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**English Syllabus**

**Graduate School of  
Agriculture and Life Science**

## COMMON SUBJECTS

| Category                     | Subjects  | Year | Credit | English | Subject Number |
|------------------------------|---|------|--------|---------|----------------|
| Common Subjects              | 農学生命科学特論 I<br>Special lecture of Life Science and Agriculture I   | 1    | 1      | OK      | 1              |
|                              | 農学生命科学特論 II<br>Special lecture of Life Science and Agriculture II | 1    | 1      | OK      | 2              |
|                              | 学術特別研究 I<br>Advanced Research I                                   | 1    | 6      | OK      | 3              |
|                              | 実践特別研究 I<br>Practical Research I                                  | 1    | 6      | OK      | 4              |
|                              | 学術特別研究 II<br>Advanced Research II                                 | 2    | 6      | OK      | 5              |
|                              | 実践特別研究 II<br>Practical Research II                                | 2    | 6      | OK      | 6              |
|                              | 課題研究 I<br>Case Study I  | 1    | 3      | OK      | 7              |
|                              | 課題研究 II<br>Case Study II  | 2    | 3      | OK      | 8              |
|                              | 学術特別演習 I<br>Advanced Seminars I                                   | 1    | 1      | OK      | 9              |
|                              | 実践特別演習 I<br>Practical Seminars I                                  | 1    | 1      | OK      | 10             |
|                              | 学術特別演習 II<br>Advanced Seminars II                                 | 2    | 1      | OK      | 11             |
|                              | 実践特別演習 II<br>Practical Seminars II                                | 2    | 1      | OK      | 12             |
|                              | プレゼンテーション演習 I<br>Presentation Practice I                          | 1or2 | 1      | OK      | 13             |
|                              | プレゼンテーション演習 II<br>Presentation Practice II                        | 1or2 | 1      | OK      | 14             |
|                              | 学会等発表<br>Academic Presentation                                    | 1or2 | 1      | OK      | 15             |
|                              | 科学英語<br>Science Communication in English                          | 1or2 | 1      | OK      | 16             |
|                              | 実践研究推進セミナー<br>Practical Study Seminars                            | 1or2 | 1      |         | 17             |
|                              | キャリア開発セミナー<br>Seminars for Carrier Development                    | 1or2 | 1      |         | 18             |
| Courses                      | 分析技術法 A<br>Analytical Methodology A                               | 1or2 | 1      |         | 19             |
|                              | 分析技術法 B<br>Analytical Methodology B                               | 1or2 | 1      |         | 20             |
|                              | 分析技術法 C<br>Analytical Methodology C                               | 1or2 | 1      |         | 21             |
|                              | 分析技術法 D<br>Analytical Methodology D                               | 1or2 | 1      |         | 22             |
|                              | 分析技術法 E<br>Analytical Methodology E                               | 1or2 | 1      |         | 23             |
|                              | 分析技術法 F<br>Analytical Methodology F                               | 1or2 | 1      |         | 24             |
|                              | 分析技術法 G<br>Analytical Methodology G                               | 1or2 | 1      |         | 25             |
|                              | 分析技術法 H<br>Analytical Methodology H                               | 1or2 | 1      |         | 26             |
|                              | インターンシップ<br>Internship  | 1or2 | 1      |         | 27             |
|                              | 特別講義 A<br>Special Lecture A                                       | 1or2 | 1      |         | 28             |
| 特別講義 B<br>Special Lecture B  | 1or2  | 1    |        | 29      |                |
| 海外調査研究<br>Oversea internship | 1or2  | 1    | OK     | 30      |                |
| Hirodai Theme Subject        | 生命科学倫理学<br>Theory of Life Science ethics                          | 1or2 | 2      |         | /              |
|                              | 白神の自然<br>Nature of Sirakami Mountains                             | 1or2 | 2      |         | 31             |

The students belonging to International Agriculture and Horticulture Course and Environmental Engineering Course can take "Nature of the Sirakami Mountains" as "Sub course subjects".

## BIOLOGY COURSE

| Category  | Subjects   | Year                               | Credit | English | Subject Number |    |
|---|--|------------------------------------|--------|---------|----------------|----|
| S<br>p<br>e<br>c<br>i<br>a<br>l<br>i<br>z<br>e<br>d<br><br>S<br>u<br>b<br>j<br>e<br>c<br>t<br>s | 森林保全生態学<br>Forest Conservation Ecology                 | 1③                                 | 1      | OK      | 32             |    |
|   | 森林保全生態学実習<br>Practice of Forest Conservation Ecology   | 1②                                 | 1      | OK      | 33             |    |
|   | 群集生態学概論<br>Community Ecology                           | 1①                                 | 1      | OK      | 34             |    |
|   | 植物分子生理学特論<br>Advanced Plant Molecular Physiology       | 1①                                 | 1      | OK      | 35             |    |
|   | 植物機能形態学特論 A<br>Plant Structure & Function A            | 1②                                 | 1      | OK      | 36             |    |
|   | 野生動物調査法<br>Techniques for Wildlife Investigations      | 1②                                 | 1      |         | 37             |    |
|   | 生態工学<br>Ecological Engineering                         | 1③                                 | 1      |         | 38             |    |
|   | 細胞遺伝学<br>Cytogenetics                                  | 1③                                 | 1      | OK      | 39             |    |
|   | 分子発生学<br>Molecular Development Biology                 | 1③                                 | 1      |         | 40             |    |
|   | 水産増殖実習<br>Practice of Aquaculture                      | 1②                                 | 1      |         | 41             |    |
|   | 動物行動論<br>A Compendium of Animal Behavior               | 1④                                 | 1      | OK      | 42             |    |
|   | 動物行動学実習<br>Practice of animal behavioral science       | 1②                                 | 1      | OK      | 43             |    |
|   | 節足動物研究法<br>Field study of Arthropods                   | 1②                                 | 1      | OK      | 44             |    |
|   | 生殖生物学特論<br>Reproductive Biology                        | 1①                                 | 1      |         | 45             |    |
|   | 生殖生物学実習<br>Practice of Reproductive Biology            | 1②                                 | 1      |         | 46             |    |
|   | 動植物研究史特論<br>Research History in Biology                | 1①                                 | 1      | OK      | 47             |    |
|   | 海産無脊椎動物学実習<br>Marine Invertebrate Zoology Field Course | 1②                                 | 1      | OK      | 48             |    |
|   | 分子細胞生物学特論<br>Molecular Cell Biology                    | 1①                                 | 1      | OK      | 49             |    |
|   | 植物機能形態学特論 B<br>Plant Structure & Function B            | 1②                                 | 1      | OK      | 50             |    |
|   | 蛍光タンパク質特論<br>Fluorescent Protein                       | 1③                                 | 1      |         | 51             |    |
|   | 細胞内共生特論<br>Intracellular symbiosis                     | 1③                                 | 1      |         | 52             |    |
|   | 動物分類学特論<br>Advanced Animal Taxonomy                    | 1②                                 | 1      | OK      | 53             |    |
|   | 植物分類学<br>Plant Taxonomy                                | 1②                                 | 1      |         | 54             |    |
|   | S<br>u<br>b<br>j<br>e<br>c<br>t<br>s                   | 生化学特論 A<br>Biochemistry A          | 1①     | 1       | OK             | 55 |
|   |  | 生化学特論 B<br>Biochemistry B          | 1②     | 1       | OK             | 56 |
|   |  | 分子生物学特論 A<br>Molecular Biology A   | 1③     | 1       | OK             | 57 |
|   |  | 生体高分子構造学 A<br>Structural Biology A | 1③     | 1       | OK             | 59 |
|   |  | 細胞制御学特論<br>Regenerative Biology    | 1③④    | 2       | OK             | 61 |
| 環境微生物学<br>Environmental Microbiology  |  | 1③④                                | 2      | OK      | 66             |    |
| 細胞工学特論 A<br>Cell Technology A   |  | 1①                                 | 1      | OK      | 67             |    |
| ゲノム科学 A<br>Genome Science A   |  | 1①                                 | 1      | OK      | 69             |    |
| ゲノム科学 B<br>Genome Science B   |  | 1②                                 | 1      | OK      | 70             |    |

