Plasma Physics and Controlled Fusion

Version	2020/1
Effective from (date of when the course was developed)	23/05/2017

ECTS Credits	4
Level/Year	Bachelor (after 2nd semester), Master and PhD students
Teaching (contact) hours	36
Total learner managed hours (incl. self-work)	108
Total hours of student learning	144

Pre-requisites	Knowledge of Calculus and General Physics corresponding to the first two years of a Bachelor's degree program in science, technology, engineering, mathematics. Good command of English. All classes and extracurricular activities are conducted in English.
Co-requisites	None
Alignment to graduate profiles	This course contributes to achievement of the graduate outcomes of the following qualifications: • Bachelor of Physics • Master of Physics • Graduate Diploma in Physics • Diploma in Physics
Course aim	The primary objective of the course is to present the fundamentals of plasma physics particularly highlighting high-temperature plasma physics and its applications to controlled fusion. The course begins with an overview of plasma phenomena and their applications.
Indicative Course content	Plasma phenomena on Earth and in the Universe; contemporary research areas and technological applications of plasmas; studies of controlled nuclear fusion. Definition of plasma; quasineutrality, Debye length, plasma frequency. Coulomb collisions, Rutherford's formula, Coulomb logarithm Motion of a single charged particle in magnetic field; Larmor radius, drifts, magnetic traps. Controlled nuclear fusion; Lawson criterion and ignition criterion. Overview of nuclear fusion research activities in Japan. Principles of plasma heating with electromagnetic waves and neutral beam injection. Principles of plasma diagnostics, active and passive measurements, line-integral data, Doppler broadening. Plasma spectroscopy. Magnetic confinement of plasma in toroidal systems. Magnetohydrodynamics. Transport in fusion plasma.

LEARNING OUTCOMES

On successful completion of this course students will be able to:	
1	Describe the plasma state of matter and its basic properties
2	Describe contemporary plasma technologies
3	Explain single particle confinement in magnetic field and transport phenomena
4	Explain principles of plasma diagnostics and plasma heating
5	Describe contemporary nuclear fusion research activities

ASSESSMENTS

Basis of assessment	Achievement based assessment			
Methods of assessment		**Learning Outcomes**	**Pass criteria (Minimum)**	**% Weightings**
Summative review		1, 5	40%	40%
Portfolio – summative of practices		2, 3, 4	40%	60%

REQUIREMENTS FOR SUCCESSFUL COURSE COMPLETION

Requirements	Mark of 40% or more in every summative assessment

RESULTS

Assessment results	Results for assessments are given in percentage marks
Course results	• Individual assessments may cover one or more of the learning outcomes. • Each summative assessment is assigned a percentage weighting. • The overall percentage mark for the course is calculated by adding the weighted results for all summative assessments.

LEARNING AND TEACHING

Learning and teaching approaches	Lectures, seminars and group discussions, learner managed activities, laboratories.
Learning and teaching resources	Textbooks, journals and library resources; use of Internet; computer software.
Learner managed activities	• Completion of course work, set assignments • Reading of course materials • Study group work • Preparation for classes • Practicing relevant skills/methods/techniques • Self-evaluation of course work • Gathering relevant contextual information/ issues/ideas to build knowledge of the subject