

SPRINGFIELD TECHNICAL COMMUNITY COLLEGE
ACADEMIC AFFAIRS

Course Number: BIOM-210 Class/Lect. Hours: 3 Lab Hours: 3 Credits: 4 Dept.: Biomedical

Course Title: Biomedical Systems Semester: Fall Year: 2018

Course Description, Prerequisite, Corequisite:

Building upon BMT-101 this course extends the exposure to and study in detail of the most common biomedical instruments. Investigation is focused on the individual instrument classes, instrument use in practice, and instrument service technique. General practice topics and instrument specific topics are studied. Some biomedical instruments may involve off-campus locations.

Course Objectives	Competencies
<p>Test Equipment and Tools</p> <ul style="list-style-type: none"> • Demonstrate proper use of common biomedical and electronic test equipment • List services which provide test equipment calibration for commonly used biomedical instruments <p>Troubleshooting</p> <ul style="list-style-type: none"> • Describe proper usage of test equipment as well as common DVM's, signal tracers and sources, oscilloscopes and loop and network testing equipment • Describe "Last good, first Bad" troubleshooting • Describe "Divide and Conquer" troubleshooting technique • Show how to use static arresting test procedures • List types of EMI which may affect the validity of test equipment results • Demonstrate diagnosis and repair of defective electronic medical equipment <p>Quality Assurance and CQI</p> <ul style="list-style-type: none"> • Describe the nature of variation • Describe how to make a histogram • Describe TQM • Describe CQI • Describe Six-Sigma • Describe ISO-9000 <p>Pumps</p> <ul style="list-style-type: none"> • Describe the function and purpose if an IV pump • Describe the function and purpose of an IV controller • Describe the function and purpose of an PCA pump 	<ul style="list-style-type: none"> * Students will be able to use an electrical safety analyzer for electrical safety measurements * Students will be able to use various required analyzers and simulators to test, calibrate and service medical equipment and systems * Students will be able to inquire, understand and follow established testing standards * Students will be able to participate in the clinical application design of selecting and layout/design of the installation of medical equipment and systems * Students will be able to participate in the installation of new medical equipment and systems * Students will be able to perform the acceptance testing for medical equipment and systems * Students will be able to work with technicians * Students will be able to participate and work on teams * Students will be able to use quality customer skills when working with clinical staff, physicians, patients, visitors and all others * Students will participate in presentations by medical device suppliers * Students should be able to investigate education and training schedule of the clinical engineering department * Students will be able to investigate the entry requirements, length and costs of training schools for medical equipment and systems * Students will be able understand the clinical engineering department performance indicators * Students will be able to understand the clinical engineering department hazard

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<ul style="list-style-type: none"> • Describe the maintenance of an IV pump <p>Battery Maintenance</p> <ul style="list-style-type: none"> • Describe the different kinds of batteries used in medical equipment • Describe the charging protocols for common batteries • Describe the limitations of different types of medical batteries <p>Medical Electrodes</p> <ul style="list-style-type: none"> • Define an electrode • Define the term “biopotentials” • Explain how impedance mismatches between electrodes and skin surfaces can affect accuracy in measurements • Give an approximate impedance of wet human skin • Give an approximate impedance of dry skin • Define the term “Half cell potential” • Name different types of electrodes and the body organs to which they are applied • Describe the chemical/paste applied between electrode and skin <p>Electrocardiographs</p> <ul style="list-style-type: none"> • Describe the fundamentals of an electrocardiograph recording • Describe the basic ECG machine • Be able to draw and describe the basic lead system • Describe the causes for most ECG recording malfunctions • Describe the basic maintenance procedures for an ECG machine <p>Physiological Pressure and other Cardiovascular Measurements and Devices</p> <ul style="list-style-type: none"> • Describe how pressure is measured • Describe the principles of defibrillation • Describe the principles and operation of the pacemaker • Describe the principles and operation of the cardioverter • List three types of cardiac arrhythmias • Describe the events taking place in each part of the ECG waveform • Troubleshoot problems associated with cardiac support machines • Sketch the main parts of a basic cardiopulmonary bypass circuit • Describe all the available types of blood pumps (roller pump; modified roller pump for pulsatile perfusion, centrifugal pump) • Describe proper testing of a defibrillator (general steps) <p>Intensive and Coronary Care Units</p> <ul style="list-style-type: none"> * Describe the function and purpose of the special care units in the hospital * List the instrument systems used in ICU and CCU * Troubleshoot common problems associated with equipment used in ICU and CCU (e.g.: bedside monitors, cardiometers, alarms, lead fault indicators, central monitoring consoles, invasive blood pressure and telemetry) 	<p>alert policies and procedures</p> <ul style="list-style-type: none"> * Students will be able to use a physiological simulator (ECG, blood pressure, temperature) * Students will be able to use a non-invasive blood pressure simulator * Students will be able to use a pressure meter * Students will be able to use a defibrillator analyzer * Students will be able to use a pulse oximeter analyzer * Students will be able to use an infusion pump analyzer * Students will be able to use digital multimeters and oscilloscopes * Students will be able to use basic soldering irons to solder and de-solder components * Students will present well written engineering reports on various medical devices * Student will understand the basic functions of the human body: <ul style="list-style-type: none"> o Blood (composition and pH) o Circulatory system o Heart chambers and valves o Cardiac physiology o Bio-potentials o Electro-conduction system of the heart o Lungs * Students will be able to perform basic preventive maintenance tests and have a basic functional knowledge of the following medical devices: <ul style="list-style-type: none"> * Electrocardiographs * Bedside physiologic monitors - ECG, BP, Temp, CO, NIBP, etc. * Central physiological stations with printers * Transport physiological monitors * Non-invasive blood pressure monitors * Defibrillators * Pacemakers (external invasive and non-invasive) * Pulse Oximeters * Incubators * Radiant warmers * Fetal monitors * Neonatal transcutaneous monitors * Ventilators * Infusion devices (IV pumps, PCA, feeding) * Respiratory therapy equipment (O2 analyzers, spirometers, nebulizers) * Suction equipment (battery and wall powered) * Electric beds * Examining lights * Transducers (blood pressure) * Patient information systems (connected to medical equipment for data input)