|  |  |    |    |     |     |
|--|--|----|----|-----|-----|
| S<br>u<br>b<br>j<br>e<br>c<br>t<br>s               | 応用微生物学特論 I<br>Applied Microbiology I                   | 1③ | 1  | OK  | 71  |
|  | 生命科学情報処理学 A<br>Information Science for Biology A       | 1③ | 1  | OK  | 73  |
|  | 生命科学情報処理学 B<br>Information Science for Biology B       | 1④ | 1  | OK  | 74  |
|  | 糖鎖生化学特論 A<br>Biochemistry of Carbohydrates A           | 1③ | 1  | OK  | 75  |
|  | 植物生化学 A<br>Plant Biochemistry A                        | 1③ | 1  | OK  | 77  |
|  | 植物生化学 B<br>Plant Biochemistry B                        | 1④ | 1  | OK  | 78  |
|  | 植物分子育種学 I<br>Plant Molecular Breeding I                | 1③ | 1  | OK  | 79  |
|  | 作物遺伝子機能解析学 I<br>Analysis of gene function in crops I   | 1③ | 1  | OK  | 81  |
|  | 生物学方法論 I<br>Method of Bioscience I                     | 1① | 1  |     | 83  |
|  | 生物学方法論 II<br>Method of Bioscience II                   | 1② | 1  |     | 84  |
|  | 構成的生態学 I<br>Constructive ecology I                     | 1① | 1  | OK  | 85  |
|  | 構成的生態学 II<br>Constructive ecology II                   | 1② | 1  | OK  | 86  |
|  | 比較内分泌学 I<br>Comparative Endocrinology I                | 1① | 1  | OK  | 87  |
|  | 比較内分泌学 II<br>Comparative Endocrinology II              | 1② | 1  | OK  | 88  |
|  | 植物真菌学 I<br>Botany & Mycology I                         | 1③ | 1  | OK  | 89  |
|  | 植物真菌学 II<br>Botany & Mycology II                       | 1④ | 1  | OK  | 90  |
|  | 果樹生理生態学 I<br>Physiology and Ecology of Fruit Tree I    | 1③ | 1  | OK  | 95  |
|  | 果樹生理生態学 II<br>Physiology and Ecology of Fruit Tree II  | 1④ | 1  | OK  | 96  |
|  | 花卉資源開発学 A<br>Development of Floricultural Resources A  | 1① | 1  | OK  | 97  |
|  | 蔬菜生理生態学 I<br>Physiology of Vegetable Crop I            | 1③ | 1  | OK  | 99  |
|  | 家畜生体機構学 A<br>Functional Anatomy of Domestic Animals A  | 1③ | 1  | OK  | 105 |
|  | 家畜生体機構学 B<br>Functional Anatomy of Domestic Animals B  | 1④ | 1  | OK  | 106 |
|  | 家畜栄養生理学 A<br>Animal Nutritional Physiology A           | 1① | 1  |     | 107 |
|  | 作物生産生態学 I<br>Crop Production Ecology I                 | 1① | 1  | OK  | 109 |
|  | 作物環境ストレス学 I<br>Crop Environmental Stress Science I     | 1③ | 1  | OK  | 111 |
|  | 農地環境工学 A<br>Agricultural Land Engineering A            | 1② | 1  |     | 117 |
|  | 農地環境物理学 A<br>Agricultural Land Environmental Physics A | 1① | 1  |     | 118 |
| 山地流域保全学 I<br>Conservation of Mountain Watersheds I | 1①   | 1  | OK | 127 |     |

① : 1st Semester      ② : 2nd Semester      →      Spring Term  
 ③ : 3rd Semester      ④ : 4th Semester      →      Autumn Term

**BIOCHEMISTRY and MOLUCULAR BIOLOGY COURSE**

| Category  | Subjects   | Year | Credit | English | Subject Number |
|---|--|------|--------|---------|----------------|
| S<br>p<br>e<br>c<br>i<br>a<br>l<br>i<br>z<br>e<br>d<br><br>S<br>u<br>b<br>j<br>e<br>c<br>t<br>s | 生化学特論 A<br>Biochemistry A                        | 1①   | 1      | OK      | 55             |
|   | 生化学特論 B<br>Biochemistry B                        | 1②   | 1      | OK      | 56             |
|   | 分子生物学特論 A<br>Molecular Biology A                 | 1③   | 1      | OK      | 57             |
|   | 分子生物学特論 B<br>Molecular Biology B                 | 1④   | 1      | OK      | 58             |
|   | 生体高分子構造学 A<br>Structural Biology A               | 1③   | 1      | OK      | 59             |
|   | 生体高分子構造学 B<br>Structural Biology B               | 1④   | 1      | OK      | 60             |
|   | 細胞制御学特論<br>Regenerative Biology                  | 1③④  | 2      | OK      | 61             |
|   | 生物有機化学特論 A<br>Bioorganic Chemistry A             | 1①   | 1      | OK      | 62             |
|   | 生物有機化学特論 B<br>Bioorganic Chemistry B             | 1②   | 1      | OK      | 63             |
|   | 天然物化学特論 A<br>Natural Products Chemistry A        | 1①   | 1      |         | 64             |
|   | 天然物化学特論 B<br>Natural Products Chemistry B        | 1②   | 1      |         | 65             |
|   | 環境微生物学<br>Environmental Microbiology             | 1③④  | 2      | OK      | 66             |
|   | 細胞工学特論 A<br>Cell Technology A                    | 1①   | 1      | OK      | 67             |
|   | 細胞工学特論 B<br>Cell Technology B                    | 1②   | 1      | OK      | 68             |
|   | ゲノム科学 A<br>Genome Science A                      | 1①   | 1      | OK      | 69             |
|   | ゲノム科学 B<br>Genome Science B                      | 1②   | 1      | OK      | 70             |
|   | 応用微生物学特論 I<br>Applied Microbiology I             | 1③   | 1      | OK      | 71             |
|   | 応用微生物学特論 II<br>Applied Microbiology II           | 1④   | 1      | OK      | 72             |
|   | 生命科学情報処理学 A<br>Information Science for Biology A | 1③   | 1      | OK      | 73             |
|   | 生命科学情報処理学 B<br>Information Science for Biology B | 1④   | 1      | OK      | 74             |
|   | 糖鎖生化学特論 A<br>Biochemistry of Carbohydrates A     | 1③   | 1      | OK      | 75             |
|   | 糖鎖生化学特論 B<br>Biochemistry of Carbohydrates B     | 1④   | 1      | OK      | 76             |
|   | 植物生化学 A<br>Plant Biochemistry A                  | 1③   | 1      | OK      | 77             |
|   | 植物生化学 B<br>Plant Biochemistry B                  | 1④   | 1      | OK      | 78             |
|   | 動物分類学特論<br>Advanced Animal Taxonomy              | 1②   | 1      | OK      | 53             |
|   | 植物分類学<br>Plant Taxonomy                          | 1②   | 1      |         | 54             |

