Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXL8044	Biomedical Electronics	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes		EXC8044 (Biomedical Electronics)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Evaluate design of building blocks for various medical instruments
	CO2	Measure various bioelectric signals using advanced electronics techniques
	CO3	Justify the necessity and principle of operation of health related medical instruments used in hospital
	CO4	Justify the importance of patient safety
	CO5	Check biomedical equipment related standards

Exp. No.	Experiment Details	Ref.	Marks
1	**Aim:** Simulate the instrumentation amplifier with TINA SPICE and plot frequency response. Implement the instrumentation amplifier with Texas Instruments ALSK or on bread board. Compare and discuss the simulation and experimental results. **Objective:** In this experiment student should understand the need of instrumentation amplifier in biomedical instrumentation. Also should able to design and implement IA with high value of gain (>1000) and CMRR. **Tasks:** i) Simulate IA for high value of gain and CMRR & obtain frequency response. ii) Implement IA using hardware components with same values & plot frequency response. iii) Verify simulation and hardware results.	1,2	**05**
2	**Aim:** To design, simulate and implement notch filter (50Hz). Plot the frequency response and compare experimental results with simulation results. **Objective:** In this experiment student should understand the need of Notch filter in biomedical instrumentation. Also should able to design and implement notch filter.	1,2	**05**

	Tasks: i) Simulate notch filter & obtain frequency response ii) Implement notch filter using hardware components with same values & plot frequency response. iii) Verify simulation and hardware results.		
3	**Aim:** To obtain, measure and analyze simulated and real time ECG waveforms using simulator board ST2351 and ST2352. **Objective:** In this experiment student should understand the measurement procedure for ECG using ST2351 and ST2352 boards. Also student should understand various lead configurations and their importance and able to analyze the recorded ECG's. Depending on the nature of ECGgraph and measured values student should able to identify the abnormalities if any. **Tasks:** i) Record simulated ECG using ST2351 board. ii) Record real time ECG using ST2352 board for different lead configurations. iii) Compare simulated & real time ECG and note down values of amplitude, time duration, etc; for P, QRS, T & U segments. iv) Note down the value of heart rate for real time ECG and identify abnormalities if any.	3	**05**
4	**Aim:** To record and analyze real time ECG waveform using ECG sensor, Ni-Elvis and LabView. **Objective:** In this experiment student should understand the recording procedure for ECG using biomedical electronics toolbox of Labview and NI-Elvis kit. Also student should understand the interfacing of hardware components electrodes-protoboard-NI-Elvis-PC with Labview. **Tasks:** i) Develop a VI to plot real time ECG graph using Labview and NI-Elvis. ii) Using Biomedical electronics toolbox plot ECG graphs for various abnormalities. iii) Compare normal and abnormal ECG graphs.	4	**05**
5	**Aim:** To record and analyze real time EEG waveform using EEG sensor, Ni-Elvis and LabView. **Objective:** In this experiment student should understand the recording procedure for EEG using biomedical electronics toolbox of Labview and NI-Elvis kit. Also student should understand the interfacing of hardware components electrodes-protoboard-NI-Elvis-PC with Labview. **Tasks:** i) Develop a VI to plot real time EEG graph using Labview	4	**05**

	and NI-Elvis. ii) Using Biomedical electronics toolbox plot EEG graphs for various abnormalities. iii) Compare normal and abnormal EEG graphs.		
6	**Aim:** To record and analyze real time EMG waveform using EMG sensor, Ni-Elvis and Labview. **Objective:** In this experiment student should understand the recording procedure for EMG using biomedical electronics toolbox of Labview and NI-Elvis kit. Also student should understand the interfacing of hardware components electrodes-protoboard-NI-Elvis-PC with Labview. **Tasks:** i) Develop a VI to plot real time EMG graph using Labview and NI-Elvis. ii) Using Biomedical electronics toolbox plot EMG graphs for various abnormalities. iii) Compare normal and abnormal EMG graphs.	4	**05**
7	**Aim:** Design, implement and demonstrate various circuits for implementation of biomedical data acquisition/ instrumentation system (Innovative – Application/Project based learning)		**05**
8	**Aim:** To demonstrate Medical instruments X-ray machine, CT machine, MRI machine, Defibrillator, Pacemaker, Bedside monitor, Dialysis machine, Anesthesia machine and electrosurgical unit **Objective:** In this experiment students will understand the working principle of imaging instruments. Also students should able to differentiate between X-ray machine, CT machine and MRI machine. **Tasks:** Draft a detailed report on imaging instruments mentioning model number of the instruments, name of the company, specifications, working principle, procedure, safety & precautions.	Based on hospital visit	**05**
		Total Marks	**40**

References:

1. John G. Webster, "Medical Instrumentation", John Wiley and Sons, 4th edition, 2010.
2. R. S. Khandpur, "Biomedical Instrumentation", TMH, 2004.
3. ST2351 & ST2352 Manual
4. www.ni.com