VM 515 Electrical, Optical and Magnetic Properties of Materials

Summer 2017

Course Syllabus

Instructor:

Dr. Hong Zhu

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Office Hours: Thursday: 13:00-14:00PM, other time by appointment

Lectures:

Class Time: Tuesday and Thursday: 14:00-15:40, Location: CRQ309

Course Topics:

Electrical properties: Fundamentals of electron theory, Schrödinger equation, Electronic structure of atoms, Energy bands in crystals, Electrical properties in metals, semiconductors and other materials, Examples of electronic devices

Optical properties: Electromagnetic theory, Origin and significance of optical properties, quantum effect, Measurement and significance of optical spectra, Light amplification, Example of optical devices

Magnetic Properties: basic concepts of magnetism, magnetic phenomenon in materials

Example of magnetic devices magnets

Course Objectives:

1. To give students an overview of the electron theory of materials, band theory, electrical behavior of metals, semiconductors, dielectrics and

noncrystalline materials, theory of optical behavior and applications, and magnetic properties and applications of ferrites and permanent magnetic materials.
2. To introduce students a broad range of materials properties, what these properties depend on, and how to exploit and tailor them for various applications.
3. To teach students the important technologies and devices which are dependent on the electrical, optical and magnetic properties of materials.

Textbook:

Electronic Properties of Materials, by Rolf E. Hummel

Materials Science and Engineering An Introduction, 8th ed., by Callister and Rethwisch

Homework:

Working the homework problems is an important mean to understand the concepts introduced in classes. Students will be expected to complete homework assignments to the best of their ability by the due date. Late homework is discouraged and will be assessed a 50% penalty. Homework more than one day late will not be accepted. Discussion of homework problems prior to working out the detailed solution is encouraged, but the work itself must be an individual endeavor. Copying of homework from others will be penalized 100%.
Homeworks are posted on the course website, and due in class according to the attached schedule.

Exam:

There will be one midterm exam and one final exam during the semester to assess your understanding of the concepts instructed in class and your ability to apply gained knowledge to problem solving. The mid-term exam will cover the material in lectures 1-12 and the final exam will cover the material 13-24 (the coverage is subject to change). The exam dates are listed on the course outline. It will be very important to show all your work to solve each problem. Partial credit will be given for correct method.

Grading

Homework+Quiz	25%
Project	20%
Midterm	25%
Final	30%
Total:	100%

Class Etiquette:

- Please try to arrive to class on time.
- Turn mobile phones off or to silent mode. If you must take a call during class, leave the classroom until finished.
- Refrain from talking and making noises which distracts other students.
- You are encouraged to participate in class and ask questions.
- You are expected to treat the instructor and fellow classmates with respect.

Evaluation:

Interactive and anonymous feedbacks during class allows instructor to be informed on student understanding of lectures. Mid-term written evaluations by students allow instructor to take mid-course corrective actions: end-of-term written evaluations by students allow instructor to improve the next offering of the course.

Honor code refresh:

All students in the class are presumed to be bound by the Honor Code of the Joint Institute (see JI's Student Handbook for Undergraduate Students for more details). Any Violation of the honor polices will be reported to the Honor Council, and if guilt is established penalties may be imposed.

VM515 Lectures & Homework Schedule – Summer 2017

(Subject to change)

Lecture	Date	Homework (due in class)	Topic/Textbook readings
1	Tuesday-5/16		**Introduction**
2	Thursday-5/18		**Duality and Schrodinger Equation**
3	Tuesday-5/23		**Schrodinger Equations for Special Cases**
4	Thursday-5/25	HW#1	**Energy Bands in Crystals**
5	Thursday-6/1		**Electrons in a Crystal**
6	Tuesday-6/6		**Electrical Conduction in Metals and Alloys**
7	Thursday-6/8		**Semiconductors**
8	Tuesday-6/13	HW#2	**Electrical Properties of Dielectrics**
9	Thursday-6/15		**Applications of Electrical Properties**
10	Tuesday-6/20		**Midterm Review**

11	Thursday-6/22		**Atomistic Theory of the Optical Properties**
12	Tuesdayg-6/27	HW#3	**Midterm Exam**
13	Thursday-6/29		**The Optical Constants**
14	Tuesday-7/4		**Application of the Optical Properties**
15	Thursday-7/6		**Foundations of Magnetism**
16	Tuesday-7/11	HW#4	**Magnetic Pheonomena**
17	Thursday-7/13		**Applications of Magnetics**
18	Tuesday-7/18		**Fundamentals of Thermal Properties**
19	Thursday-7/20		**Quantum Mechanical Considerations of Magnetics**
20	Tuesday-7/25	HW#5	**Thermal Properties**
21	Thursday-7/27		**Project Presentation I**
22	Tuesday-8/1		**Project Presentation II**

23	Thursday-8/3		**Misc**
24	Tuesday-8/8		**Final Exam**