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| Tsuyama College                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Year                                                             | 2021                                                        | Course Title                                                        | Set Theory and General Topology |
| Course Information                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             |                                                                     |                                 |
| Course Code                                                                                                                                                                            | 0090                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                  | Course Category                                             | Specialized / Elective                                              |                                 |
| Class Format                                                                                                                                                                           | Lecture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                  | Credits                                                     | Academic Credit: 2                                                  |                                 |
| Department                                                                                                                                                                             | Department of Integrated Science and Technology Electrical and Electronic Systems Program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                  | Student Grade                                               | 4th                                                                 |                                 |
| Term                                                                                                                                                                                   | Year-round                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                  | Classes per Week                                            | 1                                                                   |                                 |
| Textbook and/or Teaching Materials                                                                                                                                                     | Textbook: Kazuo Matsusaka, Introduction to Meeting and Phase (Iwanami Shoten)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                  |                                                             |                                                                     |                                 |
| Instructor                                                                                                                                                                             | YOSHIDA Eiji                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                  |                                                             |                                                                     |                                 |
| Course Objectives                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             |                                                                     |                                 |
| Learning Purposes<br>knowledge about sets and topologies, which are the basics of modern mathematics. Course Objectives                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             | Acquire basic                                                       |                                 |
| 1 To set, understand the basic properties of mapping.<br>2 To acquire basic knowledge about phase and phase space.<br>3 To acquire basic knowledge about connectivity and compactness. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             |                                                                     |                                 |
| Rubric                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             |                                                                     |                                 |
|                                                                                                                                                                                        | Excellent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Good                                                             | Acceptable                                                  | Not acceptable                                                      |                                 |
| Achievement 1                                                                                                                                                                          | Can solve applied problems related to sets and maps.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Can solve problems related to sets and maps.                     | Understand the basics of assembly and mapping.              | Doesn't understand the basics of assembly and mapping.              |                                 |
| Achievement 2                                                                                                                                                                          | Fully understand the basic properties of phase and topological space.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Understand the basic properties of phase and topological space.  | Understand the definitions of phase and topological space.  | Doesn't understand the definitions of phase and phase space.        |                                 |
| Achievement 3                                                                                                                                                                          | Fully understand the basic properties of connectivity and compactness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Understand the basic properties of connectivity and compactness. | Understand the definitions of connectivity and compactness. | Doesn't understand the definitions of connectivity and compactness. |                                 |
| Assigned Department Objectives                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             |                                                                     |                                 |
| Teaching Method                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             |                                                                     |                                 |
| Outline                                                                                                                                                                                | General or Specialized : Specialized<br>Field of learning : Mathematics / Physics (Specialized Subjects)<br>Required, Elective, etc : Elective must complete subjects<br>Foundational academic disciplines : Mathematical science / mathematics / basic analysis<br><br>Relationship with Educational Objectives :<br>This class is equivalent to "③ Acquire deep foundation knowledge of the major subject area".<br><br>Relationship with JABEE programs :<br>The main goal of learning/education in this class are "(A) and A-1".<br><br>Course outline :<br>Set and topology are the core fields that support modern mathematics along with calculus and linear algebra. It is an indispensable pillar for learning modern mathematics, and is the best subject to acquire a perspective on modern mathematics. Recently, the idea of set and topological methods has been applied in various fields of engineering. We recommend this course to students who want to study engineering well, students who want to go on to higher education, and students who like mathematics. |                                                                  |                                                             |                                                                     |                                 |
| Style                                                                                                                                                                                  | Course method :<br>Classes are centered on board writing. The goal of the class is to understand the basic contents of sets, maps, and topological spaces. Exercises may also be imposed to establish that understanding.<br><br>Grade evaluation method :<br>Two regular examinations (50%) and other tasks (50%). In addition, depending on the grade, an addition report may be assigned.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                  |                                                             |                                                                     |                                 |
| Notice                                                                                                                                                                                 | Precautions on the enrollment :<br>This is a "class that requires study outside of class hours". Classes are offered for 15 hours per credit, but 30 credit hours are required in addition to this. Follow the instruction of your instructor for these studies.<br><br>Course advice :<br>Make sure to check the contents of the set and logic learned in the basic mathematics of the first year.<br><br>Foundational subjects: Fundamental mathematics (1st year), Differential and Integral I (2nd), Fundamental linear algebra (2nd)<br>Related subjects : Algebra (5th years), Geometry (5th), Analysis (5th), etc.<br><br>Attendance advice :<br>Lectures are conducted slowly while reviewing, but independent study is important. I want you to thoroughly review each lesson.                                                                                                                                                                                                                                                                                              |                                                                  |                                                             |                                                                     |                                 |
| Characteristics of Class / Division in Learning                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             |                                                                     |                                 |
| <input type="checkbox"/> Active Learning                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> Aided by ICT                            |                                                             | <input type="checkbox"/> Applicable to Remote Class                 |                                 |
|                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             | <input type="checkbox"/> Instructor Professionally Experienced      |                                 |
| Course Plan                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                  |                                                             |                                                                     |                                 |
|                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Theme                                                            | Goals                                                       |                                                                     |                                 |

