Academic Course Description

BHARATH UNIVERSITY

Faculty of Engineering and Technology

Department of Electronics and communication Engineering

BBM405- BIOSENSORS AND TRANSDUCERS

Eighth Semester, 2016-17 (Even Semester)

Course (catalog) description

- Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications.

Compulsory/Elective course: Elective for ece students

Credit & contact hours : 3 & 45

Course Coordinator : Mr. Prasad, Assistant Professor

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Mr. Prasad	Final Year	BM Block		Prasath1989@gmail.com	9.00-9.50 AM

Relationship to other courses:

Pre –requisites **:** Biology for Engineers, Electronics & Instrumentation

Assumed knowledge : The students will have a electronics and biosensors background obtained at a high school (or Equivalent) level. In particular, working knowledge of basic electronics including Sensors, Transducers, Transistors are assumed.

Following courses : Biomedical instrumentation

UNIT - I **9**

SCIENCE OF MEASUREMENT

Units and Standards - calibration methods - statics calibration - classification of errors, error analysis - statistical methods - odds and uncertainity.

UNIT – II CHARACTERISTICS OF TRANSDUCERS **9**

Static characteristics - accuracy, precision, sensitivity, linearity etc - mathematical model of transducers - zero first - order and second - order transducers - response to impulse step, ramp and sinsoidal inputs.

UNIT – III VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation, construction details, characteristics and applications of resistance potentiometers, strain gauges, resistance thermometers, thermistors, hot-wire aneometer, piezoresistive sensors and humidity sensors.

UNIT – IV BIOSENSORS PHYSIOLOGICAL RECEPTORS - J RECEPTORS 9

Chemoreceptors, Baroreceptors, Touch receptors, Biosensors - Working Principle and Types, Applications.

UNIT – V OTHER TRANSDUCERS 9

Piezoelectric tranducers, magnetostrictive transducer, IC sensor digital transducers - smart sensor - fibre optic transducers.

TOTAL NO OF PERIODS: 45

Text Books:

1. Doeblin. E. O, Measurment Systems, McGraw Hill Book Co. 1998

2. Renganathan S, Transducer Engineering, Allied Publishers, Chennai,2000.

3.https://www1.ethz.ch/lbb/Education/Biosensors/Lecture_1_overview.pdf

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Instrumentation | Electronics | Transmission Lines and Networks | Biomedical

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 1st week	Session 1 to 12	2 Periods
2	Cycle Test-2	March 2nd week	Session 17 to 25	2 Periods
3	Model Test	April 2nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To develop problem solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems. This course emphasizes:	Correlates to program outcome		
	H	M	L
Describe the purpose and methods of measurements.	b,d,j,e	a,c,f,k	j
Explain different display and recording devices for various applications.	a,c,f,k	d,g,h	j
Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications	a,c,f,k	b,d,e,g	j
Remember and understand the concepts, types, working and practical applications of important biosensors.	a,c,f,k	b,d,e,g	j
Know some of the commonly used biomedical transducers.	e	a,b,c,d,g	j

H: high correlation, M: medium correlation, L: low correlation

Draft lecture schedule

Session	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I	**SCIENCE OF MEASUREMENT**		
1.	Units and Standards - calibration methods	No	[T1]
2.	statics calibration	No	
3.	classification of errors	No	
4.	error analysis	No	
5.	statistical methods	No	
6.	odds and uncertainity	No	
UNIT II	**CHARACTERISTICS OF TRANSDUCERS**		
7.	Static characteristics - accuracy, precision	No	[T1]
8.	sensitivity, linearity etc - mathematical model of transducers	yes	
9.	zero first - order and second -	No	
10.	response to impulse step	yes	
11.	ramp and sinsoidal inputs	No	
12.	order transducers	No	
UNIT III	**VARIABLE RESISTANCE TRANSDUCERS**		
13.	Principle of operation, construction details	No	[T1]
14.	characteristics and applications of resistance potentiometers	No	
15.	strain gauges, resistance thermometer	No	
16.	thermistors, hot-wire aneometer	No	
17.	piezoresistive sensors	No	
18.	humidity sensors	No	
UNIT IV	**BIOSENSORS - PHYSIOLOGICAL RECEPTORS - J RECEPTORS**		
19.	Chemoreceptors	No	[T1]
20.	Baroreceptors	No	
21.	Touch receptors	No	
22.	Biosensors - Applications	No	
23.	Working Principle and Types	No	
UNIT V	**OTHER TRANSDUCERS**		
24.	Piezoelectric tranducers	No	[T1]
25.	magnetostrictive transducer, - - fibre	No	
26.	IC sensor digital transducers	No	
27.	smart sensor	No	
28.	optic transducers	No	
29.	HMI / SCADA software, Active X programming.	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment /Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Mr. Prasad, Assistant professor , Department of BM **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate*:*

a. An ability to apply knowledge of mathematics, science, and engineering

b. An ability to design and conduct experiments, as well as to analyze and interpret data

c. An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. An ability to function on multidisciplinary teams

e. An ability to identify, formulate, and solve engineering problems

f. An understanding of professional and ethical responsibility

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE

Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM

Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL

Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS

Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement.

Course Teacher	Signature
Mr.Prasad	

Course Coordinator **HOD/ECE**