BM ET 2305

Biomedical Equipment 2

About Us

The College of Biomedical Equipment Technology and Imaging Academy represent a joint venture designed to meet the education, training, and professional development needs of Healthcare Technology Management professionals. Our headquarters is in San Antonio, Texas, adjacent to Fort Sam Houston, the military's home for biomedical equipment technician training. Our Imaging Academy training center is in Woodstock, Georgia, approximately 30 minutes from the Atlanta airport.

Location - Main Campus

105 Windy Meadows, Suites 201 & 202
Schertz, Texas 78154
www.cbet.edu

Mission

"The mission of the College is to provide innovative and relevant Healthcare Technology Management, Compliance, and Imaging education, training, and career services to prepare our students to meet the evolving needs of employers in the healthcare industry."

About the Course

The Biomedical Equipment II course is designed as an Interactive Distance Learning (IDL) course including asynchronous and synchronous live virtual instruction. This course will provide the student with a better understanding of the role of a biomedical technical in supporting medical equipment in a hospital

Course Description

The student will have the opportunity to learn about troubleshooting various types of equipment that are commonly used at most medical facilities. The course will provide the student with examples of common problems that can arise with a particular piece of equipment, and explore methods to resolve the issue, as well as covering preventative maintenance activities to prevent failure in the future. Students will be introduced to the Preventive Maintenance and Check Out activities related to repairing/supporting medical equipment. The course will utilize operator/user manuals and service manuals to the discussed equipment and familiarize them with how to read and navigate the manuals for proper troubleshooting techniques. The final research assignment they will comprise field research on specific pieces of medical equipment including obtaining the service manual, obtaining pricing on a new unit, obtaining the end of life of the equipment, finding third-party repair vendors, obtaining repair costs and turnaround time.
Prerequisite*s:* Biomedical Equipment I.

Learning Objectives

LO1. Understand the differences between various forms of manufacturer supplied documentation and learn how to navigate/utilize appropriately.

LO2. Understand opportunities and issues related to 3rd party parts and service for medical equipment.

LO3. Understand the purpose and significance of the Preventative Maintenance and Checkout procedures.

LO4. Understand issues around component vs board replacement in the support of medical equipment.

LO5. Improve troubleshooting abilities through a variety of scenarios utilizing manufacturer documentation.

LO6. Understand the issues related to User / Clinician Errors and the biomedical technician's role in dealing with them

LO7. Gain knowledge and understanding of support required for a variety of common pieces of medical equipment used in hospitals.

Instructor

The Biomedical Equipment II course is led by instructors via webinar and interactive distance learning formats. In addition to the weekly live sessions, instructors are accessible via the Learning Management System (LMS) daily, and by appointment via Zoom between the hours of Monday through Friday from 0800-1700 (CST).

John Schmidt is an instructor at cbet.edu teaching both CBET 2305 (Biomedical Equipment II) and CBET 2385 (HTM Applications). Prior to joining the College, John spent nearly 28-years at General Electric Healthcare in a variety of Engineering and Technical Instructor roles, specializing in Anesthesia/Life Support equipment, Ultrasound, and Information Technology classes including DICOM and HL7. John holds a Bachelor's degree in Electrical Engineering and Technology and a Master's degree in Computer Science as well as certifications including Net+ and CTT+. Throughout the course, John can be contacted directly through CANVAS messaging or via the following contact methods:

e-mail: jaschmidt@cbet.edu
phone/text: 414-405-5295

Instructional Methods and Activities

The student online learning environment is structured to mirror the course syllabus and includes all the information students require to successfully navigate the course. The online learning environment referred to as CANVAS, provides a means for students to engage, communicate, and learn. CBET instructors will actively engage students in CANVAS via discussion board forums and other activities designed to cultivate student engagement and participation.

Online Classes (Daily). Students are expected to engage in CANVAS. Courses includes weekly assignments, quizzes, tests, and other requirements prescribed by the instructor. Students are responsible for completing weekly assignments in a timely manner as prescribed by the instructor(s). It is important to remember that in addition to the resulting grades, completion of weekly assignments is also used to measure student engagement, attendance, and participation

Weekly Live Webinars. Mandatory instructor led webinars will be conducted at least once per week (60 Minutes). Additionally, students may request one-on-one counseling or tutoring sessions based on the instructor's availability. Webinars are not optional; however, we understand that from time-to-time students may not be able to attend in person. If you cannot attend a live session, the webinars will be posted in CANVAS for review.