|                                      |   |    |   |    |    |
|--------------------------------------|---|----|---|----|----|
| S<br>u<br>b<br>j<br>e<br>c<br>t<br>s | 群集生態学概論<br>Community Ecology              | 1① | 1 | OK | 34 |
|                                      | 細胞遺伝学<br>Cytogenetics                     | 1③ | 1 | OK | 39 |
|                                      | 分子発生学<br>Molecular Development Biology    | 1③ | 1 |    | 40 |
|                                      | 生殖生物学特論<br>Reproductive Biology           | 1① | 1 |    | 45 |
|                                      | 動植物研究史特論<br>Research History in Biology   | 1① | 1 | OK | 47 |
|                                      | 分子細胞生物学特論<br>Molecular Cell Biology       | 1① | 1 | OK | 49 |
|                                      | 植物分子育種学 I<br>Plant Molecular Breeding I   | 1③ | 1 | OK | 79 |
|                                      | 植物分子育種学 II<br>Plant Molecular Breeding II | 1④ | 1 | OK | 80 |
|                                      | 生物学方法論 I<br>Method of Bioscience I        | 1① | 1 |    | 83 |
|                                      | 生物学方法論 II<br>Method of Bioscience II      | 1② | 1 |    | 84 |
|                                      | 構成的生態学 I<br>Constructive ecology I        | 1① | 1 | OK | 85 |
|                                      | 構成的生態学 II<br>Constructive ecology II      | 1② | 1 | OK | 86 |
|                                      | 植物真菌学 I<br>Botany & Mycology I            | 1③ | 1 | OK | 89 |
|                                      | 植物真菌学 II<br>Botany & Mycology II          | 1④ | 1 | OK | 90 |

① : 1st Semester      ② : 2nd Semester      →      Spring Term  
 ③ : 3rd Semester      ④ : 4th Semester      →      Autumn Term

**APPLIED and FOOD SCIENCE COURSE**

| Category  | Subjects  | Year  | Credit | English | Subject Number |    |
|---|---|---|--------|---------|----------------|----|
| S<br>p<br>e<br>c<br>i<br>a<br>l<br>i<br>z<br>e<br>d<br><br>S<br>u<br>b<br>j<br>e<br>c<br>t<br>s | 植物分子育種学 I<br>Plant Molecular Breeding I                   | 1③  | 1      | OK      | 79             |    |
|   | 植物分子育種学 II<br>Plant Molecular Breeding II                 | 1④  | 1      | OK      | 80             |    |
|   | 作物遺伝子機能解析学 I<br>Analysis of gene function in crops I      | 1③  | 1      | OK      | 81             |    |
|   | 作物遺伝子機能解析学 II<br>Analysis of gene function in crops II    | 1④  | 1      | OK      | 82             |    |
|   | 生物学方法論 I<br>Method of Bioscience I                        | 1①  | 1      |         | 83             |    |
|   | 生物学方法論 II<br>Method of Bioscience II                      | 1②  | 1      |         | 84             |    |
|   | 構成的生態学 I<br>Constructive ecology I                        | 1①  | 1      | OK      | 85             |    |
|   | 構成的生態学 II<br>Constructive ecology II                      | 1②  | 1      | OK      | 86             |    |
|   | 比較内分泌学 I<br>Comparative Endocrinology I                   | 1①  | 1      | OK      | 87             |    |
|   | 比較内分泌学 II<br>Comparative Endocrinology II                 | 1②  | 1      | OK      | 88             |    |
|   | 植物真菌学 I<br>Botany & Mycology I                            | 1③  | 1      | OK      | 89             |    |
|   | 植物真菌学 II<br>Botany & Mycology II                          | 1④  | 1      | OK      | 90             |    |
|   | 栽培土壤学 I<br>Edaphology I                                   | 1①  | 1      |         | 91             |    |
|   | 栽培土壤学 II<br>Edaphology II                                 | 1②  | 1      |         | 92             |    |
|   | 適応昆虫学 I<br>Insect adaptations to enviromental changes I   | 1①  | 1      |         | 93             |    |
|   | 適応昆虫学 II<br>Insect adaptations to enviromental changes II | 1②  | 1      |         | 94             |    |
|   | 動物分類学特論<br>Advanced Animal Taxonomy                       | 1②  | 1      | OK      | 53             |    |
|   | 植物分類学<br>Plant Taxonomy                                   | 1②  | 1      |         | 54             |    |
|   | S<br>u<br>b<br>j<br>e<br>c<br>t<br>s                      | 環境微生物学<br>Environmental Microbiology            | 1③④    | 2       | OK             | 66 |
|   |   | 生命科学情報処理学A<br>Information Science for Biology A | 1③     | 1       | OK             | 73 |
| 生命科学情報処理学B<br>Information Science for Biology B   |   | 1④  | 1      | OK      | 74             |    |
| 植物生化学A<br>Plant Biochemistry A  |   | 1③  | 1      | OK      | 77             |    |
| 植物生化学B<br>Plant Biochemistry B  |   | 1④  | 1      | OK      | 78             |    |
| 蔬菜生理生態学 I<br>Physiology of Vegetable Crop I   |   | 1③  | 1      | OK      | 99             |    |
| 蔬菜生理生態学 II<br>Physiology of Vegetable Crop II   |   | 1④  | 1      | OK      | 100            |    |
| 家畜栄養生理学A<br>Animal Nutritional Physiology A   |   | 1①  | 1      |         | 107            |    |
| 家畜栄養生理学B<br>Animal Nutritional Physiology B   |   | 1②  | 1      |         | 108            |    |

① : 1st Semester      ② : 2nd Semester      →      Spring Term  
 ③ : 3st Semester      ④ : 4th Semester      →      Autumn Term

