Course Category	TBA	Credits	2
Subject Code	TBA	Taking Year	1st Grade, 2nd Grade
Course Title (Japanese)	定性的微分方程式論	Course Period	1st Semester
Course Title	Qualitative Theory of Ordinary Differential Equations	Day of the week / Hour	Thursday / The fifth period
Registration Code	TBA	Compulsory / Elective	Elective
Instructor(s)	Jitsuro Sugie	Course Qualification	Students of Postgraduate Mathematics Course

Course Style	Lecture
Course Aim	Natural phenomena, life phenomena, social phenomena are often described by differential equations. However, even if the form of the differential equation is simple such as linear form, its concrete solution can be rarely found. For this reason, solutions must be qualitatively sought. The study of the qualitative theory of ordinary differential equations may be said to have begun with the pioneering work of H. Poincare. Poincare studied topological properties of solutions of autonomous ordinary differential systems in the plane. Theory of Poincare has been taken over by the I. Bendixson, G. D. Birkhoff and others, and it has significantly developed now. The purpose of this course is to introduce the basic theory. In in this course nonautonomous systems are also dealt.
Goals and Objectives (Level of Achievement)	The achievement targets are 1. to understand the structure of solutions of linear ordinary differential equations; 2. to understand that the abstract concept and the calculation method learned in linear algebra are very important in order to check the properties of solutions of ordinary differential equations; 3. to grow the ability to analyze asymptotic properties of nonlinear ordinary differential equations.
Course Plan	1. Guidance and mental attitude in this course 2. Why the qualitative theory is necessary? 3. Existence and uniqueness of solutions 4. Ascoli-Arzelà theorem 5. Maximum solution and minimum solution 6. Presentation about the related contents (No.1) 7. Comparison theorem 8. Global existence of solutions 9. Continuity and differentiability of solutions with respect to initial conditions 10. Presentation about the related contents (No.2) 11. Fundamental solution for homogeneous linear systems 12. Nonhomogeneous linear systems and variation of constants 13. Linear systems with constant coefficients and its characteristic equation 14. Linear systems with periodic coefficients and Floquet theory 15. Presentation about the related contents (No.3)
Teaching Methods	The reports are imposed as appropriate. Students attending this course must announce the contents of self-learning sometimes. Additional presentation might be carried out outside of class time.
Key Words	Ordinary differential equations, Qualitative theory, Existence and uniqueness of solutions, Linear systems, Presentation
Texts	None
Reference Books	[1] Lefschetz, S., Differential Equations: Geometric Theory, Reprinting of 2nd Ed., Dover Publications, Inc., New York, 1977. [2] Brauer, F. and Nohel, J. A., The Qualitative Theory of Ordinary Differential Equations: An Introduction, Dover Publications, Inc., New York, 1989. [3] Sánchez, D. A., Ordinary Differential Equations and Stability Theory: An Introduction, Reprint of the 1968 original. Dover Publications, Inc., New York,

	1979. [4] 吉沢太郎，微分方程式入門，復刊基礎数学シリーズ No. 13，朝倉書店，2004. [5] 马知恩，周义仓，常微分方程定性与稳定性方法，科学出版社，2001. [6] 廖晓昕，稳定性的理论，方法和应用（第 2 版），华中师范大学出版社，2011.
Other Teaching Materials	Further references and materials will be given in this course.
Performance Evaluation	Evaluation is based up on reports (35%), class attendance (15%) and presentation (50%).
Notes on the Course	Basic knowledge about solving ordinary differential equations is required in this course. The knowledge of linear algebra is also necessary. Moreover, a high learning level of the (ε,δ)-definition of limit is required.
Office Hour	Wednesday evening (about 16:00～), Room No. 607 or No. 608, Building No. 3, Interdisciplinary Faculty of Science and Engineering
Other Notes	None