BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani

Pilani Campus

SECOND SEMESTER 2019-2020

Course Handout (Part II)

Date: 06/01/2020

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No. : **INSTR F432/EEE F432**
Course Title : **Medical Instrumentation**
Instructor In-charge : **Sujan Yenuganti**

1. Course description, Scope and Objectives

This course will cover various systems of the human physiology, signals of biological origin obtained from these systems, biosensors, transducers, bio electrodes used to acquire such signals, and amplifiers for measuring bio potentials. Electrical safety of medical devices; measurements of the blood pressure, blood flow, respiratory system, clinical laboratory equipment, medical imaging, and bioethics will also be discussed. As a result, student can understand, design and evaluate systems and devices that can measure, test and/or acquire biological information from the human body. The course is divided into four modules, wherein, the first module deals with fundamentals of medical instruments and will cover the physiological and anatomical factors that contribute to the generation of biomedical signals/images. The second module deals with data acquisition of different types of biomedical signals/images that are generated through various medical instruments and transducers. The third module deals with various Biomedical devices including Bio MEMS and drug delivery systems. Finally, the fourth module will include clinical relevance and patient's safety.

2. Prescribed Text Book

T1: Cromwell, Biomedical Instrumentation and Measurements; PHI, New Delhi, 2nd Ed. 2015.

3. Reference Books

R1: R. S. Khandpur, Handbook of biomedical instrumentation, Tata McGraw-Hill.
R2: R. M. Rangayyan, Biomedical Signal Analysis: A Case-Study Approach, John Wiley & Sons.
R3: John G Webster, Medical Instrumentation: Application and Design, John Wiley & Sons.

Additional materials (e.g., journal papers) may be provided whenever necessary.

4. Course Plan

Module	Lectures	Lecture topics	Learning Outcome
Introduction	1	Overview of the course, and its potential applications.	Students will be able to understand the significance of medical Instrumentation
Fundamentals of Medical Instruments	2-4	Introduction to medical instruments, its basic components and their classifications.	Understand the essential components that are required in medical instruments.

	5-9	Anatomical and Physiological mechanisms of the human body - Biological neurons and different biological systems: auditory, visual, respiratory, nervous and cardiovascular.	Understand the anatomy and physiology of the human body, that is required for determining the source of the biomedical signal. Understand the role of engineers in healthcare.
	10-12	Challenges involved in measuring a living system and the role of engineers in healthcare facilities.	
Data acquisition of biomedical signals/images	13-16	Transducers and electrode placement for recording the biomedical signals/images.	Understand the role of transducers and electrode placements for recording various biomedical signals. Understand the role of clinical instruments and its setup for recording biomedical signals. Understand how various biomedical signals are recorded and collected using various medical instruments and transducers.
	17-19	Clinical laboratory instruments for biomedical signals/images.	
	20-26	1D biomedical signals: Electrocardiogram (ECG), Electroencephalogram (EEG), Electroneurogram (ENG), Electromyogram (EMG), Electroretinography (ERG), Electrooculography (EOG), Event-related Potentials (ERPs), Action potential, Electrogastrogram (EGG), Phonocardiogram (PCG), Speech production and recognition, sensory and Oto-acoustic emission signals	
	27-30	2D biomedical signals (or images): X-Ray, Magnetic resonance imaging (FMRI), Ultrasonic images, CT scans, and PET.	Understand how various types of biomedical images are recorded and collected using various medical instruments and transducers.
Bio medical devices	31-37	All types of medical devices including Bio-MEMS, micro drug delivery, micro pumps, micro mixers etc.	Understand about various types of biomedical devices and their roles in real world applications of biomedical field.
Clinical Relevance	38-40	Therapeutic and prosthetic devices, rehabilitation, Patient monitoring systems and Electrical safety	Understand the challenges faced in clinics for using prosthetic device and on patient's safety.

5. Evaluation Scheme:

Evaluation Component	Duration	Weightage (%)	Date & Time	Nature of component
Mid Semester exam	90 Min.	25 %	<TEST_1>	Closed Book
Class quiz	20 Min.	15 %		Closed Book

Research based reading test	20 Min.	20%		Open Book
Comprehensive Examination	3 hours	40 %	<TEST_C>	Closed Book

6. Chamber Consultation Hour: To be announced in the class.

7. Course Notices: All notices related to the course will be placed on Nalanda/EEE office notice board.

8. Make-up Policy:

- Prior permission of the Instructor-in-Charge is usually required to take a make-up for a test.
- A make-up test shall be granted only in genuine cases where - in the Instructor's judgment – the student would be physically unable to appear for the test.
- In case of an unanticipated illness preventing a student from appearing for a test, the student must present a Medical Certificate from BITS hospital.
- In case of an unanticipated absence for a test due to a trip out of Pilani, the student must present a letter from his/her Warden or the Chief Warden certifying such absence and the reason(s).
- Requests for make-up for the comprehensive examination – under any circumstances – can only be made to Dean, Instruction Division.

Instructor-in-charge

EEE/INSTR F432