

GUJARAT TECHNOLOGICAL UNIVERSITY

DIPLOMA IN BIOMEDICAL ENGINEERING

Semester: 4

Subject Name **DIAGNOSTIC MEDICAL INSTRUMENTATION**

Sr.No	Course content
1.	Fundamental of medical instrumentation 1.1. Sources of biomedical signals, 1.2. Generalized medical instrumentation block diagram 1.3. Classification of medical instruments based on different principles i. Based on application (diagnostic, therapeutic, Imaging, analytical) ii. Based on physiological parameter and bio-potential iii. Based on Biological system iv. Based on different departments in the hospital
2.	Patient monitoring system 2.1 Blood Pressure measurement I. Introduction II. Direct method III. Indirect method such as korotkoff method(sphygmo manometer) IV. Ultrasonic Doppler shift method 2.2 Blood flow measurement I. Electromagnetic blood flow meter, II. Ultrasonic Doppler shift method: block diagram, working principle, application 2.3 Oxygen Saturation measurement (Oxymetry) a. Types of measurement (In vivo, In vitro) b. Ear oxymeter c. Pulse oxymeter 2.4 Heart Rate meter a. Techniques of heart rate measurement b. Average heart rate meter c. Instantaneous heart rate meter 2.5 Respiration Rate meter a. Impedance pneumograph b. Thermistor air way c. CO ₂ method 2.6 Temperature measurement instruments a. Different temperature transducer
3.	Audiometer 3.1. Hearing mechanism: - air & bone conduction, 3.2. Threshold of hearing 3.3. Measurement of sound 3.4. Hearing transducers 3.5. Types of audiometer 3.6. Audiometer system bakesey 3.7. Hearing aid – conventional and digital

4.	Electrocardiograph <ol style="list-style-type: none"> 4.1. Generation of ECG signal 4.2. ECG waveform 4.3. bipolar & unipolar leads 4.4. ECG readout device (block diagram, working principle) 4.5. ECG pre-amplifier 4.6. Vector cardiograph 4.7. Trade mill
5.	Electroencephalograph <ol style="list-style-type: none"> 5.1. Generation of EEG signal 5.2. 10-20 electrode placement system 5.3. EEG spectrum, amplitude and frequency band 5.4. Multichannel EEG recording system and typical external control
6.	Electromyography <ol style="list-style-type: none"> 6.1. Generation of EMG signal (voluntary & stimulated) 6.2. Motor & sensory nerve conduction 6.3. Block diagram & principal of operation of EMG machine
7.	Phonocardiography <ol style="list-style-type: none"> 7.1. Heart sounds, foetal heart sound, recording techniques, applications 7.2. Technical specifications, block diagram & principal of operation of Phonocardiograph. 7.3 Relationship between ECG & PCG & arterial BP
8.	Pulmonary function analyzer <ol style="list-style-type: none"> 8.1 Pulmonary function measurements Respiratory volumes, expiratory capacities, compliance and related pressure. 8.2 Spirometry : Basics Spirometer, wedge Spirometer, ultrasonic Spirometer

LABORATORY EXPERIENCES :

Sr. No	Name of Experiments
1	To demonstrate the Measurement of blood pressure.
2	To demonstrate the Measurement of SpO ₂ using pulse oximeter 04 & study of its controls
3	To demonstrate the Measurement of pulse rate, relative blood pressure & observation of blood pressure waveform using plethysmo graph
4	To demonstrate the Measurement of respiration rate using respiration rate meter & study of its circuit & control.
5	To perform body temperature measurement using digital temperature indicator & study of its circuit

6	To perform Measurement of air conduction & bone conduction response & study of audiometer.
7	To perform Measurement of skin response using GSR. To study lead selector network of ECG machine
8	To study lead selector network of ECG machine
9	To perform Measurement of gain and CMRR of ECG pre <u>amplifier</u>
10	To Study the effect of right leg drive in ECG output waveform.
11	To perform Measurement of CMRR & gain of EMG / EEG preamplifier
12	To demonstrate the Performance & testing of EMG stimulators
13	To demonstrate the performance of ECG machine
14	To demonstrate the performance of EEG machine
15	To demonstrate the performance of EMG machine
16	To demonstrate the performance of Spirometer machine

Demonstration:

1. Study of EMG system
2. Study of EEG system
3. Study of phonocardiogram

REFERENCES BOOKS:

1. John G. Webster, Editor Medical instrumentation application & design
John Wiley and Sons
2. R. S. Khandpur, Handbook of biomedical instrumentation ,Tata McGraw Hill
3. Lesli P Cromwell, Fred J. Weibell, Erich A. Pfeiffer Biomedical instrumentation measurements Prentice hall of India.
4. Carr Joseph J., Brown J.M Introduction to biomedical equipment technology
Pearson education Delhi
5. A. G. Patil Medical Electronics Excel Book New Delhi