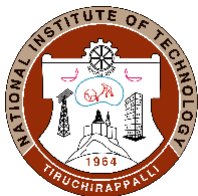




DEPARTMENT OF CHEMICAL ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	MTech and Process Control and Instrumentation		
Course Title	Biomedical Instrumentation		
Course Code	CL673	No. of Credits	3
Course Code of Pre-requisite subject(s)			
Session	January <u>2021</u>	Section (if, applicable)	--
Name of Faculty	Dr. K. Sankar	Department	Chemical Engineering
Official Email	shankark@nitt.edu	Telephone No.	--
Name of Course Coordinator(s) (if, applicable)	Dr. P. Kalaichelvi		
Official E-mail	kalai@nitt.edu	Telephone No.	+91 - 431 - 2503109
Course Type (please tick appropriately)	Programme Elective course		
Syllabus (approved in BoS)			
<p>Course Content:</p> <p>Physiological systems and measurable variables- Nature and complexities of biomedical measurements- Medical equipment standards- organization, classification and regulation- Biocompatibility - Human and Equipment safety – Physiological effects of electricity, Micro and macro shocks, thermal effects.</p> <p>Modeling and simulation in Biomedical instrumentation – Difference in modeling engineering systems and physiological systems – Model based analysis of Action Potentials - cardiac output – respiratory mechanism - Blood glucose regulation and neuromuscular function.</p> <p>Types and Classification of biological signals – Signal transactions – Noise and artifacts and their management - Biopotential electrodes- types and characteristics - Origin, recording schemes and analysis of biomedical signals Electrocardiography(ECG), with typical examples of and Electroencephalography(EEG), Electromyography (EMG)– Processing and transformation of signals- applications of wavelet transforms in signal compression and denoising.</p> <p>Advanced medical imaging techniques and modalities -Instrumentation and applications in monitoring and diagnosis- Computed tomography, Magnetic Resonance Imaging and ultrasound- Algorithms and applications of artificial intelligence in medical image analysis and diagnosis-Telemedicine and its applications in tele monitoring.</p>			



Implantable medical devices: artificial valves, vascular grafts and artificial joints- cochlear implants - cardiac pacemakers – Microfabrication technologies for biomedical Microsystems- microsensors for clinical applications – biomedical microfluid systems

REFERENCE BOOKS

1. John G.Webster, “Bioinstrumentation”, John Wiley & Sons, 2008.
2. Shayne C.Gad, “Safety Evaluation of Medical Devices”, CRC Press, Second Edition, 2002.
3. Michael C.K.Khoo, “Physiological Control Systems: Analysis, Simulation and Estimation, IEEE Press, 2000.
4. John G.Webster, “Medical Instrumentation Application and Design”, John Wiley & Sons, Third Edition, 2009.
5. L.Cromwell, Fred J.Weibell and Erich A.Pfeiffer, “Biomedical Instrumentation and Measurements”, Prentice Hall of India, Digitized 2010.
6. P.Strong, “Biophysical Measurements”, Tektronix, Digitized 2007.
7. K.Najarian and R. Splinter, “Biomedical Signal and Image Processing”, CRC Press, 2012.
8. John L.Semmlow, “Biosignal and Biomedical Image Processing”, CRC Press, First Edition, 2004.
9. Joseph J.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, Prentice Hall, Fourth Edition, 2004.
10. M. Arumugam, “Biomedical Instrumentation”, Third edn, 2016.

COURSE OBJECTIVES

To introduce the principles and design issues of biomedical instrumentation. To understand the nature and complexities of biomedical measurements

MAPPING OF COs with POs

Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
1. measurable variables in physiological systems and its complexity, medical instrument standard, biocompatibility, safety, electrical shock	1, 2, 3, 4, 11, 12
2. modeling and simulation in Biomedical instrumentation, and model based analysis	2, 3, 5, 6, 8, 10
3. analysis of biological signals – ECG, EEG, EMG	1, 2, 3, 4, 5, 6, 8, 10
4. advanced medical imaging techniques, computed tomography, MRI. And implantable medical devices	1, 2, 3, 4, 5, 6, 7, 10, 11, 12

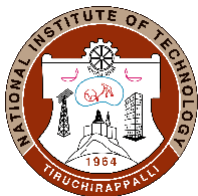
COURSE PLAN – PART II

COURSE OVERVIEW

The students will be getting knowledged about sensors/measuring instruments applicable in biomedical applications. Students will also expose to modeling and simulation of medical instrumentation. Acquire knowledge in analysiing the biomedical signals (ECG,EEG, EMG) and some of available advanced medical imaging technique as well as implantable medical devices.



COURSE TEACHING AND LEARNING ACTIVITIES			(Add more rows)
S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1	Physiological systems and measurable variables- Nature and complexities of biomedical measurements	PPT, Online
2	Week 2	Medical equipment standards- organization, classification and regulation-Biocompatibility. Human and Equipment safety – Physiological effects of electricity, Micro and macro shocks, thermal effects.	PPT, Online
3	Week 3	Modeling and simulation in Biomedical instrumentation – Difference in modeling engineering systems and physiological systems	PPT, Online
4	Week 4	Model based analysis of Action Potentials - cardiac output	PPT, Online
5	Week 5	respiratory mechanism - Blood glucose regulation and neuromuscular function.	PPT, Online
6	Week 6	Types and Classification of biological signals – Signal transactions – Noise and artifacts and their management - Biopotential electrodes- types and characteristics	PPT, Online
7	Week 7	Origin, recording schemes and analysis of biomedical signals Electrocardiography(ECG), with typical examples of and Electroencephalography(EEG), Electromyography (EMG)	PPT, Online
8	Week 8	Processing and transformation of signals- applications of wavelet transforms in signal compression and denoising.	PPT, Online
9	Week 9	Advanced medical imaging techniques and modalities - Instrumentation and applications in monitoring and diagnosis	PPT, Online
10	Week 10	Computed tomography, Magnetic Resonance Imaging and ultrasound. Algorithms and applications of artificial intelligence in medical image analysis and diagnosis-Telemedicine and its applications in tele monitoring	PPT, Online



11	Week 11	Implantable medical devices: artificial valves, vascular grafts and artificial joints- cochlear implants - cardiac pacemakers	PPT, Online
12	Week 12	Microfabriation technologies for biomedical Microsystems- microsensors for clinical applications – biomedical microfluid systems	PPT, Online

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I	Week 5	1 hr	25%
2	Assessment II (Assignment)	Week 6		10%
3	Assessment III	Week 11	1 hr	25%
4	Assessment IV (Assignment)	Week 12		10%
CPA	Compensation Assessment*	Week 12	1 hr	25%
5				
6	Final Assessment *	Week 14	2 hrs	30%

*mandatory; refer to guidelines on page 4

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Through online classroom by means of polling questions/messages/Class Committee meetings

COURSE POLICY (including compensation assessment to be specified)

The course syllabus can be covered within 12 weeks. There are 5 assessments will be conducted to evaluate the student performance. Compensation assessment can be conducted before the final exam date.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.




- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.


ACADEMIC DISHONESTY & PLAGIARISM


- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL


Dr. K. Sankar
Course Faculty


K Muthukumar
10.02.2021
CC- Chairperson


HOD



Guidelines

- a) The number of assessments for any theory course shall range from 4 to 6.
- b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.
- d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.