## INTERNATIONAL AGRICULTURE and HORTICULTURE COURSE

| Category  | Subjects  | Year | Credit | English | Subject Number |
|---|---|------|--------|---------|----------------|
| S<br>p<br>e<br>c<br>i<br>a<br>l<br>i<br>z<br>e<br>d<br><br>S<br>u<br>b<br>j<br>e<br>c<br>t<br>s | 果樹生理生態学 I<br>Physiology and Ecology of Fruit Tree I                   | 1③   | 1      | OK      | 95             |
|   | 果樹生理生態学 II<br>Physiology and Ecology of Fruit Tree II                 | 1④   | 1      | OK      | 96             |
|   | 花卉資源開発学 A<br>Development of Floricultural Resources A                 | 1①   | 1      | OK      | 97             |
|   | 花卉資源開発学 B<br>Development of Floricultural Resources B                 | 1②   | 1      | OK      | 98             |
|   | 蔬菜生理生態学 I<br>Physiology of Vegetable Crop I                           | 1③   | 1      | OK      | 99             |
|   | 蔬菜生理生態学 II<br>Physiology of Vegetable Crop II                         | 1④   | 1      | OK      | 100            |
|   | 農業生産機械学特論 A<br>Agricultural Machinery A                               | 1③   | 1      | OK      | 101            |
|   | 農業生産機械学特論 B<br>Agricultural Machinery B                               | 1④   | 1      | OK      | 102            |
|   | 生産環境計測制御学 I<br>Measurement and Control of Production Circumstance I   | 1①   | 1      | OK      | 103            |
|   | 生産環境計測制御学 II<br>Measurement and Control of Production Circumstance II | 1②   | 1      | OK      | 104            |
|   | 家畜生体機構学 A<br>Functional Anatomy of Domestic Animals A                 | 1③   | 1      | OK      | 105            |
|   | 家畜生体機構学 B<br>Functional Anatomy of Domestic Animals B                 | 1④   | 1      | OK      | 106            |
|   | 家畜栄養生理学 A<br>Animal Nutritional Physiology A                          | 1①   | 1      |         | 107            |
|   | 家畜栄養生理学 B<br>Animal Nutritional Physiology B                          | 1②   | 1      |         | 108            |
|   | 作物生産生態学 I<br>Crop Production Ecology I                                | 1①   | 1      | OK      | 109            |
|   | 作物生産生態学 II<br>Crop Production Ecology II                              | 1②   | 1      | OK      | 110            |
|   | 作物環境ストレス学 I<br>Crop Environmental Stress Science I                    | 1③   | 1      | OK      | 111            |
|   | 作物環境ストレス学 II<br>Crop Environmental Stress Science II                  | 1④   | 1      | OK      | 112            |
|   | 木材加工学 I<br>Wood Processing I  | 1①   | 1      |         | 113            |
|   | 木材加工学 II<br>Wood Processing II  | 1②   | 1      |         | 114            |
|   | 作物生産生理学 A<br>Physiology of Crop Production A                          | 1③   | 1      |         | 115            |
|   | 作物生産生理学 B<br>Physiology of Crop Production B                          | 1④   | 1      |         | 116            |
|   | 動物分類学特論<br>Advanced Animal Taxonomy                                   | 1②   | 1      | OK      | 53             |
|   | 植物分類学<br>Plant Taxonomy   | 1②   | 1      |         | 54             |

|   |  |    |   |    |     |
|---|--|----|---|----|-----|
| S<br>u<br>b<br>C<br>o<br>u<br>r<br>s<br>e<br>S<br>u<br>b<br>j<br>e<br>c<br>t<br>s | 植物分子生理学特論<br>Advanced Plant Molecular Physiology             | 1① | 1 | OK | 35  |
|   | 細胞遺伝学<br>Cytogenetics  | 1③ | 1 | OK | 39  |
|   | 節足動物研究法<br>Field study of Arthropods                         | 1② | 1 | OK | 44  |
|   | 生物有機化学特論A<br>Bioorganic Chemistry A                          | 1① | 1 | OK | 62  |
|   | 生物有機化学特論B<br>Bioorganic Chemistry B                          | 1② | 1 | OK | 63  |
|   | 植物生化学A<br>Plant Biochemistry A                               | 1③ | 1 | OK | 77  |
|   | 植物生化学B<br>Plant Biochemistry B                               | 1④ | 1 | OK | 78  |
|   | 植物分子育種学 I<br>Plant Molecular Breeding I                      | 1③ | 1 | OK | 79  |
|   | 植物分子育種学 II<br>Plant Molecular Breeding II                    | 1④ | 1 | OK | 80  |
|   | 作物遺伝子機能解析学 I<br>Analysis of gene function in crops I         | 1③ | 1 | OK | 81  |
|   | 作物遺伝子機能解析学 II<br>Analysis of gene function in crops II       | 1④ | 1 | OK | 82  |
|   | 栽培土壌学 I<br>Edaphology I                                      | 1① | 1 |    | 91  |
|   | 栽培土壌学 II<br>Edaphology II                                    | 1② | 1 |    | 92  |
|   | 灌漑利水工学 I<br>Irrigation and water utilization engineering I   | 1① | 1 |    | 129 |
|   | 灌漑利水工学 II<br>Irrigation and water utilization engineering II | 1② | 1 |    | 130 |
|   | 農地環境保全学 A<br>Agricultural Land Conservation A                | 1③ | 1 | OK | 133 |
|   | 農地環境保全学 B<br>Agricultural Land Conservation B                | 1④ | 1 | OK | 134 |

① : 1st Semester      ② : 2nd Semester      →      Spring Term

③ : 3rd Semester      ④ : 4th Semester      →      Autumn Term

## ENVIRONMENTAL ENGINEERING COURSE

| Category  | Subjects   | Year  | Credit | English | Subject Number |    |
|---|--|---|--------|---------|----------------|----|
| S<br>p<br>e<br>c<br>i<br>a<br>l<br>i<br>z<br>e<br>d<br><br>S<br>u<br>b<br>j<br>e<br>c<br>t<br>s | 農地環境工学A<br>Agricultural Land Engineering A                   | 1②  | 1      |         | 117            |    |
|   | 農地環境工学B<br>Agricultural Land Engineering B                   | 1③  | 1      |         | 118            |    |
|   | 農地環境物理学A<br>Agricultural Land Environmental Physics A        | 1①  | 1      |         | 119            |    |
|   | 農地環境物理学B<br>Agricultural Land Environmental Physics B        | 1②  | 1      |         | 120            |    |
|   | 基盤造構学 I<br>Agricultural Facilities Engineering I             | 1①  | 1      | OK      | 121            |    |
|   | 基盤造構学 II<br>Agricultural Facilities Engineering II           | 1②  | 1      | OK      | 122            |    |
|   | 地域環境システム学 I<br>Management of Rural Environmental System I    | 1③  | 1      |         | 123            |    |
|   | 地域環境システム学 II<br>Management of Rural Environmental System II  | 1④  | 1      |         | 124            |    |
|   | 地域環境計画学A<br>Regional Environmental Planning A                | 1③  | 1      | OK      | 125            |    |
|   | 地域環境計画学B<br>Regional Environmental Planning B                | 1④  | 1      | OK      | 126            |    |
|   | 山地流域保全学 I<br>Conservation of Mountain Watersheds I           | 1①  | 1      | OK      | 127            |    |
|   | 山地流域保全学 II<br>Conservation of Mountain Watersheds II         | 1②  | 1      | OK      | 128            |    |
|   | 灌漑利水工学 I<br>Irrigation and water utilization engineering I   | 1①  | 1      | OK      | 129            |    |
|   | 灌漑利水工学 II<br>Irrigation and water utilization engineering II | 1②  | 1      | OK      | 130            |    |
|   | 地域環境利用学 I<br>Rural Energy Engineering I                      | 1①  | 1      | OK      | 131            |    |
|   | 地域環境利用学 II<br>Rural Energy Engineering II                    | 1②  | 1      | OK      | 132            |    |
|   | 農地環境保全学A<br>Agricultural Land Conservation A                 | 1③  | 1      | OK      | 133            |    |
|   | 農地環境保全学B<br>Agricultural Land Conservation B                 | 1④  | 1      | OK      | 134            |    |
|   | 水利施設工学 I<br>The Water Utilization Facilities Engineering I   | 1③  | 1      |         | 135            |    |
|   | 水利施設工学 II<br>The Water Utilization Facilities Engineering II | 1④  | 1      |         | 136            |    |
|   | 動物分類学特論<br>Advanced Animal Taxonomy                          | 1②  | 1      | OK      | 53             |    |
|   | 植物分類学<br>Plant Taxonomy                                      | 1②  | 1      |         | 54             |    |
|   | S<br>u<br>b<br>j<br>e<br>c<br>t<br>s                         | 森林保全生態学<br>Forest Conservation Ecology            | 1③     | 1       | OK             | 32 |
|   |  | 野生動物調査法<br>Techniques for Wildlife Investigations | 1②     | 1       |                | 37 |
|   |  | 生態工学<br>Ecological Engineering                    | 1③     | 1       |                | 38 |
|   |  | 栽培土壌学 I<br>Edaphology I                           | 1①     | 1       |                | 91 |
| 栽培土壌学 II<br>Edaphology II   |  | 1②  | 1      |         | 92             |    |
| 農業生産機械学特論A<br>Agricultural Machinery A  |  | 1③  | 1      | OK      | 101            |    |
| 農業生産機械学特論B<br>Agricultural Machinery B  |  | 1④  | 1      | OK      | 102            |    |
| 生産環境計測制御学 I<br>Measurement and Control of Production Circumstance I                             |  | 1①  | 1      | OK      | 103            |    |
| 生産環境計測制御学 II<br>Measurement and Control of Production Circumstance II                           |  | 1②  | 1      | OK      | 104            |    |
| 木材加工学 I<br>Wood Processing I  |  | 1①  | 1      |         | 113            |    |

