B28TP Thermal Physics and Properties of Matter

COURSE DETAILS

Course Code: B28TP
Full Course Title: Thermal Physics and Properties of Matter
SCQF Level: 8
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL

Undergraduate: Yes  Postgraduate Taught: No  Postgraduate Research: No

COURSE AIMS

To introduce and develop the topics of thermal physics and the properties of matter.

To provide the mathematical techniques for analysing and solving problems in these topics.

LEARNING OUTCOMES – SUBJECT MASTERY

On completion of this course, the learner will be able to:

- Achieve a critical knowledge and understanding of the properties of matter and thermodynamics
- Demonstrate a detailed knowledge and understanding of the course topics
- Integrate previous knowledge from the physics programme with the topics discussed in the course
- Apply the theory of the course topics to problems or situations not previously encountered

LEARNING OUTCOMES – PERSONAL ABILITIES

Personal abilities are embedded in the course. The course provides the opportunity to:

Apply the advanced core knowledge expected of a professional physicist to gain professional level insights,

Communicate effectively with professional level colleagues

Interpret, use and evaluate critically a wide range of data to solve problems of both a familiar and unfamiliar nature
Manage time effectively, work to deadlines and prioritise workloads

Use a range of ICT skills with on-line materials and web links to support the learning process

Apply strategies for appropriate selection of relevant information from a wide source and large body of knowledge

Exercise significant initiative and independence in carrying out learning activities and researching information

SYLLABUS

Concept of heat and temperature

Heat capacities, equipartition of energy, heat transport (conduction, convection and radiation), measurement of temperature and definition of temperature scales, black-body radiation

The laws of thermodynamics

Zeroth Law; First law of thermodynamics (concepts of work and internal energy); Second law of thermodynamics (entropy, arrow of time). Free energies.

Physics of the atmosphere

Phase diagram of water, composition of the atmosphere, pressure gradients (vertical and horizontal), radiation balance and the physics of global warming

Generation of energy
Carnot cycle, thermodynamic efficiency of turbines and car engines, efficiency of heat pumps and refrigerators, exploitation of nuclear fission and fusion for electricity generation

Properties of matter

The three phases (gases, liquids, solids) and phase diagrams, kinetic theory of gases, dynamics of fluids including Bernolli’s equation and viscosity; Gas Laws up to Van der Waal’s eqn; Maxwell-Boltzmann distribution & Fermi-Dirac distribution.

Mechanical properties of matter: elasticity and thermal expansion.

LOCATION AND ASSESSMENT METHODS

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