INSTITUTO DE FÍSICA
FACULTAD DE FÍSICA

COURSE	:	**DEFECTS IN SOLIDS, SEMICONDUCTOR AND SUPERCONDUCTIVITY**
TRANSLATION	:	DEFECTOS EN SÓLIDOS: SEMICONDUCTORES Y SUPERCONDUCTIVIDAD
NUMBER	:	FIM3010
CREDITS	:	15 UC/ 9 SCT
MODULES	:	02 THEORETICAL LECTURES
REQUISITES	:	FIZ3600
CONECTOR	:	AND
RESTRICTIONS	:	030501, 030401, 030801, 030802, 030803, 020601, 020701
CHARACTER	:	OPTATIVE
FORMAT	:	THEORETICAL LECTURES
QUALIFICATION	:	STANDARD
KEY WORD	:	DEFECTS IN SOLIDS, SEMICONDUCTORS, SUPERCONDUCTIVITY
DISCIPLINE	:	PHYSICS

I. COURSE DESCRIPTION

The properties of the materials depend to a great extent on their crystalline structure and the growth or manufacturing conditions, which in general lead to structures with the presence of defects. The main objective of this course will be the study of the way in which defects in solids affect the properties and behavior of materials. How transformation (fabrication) can affect properties and behavior, semiconductor applications, and superconductor theory will also be covered.

II. LEARNING OUTCOMES

- Fully understand how the physical and chemical properties of solids are affected by the presence of defects.
- Understand how the properties of solids can be "manipulated" by varying the structure and processing conditions.

III. CONTENT

1. Specific Defects
1.1 Point defect in a one-dimensional network.
1.2 Point defects: thermal defects, Frenkel defects, Schottky defects.
1.3 Concentration of point defects in thermal equilibrium.
2. Linear defects
2.1 Dislocations.
2.2 Volterra construction of dislocations.
2.3 Elastic deformation associated with dislocations.
2.4 Forces on dislocations.
2.5 Energy of a helical dislocation.
3. Surface defects
3.1 Free surfaces: Relaxation and reconstruction
3.2 Crystallography of surfaces.
3.3 Electronic structure of the surface.
3.4 Tangential transport to the surface.
3.5 Internal surfaces: grain boundaries and packaging defects.
4. Atomic diffusion

4.1 Types and mechanisms of diffusion.
4.2 Stationary and non-stationary state diffusion: Fick's laws.
4.3 Random walk.
4.4 Kirkendall effect.
4.5 Diffusion and ionic conductivity.
5. Semiconductors
5.1 Electronic properties of semiconductor elements.
5.2 Comparison of the structure of bands of metals, insulators and semiconductors.
5.3 Electronic excitation: electromagnetic absorption and thermal excitations.
5.4 Effective mass
5.5 Parabolic band approximation
5.6 Intrinsic semiconductors.
5.7 Doped semiconductors.
5.8 Effects of temperature on mobility.
5.9 Electrical conductivity and Hall effect in semiconductors.
6. Superconductivity
6.1 Phenomenology of superconductivity.
6.2 Thermodynamics of superconductors.
6.3 BSC theory.
6.4 Flow quantization.
6.5 Josephson effect.
6.6 High Tc superconductors.

IV. METHOLOGICAL STRATEGIES

- Theoretical classes.
- Homework.

V. EVALUATIVE STRATEGIES

- Three tests.
- Homework.

VI. BIBLIOGRAPHY

REQUIRED

Ashcroft, N. and Mermin, N. Solid State Physics. Saunders College, 1976

Hofmann, P. Solid State Physics. Wiley-VCH Verlag GmbH & Co, 2008

Marder, M.P. Condensed Matter Physics. John Wiley & Sons, Inc., 2000

Quinn, J. and Yi, K.S. Solid State Physics: Principles and Modern applications. Springer, 2009

R. Phillips, R. Cristals, defects and microstructures. Cambridge University press, 2004

Wahab, M.A. Solid State Physics. Segunda edición, Alphs Science International Ltd., 2005

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OPTIONAL

N/A