

Faculty of Engineering & Technology

Solid State Physics

Information :

Course Code : PHY 232

Level : Undergraduate

Course Hours : 3.00- Hours

Department : Department of Electrical Engineering

Instructor Information :

Title	Name	Office hours
Lecturer	AHMED MOHAMED ALI ASHOUR AHMED	12
Lecturer	AHMED MOHAMED ALI ASHOUR AHMED	12
Assistant Lecturer	Mahmoud Ahmed Nasr Kamal Abdo Mostafa	8
Assistant Lecturer	Mahmoud Ahmed Nasr Kamal Abdo Mostafa	8

Area Of Study :

- Enrich students knowledge about principles of classical, modern and quantum physics
- Prepare students to apply principles of quantum physics on atomic structure and semiconductors.
- Train students to apply solid state physics and semiconductor on applications related to electrical engineering.

Description :

Classification of waves. Max-Planck's principle, photoelectric effect, the wave properties of particles, the quantum wave, particle in an infinite/finite potential well, tunneling effect. Hydrogen atom: Bohr's model, quantum model and wave function, solids classification and crystalline structure. Energy bands, Fermi-Dirac distribution, Carrier densities and transport, recombination and generation, drift-diffusion model, Intrinsic and extrinsic semiconductors, PN junction: structure and principle of operation, diode current, reverse bias, diode as a circuit element.

Course outcomes :

a. Knowledge and Understanding: :

1 -	Explain the basic principles of waves and its applications on light waves.
2 -	Illustrate the basic principles of Max-Planck and photoelectric effect.
3 -	Explain fundamentals of quantum mechanics.
4 -	Describe the basic principles of atomic physics and crystalline structures.
5 -	Explain the basic theory of semiconductors and its applications.

b. Intellectual Skills: :

1 -	Apply Max-Planck principle on photoelectric effect to determine the energy of electrons.
2 -	Evaluate the expectation values of dynamic variables of electrons using quantum mechanics.
3 -	Evaluate the main characteristics of atomic physics.
4 -	Investigate the basic characteristics of semiconductors.

c. Professional and Practical Skills: :

1 -	Measure the parameters of photoelectric phenomenon.
2 -	Test the characteristics of electrons using a magnetic field.
3 -	Sketch the diode characteristic curve.

d. General and Transferable Skills: :

1 -	Work effectively in a team.
2 -	Communicate effectively.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Classification of waves	5	3	2
Max-Planck's principle, photoelectric effect	10	6	4
The wave properties of particles, the quantum particle, uncertainty Heisenberg's principle	5	3	2
Particle as a wave	5	3	2
Particle in an infinite/finite potential well, tunneling effect	5	3	2
Hydrogen atom: Bohr's model, quantum model and wave function equation in one dimension	10	6	4
Solids classification and crystalline structure	8	6	2
Energy bands, Fermi-Dirac distribution,	5	3	2
Carrier densities and transport, recombination and generation	5	3	2
Drift-diffusion model, Intrinsic and extrinsic semiconductors	5	3	2
PN junction: structure and principle of operation, diode current, reverse bias, diode as a circuit element.	12	6	6

Teaching And Learning Methodologies :

Interactive Lecturing
Discussion
Problem solving
Experimental learning
Cooperative Learning

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
Assignment	5.00		
Course Project	5.00		
Final Exam	40.00		
Lab.	10.00		
Mid-Term Exam 1	10.00		

Mid-Term Exam 2	20.00		
Participation	10.00		

Recommended books :

College Physics - Giambattista and Richardson, Mac gramtill, 3rd edition.
Principles of Physics - Halliday and Resnick, Jearl Walker, 9th Edition.
- "Physics for Scientists and Engineers with Modern Physics" 9th Edition, Serway / Jewett.