①: 1st Semester    ②: 2nd Semester    →    Spring Term

③: 3rd Semester    ④: 4th Semester    →    Autumn Term

|                                  |   |
|----------------------------------|---|
| Subject No                       | 1   |
| Subject Title                    | Special lecture of Life Science and Agriculture I   |
| Credit                           | 1   |
| Time                             |   |
| Name of Teacher                  |   |
| Specific Goals                   | In order to establish future career plan, visit prefectural government and regional research center.  |
| Outlines of Class                | Students will learn how education will be applied to future career<br>Students will learn how one's future career will be considered<br>Students will discuss how education and research will contribute to society |
| Content                          | Details will be announced later.  |
| Preparation, review of the class | Preresearch for regional government and research organization   |
| Text Book                        | Distribute handout at guidance  |
| Evaluation Method                | Discussion and report   |
| Points of Attention              | Students need to know what the local government or local research institutes are doing by a newspaper, etc in advance.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 2   |
| Subject Title                    | Special lecture of Life Science and Agriculture II (Biology)  |
| Credit                           | 1   |
| Time                             |   |
| Name of Teacher                  |   |
| Specific Goals                   | Students figure out social requirements of "biologically-correct" knowledge and practical skills obtained from the study in the graduate school.<br>Students consider how to utilize such knowledge and skills for the quality of life of themselves and of people around them, and discuss how to apply biological researches to respond to social requirements.   |
| Outlines of Class                | Students attend lectures provided by speakers who visit the graduate school from other research organizations, and learn how to make research plans and how to solve practically the problem.<br>Each student comprehends several research papers preceding their research project to know the significance of their research area.<br>Each student introduces the contents of the papers they have read, and discuss their scientific and social significance. |
| Content                          | 1st wk. Guidance.<br>2nd wk. Lecture on the ways to read, write, and present scientific contents.<br>3rd wk. Presentations to show the scientific contents in English research papers.<br>Discussion on their significance.<br>4th wk. As above.<br>5th wk. As above.<br>6th wk. As above.<br>7th wk. Lecture by a speaker from other research organizations.<br>8th wk. As above.<br><br>Details will be announced later.                                      |
| Preparation, review of the class | Deep understanding of their research project. Careful reading of papers related to their research project.  |
| Text Book                        | The instructor distributes some materials (printed papers or others), as the need arises.   |
| Evaluation Method                | Active commitment to discussion, deep understanding of scientific contents in the papers they have read, active effort on making appropriate slides.  |
| Points of Attention              | Based on each course  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 2  |
| Subject Title                    | Special lecture of Life Science and Agriculture II<br>(Biochemistry and Molecular Biology)   |
| Credit                           | 1  |
| Time                             |  |
| Name of Teacher                  |  |
| Specific Goals                   | Students will think about how the knowledge and skills you acquire while you are in school can be used in the real society.<br>Students will know what society wants from science and technology.  |
| Outlines of Class                | Students will visit public research institutes that conduct research according to the needs of local communities and learn how to use the knowledge and skills learned in graduate school in society<br>Students will receive lectures by course teachers who have deep relationships with companies, and deepen their awareness of the relationship between universities and society. |
| Content                          | 1st Guidance<br>2nd to 6th<br>Visit to Hirosaki Industrial research Center, Aomori industrial technology Center<br>7th Lecture<br>8th Lecture<br><br>Details will be announced later.  |
| Preparation, review of the class | Nothing Special  |
| Text Book                        | Nothing Special  |
| Evaluation Method                | Report   |
| Points of Attention              | Nothing Special  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 2  |
| Subject Title                    | Special lecture of Life Science and Agriculture II<br>(Applied Biology and Food Science)   |
| Credit                           | 1  |
| Time                             |  |
| Name of Teacher                  |  |
| Specific Goals                   | In order to establish future career plan, students consider how to utilize the knowledge they acquire in master program in a society.<br>To know the needs of society and make good use of it for launching a business.  |
| Outlines of Class                | Students consider how to utilize the knowledge and skills obtained from the study in the graduate school in a society thorough the lectures given by the guests from cooperations, local governments and research institutes.<br>Students learn how to develop their career and learn business activities of the companies which are playing active roles in a society.<br>Students discuss how the output of the education and research of thier course will contribute to a community. |
| Content                          | Students know the measures of regional research institutes and make the most of it in career development.<br>Students visit local companies and know their actual business activities and outcomes.<br>Students discuss how the output of the education and research of thier course will contribute to a community.<br><br>Details will be announced later.   |
| Preparation, review of the class | Learn regional requirment before class   |
| Text Book                        | Distribute handout at guidance   |
| Evaluation Method                | Discussion and report  |
| Points of Attention              | Learn regional requirment before class   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 2  |
| Subject Title                    | Special lecture of Life Science and Agriculture II<br>(International Agriculture and Horticulture)   |
| Credit                           | 1  |
| Time                             |  |
| Name of Teacher                  |  |
| Specific Goals                   | In order to establish future career plan, students consider how to utilize the knowledge they acquire in master program in a society.<br>To know the needs of society and make good use of it for launching a business.  |
| Outlines of Class                | Students consider how to utilize the knowledge and skills obtained from the study in the graduate school in a society thorough the lectures given by the guests from cooperations, local governments and research institutes.<br>Students learn how to develop their career and learn business activities of the companies which are playing active roles in a society.<br>Students discuss how the output of the education and research of thier course will contribute to a community. |
| Content                          | Students know the measures of regional research institutes and make the most of it in career development.<br>Students visit local companies and know their actual business activities and outcomes.<br>Students discuss how the output of the education and research of thier course will contribute to a community.<br><br>Details will be announced later.   |
| Preparation, review of the class | Students need to research on measures of regional governments and research institutes.   |
| Text Book                        | Instruction will be given at guidance  |
| Evaluation Method                | Class Attitudes and Report   |
| Points of Attention              | Students need to know what the local government or local research institutes are doing by a newspaper,etc in advance.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 2  |
| Subject Title                    | Special lecture of Life Science and Agriculture II<br>(Agricultural and Environmental Engineering)   |
| Credit                           | 1  |
| Time                             | Intensive course in spring term  |
| Name of Teacher                  | Part time lecturer   |
| Specific Goals                   | This course aims to understand the design and construction of structure for agricultural and environmental engineering at the sites.   |
| Outlines of Class                | This course studies about some examples of design and construction of structures for agricultural and environmental engineering (1st day) and go to field work (2nd day).              |
| Content                          | Lec.1-5 Design and construction of structures for agricultural and environmental engineering.<br>Lec.6-8 Field work of some structures for agricultural and environmental engineering. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | A report about all lectures and fieldwork.   |
| Points of Attention              | Students would be better wearing clothing and shoes comfortable to move around in field work.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 3   |
| Subject Title                    | Advanced Research in Biology I  |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will acquire the experimental skills necessary to play an active role as researchers in each field.<br>Students will make a research plan from the academic perspective and acquire the ability to carry out their plan.<br>Students will collect their experiment data and acquire ability to analyze them.                       |
| Outlines of Class                | Students will plan and carry out experiments based on master's research topics related to the research of each supervisor<br>Students make a plan of their research from an academic perspective, conduct an experiment, discuss and consider the results and put their research to the next level.   |