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<p>-----</p> <p>Operating Room Familiarization</p> <ul style="list-style-type: none"> • Describe the functions of the Operating Room (OR) • Describe the protocols involved in working in the Operating Room • List the special equipment used in the OR • List the functions of the equipment used in the OR • List the safety precautions observed in the OR • List the different methods of sterilization • Describe different methods of sterilization (steam, ETO, etc.) <p>Electrosurgery Generators and Lasers</p> <ul style="list-style-type: none"> • Describe the function of the Electrosurgery (ESU) generator • Describe the operation of the Electrosurgery generator • Sketch the block diagram and related waveforms of an Electrosurgery generator • List the safety measures to be adopted when using the Electrosurgery generator • Describe the type of waveforms generated (coagulate, cut) • List the frequencies commonly used by Electrosurgical scalpels • Describe "REM" • Describe testing requirements for Electrosurgery Units • Describe the different types of lasers <p>Clinical Laboratory</p> <ul style="list-style-type: none"> • State the main functions and composition of blood • List the instruments used in the medical laboratory (calorimeters, photometer, spectrophotometer, pH analyzer, autoanalyzer, chromatograph, dialyzer) • State the maintenance procedures for the following medical lab instruments: <ul style="list-style-type: none"> ○ Blood Gas Analyzers ○ Co-Oximeters ○ Centrifuges ○ Microscopes ○ Cell Counters ○ Chemistry Analyzers <p>Medical Ultrasound Instruments</p> <ul style="list-style-type: none"> • Describe applications of medical diagnostic ultrasound (cardiology, ob/gyn, general radiology, etc.) • Explain the purpose of ultrasound in medical applications • Define the terms associated with ultrasound (e.g.: wavelength, acoustics, reflection, refraction, piezo effects, echocardiography, doppler effects) • Explain the physics of sound waves wavelength, velocity, period, frequency, reflection, refraction and resonator • Explain the biological effects of ultrasound • Describe the operation of the instruments used in delivering ultrasound 	

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<p>(Doppler flow, meter, blood pressure monitor, fetal monitor, echocardiography and echoencephalography)</p> <ul style="list-style-type: none"> • Describe the operation ultrasound instruments • List safety precautions regarding the maintenance and use of ultrasound instruments • Describe the types of transducers used in medical diagnostic ultrasound • Distinguish between “sector” scans and “linear” scans • Define “axial resolution” and “lateral resolution” • Define “dead zone” as it applies to ultrasound • Describe the “front end” of an ultrasound scanner • Define “scan conversion” <p>Hemodialysis Equipment</p> <ul style="list-style-type: none"> • Describe the functions of the kidneys • Define terms used in the study of the kidneys (e.g.: dialysis, renal, dialysate, etc.) • Explain why kidney failure requires hemodialysis treatment • State the functions of the dialysis machine • Sketch the main function blocks of a dialysis machine (e.g.: power supply, pressure monitor, blood pump, temperature system, bath delivery system, drain system, circulating system and control panel) • Explain the function of each block or section of the machine • State the special safety precautions associated with the wet environment of a dialysis machine (e.g.: magnetically coupled motor shaft impeller system, ground fault interrupters) • State some of the common problems with dialysis machines <p>Radiology</p> <ul style="list-style-type: none"> • List the main functions of an X-ray machine • Describe the therapeutic applications of X-ray machines • State the diagnostic (measurement) function of an X-ray machine • State the different categories of X-ray machines (e.g.: still picture, continuous picture and motion picture) • List the dangers associated with X-rays • Name the units used for measuring radioactivity (e.g.: curie, Roentgen, Dose rate) • Explain the terms used in the study of radiology (e.g.: gamma, beta and alpha rays, nuclear radiation, etc.) • Sketch the circuit diagram of an X-ray tube • Sketch the circuit diagram of a Geiger-Mueller tube • Explain how the X-ray tubes work • Discuss the safety precautions associated with the handling of X-ray tubes • List common problems/faults of X-ray tubes • Sketch the circuit diagram of an X-ray machine 	

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Certification <ul style="list-style-type: none">• Describe the purpose of certification• List the qualifications required for certification• List the components of the exam.	