Online Discussion Forum (daily/weekly). CANVAS includes a discussion board with weekly prompts and instructions for completing daily/weekly assignments. Students are required to respond to all weekly discussion board topics and instructor-directed prompts. Responses must be substantive and meet the minimum word count requirement. **Additionally, students are required to engage with peers by responding to no fewer than two student responses per discussion question.** Student participation and attendance in CANVAS is reported to the Director of Education on a weekly basis and the information is used, in part, to measure attendance and participation in the course.

Virtual Reality (VR) Activities. Students will perform selected specific tasks utilizing VR headsets and/or VR walkthroughs.

Week 1/Module 1

Learning Objectives	
TLO 1	Understand the differences and appropriate uses for a variety of Manufacturer documentation including User Manuals and Service Manuals
TLO 2	Utilize/Improve troubleshooting skills
TLO 3	Gain knowledge and understanding of support required for a variety of common pieces of medical equipment used in hospitals.

Module 1 Overview
Students will be introduced to and provided with an overview of differences between manufacturer supplied documentation including a Service Manual and an Operator/User Manual. Additional topics will include the significance and frequent role of the biomedical technician performing Preventive Maintenance procedures.

Webinar Session (60 Minutes)
The Week 1 webinar will include the following:

- Introductions and a course overview with a focus on the syllabus and student deliverables throughout the course
- Introduction to the Preventive Maintenance procedure with a focus on parts replacement, calibration, and testing.

Assignments

1. Read provided materials related to Patient Monitors, Patient Simulators, ECG Parameters/Leads, Respiratory Parameters, Electrodes, Temp, NIBP, IBP, SPO2, Cardiac Output. Answer required questions.
2. Utilizing provided manufacturer documentation, answer questions related to troubleshooting for the following equipment:
    a. Patient Bed
    b. Infusion Pump w/Drug Library
    c. Ventilator
3. Watch video covering service and operator manuals.
4. Write weekly summary of 350+ words.
5. Discussion Question (DQ) 1 Topic: –Introduce yourself. *No peer responses are required.*
6. Discussion Question (DQ) 2 Topic: Pros and cons of 3rd party parts/service.

*** Discussion Questions*
- *Initial response – 200 word minimum for full credit – DUE FRIDAY*
- *Two Peer/student responses – 150 word minimum each for full credit*

Week 2/Module 2

Learning Objectives.	
TLO 1	Understand the pros and cons of 3rd party parts and service and equipment modifications.
TLO 2	Review/understand the Purpose and Significance of the Preventative Maintenance (PM)
TLO 3	Utilize/Improve troubleshooting skills
TLO 4	Gain knowledge and understanding of support required for a variety of common pieces of medical equipment used in hospitals.

Module 2 Overview
Students will be introduced to and provided with an overview of problem-solving techniques and the use of Flow Charts that are frequently provided in Service Manuals for medical equipment.

Webinar Session (60 Minutes)
The Week 2 webinar will include the following:

- Review of Week 1 Assignment highlights.
- Service Manual / Operator-User Manual differences
- Third party parts/service
- Equipment Modifications

Assignments

1. Read provided materials related to defibrillators, electrocardiographs, Holter monitors, and treadmill systems. Answer required questions.
2. Perform Preventive Maintenance procedure using VR Headset/content on Lifepak 20 defibrillator
3. Watch video on troubleshooting with flowcharts.
4. Write weekly summary of 350+ words.
5. Discussion Question (DQ) 1 Topic: Equipment modifications.

*** Discussion Questions*

- *Initial response – 200 word minimum for full credit – DUE FRIDAY*
- *Two Peer/student responses – 150 word minimum each for full credit*

Week 3/Module 3

Learning Objectives	
TLO 1	Introduce the skill of soldering and its place in the biomed department
TLO 2	Understand the dilemma of Component vs Board level replacement
TLO 3	Utilize/Improve troubleshooting skills
TLO 4	Gain knowledge and understanding of support required for a variety of common pieces of medical equipment used in hospitals.

Module 3 Overview
Students will be introduced to the process of soldering/desoldering, and the use of electrical tape, and/or shrink tubing when making electrical Connections. A discussion will be led by the instructor on the pros and cons of component replacement versus board replacement.

Webinar Session (60 Minutes)
The Week 3 webinar will include the following:

- Review of Week 2 Assignment Highlights.
- Soldering process and required equipment including protecting the connection
- Component vs Board replacement

Assignments

1. Read provided materials related to Monitoring stations, medical telemetry hardware, and infusion pumps. Answer required questions.
2. Utilizing provided manufacturer documentation, answer questions related to troubleshooting for the following equipment:
    a) Cell Washer
    b) Intra-Aortic Balloon Pump
    c) Radiant Warmer
3. Watch video on soldering techniques and equipment.
4. Write weekly summary of 350+ words.
5. Discussion Question (DQ) 1 Topic: Component repair vs Board replacement.