|              |             |      |                                             |                                                            |
|--------------|-------------|------|---------------------------------------------|------------------------------------------------------------|
| 1st Semester | 1st Quarter | 1st  | Guidance, concept of set                    | Understand the concept of sets                             |
|              |             | 2nd  | Operations between sets                     | Learn the operation of sets                                |
|              |             | 3rd  | The concept of mapping                      | Understand the concept of mapping                          |
|              |             | 4th  | Surjective, injective, bijective            | Understand surjectiveness, injectiveness, etc. of maps     |
|              |             | 5th  | Euclidean space                             | Understanding Euclidean space                              |
|              |             | 6th  | Open set and closed set of Euclidean space  | Understanding open sets in Euclidean space                 |
|              |             | 7th  | Basis of open set system in Euclidean space | Understand the role of open set systems in Euclidean space |
|              |             | 8th  | 1st semester mid-term exam                  |                                                            |
|              | 2nd Quarter | 9th  | Continuous function in Euclidean space      | Understanding continuous functions in Euclidean space      |
|              |             | 10th | Topology                                    | Understand what topology is                                |
|              |             | 11th | Open set, open nucleus                      | Understand how open sets are defined                       |
|              |             | 12th | Closed set, closure                         | Understand how closed sets are defined                     |
|              |             | 13th | Neighborhood                                | Understand what a neighborhood is                          |
|              |             | 14th | Comparison of topology                      | Understand how to compare phases                           |
|              |             | 15th | (1st semester final exam)                   |                                                            |
|              |             | 16th | Return and commentary of exam answers       |                                                            |
| 2nd Semester | 3rd Quarter | 1st  |                                             |                                                            |
|              |             | 2nd  |                                             |                                                            |
|              |             | 3rd  |                                             |                                                            |
|              |             | 4th  |                                             |                                                            |
|              |             | 5th  |                                             |                                                            |
|              |             | 6th  |                                             |                                                            |
|              |             | 7th  |                                             |                                                            |
|              |             | 8th  |                                             |                                                            |
|              | 4th Quarter | 9th  |                                             |                                                            |
|              |             | 10th |                                             |                                                            |
|              |             | 11th |                                             |                                                            |
|              |             | 12th |                                             |                                                            |
|              |             | 13th |                                             |                                                            |
|              |             | 14th |                                             |                                                            |
|              |             | 15th |                                             |                                                            |
|              |             | 16th |                                             |                                                            |

#### Evaluation Method and Weight (%)

|                         | Examination | Presentation | Mutual Evaluations between students | Behavior | Portfolio | Other | Total |
|-------------------------|-------------|--------------|-------------------------------------|----------|-----------|-------|-------|
| Subtotal                | 50          | 0            | 0                                   | 0        | 0         | 50    | 100   |
| Basic Proficiency       | 50          | 0            | 0                                   | 0        | 0         | 50    | 100   |
| Specialized Proficiency | 0           | 0            | 0                                   | 0        | 0         | 0     | 0     |
| Cross Area Proficiency  | 0           | 0            | 0                                   | 0        | 0         | 0     | 0     |