Common Specialized Subjects of the School of Multidisciplinary Sciences

Subject Code	Subject	Credit	Content of subject	
10SMS001	Introduction to Statistical Modeling I	2	Since data obtained from the real world are huge and diverse, it is important to establish a set of analytic methods based on statistical modeling, which enables us to capture basic characteristics of such big data. In this course, we study various statistical models (e.g., the normal linear model and the generalized linear model) along with classical inference techniques within the framework of regression analysis.	All the teaching staff in the field of Statistical Modeling
10SMS002	Introduction to Statistical Modeling Ⅱ	2	This course deals with statistical modelling methods of various types of time-series and spatio-temporal data. Model-based inference, prediction, and computational algorithms for practical applications are also discussed.	
10SMS003	Introduction to Statistical Data Science Ⅰ	2	This course deals with various data collection methods and practical data analysis methods widely applied in scientific investigation and research, involving practices using statistical software R, SAS, etc.	All the teaching staff in the field of Statistical Data Science
10SMS004	Introduction to Statistical Data Science Ⅱ	2	The lectures are centered around information theory and statistics, covering statistical models, likelihood, maximum likelihood method, entropy and information quantity, Akaike information criterion, and model evaluation.	
10SMS005	Introduction to Statistical Inference Ⅰ	2	The lectures in this subject explore fundamental concepts relating to theories of statistical inference. More specifically, the subject covers the fundamentals of probability theory, statistical inference theory, asymptotic theory, linear models, and Bayesian statistics.	All the teaching staff in the field of Statistical Inference and Mathematics
10SMS006	Introduction to Statistical Inference Ⅱ	2	The lectures in this subject explore fundamental concepts relating to theories of statistical inference. More specifically, the subject covers the fundamentals of probability theory, statistical inference theory, asymptotic theory, linear models, and Bayesian statistics.	
10SMS007	Computational Methodology in Statistical Inference Ⅰ	2	The lectures cover fundamentals of computational inference such as applied/numerical linear algebra, matrix differential calculus, large-scale linear computing, theory and algorithms of optimizaiton, state space representations of dynamical systems and canonical forms.	All the teaching staff of Department of Statistical Science
10SMS008	Computational Methodology in Statistical Inference Ⅱ	2	This course deals with statistical models in machine learning and computational methodologies for treating such models. Topics include graphical modeling, hidden Markov model, hierarchical Bayesian models, EM algorithms, variational Bayesian algorithms, and Markov chain Monte Carlo methods.	
10SMS009	Introduction to Polar Multidisciplinary Science	1	Introduction to Polar Multidisciplinary Science describes how the Japanese scientific obseervations in the polar regions have initiated and developed into Multidisciplinary Science, i.e., Polar Science, from historical, social and logistic engineering point of view.	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		

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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.	Koichiro Doi
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.	Koji Nishimura Yoshihiro Tomikawa
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 our as a field course.	Ryousuke Makabe
10SMS015	Introduction to the atmospheric and hydrospheric sciences	2	This subject is designed to provide a fundamental grounding in the physics and chemistry needed to understand phenomena occurring in the atmosphere, cryosphere and ocean of the Earth.	Hiroyuki Enomoto Shuji Fujita Shuki Ushio Jun Inoue
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 programmming, and design of the methods for solving the models.	UNO Takeaki
10SMS018	Quantum information and computing	2	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. 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. The completion of this lecture course is required to take any advanced courses on quantum information related subjects.	NEMOTO Kae MATSUMOTO Keiji
10SMS019	High-Performance Computing	2	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.	AIDA Kento KOIBUCHI Michihiro TAKEFUSA Atsuko
10SMS020	Information Sharing System Architecture	2	This course will discuss information and communication network architectures, including (1) advanced networking technologies and network systems technologies for a variety of telecommunication network services, (2) circuit switching and packet switching, network layering and each layer's function. The course will also and (3)Security Technology.	URUSHIDANI Shigeo TAKAKURA Hiroki KURIMOTO Takashi
10SMS021	Applied Linear Algebra	2	We will give an overview of the fundamentals of linear algebra and introduce some applications.	HAYAMI Ken GOTODA Hironobu SATOH Shin'ichi KISHIDA Masako

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10SMS022	Introduction to Software Science Ⅰ	2	This course presents two main themes in Software Science, representation of software (programming and modeling) and software systems.	All professors in Software Science
10SMS023	Introduction to Software Science Ⅱ	2	This course presents basic knowledge of Software Science focusing on the data management, data processing, and data analysis.	All professors in Software Science
10SMS024	Introduction to Multimedia Information Science	2	This lecture is an omnibus lecture series by the all faculty members of Multimedia Information Science. The course will cover a broad range of topics of Multimedia Information Science.	All professors in Multimedia Information Science
10SMS025	Introduction to Intelligent Systems Science Ⅰ	2	This course gives knowledge on fundamental fields, AI, soft computing, cognitive science, natural language processing for intelligent systems science.	INOUE Katsumi YAMADA Seiji ICHISE Ryutaro INAMURA Tetsunari MURATA Shingo HOULE Michael E
10SMS026	Introduction to Intelligent Systems Science Ⅱ	2	This course gives knowledge on fundamental fields, such as advanced reasoning, agent technology, natural language processing and interface for intelligent systems science.	SATOH Ken TAKEDA Hideaki PRENDINGER Helmut OHMUKAI Ikki SUGIYAMA Mahito BONO Mayumi MIZUNO Takayuki
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 Enviroment 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. (3 classes, Prof. HOULE)	HAYAMI Ken HOULE Michael E KANEKO Megumi KISHIDA Masako JONES Caryn

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10SMS038	Scientific Writing	1	(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) 3 classes by Prof. HOULE: 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. (II) Reading (3 classes by Prof. HAYAMI and Assoc. Prof. KISHIDA) 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.	HAYAMI Ken HOULE Michael E KISHIIDA Masako 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 acquision, data construction and data analysis.	YAMAJI Kazutsuna