

# BIO ELECTRONICS SENSOR

(Elective Subject)

<b>Course Code:</b>	13B1WEC833	<b>Semester:</b>	8 <sup>th</sup> Semester, B. Tech (ECE)
<b>Credits:</b>	3	<b>Contact Hours:</b>	L-3, T-0, P-0

## Course Objectives

The objectives are to study

1. transducers, sensors (bio sensor)
2. bio-potentials, electrodes and amplifiers
3. bio-signal amplifiers
4. Fuzzy implementation, petrinet implementation

## Course Outcomes

After studying this course the students would gain enough knowledge

1. What are sensors, actuators and transducers?
2. How the students can design circuit diagram of bio-sensor for electrical and non- electrical signals?
3. the students will reach a sufficient knowledge of different types of bio electric amplifiers
4. the students will reach a sufficient knowledge and skill for being able of choosing novel solutions in terms of bio-signal Amplifiers
5. What are bio-potential and its amplifiers?
6. the students will reach a sufficient knowledge and skill for being able of choosing novel solutions in terms of bio-signal Amplifiers
7. Understand the design abstraction levels in bio-sensing Microsystems and design of signal acquisition interface for bio-sensing systems

## Course Contents

Unit	Topics	References (chapter number, page no. etc)	Lectures
<b>1.</b>	<b>Introduction</b> : Introduction to Sensor, Bio electronic, Bioelectronics Sensor, Systems biology and Synthetic biology	Reddy : Chapter 1 Carr : Chapter 3, 4	3
<b>2.</b>	<b>Electrodes, Sensors and transducers</b> : Sensor/Actuators, Active v/s passive sensors, sensor error sources, sensor terminology, Types of Sensors, Bio sensor, Block diagram of Bio-sensor for electrical and non electrical signals, electrodes for biophysical sensing, transducers, performance parameters of sensors, complete circuit diagram of bio sensor.	Carr : Chapter 6	9
<b>3</b>	<b>Bio-potential Electrodes</b> : The electrode-electrolyte interface, polarization, polarizable	Ref Book : Point No 3	9

	and non-polarizable electrodes, Electrode behavior and circuit models, body surface recording electrodes, internal electrodes, micro electrode, macro electrode		
4	<b>Bio-electric Amplifiers</b> : Voltage, current, power amplifiers, Low gain, medium gain, high gain amplifiers	Carr : Chapter 7	9
5	<b>Bio-potentials:</b> ECG, EEG, EMG, ERG, EOG, its amplitude and bandwidth, Electrodes for Bio-potential Recordings, Electrical Interference Reduction.	Carr : Chapter 8	5
6	<b>Bio-potential Amplifiers:</b> Operational amplifiers, basic amplifier configurations, multiple input circuits, differential amplifiers, signal processing circuits, isolation amplifiers, IMRR, ECG Amplifier, functional block, interference from electric devices, transient protection, common mode and other interference reduction circuits, Driven right leg circuit, amplifiers for other bio-potential signals, pre amplifier.	Ref Book : Point No 4	6
7	<b>Bio-signal Amplifiers</b> : Instrumentation amplifier, Chopper Amplifier, Carrier Amplifier	Ref Book : Point No 6	3
<b>Total Number of Lectures</b>			44

## Evaluation Scheme

1. Test 1 :15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
  - 10 Marks : Class performance, Tutorials & Assignments
  - 10 Marks : Quizzes
  - 5 marks : Attendance

## Text Books

1. Carr, JJ , Brown, JM, “Introduction to Biomedical Equipment Technology”, Pearson, 4<sup>th</sup> Ed.
2. Reddy, D.D., Hussian, O.M., Gopal, D.V. R., Rao, D. M., Sastry, K.S. : Biosensors and Bioelectronics, I.K. International Pub

## Reference Books

1. Cromwell L, Weibell FJ, Pfeiffer EA, “Biomedical Instrumentation and Measurements”, PhI
2. <http://www.egr.msu.edu/classes/ece445/mason/Files/7-BioAmps.pdf>

3. [http://www.fis.uc.pt/data/20062007/apontamentos/apnt\\_134\\_5.pdf](http://www.fis.uc.pt/data/20062007/apontamentos/apnt_134_5.pdf)
4. [https://ay14-15.moodle.wisc.edu/prod/pluginfile.php/74584/mod\\_resource/content/1/Ch06-MI4e-7-11-08.pdf](https://ay14-15.moodle.wisc.edu/prod/pluginfile.php/74584/mod_resource/content/1/Ch06-MI4e-7-11-08.pdf)
5. [http://www.kau.edu.sa/Files/0003605/Files/69647\\_Origin%20of%20Bio-Potentials.pdf](http://www.kau.edu.sa/Files/0003605/Files/69647_Origin%20of%20Bio-Potentials.pdf)
6. [http://www.fis.uc.pt/data/20062007/apontamentos/apnt\\_134\\_5.pdf](http://www.fis.uc.pt/data/20062007/apontamentos/apnt_134_5.pdf)
7. Neil Weste and David Harris, "CMOS VLSI Design", 4<sup>th</sup> Ed., Addison Wesley, 2011.
8. Gayakwad, R. A. "Op-amps and Linear Integrated Circuits", PHI 3rd Ed.
9. Klir, G. J., Yuan, B "Fuzzy Sets and Fuzzy Logic PHI.
10. Douglas A Pucknell et al, "Basic VLSI Design", 3<sup>rd</sup> Ed., Prentice Hall, 2004