Course Title	Course Code	Number of Study Hours			Year	Level	Prerequesits
		Theoritical	Laboratory	Credit			
Solid State Physics 2	471PHYS	3	1	4	4th	8th	371PHYS

(1) Brief Course Description

This course is a continuation of solid state physics 1 course. In its first part, it covers quantum approach of free electron theory of solids, band theory of solids, electrical, dielectric and magnetic properties of solids. The second part deals with semiconductor physics theory and applications which cover energy bands and carrier concentrations in semiconductor at equilibrium, carrier transport phenomena and some devices applications.

(2) Course Objectives

This course is designed to provide student with:

- The free electron gas theory, the basic concepts of quantum mechanics, statistical mechanics and atomic spectroscopy.
- The free electron theory of metals, the band theory of solids and Bloch wave function to understand the origin of energy bands in metals and semiconductors.
- Kronig-Penny model of solids according to band theory.
- Solids to metal insulator and semiconductors according to their band diagram and with respect to their different properties.
- The solid metals and semiconductors according to their, electric, dielectric and magnetic properties.
- Experiments included in the lab. section to acquire the experience with laboratory's apparatus, interpret different experimental results, and justify different phenomena experimentally.

(3) Course Contents

The theoretical part :

- **Free electron theory of metals according to quantum theory** (the properties of the essential state of Fermi-gas, Fermi-distribution of electrons, Fermi-Dirac distribution, electronic specific heat of metals, them-ionic emission).
- **The band theory of solids** (schrodinger equation for solids-the origin of energy bands in solids-Bloch function- wave function properties of the electron in the crystal and Briolloun zones-Kronig-Penny model- classification of solids according to band theory, the effective mass of electron.
- **Insulators and ferro-electric substances** (the electric fields in insulators- dielectric constant and electric polarization- ferro-electric crystals).
- **Semiconductors**: pure semiconductors - doped semiconductors, concentration of the electric charge carriers, energy bands and charge carrier in equilibrium, generation rate and recombination of the electric charge carriers, transport phenomena and applications**.**

The experimental part :

- Analysis of dielectrics using x-rays.
- Hall effect.
- The photo-conductivity.
- The luminesces .
- The ferro-magnetism.
- Absorption coefficients of insulators.
- The thermo-electric effect.
- Band gap of semiconductors.
- Planck's constants using Light emitting diodes.
- Solar cell experiments.

(4) Assessment Criteria

- Periodic Exams: 15%
- Oral, student activity and Essay: 10%
- Laboratory Work :25%
- Final Exam:50%

(5) Course Teaching Strategies

- Lectures, Paper Assignments, Homework, Web-based Assignments

(6) Text Book:

- Introduction to solid states, C. Kittle, 7th Edition, John-Wiley and sons Inc. 2007.

(7) Reference Books

- Principles of the solid state, H. V. Keer, Wiley Eastern limited, London, 1993.
- The solid state, H. M. Rosenberg, Oxford Press, 1988.