| Content                          | 1. Students will carry out the investigations to understand the reserach theme and its back ground.(Read carefully the related papers.)<br>2.Students will set a goal in their research and experiments, and make a plan with your supervisor.<br>3. Studetns will check the progress of their research through a regular meeting in a lab. |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 3   |
| Subject Title                    | Advanced Research in Biochemistry and Molecular Biology I   |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students acquire the skills for experiments and basis research skills for playing active part as a reseracher in a life science field.  |
| Outlines of Class                | The content of the experiment varies depending on the supervisor.<br>Students make a plan of their research from an academic perspective, conduct an experiment, discuss and consider the results and put their research to the next level.   |
| Content                          | 1. Students will carry out the investigations to understand the reserach theme and its back ground.(Read carefully the related papers.)<br>2.Students will set a goal in their research and experiments, and make a plan with your supervisor.<br>3. Studetns will check the progress of their research through a regular meeting in a lab. |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Technical books , Reviwes, Papers of each field   |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 3   |
| Subject Title                    | Advanced Research in Applied Biology and Food Science I   |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Research plan should be deeply discussed with adviser<br>Graduate students makes research plan and conduct research<br>Data analysis and conclusion of each experiments should be deeply discussed with adviser |
| Outlines of Class                | Graduate student manage all research.<br>Each student should pay much attention to conduct research under fair management and science ethics  |
| Content                          | Research will be conducted in each laboratory under each adviser  |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | Research results will be summarized as master thesis and parts will be published under peer review journal.   |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 3  |
| Subject Title                    | Advanced Research in International Agriculture and Horticulture I  |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will plan and carry out experiments based on master's research topics related to the research of each supervisor<br>Students make a plan of their research from an academic perspective, conduct an experiment, discuss and consider the results and put their research to the next level.  |
| Outlines of Class                | Students will plan and carry out experiments based on master's research topics related to the research of each supervisor<br>Students make a plan of their research from an academic perspective, conduct an experiment, discuss and consider the results and put their research to the next level.<br>In addition to how to conduct research in horticulture agriculture, students will learn how to conduct academic conference presentations and how to submit paper including their master's thesis. We will make an appropriate presentation of the course of the research of the master's thesis, and deepen our understanding through Q & A sessions. |
| Content                          | 1. Students will carry out the investigations to understand the research theme and its back ground.(Read carefully the related papers.)<br>2.Students will set a goal in their research and experiments, and make a plan with your supervisor.<br>3. Students will check the progress of their research through a regular meeting in a lab.  |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 3  |
| Subject Title                    | Advanced Research in Agricultural and Environmental Engineering I  |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It puts on the sense of ethics as the researcher of a master for 1st year. It establishes a research policy and begins a data collection for making a doctoral thesis from a studying point of view.   |
| Outlines of Class                | It performs the study guidance of the first stage for making the doctoral thesis by a guidance teacher.  |
| Content                          | It's learned about a way of thinking, an idea way, a conduct code and the sense of ethics for a researcher. It searches the book of reference for past study and data collection to consider the doctoral thesis. A research policy for a report generation is established, and it's based on a research policy and a plan of experiment and search are drafted. A plan of experiment and search executes and the data is collected. Method of experiment and practice is advanced by consulting with a guidance teacher, and the advanced seminars in agricultural and environmental engineering I is being advanced concurrently. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated overall to consider research situation by a guidance teacher (100%).  |
| Points of Attention              | It's essential to advance personally in case of research.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 4  |
| Subject Title                    | Practical Research in Biology I  |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students acquire the skills for experiments and basis research skills for playing active part as a reseracher in a life science field.<br>Students acquire the ability to plan and carry out research from a practical perspective.<br>Students acquire the ability to collect and analyze the data obtained by experiments.                 |
| Outlines of Class                | Students plan and carry out experiments based on master's research topics related to the research of each supervisor.<br>Students plan the research from a practical point of view on the issues of each field, carry out experiments, discuss and consider the results, and move the research to the next stage.                            |
| Content                          | 1. Students will carry out the investigations to understand the reserach theme and its back ground.(Read carefully the related papers.)<br>2.Students will set a goal in their research and experiments, and make a plan with your super visor.<br>3. Studetns will check the progress of their research through a regular meeting in a lab. |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 4  |
| Subject Title                    | Practical Research in Biochemistry and Molecular Biology I   |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will acquire the experimental techniques and thoughts necessary to be an advanced engineer in the field of molecular life sciences, and complete the master's research.   |
| Outlines of Class                | The content of the experiment varies depending on the supervisor.<br>Students will develop research experiments with a view to practical applications on the issues of the each field, conduct an experiment, discuss and consider the results and put their research to the next level.   |
| Content                          | 1. Students will carry out the investigations to understand the research theme and its background. (Read carefully the related papers.)<br>2. Students will set a goal in their research and experiments, and make a plan with your supervisor.<br>3. Students will check the progress of their research through a regular meeting in a lab. |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 4   |
| Subject Title                    | Practical Research in Applied Biology and Food Science I  |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Research plan should be deeply discussed with adviser<br>Graduate students make research plan and conduct research<br>Data analysis and conclusion of each experiment should be deeply discussed with adviser |
| Outlines of Class                | Graduate student manage all research.<br>Each student should pay much attention to conduct research under fair management and science ethics  |
| Content                          | Research will be conducted in each laboratory under each adviser  |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | Research results will be summarized as master thesis and parts will be published under peer review journal.   |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 4  |
| Subject Title                    | Practical Research in International Agriculture and Horticulture I   |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will learn and explain the latest knowledge by reading academic papers related to research topics.<br>Through Q & A session, students will present what they understand, and explore issues and find solutions<br>Students will present the data obtained from their research.<br>To become a professional engineer, students will understand the specialized contents of each education field. |
| Outlines of Class                | Students will read and present academic papers related to research topics and understand them.<br>Through Q and A session and discussion on the content of presentation, students will explore issues and solutions in order to deepen their understanding.  |
| Content                          | 1. Students will find papers related to research topics, summarize and present contents.<br>2. Through Q & A session, students will present what they understand, and explore issues and find solutions<br>3. Students will present the data obtained from their research and receive advice from his supervisor on the content  |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 4  |
| Subject Title                    | Practical Research in Agricultural and Environmental Engineering I   |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It puts on the sense of ethics as the researcher of a master for 1st year. It establishes a research policy and begins a data collection for making a doctoral thesis from a practicing point of view.   |
| Outlines of Class                | It performs the study guidance of the first stage for making the doctoral thesis by a guidance teacher.  |
