

Sessionals : 30

1. Basics of orthopedics
  2. Physiology of bones
    - a) Calcium and phosphorous metabolism
    - b) Bone physiology
    - c) Vitamin 'D' metabolism
    - d) Effects of hormones and humoral agents on calcium metabolism
  3. Skeletal System
    - Organization
    - Bone formation and growth
    - Fracture healing
    - Bio-mechanism of joints
  4. General Orthopedics
    - a) Gait
    - b) amputations
    - c) Prosthesis and Research work
  5. Rehabilitation
- Diagnostic aids in orthopedics
- a) Radiological
  - b) Electrophysiological
  - c) Bone densitometry
  - d) Arthroscopy

#### Reference Books:

1. Textbook of Orthopaedics by Prakash P. Kotwal, mayilvahanan Natarajan, Elsevier Publications, 2005.
2. Essentials of Rehabilitation for orthopaedic surgeons by John Ebnezar, Jaypee Brothers Medical Publishers Pvt, Ltd., 2006.
3. Principles and practice of Orthopedics by Dr. C. Vyagreswarude, Andhra University press 1993.

## Elective III: BIOLOGICAL EFFECTS OF RADIATION

Subject Code: MTBM – 2.3

Credits: 3

Max. Marks: 70

Sessionals: 30

### 1. Action of Radiation in Living cells

Various theories related to radiation at cellular level. DNA and chromosomal damages.

### 2. Somatic Application of Radiation

Radio sensitivity protocols of different tissues of human. LD50/30 effective radiation on skin, Bone marrow, eye, endocrine glands, and basis of radio therapy.

### 3. Genetic Effects of Radiation

Threshold and linear dose, gene control hereditary diseases effect of dose.

### 4. Effect of Microwave and RF with matters

Effects of various human organs and systems. Wavelength in tissue, non thermal interaction. Standards of protection, national and international standards and precautions.

### 5. UV Radiation

Classification of sources, measurement, photo medicine, UV radiation safety visible and infrared radiation.

#### TEXT BOOKS:

1. Glasser O., *Medical Physics*, Volume I, II, III, The year book publishers Inc, Chicago 1980.

#### REFERENCE BOOKS:

1. Mosely H., *Non ionizing Radiation*, Adam-Hilgar, Bristol 1988.

### **Elective III: BIOMEMS AND BIOSENSORS**

**Credits : 3**

**Subject Code: MTBM –2.3**

**Max. Marks : 70**

**Sessionals : 30**

1. Introduction to BioMEMS, Silicon Microfabrication, “Soft” Fabrication Techniques, Polymer Materials, Microfluidic Principles.
2. Sensor Principles and Microsensors, Microactuators and Drug Delivery, Clinical Laboratory Medicine, Micro-Total-Analysis Systems, Detection and Measurement Methods,.
3. Genomics and DNA Microarrays, Proteomics and Protein Microarrays, Emerging BioMEMS Technology, Power, Data, and RF Safety, Biocompatibility.
4. Biosensors based on antigen-antibody interactions, avidin-biotin mediated biosensors, functionalized electrodes as electrochemical biosensors, wired peroxidase based biosensors.
5. Electrochemical enzyme immunoassay, liposomes in immunodiagnostics, polyion sensors, piezoelectric immunosensors, SPV biosensors, SPR biosensors, dual electrode enzyme sensors.

**Text books:**

1. Handbook of Biosensors and Electronic Noses: Medicine, Food and the Environment: CRC-Press; 1 edition; 1996
2. Steven S. Saliterman, Fundamentals of BioMEMS and Medical Microdevices, SPIE Press Monograph Vol. PM153, 2006

**Reference:**

1. Biosensors: Oxford University Press, USA; 2 edition, 2004 D. L. Wise, Biosensors: Theory and Applications, CRC Press, 1993
2. Rao & Guha, Principles of Medical Electronics & Biomedical Instrumentation, Orient Longman, 2001

## **Elective-IV: MEDICAL IMAGE PROCESSING**

**Credits: 3**

**Subject Code: MTBM – 2.4**

**Max. Marks: 70**

**Sessionals : 30**

1. Imaging In medicine – CT scan principle – reconstruction from projection – Fourier slice theorem -
2. Parallel and fan beam projection algorithm –
3. Uniqueness and resolution – X – ray - ultrasound – microwave tomography-
4. Positron Emission Tomography
5. MRI systems – T1 and T2 based imaging
6. Image processing in medicine – digital image processing –
7. Contrast enhancement – edge shaping –
8. Digital image compression for transmission – Safety consideration in medical imaging.

