10752 – 713 (8) Solid State Physics (1.5L, 1.5P)

2022

Course summary:

Diffraction by crystals and the reciprocal lattice. Periodic crystal potentials, the tight-binding model, semi-conductors. Magnetism: para-, dia-, ferro- and antiferromagnetism. Superconductivity.

Module relevance in programme:

The course aims to introduce fundamental concepts and techniques for describing matter in its solid state. Students will be exposed to the standard approximations, models and methods concerning this discipline. Important applications in current-day technology, industry, and research will be introduced as well.

Learning Goals: Specific heat problem in a crystal; Free electron gas; Vibration in solids and phonons; Geometry of crystals; Neutron and X-ray diffraction; Electron in solids and bands theory; Physics of semiconductors: an introduction; Magnetism: an introduction.

Outcomes of course:

The course is intended as introduction to various aspects of solid state physics. Students who complete the course will be familiar with the basic physical principles underlying a variety of fundamental phenomena in the solid state.

Lecturer:

Prof H Weigel
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Mentor:

The Department of Physics has appointed a staff member as mentor for each year of its physics programme to be available to students for consultation. Students should feel free to discuss general issues related to the physics programme or specific modules in the programme with the relevant mentor, in addition to usual consultations with their individual lecturers of modules.

The mentor for the Honours programme and its modules is Dr P Southey (southey@sun.ac.za)

Course content:

Lectures and tutorials are face-to-face. Please follow all the required protocols and rules.

Specific heat problem: Boltzmann, Einstein and Debye model. Electrons in metals: Drude and Sommerfeld theory. Vibration in solids and phonons. Tight binding model: an introduction. Geometry of crystals. Neutron and X-ray diffraction. Electron in solids and bands theory. Application to the bands theory: physics of semiconductors. Magnetism: para-, dia- ,ferro- and antiferromagnetism.

Practical (Tutorials):

Weekly tutorials (as per honours course schedule)

Study material:

Recommended textbooks: D.L. Sidebottom “Fundamentals of condensed matter and crystalline physics”, and S.H.Simon “The Oxford Solid State Basic”

Assessment:

Methods of Assessments
Assessment shall occur by means of continuous assessment, comprising the following: One final written exam;homework assignments; one oral examination. Subject to change wrt COVIT protocols.

Venue and time of assessment opportunities
See timetable

Availability of marks:
Immediately following assessment or assignment.

Calculation of final mark for the module:
Final test 50/100, homework assignments 25/100, oral examination 25/100