

Common Specialized Subjects of the School of Multidisciplinary Sciences

Course Code	Subject	Credit	Content of subject	Instructor
10SMS041**	Introduction to Time Series and Spatial Modeling	2	This course introduces the foundations of time series analysis, point process, and spatial/spatio-temporal modeling. Emphasis is placed on statistical modeling and model selection by information criteria. ✘Students who have already taken " Introduction to Statistical Modeling I (10SMS001)" " Introduction to Statistical Modeling II (10SMS002)" can't take this subject.	All the teaching staff of Department of Statistical Science
10SMS042**	Introduction to Multivariate Analysis	2	This course deals with a wide range of techniques (regression analysis, discriminant analysis, principal component analysis, factor analysis, covariance structure analysis, etc.) for analyzing multivariate data. ✘Students who have already taken " Introduction to Statistical Data Science I (10SMS003)" "Introduction to Statistical Data Science II (10SMS004)" can't take this subject.	
10SMS043**	Introduction to Probability and Stochastic Processes	2	The lectures in this subject explore fundamental concepts relating to theories of probability and stochastic processes. More specifically, the subject covers probability space, random variable, convergence, generating and characteristic functions, Poisson process, and Markov chain. ✘Students who have already taken "Introduction to Statistical Inference I (10SMS005)" can't take this subject.	
10SMS044**	Introduction to Mathematical Statistics	2	This lecture course provides an overview of the theory of mathematical statistics. The main topic of the course is the theory of statistical inference. Specifically, the course deals with summary statistics, sampling distributions, point estimation, interval estimation, hypothesis testing and regression models. Applications of the theory of mathematical statistics to real problems are also discussed. ✘Students who have already taken "Introduction to Statistical Inference II (10SMS006)" can't take this subject.	
10SMS045**	Introduction to Computational Mathematics	2	The lectures cover fundamentals of computational inference such as applied/numerical linear algebra, matrix differential calculus, large-scale linear computing, linear programming, integer programming, dynamic programming, and theory and algorithms of optimization, state space representations of dynamical systems and canonical forms. ✘Students who have already taken "Computational Methodology in Statistical I (10SMS007)" can't take this subject.	
10SMS046**	Introduction to Statistical Machine Learning	2	The lectures discuss methods and theory of statistical machine learning including support vector machines, deep learning, Gaussian processes, ensemble learning, transfer learning, reinforcement learning, and statistical learning theory. ✘Students who have already taken "Computational Methodology in Statistical II (10SMS008)" can't take this subject.	
10SMS047**	Introduction to Computational Inference	2	This course deals with methodologies in computational statistics with their applications in statistics and machine learning. Topics include nonparametric bootstrap, Markov chain Monte Carlo, particle filter, graphical modeling and belief propagation, EM algorithm, and variational Bayesian inference. ✘Students who have already taken "Computational Methodology in Statistical II (10SMS008)" can't take this subject.	

