Special Subjects of the Department of Fusion Science

Field	Subject Code	Subject	Credit	Content of subject	
Device system / Research operation / Plasma heating / Diagnostics / Plasma simulation / Particle simulation / Magneto hydrodynamic simulation	20DFS001	Plasma Physics Ⅰ	2	This lecture introduces basic physics required for understanding of not oly high temperature plasmas but also plasmas in a wide range. Basics of single particle motions, plasmas as fluids and diffusion is explained with regard to behavior of plasmas.	Hiromi Takahishi
	20DFS002	Plasma Physics Ⅱ	2	Fundamental physics concepts for understanding plasmas will be described. Characteristic phenomena in plasma physics will be explained, such as relations between the distribution function in velocity space and the plasma fluid description, transport and resistivity.	Katsuji Ichiguchi
	20DFS003	Fundamentals of Plasma Experiment Ⅰ	2	Fundamentals of magnetic confinement system, the high temperature plasma diagnostics, heating systems and plasma wall interactions are reviewed. Issues in the development of fusion power reactor are also considered. Students will learn some useful experimental techniques, such as noise, sensor, cable, laser, data analysis, and so on.	Gen Motojima
	20DFS004	Fundamentals of Plasma Experiment Ⅱ	2	In realizing buring fusion plasma, the behaviors of energetic particles, such as fusion born alpha particles, mut be understood. Several types of heating methods are applied to generate energetic particles and dianostic methods are also applied to examine the particles' behaviors., In the lecture, the principles of these methods are explained and the example of the methods are shown based on the LHD experiment. Basic knowlede to understand the energetic particles in plasmas, such as orbit topology and relaxation process of energetic particles in plasmas, are also discussed.	Masaki Osakabe
	20DFS005	Advances in Plasma Science Ⅰ	2	This lecture is an introduction of the plasma material interactions. The elementary processes of the interactions, namely, radiation damages which is caused by the plasma exposure and plasma responses to the material behaviors are explained.	Ryuichi Sakamoto
	20DFS006	Advances in Plasma Science Ⅱ	2	This lectuer is an introduction of atomic and molecular processes applied in fusion and related plasma researches. Basics of atomic and molecular physics including structures, spectra, collision processes with electrons, ions, and photons, and kinetics of chemical reactions, collisional–radiative model, and radiation transfer are explained. Applications of the atomic and molecular processes in plasma researches are outlined.	Izumi Murakami
	20DFS007	Fusion System Engineering Ⅰ	2	This lecture is an introduction to fusion engineering. Features and functions of fusion power plant systems and their subsystems such as superconducting magnets, heating devices, divertor, and blankets are reviewed. Concerning the magnets, properties of materials at low temperatures and superconductivity are reviewed, and their issues are discussed. In addition, technical issues of divertor and blankets for high heat flux and neutron irradiation are discussed.	Shinsaku Imagawa
	20DFS008	Fusion System Engineering Ⅱ	2	This lecture is an introduction to superconducting coils for fusion. An outline is given of features of superconducting coils for fusion and the history of developments. Technical issues related to fusion energy reactors are discussed, focussing on supporting structure, the maximum field, quench protection, and irradiation effect.	Kazuya Takahata
	20DFS009	Fusion Reactor Materials Ⅰ	2	Fundamentals of microstructure and mechanical properties of materials, basic and combined process of neutron irradiation effects, irradiation tests technology, status and issue in developing low activation materials and functional materials for fusion blankets are reviewed.	Takuya Nagasaka
	20DFS010	Fusion Reactor Materials Ⅱ	2	Topics of this lecture are roles of funtional materials for tritium breeding, neutron multiplying, radiation shielding, electrical insulation, optical measurements, etc. and their properties under a fusion reactor environment. Mechanisms of neutron/gamma–ray transports, nuclear heating and irradiation effects in the materials are also explained.	Teruya Tanaka