| Content                          | It's learned about a way of thinking, an idea way, a conduct code and the sense of ethics for a researcher. It searches the book of reference for past study and data collection to consider the doctoral thesis. A research policy for a report generation is established, and it's based on a research policy and a plan of experiment and search are drafted. A plan of experiment and search executes and the data is collected. Method of experiment and practice is advanced by consulting with a guidance teacher, and the advanced seminars in agricultural and environmental engineering I is being advanced concurrently. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated overall to consider practical research situation by a guidance teacher (100%).  |
| Points of Attention              | It's essential to advance personally in case of research.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 5   |
| Subject Title                    | Advanced Research in Biology II   |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will master experimental skills required for accomplishing eminent biological researches and complete their master's thesis.<br>Students will make a research plan from the academic perspective and acquire the ability to carry out their plan.<br>Students will collect their experiment data and acquire ability to analyze them.              |
| Outlines of Class                | Students will plan and carry out experiments based on their master's research theme related to their supervisors' research.<br>Students make a plan of their research from an academic perspective, conduct an experiment, discuss and consider the results, and complete their master's thesis.  |
| Content                          | 1. Students will carry out the investigations to understand the research theme and its background. (Reading carefully the related papers.)<br>2. Students will set a goal in their research and experiments, and make a plan after consulting with your supervisor.<br>3. Students will check the progress of their research at a regular meeting in a lab. |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 5   |
| Subject Title                    | Advanced Research in Biochemistry and Molecular Biology II  |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students acquire the skills for experiments and thinking skills for playing active part as a researcher in a life science field and complete their master's thesis.   |
| Outlines of Class                | The content of the experiment varies depending on the supervisor.<br>Students carry out their research and experiments from an academic perspective and summarize the results of their research including the results of "the Advanced Research in Biochemistry and Molecular Biology I" in order to complete their master's thesis.  |
| Content                          | 1. Students will review the content of "the Advanced Research in Biochemistry and Molecular Biology I" and confirm the research goal and replan the experiments if necessary.<br>2. Students will prepare for presenting the research results in "Academic Presentation"<br>3. Students will summarize the results of research as a master's thesis.<br>4. Students will make an oral presentation in a regular meeting in a lab. |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Technical books, Reviews, Papers of each field  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 5  |
| Subject Title                    | Advanced Research in Applied Biology and Food Science II   |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will make a research plan from an academic perspective and acquire the ability to carry out their plan.<br>Students will collect their experiment data and acquire ability to analyze them.   |
| Outlines of Class                | Students will plan and carry out experiments based on their master's research theme related to their supervisors' research.<br>Students will make a plan of their research, conduct an experiment, collect and analyze the data after consultation with their supervisors. |
| Content                          | Students will carry out their research under their supervisors' guidance and learn research ethics.  |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | Active participation in research   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 5   |
| Subject Title                    | Advanced Research in International Agriculture and Horticulture II  |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students acquire the skills for experiments and thinking skills for playing active part as a researcher in a Agriculture and Horticulture field and complete their master's thesis.<br>Students will make a research plan from an academic perspective and acquire the ability to carry out their plan.<br>Students will collect their experiment data and acquire ability to analyze them. |
| Outlines of Class                | Students will plan and carry out experiments based on their master's research theme related to their supervisors' research.<br>The content of the experiment varies depending on the supervisor.<br>Students make a plan of their research from an academic perspective, conduct an experiment, discuss and consider the results, and complete their master's thesis.                       |
| Content                          | 1. Students will carry out the investigations to understand the research theme and its background. (Read carefully the related papers.)<br>2. Students will set a goal in their research and experiments, and make a plan with your supervisor.<br>3. Students will check the progress of their research at a regular meeting in a lab.   |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 5   |
| Subject Title                    | Advanced Research in Agricultural and Environmental Engineering II  |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | It puts on the sense of ethics as the researcher of a master for second year. It analyses the collecting data for making a doctoral thesis from a studying point of view and gathers the results of study.  |
| Outlines of Class                | It performs the study guidance of the last stage for making the doctoral thesis by a guidance teacher.  |
| Content                          | It's learned about a way of thinking, an idea way, a conduct code and the sense of ethics for a researcher. It searches the book of reference for past study and data collection to consider the doctoral thesis. It analyses the collecting data for making a report generation and gathers the results of study. Method of experiment and research is advanced by consulting with a guidance teacher, and the advanced seminars in agricultural and environmental engineering II is being advanced concurrently. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |   |
| Text Book                        |   |
| Evaluation Method                | It's estimated overall to consider research situation by a guidance teacher (100%).   |
| Points of Attention              | It's essential to advance personally in case of research.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 6  |
| Subject Title                    | Practical Research in Biology II   |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students acquire the skills for experiments and basis research skills for playing active part as a reseracher in a life science field, and complete the master's research.<br>Students acquire the ability to plan and carry out research from a practical perspective.<br>Students acquire the ability to collect and analyze the data obtained by experiments. |
| Outlines of Class                | Students plan and carry out experiments based on master's research topics related to the research of each supervisor.<br>Students plan the research from a practical point of view on the issues of each field, carry out experiments, discuss and consider the results, and finish their master's thesis.   |
| Content                          | 1.Students will conduct research to understand the research theme and its background (e.g., read the relevant papers).<br>2.Students will set goals for research experiments in the year of the master's program and prepare a plan with your supervisor.<br>3.Students will check the progress of research through regular reporting meetings in a lab.         |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 6  |
| Subject Title                    | Practical Research in Biochemistry and Molecular Biology II  |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will acquire the experimental techniques and thoughts necessary to be an advanced engineer in the field of molecular life sciences, and complete the master's research.   |
| Outlines of Class                | Students will develop research experiments seeking a practical applications on the issues of the field and complete the master's thesis in conjunction with the results of Practical Research I.   |
| Content                          | 1.Students will look back on practical special research I, confirm the research goals, and re-plan the experiments if necessary.<br>2.Students will summarize the results of their research as master's thesis.<br>3.Students will make an presentation of master's thesis at the report meeting held in the course. |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The content of the thesis and master's research final presentation will be evaluated too.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 6   |
| Subject Title                    | Practical Research in Applied Biology and Food Science II   |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Research plan should be deeply discussed with adviser<br>Graduate students makes research plan and conduct research<br>Data analysis and conclusion of each experiments should be deeply discussed with adviser |
| Outlines of Class                | Graduate student manage all research.<br>Each students should pay much attention to conduct research under fair management and science ethics   |
| Content                          | Research will be conducted in each laboratory under each adviser  |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | Research results will be summarized as master thesis and parts will be published under peer review journal.   |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 6  |
| Subject Title                    | Practical Research in International Agriculture and Horticulture II  |