*** Discussion Questions*
- *Initial response – 200 word minimum for full credit – DUE FRIDAY*
- *Two Peer/student responses – 150 word minimum each for full credit*

Week 4/Module 4

Learning Objectives	
TLO 1	Understand the scope and issues of mistakes made in hospitals and the role of the biomed
TLO 2	Utilize/Improve troubleshooting skills
TLO 3	Gain knowledge and understanding of support required for a variety of common pieces of medical equipment used in hospitals.

Module 4 Overview.
Students will be introduced to the problem of mistakes made in hospitals. Students will be provided with techniques on communication in the workplace and examples of how to deal with clinician errors.

Webinar Session (60 Minutes)
The Week 4 webinar will include the following:

- Review of Week 3 Assignment highlights.
- User / Clinician Errors
- Introduction to Infant Warmers/Incubators

Assignments

1. Read provided materials related to Blood Warmers, Electrosurgery, Fetal Monitors, Infant Incubators, and Infant Radiant Warmers. Answer required questions.

2. Utilizing provided manufacturer documentation, answer questions related to troubleshooting for the following Anesthesia systems:

- Datex-Ohmeda Aestiva
- Drager Fabius Tiro
- MindRay A5 & A3

3. Write weekly summary of 350+ words.

4. Discussion Question (DQ) Topic: Dealing with intermittent issues.

*** Discussion Questions*
- *Initial response – 200 word minimum for full credit – DUE FRIDAY*
- *Two Peer/student responses – 150 word minimum each for full credit*

Week 5/Module 5

Learning Objectives	
TLO 1	Understand the differences between situational and non-situational communication
TLO 2	Understand the importance of the Checkout procedure
TLO 3	Utilize/Improve troubleshooting skills
TLO 4	Gain knowledge and understanding of support required for a variety of common pieces of medical equipment used in hospitals.
TLO 5	Further PM related experience by performing a PM on a Philips-EPIQ-7 utilizing VR headset and/or VR walkthrough.

Module 5 Overview.
Week 4 activities will be reviewed. Students will be introduced to and provided techniques on communication in the workplace. An introduction to Anesthesia systems will be covered.

Discussion Questions

Webinar Session (60 Minutes)
The week 5 webinar will include the following:

- Review of Week 4 Assignment highlights.
- Discussion on Checkout Procedure
- Introduction to Anesthesia systems

Assignments

1. Read provided materials related to Biofeedback, Diathermy, Interferential Treatment (TENS), Traction, Therapeutic Ultrasound, Wax baths. Answer required questions.

2. Complete the assigned VR activity (Preventive Maintenance) on the Philips-EPIQ-7. Use the VR headset if you have access to one, if not, watch the provided video. Answer follow-up questions.

3. Write weekly summary of 350+ words.

4. Discussion Question (DQ) Topic: Typical day in a biomed role. (topic varies) What would you do?

*** Discussion Questions*
- *Initial response – 200 word minimum for full credit – DUE FRIDAY*
- *Two Peer/student responses – 150 word minimum each for full credit*

Week 6/Module 6

Learning Objective 6.	
TLO 1	Utilize necessary resources, including those covered in this course to research and locate information about specific medical equipment for the final project.
TLO 2	Gain knowledge and understanding of support required for a variety of common pieces of medical equipment used in hospitals.

Module 6 Overview.
Students will be introduced to the detailed instructions for the final project. In addition, an introductory discussion on Diagnostic Ultrasound will be presented.

Discussion Questions.
None

Webinar Session (60 Minutes). The week 6 webinar will include the following:

- Review of Week 5 Assignment highlights.
- Introduction to Diagnostic Ultrasound

Assignments

1. Complete the Final Project.

2. Write weekly summary of 350+ words.

Note: Please remember to complete the end of course survey prior to the end of the last day of class.

Course Grade Distribution

Discussion Board Question Responses	15%
Weekly Summary	10%
Weekly Reading / Troubleshooting Activities with Quizzes	60%
Final Project	15%

Discussion Board Grading Criteria (15% of overall grade)

Students are required to respond to all weekly discussion board topics and instructor-directed prompts. Responses must be substantive and meet the minimum word count requirement. Additionally, students are required to engage with peers by responding to no fewer than three peer-to-peer responses per week. The following rubric is used as a guide by instructors to evaluate and grade student responses to discussion questions and peer-to-peer engagement:

