BENG-499-001 Engineering World Health
Fall 2017

Instructor: Ahsanul Haque
E-mail: ahaque2@gmu.edu

Correspondence will only be answered if directed to ahaque2@gmu.edu. The subject line will read: “BENG-499”, (your last name, first initial), topic of email. Anything else will be ignored.

Instructor Office Hours: After class. Other times may be arranged by appointment.

If you cannot attend the provided office hours, please feel free to contact me via email with questions that you have, or to schedule an alternate meeting time.

Office Hours Location: ENGR 3707 (ECE Adjunct Faculty Office)

Catalog Description:

This course covers the major types of medical equipment, including the principles of operation, the physiology underlying the measurement, the major functional (system) pieces for each instrument, and typical problems/applications of each instrument. Special focus is placed on making reliable and safe repairs in a low resource setting: Troubleshooting, creative problem solving, calibration and testing.

Laboratory sessions will focus on learning hands on and technical knowledge required for completing basic electronic and mechanical repairs. Basic electronics through simple power supply design will be covered.

Text Books and Resources (Provided):

- Medical Instrumentation in the Developing World https://www.amazon.com/Medical-Instrumentation-Developing-Robert-Malkin-ebook/dp/B00QSKUOUC
- EWH Laboratory Manual
- EWH BMET Library http://library.ewh.org/
- EWH Troubleshooting Guides http://library.ewh.org/greenstone/cgi-bin/library.cgi?e=d-00000-00---off-0BMETLibraryLaunch--00-2----0-10-0---0---0direct-10----4------0-11-10-en-50---20-about---00-3-1-00-00--4---0-0-01-10-0utfZz-8-00&a=d&c=BMETLibraryLaunch&cl=CI2.4

Course Requirements

Lecture: There is a lecture each day. Attendance is taken in lecture. Unexcused absences may result in expulsion from the program.

Lab Work: Attendance is taken in lab each day. Unexcused absences may result in expulsion from the program. You will be required to demonstrate your lab to your TA or professor each day.

Homework: This course has one to twenty pages of reading per week

Quizzes: This class has a daily quiz on the assigned reading.
Course Objectives:

Students who successfully complete this course are expected to have met the following learning objectives:

1. Being aware of differences in working in hospitals in rural Guatemala
   a. Workers who may not speak English
   b. Rural way of life in Guatemala
   c. Cleanliness
   d. Food
   e. Living conditions
   f. Lack of easy access to materials needed for repairs
2. Being able to use all of the tools in the toolkit
   a. Knowing what each one does
   b. Knowing when to use each
3. Becoming a Critical Thinker
   a. Knowing what questions to ask to troubleshoot equipment problems
   b. Knowing how to find the answers to those questions
4. Being aware of the equipment that may be found
   a. Function
   b. Methods to achieve the function
   c. Possible sources of failure
   d. Knowing how to relate Item 3 to the particular piece of equipment
5. Knowing the technical systems that may be encountered
   a. Electrical
   b. Control systems
   c. Sensing
   d. Motors
   e. Hydraulic
   f. Tubing
   g. Fittings
   h. Valves
      i. Shut-off
      ii. Check
   i. Pneumatic
   j. Snoop for leaks
6. Mechanical
   a. Bearings/bushings
   b. Lubrication/friction
   c. Coefficient between materials
   d. Rotating equipment
   e. Gears
      i. Spur
      ii. Helical
      iii. Worm
7. Sprockets and chains
8. Pulleys and belts
9. Slides
10. Heat transfer
    a. Radiators
    b. Heat sinks
    c. Thermal grease
**Attendance**

Attendance in class is **mandatory**. Failure to attend class will adversely affect your final grade. You are responsible for all material covered in class. **Note: classroom notes are extremely important.**

**Privacy**

Instructors respect and protect the privacy of information related to individual students. Issues relating to an individual student will be discussed via email, telephone or in person. Instructors will not discuss issues relating to an individual student with other students (or anyone without a need to know) without prior permission of the student.

Assessable work other than final exams will be returned to individual students directly by the Instructor (or by a faculty or staff member or a Teaching Assistant designated by the Instructor, or via another secure method). Under no circumstances will a student's graded work be returned to another student.

Students should also strive to respect the privacy of the faculty and staff and should not expect the instructor to respond to emails during times that are outside of regular business hours.

**Disability Accommodations**

If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Office of Disability Services (SUB I, Rm. 2500; 993-2474; http://ods.gmu.edu) to determine the accommodations you need; and 2) talk with the instructor to discuss your accommodation needs as well as submit the document to your instructor describing the requested accommodations. Only those accommodations listed on the document may be provided by the instructor.

The Office of Disability Services (ODS) works with disabled students to arrange for appropriate accommodations to ensure equal access to university services. Any student with a disability of any kind is strongly encouraged to register with ODS as soon as possible and take advantage of the services offered.

Accommodations for disabled students must be made in advance – ODS cannot assist students retroactively, and at least one week's notice is required for special accommodations related to exams. Any student who needs accommodation should contact the Instructor during the first week of the semester so the sufficient time is allowed to make arrangements.

http://ds.gmu.edu/

**Honor Code**

The integrity of the University community is affected by the individual choices made by each of us. GMU has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct.

Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using MLA or APA format. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me. The link below contains further information about the GMU honor code:

http://oai.gmu.edu/
**Grading**

The course cumulative grade is on a strict numerical basis based on the weighted sum of the following:

- TBD

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Letter Grade</th>
<th>Score Range</th>
<th>Letter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 97%</td>
<td>A+</td>
<td>74-77%</td>
<td>C+</td>
</tr>
<tr>
<td>94-96%</td>
<td>A</td>
<td>70-73%</td>
<td>C</td>
</tr>
<tr>
<td>90-93%</td>
<td>A-</td>
<td>66-69%</td>
<td>C-</td>
</tr>
<tr>
<td>86-89%</td>
<td>B+</td>
<td>60-65%</td>
<td>D</td>
</tr>
<tr>
<td>82-85%</td>
<td>B</td>
<td>0-59%</td>
<td>F</td>
</tr>
<tr>
<td>78-81%</td>
<td>B-</td>
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</table>

**Other Course Policies**

- Important announcements may be posted on Blackboard so please make sure to follow the announcements and discussion board periodically. The discussion board on Blackboard may also be used for online discussions between students.
- **Late submissions or assignments sent via email will not be accepted except under highly legitimate circumstances.** Failure to submit your own work will result in penalty per the honor code.
- Any student acting in disrupting behavior may be asked to leave the classroom by the instructor.
- You may direct your questions to the course instructor during regular office hours. You may also request an appointment to meet with him/her if you are unavailable during these office hours.
- Students with special requests/circumstances need to contact the instructor within a week after these special circumstances arise.
- The last day to drop the course with no tuition liability is September 5th. The last day to drop is September 29th. The selective withdrawal period is October 2–October 27. Please check the GMU academic calendar for further information regarding important dates for the fall semester:

**Proposed Class Schedule**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture Topics (Textbook)</th>
<th>Lab Exercises (Lab book)</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08/28</td>
<td>Introduction</td>
<td>1. Introduction to the course and your toolkit</td>
<td>Reading Textbook: Section 1, 2.1 Lab book: Section 2, 11</td>
</tr>
<tr>
<td>2</td>
<td>09/04</td>
<td>1.0 Intro to Developing World Medical Equipment 2.1 Working in the Operating Theatre and ICU</td>
<td>11. Introduction to the developing world 2. Extension Cord</td>
<td>Reading Textbook: Section 4.1 Lab book: Section 3, 12</td>
</tr>
<tr>
<td>3</td>
<td>09/11</td>
<td>4.1 Electrical Safety</td>
<td>3. Introduction to Soldering &amp; Desoldering 12. Working in a Developing World Hospital</td>
<td>Reading Textbook: Section 2.16, 2.19 Lab book: Section 4</td>
</tr>
<tr>
<td>4</td>
<td>09/18</td>
<td>2.16 Theatre Lamps and Other Lights 2.19 Batteries</td>
<td>4. Electronics and the DVM</td>
<td>Reading Textbook: Section 2.5, 2.7 Lab book: Section 5</td>
</tr>
<tr>
<td>5</td>
<td>09/25</td>
<td>2.5 Electrocardiographs 2.7 Pulse Oximeter</td>
<td>5. Introduction to LED Flashlight</td>
<td>Reading Textbook: Section 2.9, 2.12 Lab book: Section 7, 17</td>
</tr>
<tr>
<td>6</td>
<td>10/02</td>
<td>2.9 Fetal Monitor and Fetal Doppler 2.12 Phototherapy Lights</td>
<td>7. Fuses 17. Assessing Needs in Developing World Hospital</td>
<td>Reading Textbook: Section 2.10, 2.11 Lab book: Section 6</td>
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<tr>
<td>7</td>
<td>10/09</td>
<td>2.11 Infant Warmer 2.10 Infant Incubator</td>
<td>6. Power Supplies</td>
<td>Reading Textbook: Section 2.2 Lab book: Section 8</td>
</tr>
<tr>
<td>8</td>
<td>10/16</td>
<td>2.2 Ventilators</td>
<td>8. Variable Power Supplies</td>
<td>Reading Textbook: Section 2.3 Lab book: Section 9</td>
</tr>
<tr>
<td>9</td>
<td>10/23</td>
<td>2.3 Oxygen Concentrators</td>
<td>9. Batteries and Charging Batteries</td>
<td>Reading Textbook: Section 2.4, 2.15 Lab book: Section 10</td>
</tr>
<tr>
<td>10</td>
<td>10/30</td>
<td>2.4 Fluid Pumps</td>
<td>10. Troubleshooting</td>
<td>Reading Textbook: Section 2.6 Lab book: Section 14</td>
</tr>
<tr>
<td>11</td>
<td>11/06</td>
<td>2.6 Blood Pressure Machines</td>
<td>14. Troubleshooting Medical Equipment</td>
<td>Reading Textbook: Section 2.17, 2.18 Lab book: Section 13,19</td>
</tr>
<tr>
<td>13</td>
<td>11/20</td>
<td>Culture/Trip Info</td>
<td>15. Planning Days 16. How to Take Inventory 18. Other Forms</td>
<td>Reading Textbook: Section 3.3 Lab book: Section 17</td>
</tr>
<tr>
<td>14</td>
<td>11/27</td>
<td>3.3 Centrifuges</td>
<td>17. Assessing Needs in a Developing World Hospital</td>
<td>Reading Textbook: Section 3.5, 3.7</td>
</tr>
<tr>
<td>15</td>
<td>12/04</td>
<td>3.5 Water Baths, Stir and Hot Plates 3.7 Autoclaves</td>
<td>Discussion of Design Videos for Developing Countries</td>
<td></td>
</tr>
</tbody>
</table>

**Disclaimer:** This calendar is tentative and may be subject to change.