

# Engineering Program

Specialty	Medical Equipment Technology
Course Number	02040613
Course Title	Biomedical Instrumentation
Credit Hours	3
Theoretical Hours	3
Practical Hours	0

**Brief Course Description:**

The student should acquire a good knowledge in the Basic Concepts of Medical Instrumentation, Basic sensors and principles , Amplifiers and signals processing, Amplifiers and signal processing and the concept of biopotential amplifiers and electrodes

**Detailed Course Description:**

Unit Number	Unit Name	Unit Content	Time Needed
1.	Basic Concepts of Medical Instrumentation	<ul style="list-style-type: none"> <li>▪ Generalized medical instrumentation systems</li> <li>▪ Alternative operational modes</li> <li>▪ Classification of biomedical instruments</li> <li>▪ Interfering and modifying inputs</li> <li>▪ Compensation techniques</li> <li>▪ Generalized static and dynamic characteristics .</li> </ul>	
2.	Basic sensors and principles	<ul style="list-style-type: none"> <li>▪ Displacement measurements</li> <li>▪ Resistive sensors</li> <li>▪ Bridge circuits</li> <li>▪ Inductive sensors</li> <li>▪ Capacitive sensors</li> <li>▪ Piezoelectric sensors</li> <li>▪ Temperature measurements</li> <li>▪ Thermocouple , thermistor</li> <li>▪ Fiber optic temperature sensors</li> <li>▪ Optical measurements</li> <li>▪ Chemical biosensors</li> </ul>	
3.	Amplifiers and signals processing	<ul style="list-style-type: none"> <li>▪ Ideal Op Amps</li> <li>▪ Inverting amplifiers</li> <li>▪ Non inverting amplifiers</li> </ul>	

		<ul style="list-style-type: none"> <li>▪ Differential amplifiers</li> <li>▪ Comparators</li> <li>▪ Rectifiers</li> <li>▪ Logarithmic amplifiers</li> <li>▪ Integrators</li> <li>▪ Differentiators</li> <li>▪ Active filters</li> <li>▪ Frequency response</li> <li>▪ Offset voltage</li> <li>▪ Bias current</li> <li>▪ Input and output resistance</li> <li>▪ Phase-sensitive demodulators</li> <li>▪ Timers</li> <li>▪ Microcomputers in medical instrumentation</li> </ul>	
4.	Biopotential electrodes	<ul style="list-style-type: none"> <li>▪ The electrode electrolyte interface</li> <li>▪ Polarization</li> <li>▪ Polarizable and nonpolarizable electrodes</li> <li>▪ The electrode – skin interface and motion artifact</li> <li>▪ Body surface recording electrodes                             <ul style="list-style-type: none"> <li>○ Metal-plate electrodes</li> <li>○ Suction electrodes</li> <li>○ Floating electrodes</li> <li>○ Flexible electrodes</li> </ul> </li> </ul>	

		<ul style="list-style-type: none"> <li>▪ Internal electrodes</li> </ul>	
	Biopotential amplifiers	<ul style="list-style-type: none"> <li>• Basic requirements</li> <li>• The electrocardiograph</li> <li>• Problems frequently encountered</li> <li>• Transient protection</li> <li>• Common-mode and other interference reduction circuits</li> <li>• Amplifiers for other biopotential signals</li> <li>• Example of biopotential preamplifier</li> </ul>	

Evaluation Strategies:

Exams		Percentage	Date
Exams	Med-Term Exam	40%	--/--/----
	Final Exam	50%	--/--/----
Homework and Projects		10%	
Discussions and lecture presentations			

Teaching Methodology:

- ❖ Lecture- Board, Data Show

Text Books & References:

1. Medical Instrumentation , Application and design ; webester

.

# Engineering Program

Specialty	Medical Equipment Technology
Course Number	020406132
Course Title	Biomedical Instrumentation lab
Credit Hours	1
Theoretical Hours	0
Practical Hours	3

**Brief Course Description:**

The student should acquire a good knowledge in the Basic Concepts of Medical Instrumentation, Basic sensors and principles , Amplifiers and signal processing and the concept of biopotential amplifiers and electrodes



**Detailed Course Description:**

Unit Number	Unit Name	Unit Content	Time Needed
5.	Basic Concepts of Medical Instrumentation	<ul style="list-style-type: none"> <li>▪ Generalized medical instrumentation system</li> <li>▪ Classification of biomedical instruments</li> </ul>	
6.	Basic sensors and principles	<ul style="list-style-type: none"> <li>▪ Displacement measurements</li> <li>▪ Resistive sensors</li> <li>▪ Bridge circuits</li> <li>▪ Inductive sensors</li> <li>▪ Capacitive sensors</li> <li>▪ Piezoelectric sensors</li> <li>▪ Temperature measurements</li> <li>▪ Thermocouple , thermistor</li> <li>▪ Fiber optic temperature sensors</li> <li>▪ Optical measurements</li> <li>▪ Chemical biosensors</li> </ul>	

<p>7.</p>	<p>Biopotential electrodes</p>	<ul style="list-style-type: none"> <li>▪ The electrode – skin interface and motion artifact</li> <li>▪ Body surface recording electrodes                             <ul style="list-style-type: none"> <li>○ Metal-plate electrodes</li> <li>○ Suction electrodes</li> <li>○ Floating electrodes</li> <li>○ Flexible electrodes</li> </ul> </li> <li>▪ Internal electrodes</li> </ul>	
	<p>Amplifiers and signals processing</p>	<ul style="list-style-type: none"> <li>▪ Ideal Op Amps</li> <li>▪ Inverting amplifiers</li> <li>▪ Non inverting amplifiers</li> <li>▪ Differential amplifiers</li> <li>▪ Comparators</li> <li>▪ Rectifiers</li> <li>▪ Logarithmic amplifiers</li> <li>▪ Integrators</li> <li>▪ Differentiators</li> <li>▪ Active filters</li> <li>▪ Frequency response</li> <li>▪ Offset voltage</li> <li>▪ Bias current</li> <li>▪ Input and output resistance</li> <li>▪ Phase-sensitive demodulators</li> </ul>	

		<ul style="list-style-type: none"> <li>▪ Timers</li> <li>▪ Microcomputers in medical instrumentation</li> </ul>	
	Biopotential amplifiers	<ul style="list-style-type: none"> <li>• Basic requirements</li> <li>• The electrocardiograph</li> <li>• Problems frequently encountered</li> <li>• Transient protection</li> <li>• Common-mode and other interference reduction circuits</li> <li>• Amplifiers for other biopotential signals</li> <li>• Example of biopotential preamplifier</li> </ul>	

Evaluation Strategies:

Exams		Percentage	Date
Exams	Med-Term Exam	30%	--/--/----
	Final Exam	50%	--/--/----
Homework and Projects		20%	
Discussions and lecture presentations			

Teaching Methodology:

- ❖ Lecture- Board, Data Show

Text Books & References.