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10SMS009**	Introduction to Polar Multidisciplinary Science	1	In this class, we will give lectures from multiple perspectives on the history, present state, and future prospects of scientific observations that Japan is advancing in the Antarctic and Arctic regions, including scientific research, logistics aspects, environmental protection perspectives, and relationships with social life, and introduce the overall picture and attractiveness of multidisciplinary science conducted in the unique field of the polar region.	All professors in Polar Science
10SMS010**	Introduction to Advanced Earth Science I	2	Topics from each research discipline are studied with special interest of international circumstances.	Academic staffs in Polar Science
10SMS011**	Introduction to Advanced Earth Science II	2		
10SMS012**	Introduction to Earth's Metrology	2	To assess the natural environment of the polar regions, various means of geophysical observation are necessary, most notably remote sensing techniques using artificial satellites. It is also very useful to know how, over the long course of human history, people managed to measure such things as time, geographical location, distance on the Earth's surface, and how developed devices enabling these to be measured with enhanced precision. This subject explores the history of various kinds of geophysical measurement and discusses the current technological status and future developments.	DOI Koichiro
10SMS013**	Metrology for space and atmosphere	2	In order to measure physical quantities in the space and upper atmosphere, ground and/or satellite based remote sensing techniques are commonly employed as well as air/space/rocket-borne in-situ measurements, wherein the estimates are obtained by solving inverse problems. In this course, students are to learn the framework of the measurement and the inverse problems, together with the essential data analysis theories, in respect with the space and upper atmosphere.	TOMIKAWA Yoshihiro
10SMS014**	Marine Ecology	2	The world ocean covers approximately 70% of the earth's surface and has an average depth of about 3,800 m. The Ocean provide a vast living space for marine life. This subject explores various types of marine environmental systems, in particular through the biological processes associated with plankton community of the pelagic ecosystem. Sampling and observation of marine organisms at sea will be carried out as a field course.	MAKABE Ryouyusuke
10SMS015**	Introduction to the atmospheric and hydrospheric sciences	2	This subject is designed to provide a geophysical and geochemical outline of phenomena occurring in the atmosphere, cryosphere, and ocean of the Earth for the integrated understanding of the processes in the polar regions.	ENOMOTO Hiroyuki FUJITA Shuji USHIO Shuki INOUE Jun
10SMS036**	Introduction to Mathematical Logic	2	Basic knowledge of mathematical logic, in particular, first-order logic will be explained.	TATSUTA Makoto
10SMS017**	Introduction to Algorithms	2	We explain the fundamentals of algorithms that are used in programming, and design of the methods for solving the models.	UNO Takeaki

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10SMS018**	Quantum Information and Computing	2	<p>This course will be an introduction to the field of quantum information and computing. No prior knowledge of quantum information will be assumed, so is suitable for those who are interested in learning about this topic with minimal background. We will start by describing elementary aspects of quantum mechanics, such as Schrodinger's equation, Hilbert spaces, superposition, and measurement. These concepts will then be applied to quantum gates and circuits, discussing various operations that would take place in a quantum computer. Several quantum algorithms that perform tasks faster than classical algorithms will be discussed.</p> <p>The concept of entanglement will be discussed, along with applications such as quantum teleportation. Some of the extensions of classical information theory to its quantum counterpart will be discussed.</p> <p>The completion of this lecture course is required to take any advanced courses on quantum information related subjects.</p>	Please refer to the Web Syllabus 2022
10SMS019**	High-Performance Computing	2	<p>This course gives lectures on theory, implementation, application and future directions of the high performance computing technology utilizing supercomputers, PC clusters, on-chip multiprocessors and grid computing.</p>	AIDA Kento KOIBUCHI Michihiro TAKEFUSA Atsuko ISHIKAWA Yutaka
10SMS020**	Information Sharing System Architecture	2	<p>This course will discuss information and communication network architectures, including</p> <p>(1) advanced networking technologies and network systems technologies for a variety of telecommunication network services,</p> <p>(2) circuit switching and packet switching, network layering and each layer's function.</p> <p>The course will also and (3) Security Technology.</p>	URUSHIDANI Shigeo TAKAKURA Hiroki KURIMOTO Takashi
10SMS021**	Applied Linear Algebra	2	<p>Linear algebra is significantly essential in natural science and engineering. Moreover, it becomes to play an important role in data science recent years. In this lecture, we will learn the basic properties and numerical methods of linear algebra. We will also learn about practical applications.</p>	SUGIMOTO Akihiro KISHIDA Masako SATO Shin'ichi
10SMS022**	Introduction to Software Science I	2	<p>This course presents two main themes in Software Science, representation of software (programming and modeling) and software systems.</p>	All professors in Software Science
10SMS023**	Introduction to Software Science II	2	<p>This course presents basic knowledge of Software Science focusing on the data management, data processing, and data analysis.</p>	All professors in Software Science
10SMS024**	Introduction to Multimedia Information Science	2	<p>Lectures on the academic fields included in multimedia information science will be given by the faculty members in the field of media information science. In this course, students will learn about various topics and trends in media processing, with the aim of acquiring knowledge in the fundamental fields, and being able to use that knowledge by themselves.</p>	All professors in Multimedia Information Science
10SMS025**	Introduction to Intelligent Systems Science I	2	<p>This course gives knowledge on fundamental fields, AI, soft computing, cognitive science, and robotics for intelligent systems science.</p>	Please refer to the Web Syllabus 2022