	Beginning 0-25 Points	Developing 25-50 Points	Accomplished 50-75 Points	Exemplary 75 to 100 Points
Weekly Discussion Question Responses (Minimum 200-word initial response and minimum (2) 150 word peer/student responses each week).	Contributes fewer than the required 2 Discussion Question (DQ) responses.	Contributes 2 Discussion Question (DQ) responses but one or both fail to meet minimum word-count requirements for the DQ.	Contributes by providing 2 Discussion Question (DQ) responses and meets the minimum word count requirements for the DQ.	Exceeds required DQ word count requirements and/or provides an exemplary response to a DQ.
Weekly Engagement with peers (Minimum of two 200-word responses to peers each week).	Contributes fewer than the required peer-to-peer responses in the discussion forum.	Contributes 3 peer-to-peer responses in the discussion forum but fails to meet minimum word-count requirements and lacks substance.	Contributes by providing 3 peer-to-peer responses and meets the minimum word count requirement for the peer-to-peer response	Exceeds required peer-to-peer response requirements by meeting the minimum word count requirement and providing substantive responses to peers.
Quality and Content of DQ responses and peer-to-peer responses in the Discussion Forum.	Postings in the discussion forum are not relevant to the assigned topic, are inaccurate, or misrepresented.	Postings in the discussion forum address peripheral topics, are generally accurate, but may contain factual omissions and/or errors.	Postings are generally substantive; however, responses rely too heavily on opinion than fact. Postings meet word count requirements but lack scholarly tone or appropriate references.	Discussion Question and Peer-to-Peer postings consistently contribute to the discussion, contain substantive comments backed by relevant references and encourage open dialogue and additional discussion in the class.

Weekly Summary (10% of overall grade)

Instructor led webinars will be conducted at least once per week (60 Minutes). If you cannot attend a live session, the webinars will be posted in CANVAS for review. Students are expected to provide a weekly summary which can include information related to the webinar, assignments, discussions, and more.

Weekly Reading / Troubleshooting Activities with Quizzes (60% of overall grade)

Students will be assigned homework on a weekly basis which will include assigned reading with quizzes and two Virtual Reality activities. Instructors will endeavor to ensure that students possess a clear understanding of the requirements and expectations.

Final Project (15%)

This course has a Final Project which will be covered in full during Week 5 and Week 6 webinars. The final project is due on the last day of the course.

Late Assignments

Assignments submitted after the due date will have a deduction of up to 3.3% of the assignment's maximum point value, per day. If the student has discussed the potential lateness of the assignment with the instructor prior to the due date, this deduction may be waived.

Grading System for the College of Biomedical Equipment Technology

A	90-100	4.0	F	59 & Below	0.0
B	80-89	3.0	W	Withdrawal	N/A
C	70-79	2.0	I	Incomplete	N/A
D	60-69	1.0	T	Transfer N/A	

To receive an incomplete "I", the student must petition the instructor for an extension to complete the required coursework. The student must be able to pass the course with the completed work and garner a grade of 70 or better. Incomplete grades that are not completed within 7 business days after the beginning of the next session will be converted to the existing grade earned in the course and will affect the student's GPA accordingly. CBET reserves the right to extend the time needed to fulfill the incomplete.

An "I" does not count towards the Grade Point Average (GPA) until a grade is assigned. A "W" is given when a student is dropped from the roster during the course and does not replace the previous grade(s). Grades of "W" and "F" are recorded in the academic transcript and reflected in the GPA. When a course is repeated after failure or withdrawal, the later grade will replace the first grade in calculating the CGPA. The clock hours of the course repetition are counted toward the maximum timeframe. CBET shall record a grade of "incomplete" for a student who withdraws but is not entitled to a refund if the student requests the grade at the time the student withdraws, and the student withdraws for an appropriate reason unrelated to the student's academic status.

A student must repeat a course in which a grade of "F" was received. A student can repeat each course once, however, once they reach 1.5 times the length of time required for graduation, they will be dropped from the program. If a student fails any course a second time, he/she will be dropped from the program. A failed course will be rescheduled for the earliest possible module at the discretion of the Director of Education. Students will be charged to retake the course.

Texts, Readings, Instructional Resources

The Biomed's Handbook (Medical Device Support) – Version 2 Publisher: Walter Brisebois – Copyright © 2019 ISBN: 978-0-9698891-1-3	Introduction to Biomedical Instrumentation: The Technology of Patient Care; Barbara L. Christe Publisher: Cambridge University Press – Copyright © 2009 ISBN: 978-0-521-51512-2

Additional Resources and Points of Contact

Students requiring additional administrative support are encouraged to contact the Colleges Student Advocate, Mrs. Terri Gomez, at 210.233.1102 or via e-mail at tgomez@cbet.edu
For a complete list of administrative policies and regulations refer to the CBET Catalog at https://cbet.edu/course-catalog

NOTE: THE INSTRUCTOR RESERVES THE RIGHT TO MODIFY THIS SYLLABUS and COURSE OUTLINE