### **Reference Books:**

1. Albert Kacovasaki : Medical imaging systems
2. Gonzalves : Digital Image processing
3. Rosenfield & A.C. Kak : Image processing Vol. 1,2

## **Elective-IV: NANO TECHNOLOGIES AND APPLICATIONS**

**Credits: 3**

**Subject Code: MTBM – 2.4**

**Max. Marks: 70**

**Sessionals : 30**

Unit 1: Introduction to Nanotechnology

Essence of Nanotechnology, Nano in daily life, Brief account of nano applications, Properties of nano materials, Metal nano clusters, Semiconductor nano particles.

Unit 2: Nano Materials

Nano composites, Nanofying electronics, Sensing the environment, Mechanising the micro world, Energy and cleaner environment with nano technology.

Unit 3 : Carbon Nano Structures

Introduction, Carbon molecules, Carbon clusters, Carbon nanotubes, Applications of carbon nanotubes.

Unit 4: Diagnosing Personal Health and Medical Applications

Lab on a chip, Super X -ray vision, Mapping the genes, Understanding how pharmaceutical company develops drugs, Delivering a new drug the Nanotech way, Cooking cancer with nano cells, Biomimetics.

Unit 5: Biological Materials

Introduction, Biological building blocks, Nucleic acids, Biological nanostructures.

### **Textbooks**

1. Nanotechnology by Richard Booker, Earl Boysen, Wiley Publishing Inc., 2006.
2. Introduction to Nanotechnology by Charles P. Poole Jr., Frank J. Owens, John Wiley & Sons Publications, 2003.

## **Elective-IV: ROBOTICS AND ARTIFICIAL INTELLIGENCE**

**Credits: 3**

**Subject Code: MTBM – 2.4**

**Max. Marks: 70**

**Sessionals : 30**

1. Robots: Basic components – Classification – performance characteristics.
2. Sensors and vision systems: Transducers and sensors – Tactile sensors – Proximity and range sensors – Acoustic sensors – Vision systems – Image processing and analysis – Image data reduction – Segmentation feature extraction – Object recognition.
3. Robot motion analysis and control: Manipulator kinematics – Homogeneous transformation and robot kinematics – Robot dynamics – Configuration of a robot controller.
4. Definition and scope of Artificial Intelligence (AI) – Fundamentals of expert systems – data base programs versus expert systems – components, features and categories of expert systems.
5. Heuristic search – 8 puzzle problem – control strategies – production system characteristics – knowledge representation – matching heuristic function – search methods – problem reductions – Hierarchical planning.
6. Introduction to knowledge representation – representing simple facts in logic – resolution – propositional logic – predicate logic – Non monotonic reasoning – statistical and probabilistic reasoning – rule based systems.
7. Characteristics of AI language – PROLOG and LISP – symbol manipulation – LISP functions definitions, predicates, conditional, recursion – iteration – properties – lists, arrays, I/O statements – search, sort, hill climbing methods – perception and learning.

**AUDIT COURSE**

**Subject Code: MTBM – 2.5**

**Credits: 0**  
**Max. Marks: 70**  
**Sessionals : 30**



**BIO-MEDICAL IMAGE PROCESSING LAB**

**Credits: 2**

**Subject Code: MTBM -2.6**

**Max. Marks: 100**

**BIO INSTRUMENTATION LAB-II**

**Subject Code: MTBM -2.7**

**Credits: 2**

**Max. Marks: 100**

## Elective V: CLINICAL MEDICINE

**Credits : 3**

**Subject Code: MTBM – 3.1**

**Max. Marks : 70**

**Sessionals : 30**

1. Evaluation of Headache Evaluating  
Chronic Cough  
An Approach to Interpret Arterial Blood Gases Pre-operative  
Medical Evaluation
2. Adult Immunisation  
Newer Developments in Management of Hypertension  
Exercise Testing in Diagnosis and Prognosis of Heart Disease : An Overview  
Cardiovascular Risk Assessment  
Management of Valvular Heart Disease
3. Update on Management of Type 2 Diabetes Mellitus  
Postprandial Hyperglycaemia : A Real Challenge in Diabetes Mellitus Vascular  
Complications in diabetes – Clinical Evaluation and Screening Antithyroid Drugs  
Viral Hepatitis
4. Iron Deficiency Anaemia Typhoid  
Fever  
Millary Tuberculosis  
Multidrug-resistant Tuberculosis (MDR-TB) Diagnostic  
Approach to Malaria
5. Preventive Strategies in Acute Renal Failure Management of  
Anaemia of Chronic Renal Disease Urinary Tract Infection  
Parkinson's Disease Management of Difficult  
Asthma  
Advances in the Treatment of Rheumatoid Arthritis and Spondyloarthropathes