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10SMS026**	Introduction to Intelligent Systems Science II	2	This course gives knowledge on fundamental fields, such as advanced reasoning, agent technology, interface and data analysis methods, for intelligent systems science.	SATOH Ken TAKEDA Hideaki PRENDINGER Helmut SUGIYAMA Mahito BONO Mayumi MIZUNO Takayuki SUGAWARA Saku
10SMS039**	Introduction to Information Environment Science	2	As the progress of information technology, interaction of society, technology and information is facing great changes. This course introduces researches on creation, distribution, usage and storage of information. Participants are expected to understand the issues and trend of researches on the relationships between information and society. ※Students who have already taken "Introduction to Information Environment Science I (10SMS027)" can't take this subject.	All professors in Information Environment Science
10SMS037**	Scientific Presentation	1	(I) We will foster skills for scientific presentation, asking and answering questions, and debate. Specifically: (1) Material on good presentation technique and some English language skills will be presented (1 class, Assoc. Prof. KANEKO) (2) Initial Evaluation: We will ask you to present on your research or study, and debate. (1-2 classes, all teachers) (3) 8 classes by Ms. JONES provide practical instruction for students to improve their presentation materials and presenting skills. We explore in detail the function, structure, form, and content of scientific presentations, referring to the individual scientific presentations they have made. We discuss how best to convey their research in different settings (e.g., in their research group, at a scientific conference in their field, and to a general science audience). Students also work together to provide feedback and suggestions for improving their scientific presentations. All classes are interactive. Students actively problem-solve common issues facing presenters and practice all aspects of presenting during the classes. (4) Final Evaluation: We will ask you to present on your research or study, and debate, and measure the progress. (1-2 classes, all teachers) (II) Training for scientific writing: The students will be asked to read the titles, abstracts and introductions of several real research papers of varying quality, to critique them, and to correct one of them. Then, examples of the students' own technical writing will be treated.	KANEKO Megumi IGARASHI Ayumi WU Stephen (Dep. of Statistical Science) JONES Caryn

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10SMS038**	Scientific Writing	1	<p>(I) We will train the ability to write scientific papers. Specifically: (1) 8 classes by Ms. JONES focus on how to write effective research papers. We examine in detail: the roles and responsibilities of authors and other actors in the scholarly publishing industry; communicating effectively with the different actors; recent changes in scholarly publishing and the implications for authors; good practices to underpin effective science writing (from conception of the research through writing, submission, and peer review to publication and beyond); avoiding and resolving common issues (plagiarism and self-plagiarism, authorship, copyright, predatory journals and conferences, etc.); establishing structure and logical flow; strategies and practical tips for writing clearly, accurately, concisely, and authoritatively; and self-editing and proofing. All classes are interactive, involving practical exercises and encouraging problem-solving. Students complete a short writing assignment as part of this course. (2) Training for scientific writing (3 classes by Assoc. Prof. WU, Assoc. Prof. KANEKO and Assis. Prof. IGARASHI) The students will be asked to read the titles, abstracts and introductions of several real research papers of varying quality, to critique them, and to correct one of them. Then, examples of the students' own technical writing will be treated.</p> <p>(II) Reading We will read English articles, for example from Nature or Science. We will ask each student to read aloud a paragraph or two in turn, and summarize. Then, we will ask questions and we will have discussions related to the article.</p>	KANEKO Megumi IGARASHI Ayumi WU Stephen (Dep. of Statistical Science) JONES Caryn
10SMS034**	Introduction to Information Security Infrastructure	2	Information security technology, service, system, rule, and law give a fundamental framework for providing ICT (information and communication technology) systems and services. This course will introduce information security and give its explain in an ICT governance way.	ECHIZEN Isao TAKAKURA Hiroki OKADA Hitoshi
10SMS035**	Introduction to Big Data Science	2	This course will introduce basic concepts and methodologies of large scale data processing, analysis, security, and visualization by discussing relevant applications.	Professors related to Big Data
10SMS040**	Practical Data Science	2	To practice data science, we will discuss subjects such as data acquisition, data construction and data analysis.	YAMAJI Kazutsuna

A two-digit number or letter will be entered to ** according to the semester or the lecturer in charge.