EC537- Biomedical Engineering

CREDIT HOURS

3 Hours

CONTACT HOURS (Hours/week)

Lecture: 2; Tutorial: 2

COURSE COORDINATOR

Dr. Khaled Shehata

TEXT BOOK

R.S. Khandpur, Handbook of Biomedical Instrumentation, McGraw Hill, 2000.

COURSE DESCRIPTION

Biomedical instrumentation, basics of biomedical engineering, biological phenomena, biopotentisl amplifiers, electronic pacemaker circuits.

PREREQUISITE:

EC 434

RELATION OF COURSE TO PROGRAM

Elective

COURSE INSTRUCTION OUTCOMES

The student will be able to apply their knowledge of electronic circuits into the analysis and design of medical equipment with emphasis on electrocardiographs, electroencephalographs, and pacemakers

TOPICS COVERED

- Introduction" Overview of course contents, Overview of text book and references, Grading Policy, Definition of medical instruments, Historical consideration"
- Biological Currents "Law of diffusion, Drift equation, Einstein relation ship, Examples of two ion currents"
- Biological Currents "Goldmann's equation, Nernst equation, Tissue equivalent circuit, Depolarization of living cells, Biopotentials in the heart, Electrocardiograms"
- Biological Currents" Electrode charge distributions, Electrode equivalent circuit, Electrode impedance measurement, Numerical example"
- Thermal transducer "Semiconductor Thermistor, Whetstone bridge circuits, Conductor Thermistor, Numerical examples
- Strain Gauges "Blood volume measurement, Strain gauge silicon wire, Numerical examples"
- Differential Capacitive Transducer "Tissue displacement measurement, Capacitor in bridge circuits, Numerical examples"
- Biopotential Amplifiers "Potential difference in ECG and EEG equipment, Transistor differential amplifiers, Operational amplifier analysis, Biopotential measurement

interference, Equivalent circuits for power line interference, Common mode Rejection Ratio, Numerical examples"

- Common mode Voltage Reduction" Electrocardiographs, Analysis of common mode Reduction circuits, Numerical examples, ECG block diagrams.
- ECG Lead connection "Standard ECG lead connections, Block diagram for standard ECG, Numerical examples, Augmented ECG lead connection, Chest ECG lead connections"
- EEG Active filters "EEG frequency bands, Active low pass filters for delta bands, Active high pass filters for beta bands, Active band pass filters for theta and alpha bands, Active notch filters for common mode reduction, Second written examination"
- Electronic Pacemaker circuits "Astable Multivibrators, Monostable Multivibrators, Illustrative pacemaker circuits, Numerical examples"

CONTRIBUTION OF COURSE TO MEET THE REQUIREMENTS OF CRITERION 5:

Professional component Content			
Math and Basic Sciences	**Engineering Topics**	**General Education**	**Other**
	✓		

RELATIONSHIP OF COURSE TO STUDENT OUTCOMES:

Student Outcomes		Course aspects
A	An ability to apply knowledge of mathematics, science, and engineering	
B	An ability to design and conduct experiments, analyze and interpret data.	b_1 b_2 b_3 b_4
C	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economics, environmental, social, political, ethical, health, and safety, manufacturability, and sustainability	c_1 c_2 c_3
D	An ability to function on multi-disciplinary teams.	d_1 d_2 d_3 d_4
E	An ability to identify, formulate, and solve engineering problems	e_1 e_2 e_3
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 social content	
I	A recognition of the need for, and an ability to engage in life-long learning.	
J	A knowledge of contemporary issues within and outside the electrical engineering profession.	j_1 j_2
k	An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.	k