



BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

SECOND SEMESTER 2020-21
COURSE HANDOUT

Date: 01.01.2021

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 : **EEE/INSTR F432**
Course Title : **Medical Instrumentation**
Instructor-in-Charge : **SUJAN YENUGANTI**
Instructor(s) : **-----**
Tutorial/Practical Instructors: **-----**

1. Course Description: Basic components of bio-medical instruments, bio-electric signals & recording electrodes, transducers, recording and display devices. Patient care and monitoring systems, cardiovascular measurements-blood pressure, blood flow, cardiac output, heart sounds etc.; instrumentation for respiratory and nervous systems, analysis of EEG, ECG, EMG, EOG and action potentials, non- invasive diagnostic measurements - temperature, ultrasonic diagnosis, CAT scan techniques, sensory measurements-motor response, analysis of behaviour etc. biotelemetry, biofeedback, clinical laboratory instruments, X-ray diagnosis. Recent advances in biomedical instrumentation- microprocessor based systems, lasers & optical fiber based systems.

2. Scope and Objective of the Course: 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, students 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.

3. Text Books:

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

4. Reference Books:

R1: R. S. Khandpur, Handbook of biomedical instrumentation, Tata McGraw-Hill.

R2: C. Raja Rao & S. K Guha, Principles of Medical electronics and Biomedical Instrumentation, University press.

R3: John G Webster, Medical Instrumentation: Application and Design, John Wiley & Sons.



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5. Course Plan:

Module	Lecture topics	Reference	Learning Outcome
Introduction	Overview of the course, and its potential applications.	T1	Students will be able to understand the significance of medical Instrumentation
Fundamentals of Medical Instruments	Introduction to medical instruments, its basic components and their classifications.	T1	Understand the essential components that are required in medical instruments.
	Anatomical and Physiological mechanisms of the human body - Biological neurons and different biological systems: auditory, visual, respiratory, nervous and cardiovascular.	T1,R1 & R2	Understand the anatomy and physiology of the human body, that is required for determining the source of the biomedical signal.
	Challenges involved in measuring a living system and the role of engineers in healthcare facilities.	R1	Understand the role of engineers in healthcare.
Data acquisition of biomedical signals/images	Transducers and electrode placement for recording the biomedical signals/images.	T1,R1 & R3	Understand the role of transducers and electrode placements for recording various biomedical signals.
	Clinical laboratory instruments for biomedical signals/images.	T1, R1	Understand the role of clinical instruments and its setup for recording biomedical signals.



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	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		Understand how various biomedical signals are recorded and collected using various medical instruments and transducers.
	2D biomedical signals (or images): X-Ray, Magnetic resonance imaging (fMRI), Ultrasonic images, CT scans, and PET.	R1	Understand how various types of biomedical images are recorded and collected using various medical instruments and transducers.
Bio medical devices	All types of medical devices including Bio-MEMS, micro drug delivery, micro pumps, micro mixers etc.	R3	Understand about various types of biomedical devices and their roles in real world applications of biomedical fields.
Clinical Relevance	Therapeutic and prosthetic devices, rehabilitation, Patient monitoring systems and Electrical safety	T1	Understand the challenges faced in clinics for using prosthetic devices and on patient's safety.



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6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of component (Close Book/ Open Book)
Mid-Semester Test	90 Min.	25%	TBA	Closed Book
Comprehensive Examination	2 h	40%	7th May FN	Closed Book
Class Quiz	15 Min.	15%		Closed Book
Assignment		20%		Open Book
		100%		

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

8. Notices: All notices related to the course will be placed on Nalanda.

9. Make-up Policy:

Prior permission of the Instructor-in-Charge is usually required to take a make-up for a test.

In case of an unanticipated illness preventing a student from appearing for a test, the student must present a Medical Certificate.

10. Note (if any):

Instructor-in-charge
Course No. EEE/INSTR F432