**EE 423/523 -- Homework 3– Due October 5, 2021**

**Submit electronically through drop box on UBlearns**

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ I.D. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Solve the following problems: 6.1, 6.2, 6.3, 6.4, 6.5, 6.7, from the text as well as the two applet exercises below (**Total 8 points**):

A list of Java applets that you may find useful for the course can be found at the following link: <http://www.ee.buffalo.edu/faculty/mitin/applets.html>

If you have trouble running the applets, read the instructions on the following page.

**Applet Exercise 1- Using applet “Carbon Nanotube”**

<http://www.ee.buffalo.edu/faculty/mitin/applets/carbonnanotube/carbonnanotube.html>

Demonstrate an armchair, zig-zag, and chiral carbon nanotubes with the following properties:

a) Armchair with for some between 5 and 8. What is its chiral angle?

b) Zig-zag with and between 5 and 8. What is its chiral angle?

c) Chiral with chiral angle of . What is the minimum value of (*n*, *m*)?

Copy those three images from the web into your homework

**Applet Exercise 2- Using applet “Quantum Dot”**

<http://www.ee.buffalo.edu/faculty/mitin/applets/quantumdot/quantumdot.html>

You can adjust the radius of the dot by dragging the tip of the arrow.

For a and b, set the radius, , to and specify your setting.

1. Determine Vb, the number of energy levels, and the energy of the lowest energy level for dots in a matrix.
2. Determine Vb, the number of energy levels, and the energy of the lowest energy level for dots in a matrix.
3. What is the cause for the differences in these values between the two materials?
4. What happens to these values when the radius is changed?
5. A quantum dot of is surrounded by (select from the dropdown menu)*.* By using the applet, determine an appropriate value for to achieve a barrier height of . Then find a value of that would result in the first and second energy levels equaling and , respectively. Include a capture of the applet with your results in your submission.

For most of these applets, you will need to have Java installed on your computer. Since most browsers have discontinued NPAPI support, you will also need to install a 3rd party plugin if your browser is up to date. Instructions on how to do so on most modern browsers can be found here: <https://www.digitalcitizen.life/how-enable-java-all-major-web-browsers>

Additionally, you may need to create security exceptions for the relevant pages in the Java control panel as the security requirements for Java have changed considerably in recent years. Instructions on doing so for Windows and Mac can be found here: <https://www.java.com/en/download/help/jcp_security.xml>

By adding “http://www.ee.buffalo.edu/faculty/mitin/” to your exception site list, you will be able to access all of the applets hosted locally (including the two used in this assignment). Some of the other applets (noted in their description) will also require their URLs be added to the list in order for you to use them.

It is advised that you only run the plugin on trusted sites due to Java-related security concerns.