**Global Learning Initiatives Program Course Syllabus**

Please complete the following form in English. The information will be updated to the Global Learning Initiatives Program website for students’ reference. If you will be offering more than one course, please fill out one form per course offered. Examples in grey.

**Course Information**

|  |  |
| --- | --- |
| Course Name\*provide the **English** course name of the course.  | Electronic Properties of Materials |
| Lecturer(s)\*provide the lecturers’ **English** name. If there are more than one lecturer, please indicate all lecturers in the column. | Prof. Sheng-Shiuan Yeh |
| Course Description\*briefly describe the contents covered in the courses. | This course introduces the fundamental concepts of the electronic properties of materials. |
| Course Objectives\*list out knowledge or skills students should acquire upon completion of course. | To understand the fundamental concepts of the electronic properties of materials. |
| Suggested Proficiencies(if any)\*list preferred knowledge or skills students should have before taking the course. | Basic semiconductor physics |
| Reading List(if any)\*list out the textbooks, references, or other reading materials. | 1. D. K. Ferry and J. P. Bird, Electronic Materials and Devices (Academic Press, 2001).
2. Rolf E. Hummel, Electronic Properties of Materials (Springer New York, 2011)
 |
| Grading Criteria\*how would the students be assessed during the course. | 1. Homework and Assignments, Exams and Quizzes, Evaluation and Grading Policy:
* Homework: 30%
* Midterm Exam: 35%
* Final exam (or report): 35%
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**Course Schedule**

Please complete the following table with the dates and expected course topics. If there are more than one lecturers instructing the course, please also indicate the lecturer for each class.

|  |  |  |  |
| --- | --- | --- | --- |
| Class | Date (YYYY/MM/DD) | Course Topic | Lecturer |
| 1 | 2023/9/11 | * Course introduction
* Electromagnetic waves (light) are particles
* Particles (electrons) are waves – mater waves
* The kinetics of mater wave – The Schrödinger Equation
 | Prof. Sheng-Shiuan Yeh |
| 2 | 2023/9/18 | * The application of Schrödinger Equation
	+ Free particle
	+ Particle in a box
	+ Electron in a hydrogen atom
 | Prof. Sheng-Shiuan Yeh |
| 3 | 2023/9/25 | * Covalent bonding, ionic bonding, and metallic crystals
* Quantum free-electron gas
	+ The free-electron gas at absolute zero temperature
 | Prof. Sheng-Shiuan Yeh |
| 4 | 2023/10/2 | * Quantum free-electron gas
	+ Density of states
	+ The free-electron gas at non-zero temperature
 | Prof. Sheng-Shiuan Yeh |
| 5 | 2023/10/9 | * Quantum free-electron gas
	+ Dynamics of the free-electron gas
	+ Bloch's theorem
 | Prof. Sheng-Shiuan Yeh |
| 6 | 2023/10/16 | * Energy gaps: two models
	+ Nearly-Free Electrons in Crystals
	+ Kronig-Penney Model
 | Prof. Sheng-Shiuan Yeh |
| 7 | 2023/10/23 | * Energy gaps:
	+ Atomic Origins of Energy Gaps
 | Prof. Sheng-Shiuan Yeh |
| 8 | 2023/10/30 | Midterm exam | Prof. Sheng-Shiuan Yeh |
| 9 | 2023/11/6 | * Electron Dynamics in Energy Bands
* Effective Mass of Electrons in Energy Bands
* Metals, semiconductors, and insulators
* Holes
 | Prof. Sheng-Shiuan Yeh |
| 10 | 2023/11/13 | * Semiconductors
	+ Intrinsic semiconductors
 | Prof. Sheng-Shiuan Yeh |
| 11 | 2023/11/20 | * Semiconductors
	+ Extrinsic semiconductors
	+ Carriers in extrinsic semiconductors
	+ Carrier statistics in semiconductors
 | Prof. Sheng-Shiuan Yeh |
| 12 | 2023/11/27 | * Semiconductors
	+ Carrier drift in semiconductors
	+ Semiconductor band structures
 | Prof. Sheng-Shiuan Yeh |
| 13 | 2023/12/4 | Phonons | Prof. Sheng-Shiuan Yeh |
| 14 | 2023/12/11 | * Insulators
	+ Dielectric properties of insulators templates
 | Prof. Sheng-Shiuan Yeh |
| 15 | 2023/12/18 | * Insulators
	+ Dielectrics: a Microscopic Approach
	+ Ferroelectricity and Piezoelectricity
 | Prof. Sheng-Shiuan Yeh |
| 16 | 2023/12/25 | Final exam | Prof. Sheng-Shiuan Yeh |