

**SRM UNIVERSITY**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**SCHOOL OF BIO ENGINEERING**  
**DEPARTMENT OF BIOMEDICAL ENGINEERING**

**LESSON PLAN**

**Course Code: BM1006**

**Course Title: BIOMEDICAL SENSORS AND MEASUREMENT DEVICES**

**Semester: III SEM B. Tech**

**Course Timings:**

DAY	1	2	3	4	5	6	7
DAY 1							
DAY 2							
DAY 3							
DAY 4					<b>BM1006</b>	<b>BM1006</b>	
DAY 5					<b>BM1006</b>		

**Location: School of Bioengineering (5<sup>th</sup> floor- B603)**

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**TEXTBOOKS:**

1. Sawhney A.K, "A course in electrical and electronic measurements and instrumentation", Dhanpat Rai & Co (P) Ltd, Educational and Technical Publishers, 1996.
2. Cooper, "Electronic Instrumentation and Measurement techniques" Prentice Hall of India, 1998. REFERENCES

**REFERENCES:**

1. Renganathan S, "Transducer engineering", Allied Publishers Limited, 2003.
2. Murty DVS, "Transducer and instrumentation", PHI, second edition, 2008.
3. Manoj Kumar Ram, Venkat R, Bhethanabolta, "Sensors for chemical and biological applications", CRC press, 2010
4. Patranabis D, "Sensors and transducers", PHI, Second Edition, 2004.
5. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs and applications", Third edition, Springer International, 2010.
6. Doebelin, "Measurements Systems: Application and Design", Tata McGraw- Hill, 2003. . Neubert HKP, "Instrument Transducers", Oxford University Press, 1999.

**PURPOSE:**

To gain knowledge about the measuring instruments and the methods of measurement.

**INSTRUCTIONAL OBJECTIVES:**

1. To get the basic idea of measurements and the errors associated with measurement
2. To know about the types of transducers available
3. To understand the function of signal generators and analyzers
4. To gain knowledge on functioning of the various measuring instruments and display devices in the application of biomedical signal recorders

S.NO	Day Order	Hour	Topic	Teaching method	Reference Material
<b>UNIT-I MEASUREMENT SYSTEM AND BASICS OF TRANSDUCER</b>					
1.	4	5	Measurements and generalized measurement system	BB	T1
2.	4	6	Static characteristics, Accuracy, Precision, Linearity, Hysteresis, Threshold	BB	T1,T2
3.	5	5	Dynamic range, Dynamic Characteristics	BB	T1
4.	4	5	Calibration, Standards	BB	T1
5.	4	6	AC bridges	BB	T1
6.	5	5	DC bridges	BB	T1
7.	4	5	Transducer: Basics, Classification	BB	T1,T2
8.	4	6	Characteristics and Choice of Primary sensing elements, POT	BB	T1,T2
9.	5	5	Thermistor, Thermocouple, Temperature compensation	BB	T1,T2,R1
<b>UNIT –II MEASUREMENT OF NON-ELECTRICAL QUANTITIES</b>					
10.	4	5	LVDT	BB	T1,T2,R1
11.	4	6	Strain gauges	BB	T1,T2,R1
12.	5	5	Pressure Transducer	BB	T1,T2,R1
13.	4	5	Capacitive Transducer	BB	T1,T2,R1
14.	4	6	Inductive Transducer	BB	T1,T2,R1
15.	5	5	Piezo electric, Hall effect Transducers	BB	T1,T2,R1
16.	4	5	Optoelectronic- Digital encoding	BB	T1,T2,R1
17.	4	6	Fiber optic: Flow and liquid level Sensors	BB	T1,T2,R1
18.	5	5	Electrochemical transducer	BB	T1,T2,R1
<b>UNIT –III SIGNAL GENERATORS AND SIGNAL ANALYZER</b>					
19.	4	5	Signal generator: AF	BB	T1,T2
20.	4	6	Signal generator: Pulse	BB	T1,T2
21.	5	5	Amplitude Modulation	BB	T1,T2
22.	4	5	Frequency Modulation	BB	T1,T2
23.	4	6	Function Generator	BB	T1,T2
24.	5	5	Sweep frequency Generator	BB	T1,T2

25.	4	5	Signal analyzer: Wave	BB	T1,T2
26.	4	6	Signal analyzer: Spectrum	BB	T1,T2
27.	5	5	Signal analyzer: Logic and Distortion	BB	T1,T2
<b>UNIT IV- DIGITAL DATA DISPLAY AND RECORDING SYSTEM</b>					
28.	4	5	DVM and millimeters		T1,T2
29.	4	6	Frequency Measurement	BB	T1,T2
30.	5	5	Period measurement	BB	T1,T2
31.	4	5	Time interval and pulse width measurement	BB	T1,T2
32.	4	6	Graphic recorders-strip chart, X-Y recorder	BB	T1,T2
33.	5	5	Magnetic tape recorder	BB	T1,T2
34.	4	5	CRO basics	BB	T1,T2
35.	4	6	CRT, General purpose Oscilloscope, Dual trace Oscilloscope	PR	T1,T2
36.	5	5	Dual beam, Sampling oscilloscope, Digital storage oscilloscope	PR	T1,T2
<b>UNIT V- MEDICAL APPLICATIONS OF SENSORS</b>					
37.	4	5	Gas sensor, NBC agent	BB	R3
38.	4	6	Microbial sensor	PR	R3
39.	5	5	Electro analytical sensor	BB	R3
40.	4	5	Enzyme based sensor, Glucose sensor,	BB	R3
41.	4	6	Electronic nose, Halitosis, Breath analysis	BB	R3
42.	5	5	Electronic nose-Kidney disease, Skin analysis, Lung cancer	BB	R3
43.	4	5	Advances in sensor technology: Lab-on-a –chip	PR	R3
44.	4	6	Smart sensor, MEMS and Nano sensor	PR	R3
45.	5	5	Enzyme immobilization of chemical analyses	BB	R3
46.	4	5	Radiation sensor, Thermal radiation sensor	BB	R3

**Test Portions:**

Cycle test I: 1½ Units (Sl. No 1 to 14)

Cycle test II: 1½ Units (Sl. No 15 to 27)

Model Exam: All 5 units

**Assessment details:**

Cycle Test1- 10 marks

Cycle Test2- 10 marks

Model Exam - 20 marks

Surprise test - 05marks

Attendance -05markss

