

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M. E. Embedded Systems (Branch Code - 54)

**Year – I (Semester – I) (W.E.F. July 2013)**

### **Subject: Biomedical Instrumentation and Signal Processing (715405) Major Elective-I**

<b>Sr. No.</b>	<b>Course Content</b>	<b>Hours</b>
<b>1</b>	Needs and objectives for Instrumentation in Biomedical Engineering; The Man-Instrument system; Depolarization & Repolarization of cell and Action Potential; Electrode theory: Surface, Needle and Microelectrodes; Classification of physical sensors, Integrated, Intelligent or Smart sensors, Biosensing Principles and sensing methods, biosensors arrays and implantable devices; The types of Biomedical signals: ECG, EEG, EMG, EOG, ERG etc.	<b>5</b>
<b>2</b>	The Heart and human cardiovascular System; The Electrocardiogram (ECG), Phonocardiography, Blood pressure & Heart rate measurements, Blood flow measurements, Doppler, Echocardiography, The ECG amplifiers and Electrocardiograph Machine; The 12-lead ECG recording system	<b>5</b>
<b>3</b>	The Human Nervous System; Electroencephalogram (EEG); The EEG Machine and EEG recording system; EEG, SER, EMG, Scanning Techniques; The Human Respiration System; Respiratory Disorders and their Diagnosis: X-rays, Volumes & capacity (Spirometry), Bronchoscopy, Laryngoscopy, CT scan, Tomography, sonography, MRI, etc.	<b>8</b>
<b>4</b>	Biotelemetry systems; The ECG telemetry system; Telemedicine and Teleradiology; PACS and DICOM systems	<b>4</b>
<b>5</b>	The need for Biomedical Signal Processing Noise and artifacts in Biomedical signals; The ECG signal processing techniques: baseline wander, power line interference and electrode motion artifact removal using linear and non-linear digital filters; The QRS complex detection techniques: Pan-Tompkins algorithm, Derivative based and template matching techniques	<b>10</b>
<b>6</b>	The types of noise in EEG signals; Estimation and removal of EOG noise from EEG signal: non-adaptive and adaptive techniques; The EEG signal estimation: auto-regressive (AR) and auto-regressive moving average (ARMA) modeling	<b>8</b>

#### **Text Books:**

1. Biomedical Instrumentation & Measurements, Second Edition, Author: Leslie Cromwell, PHI Learning
2. Introduction to biomedical equipment and technology, Fourth Edition, Author: Joseph J. Carr, John Michael Brown, Pearson Education

3. Medical instrumentation Application and Design, Fourth Edition, Author: John G. Webster, John W. Clark, Wiley Publisher
4. Biomedical Digital Signal Processing, First Edition, Author: Willis J. Tompkins, PHI
5. Bioelectrical Signal Processing in Cardiac and Neurological Applications, First Edition, Author: Leif Sornmo, Pablo Laguna, Academic Press

**Reference Books:**

1. Hand Book of Biomedical Instrumentation, Second Edition, Author: R. S. Khandpur, Tata McGraw-Hill Education