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Device system / Research operation / Plasma heating / Diagnostics / Plasma simulation / Particle simulation / Magneto hydrodynamic simulation	20DFS011	Advances in Fusion Science Ⅰ	2	Waves in fusion plasma is lectured and fundementals of interactions between waves and plasmas are studied. As a basis to consider fusion plasmas, magnethydrodynamics, equilibrium and stability are lectured. Furthermore, the kinetic and non-linear phenomena are addressed.	Tomohiro Morisaki
	20DFS012	Advances in Fusion Science Ⅱ	2	Fundamental plasma physics is lectured for fusion plasmas on the topics of MHD equilibrium and stability analysis. Their applications to confinement devices are explained. Plasma-wave interaction and stability analysis with energetic particles are addressed for fusion plasmas.	Masayuki Yokoyama
	20DFS013	Fundamentals of Simulation Science Ⅰ	2	Basic numerical methods for studying a variety of plasma behaviors by means of kinetic or fluid simulation models are described. Their features, limitations, and numerical errors are also discussed with practical examples.	Seiji Ishiguro
	20DFS014	Fundamentals of Simulation Science Ⅱ	2	Computer simulation is a powerful tool to understand and predict complex dynamics of plasmas. In this lecture, both the particle and fluid methods employed in plasma simulation are mainly reviewed. Basic physics related to the simulation is also explained.	Hiroaki Ohtani
	20DFS015	Mathematical Physics Ⅰ	2	Diverse phenomena with disparate spatiotemporal scales exist in plasmas. In this series of lectures, one learns how various theoretical models suitable for investigating the phenomena in different hierarchies can be derived by applying appropriate mathematical techniques and approximations.	Hideo Sugama
	20DFS016	Mathematical Physics Ⅱ	2	Various mathematical methods are used to theoretically treat complex physical systems such as plasmas. In this lecture, the mathematical methods for kinetic/fluid description of plasmas are explained.	Ryutaro Kanno
	10DFS001	Scientific English Writing and Presentation at International Conferences	2	Because international collaboration is often required for the successful development of magnetic fusion energy, as seen in the case of ITER, the ability of communication in English is a "prerequisite" to be a successful research scientist. A series of lectures will provide students with the basic knowledge to write and present technical papers in English for international conferences, also with practice in reading technical literature and a with a review of relevant grammatical topics.	Byron Peterson
	90DFS001	Fusion plasma science exercise ⅠA	2	Exercises of experimental, theoretical and simulation science are given by advisering professors and other teachers. Discussions on the processes and results of research are guided which are necessary to complete educational course.	All teachers
	90DFS002	Fusion plasma science exercise ⅠB	2		
	90DFS003	Fusion plasma science exercise ⅡA	2		
	90DFS004	Fusion plasma science exercise ⅡB	2		
	90DFS005	Fusion plasma science exercise ⅢA	2		
	90DFS006	Fusion plasma science exercise ⅢB	2		
	90DFS007	Fusion plasma science exercise ⅣA	2		
	90DFS008	Fusion plasma science exercise ⅣB	2		
	90DFS009	Fusion plasma science exercise ⅤA	2		
	90DFS010	Fusion plasma science exercise ⅤB	2		
	90DFS011	Fusion plasma science investigation ⅠA	2	Seminar is organized for small number of students on fusion plasma science. Basic scientific knowledge, intelligence and flexibility are trained for the basis of original research. Teachers in the same research field as students lead seminar as core members.	All teachers
	90DFS012	Fusion plasma science investigation ⅠB	2		
	90DFS013	Fusion plasma science investigation ⅡA	2		
	90DFS014	Fusion plasma science investigation ⅡB	2		

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Device system / Research operation / Plasma heating / Diagnostics / Plasma simulation / Particle simulation / Magneto hydrodynamic simulation	90DFS015	Fusion plasma science investigation ⅢA	2	Seminar is organized for small number of students on fusion plasma science. Basic scientific knowledge, intelligence and flexibility are trained for the basis of original research. Teachers in the same research field as students lead seminar as core members.	All teachers
	90DFS016	Fusion plasma science investigation ⅢB	2		
	90DFS017	Fusion plasma science investigation ⅣA	2		
	90DFS018	Fusion plasma science investigation ⅣB	2		
	90DFS019	Fusion plasma science investigation ⅤA	2		
	90DFS020	Fusion plasma science investigation ⅤB	2		
	90DFS021	Exercise of scientific paper analysis ⅠA	2	Fundamentals of scientific understanding and English reading ability are improved through group reading of important papers in fusion plasma science. Practical ability of writing scientific paper is also improved.	All teachers
	90DFS022	Exercise of scientific paper analysis ⅠB	2		
	90DFS023	Exercise of scientific paper analysis ⅡA	2		
	90DFS024	Exercise of scientific paper analysis ⅡB	2		
	90DFS025	Exercise of scientific paper analysis ⅢA	2		
	90DFS026	Exercise of scientific paper analysis ⅢB	2		
	90DFS027	Exercise of scientific paper analysis ⅣA	2		
	90DFS028	Exercise of scientific paper analysis ⅣB	2		
	90DFS029	Exercise of scientific paper analysis ⅤA	2		
	90DFS030	Exercise of scientific paper analysis ⅤB	2		
	90DFS031	Fusion plasma science seminar	2	Learn latest informations on research activities by attending colloquiums on fusion plasma sciences. Improve student's ability of preparing and talking in the presentation by practicing by themselves.	