### **Textbook**

1. Clinical Medicine by AK Agarwal and DG Jain

## **Elective V: ELECTROCARDIOGRAPHY SIGNAL ANALYSIS**

**Credits : 3**

**Subject Code: MTBM – 3.1**

**Max. Marks : 70**

**Sessionals : 30**

1. Projections of the cardiac vector on planes (vectorcardiographic loops) and lines (usually the standard 12 leads), and relates the waves, intervals and segments, corresponding phases of the cardiac contraction cycle, usefulness of the systematic approach to clinical ECG analysis
2. Techniques of ECG acquisition, instrumentation amplifier, 50 and 60 Hz notch filters, storage formats for the ECG, MIT-BIH database for QRS detection algorithms, false positive and false negative beats in an ECG recording.
3. ECG statistics, noise, artifacts, and missing data, standard clinical features of the ECG-parameters of the QRS complex, RR interval length, PR and QT intervals, QT hysteresis, models for ECG and RR interval processes
4. linear and nonlinear filtering methods, Numerous techniques are presented: Wiener and Wavelet Filtering, Principal Component Analysis, Neural Networks, Lyapunov Exponents, Entropy, presentation of the T-wave alternans phenomenon, measurement techniques,
5. Techniques for estimating the respiratory frequency in ECG, ST analysis. Probabilistic Modeling Approach to interpretation of the ECG.

### **TEXT BOOKS:**

1. "Advanced Methods and Tools for ECG Data Analysis", by Gari D. Clifford, Francisco Azuaje and Patrick E. McSharry (Editors).
2. ECG Signal Processing, Classification and Interpretation: A Comprehensive Framework of Computational Intelligence, Adam Gacek, Witold Pedrycz

## Elective V: BIOMATERIALS AND ARTIFICIAL ORGANS

**Credits : 3**

**Subject Code: MTBM – 3.1**

**Max. Marks : 70**

**Sessionals : 30**

1. Structure of biomaterials:  
Definition and classification of biomaterial – mechanical properties – visco – elasticity, elasticity of Non – Hookean material
2. Biocompatibility:  
Wound healing process – body response to implants – blood compatibility
3. Metallic implants:  
Stainless steel – cobalt based alloys – titanium based alloys – applications – deterioration of metallic implants
4. Ceramic and polymeric implants:  
Aluminum oxides, Hydroxyapatite, Glass ceramics carbons, polymerization, acrylic polymers, rubbers, high strength thermoplastics, medical applications, deterioration of polymers.
5. Soft – tissue replacement implants:  
Sutures, Surgical tapes, adhesives, percutaneous and skin implants
6. Hard – tissue replacement implants:  
Internal fracture fixation devices, joint replacements dental implants
7. Artificial kidney devices:  
Methods of artificial waste removal – hemodialysis, artificial kidney system.
8. Artificial heart – lung device:  
Use of patients Lungs for gas exchange – the ideal heart – lung devices – comparison of natural and artificial lungs.

### Reference Books:

1. “Biomaterials science and engineering” 1984, Plenum press, New York, John Bu Park
2. “Biomaterial – an Interfacial approach” 1982, Academic press, New York, L.L. Hence & E.C. Ethridge.
3. “Biomedical engineering principles – an introduction to fluid, heat and mass transport processors” 1976, Marcel Decker, New York, David D. Cooney
4. Introduction to Bio – Materials by J. Park.

**Core Elective: HOSPITAL MANAGEMENT AND SUPPORTING SYSTEM**

**Credits : 3**

**Subject Code: MTBM – 3.2**

**Max. Marks : 70**

**Sessionals : 30**

1. Evolution of hospitals Hospital Administration Outpatient Department (OPD) Inpatient (IP) Services
2. Operation Theatre Complex (OT Complex) Delivery Suite Pharmacy Laboratory Services (LAB)
3. Radiology Department (X-ray Department) Central Sterile Supply Department (CSSD) Medical Records Department (MRD)
4. Medico-legal Sciences Professional Ethics Labor Laws
5. Building Requirements Laboratory Services  
Blood Bank, Drug and Cosmetic Rules for regulation of blood banks, Drug and Cosmetic Rules Radiological and Imaging Services
6. Material Management Hospital Dietary Services Ambulance Services
7. Hospital Environmental Control  
Hospital Waste Management, Bio-Medical Waste (Management & Handling), Rules
8. Autopsy and Mortuary Management  
Fire Prevention, Communication and Workshop Transplantation of Human Organs Act

**Textbooks**

1. The Hospital Administrator by M.A. George, Jaypee Publications, 2005.
2. Essentials for Hospital Support Services and Physical Infrastructure by Madhuri Sharma, Jaypee Publications