| Credit                           | 6  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students acquire the skills for experiments and basis research skills for playing active part as a reseracher in a life science field, and complete the master's research.<br>Students acquire the ability to plan and carry out research from a practical perspective.<br>Students acquire the ability to collect and analyze the data obtained by experiments. |
| Outlines of Class                | Students plan and carry out experiments based on master's research topics related to the research of each supervisor.<br>Students plan the research from a practical point of view on the issues of each field, carry out experiments, discuss and consider the results, and finish their master's thesis.   |
| Content                          | 1.Students will conduct research to understand the research theme and its background (e.g., read the relevant papers).<br>2.Students will set goals for research experiments in the year of the master's program and prepare a plan with your supervisor.<br>3.Students will check the progress of research through regular reporting meetings in a lab.         |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 6   |
| Subject Title                    | Practical Research in Agricultural and Environmental Engineering II   |
| Credit                           | 6   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | It puts on the sense of ethics as the researcher of a master for second year. It analyzes a data and gathers results of study for making a doctoral thesis from a practicing point of view.   |
| Outlines of Class                | It performs the study guidance of the last stage for making the doctoral thesis by a guidance teacher.  |
| Content                          | The study is advanced by considering a way of thinking, an idea way, a conduct code and the sense of ethics for a researcher. It analyzes a data and makes a report generation. Method of experiment and practice is advanced by consulting with a guidance teacher, and the practical seminars in agricultural and environmental engineering II is being advanced concurrently. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |   |
| Text Book                        |   |
| Evaluation Method                | It's estimated overall to consider practical research situation by a guidance teacher (100%).   |
| Points of Attention              | It's essential to advance personally in case of research.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 7  |
| Subject Title                    | Case Study I (Biology)   |
| Credit                           | 3  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students acquire the skills for experiments and basis research skills for playing active part as a reseracher in a life science field.<br>Students acquire the ability to plan and carry out research from a practical perspective.<br>Students acquire the ability to collect and analyze the data obtained by experiments.                 |
| Outlines of Class                | Students plan and carry out experiments based on master's research topics related to the research of each supervisor.<br>Students plan the research from a practical point of view on the issues of each field, carry out experiments, discuss and consider the results, and move the research to the next stage.                            |
| Content                          | 1. Students will carry out the investigations to understand the reserach theme and its back ground.(Read carefully the related papers.)<br>2.Students will set a goal in their research and experiments, and make a plan with your super visor.<br>3. Studetns will check the progress of their research through a regular meeting in a lab. |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 7   |
| Subject Title                    | Case Study I (Biochemistry and Molecular Biology)   |
| Credit                           | 3   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | In order to further develop the skills acquired in the field of molecular life sciences acquired in practice, students will acquire experimental techniques and thinking in a developmental manner.   |
| Outlines of Class                | The content of the experiment varies depending on the supervisor.<br>Studentse will develop the knowledge and technologies gained in their work and put their research to the next level.   |
| Content                          | 1.Students will conduct research to understand the research theme and its background (e.g., read the relevant papers).<br>2.Students will set goals for research experiments in the year of the master's program and prepare a plan with your supervisor.<br>3.Students will check the progress of research through regular reporting meetings in the laboratory. |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 7   |
| Subject Title                    | Case Study I (Applied Biology and Food Science)   |
| Credit                           | 3   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will require ability to make a research plan from a view of returnees<br>Students will require ability to analyze data and conclude from the data.   |
| Outlines of Class                | Make a research plan from a view of returnees with deep discuaasion with advisers<br>Analyze data and conclude from the data  |
| Content                          | Research will be conducted in each laboratory under each adviser<br>In parallele with research, understand research ethics including appropriate references, fair management and general science ethics |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | Instruction will be given by supervisor   |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 7   |
| Subject Title                    | Case Study I (International Agriculture and Horticulture)   |
| Credit                           | 3   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students acquire the skills for experiments and basis research skills for playing active part as a reseracher in a life science field.<br>Students acquire the ability to plan and carry out research from a practical perspective.<br>Students acquire the ability to collect and analyze the data obtained by experiments.                                      |
| Outlines of Class                | Students plan and carry out experiments based on master's research topics related to the research of each supervisor.<br>Students plan the research from a practical point of view on the issues of each field, carry out experiments, discuss and consider the results, and move the research to the next stage.   |
| Content                          | 1.Students will conduct research to understand the research theme and its background (e.g., read the relevant papers).<br>2.Students will set goals for research experiments in the year of the master's program and prepare a plan with your supervisor.<br>3.Students will check the progress of research through regular reporting meetings in the laboratory. |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 7  |
| Subject Title                    | Case Study I (Agricultural and Environmental Engineering)  |
| Credit                           | 3  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It puts on the sense of ethics as the researcher of a master for 1st year. It establishes a research policy and begins a data collection for making a report generation from a practicing point of view.   |
| Outlines of Class                | It performs the study guidance of the first stage for making the report generation by a guidance teacher.  |
| Content                          | It's learned about a way of thinking, an idea way, a conduct code and the sense of ethics for a researcher. It searches the book of reference for past study and data collection to consider the report generation. A research policy for a report generation is established, and it's based on a research policy and a plan of experiment and search are drafted. A plan of experiment and search executes and the data is collected. Method of experiment and practice is advanced by consulting with a guidance teacher. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated overall to consider research situation by a guidance teacher (100%).  |
| Points of Attention              | It's essential to advance personally in case of research.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 8   |
| Subject Title                    | Case Study II (Biology)   |
| Credit                           | 3   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students acquire the skills for experiments and basis research skills for playing active part as a reseracher in a life science field,and complete their master's thesis.<br>Students acquire the ability to plan and carry out research from a practical perspective.<br>Students acquire the ability to collect and analyze the data obtained by experiments. |
| Outlines of Class                | Students plan and carry out experiments based on master's research topics related to the research of each supervisor.<br>Students plan the research from a practical point of view on the issues of each field, carry out experiments, discuss and consider the results, and finish their master's thesis or research report.                                   |
| Content                          | 1.Students will conduct research to understand the research theme and its background (e.g., read the relevant papers).<br>2.Students will set goals for research experiments in the year of the master's program and prepare a plan with your supervisor.<br>3.Students will check the progress of research through regular reporting meetings in a lab.        |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 8  |
| Subject Title                    | Case Study II (Biochemistry and Molecular Biology)   |
| Credit                           | 3  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will further develop the knowledge and technologies accumulated in the research and complete the master's thesis.   |
| Outlines of Class                | The content of the experiment varies depending on the supervisor.<br>On the subjects of the field, students will develop research with the intention of returning the knowledge they have gained to society, and complete the master's thesis.   |
| Content                          | 1.Students will look back on practical case study I, confirm the research goals, and re-plan the experiments if necessary.<br>2.Students will summarize the results of their research as master's thesis.<br>3.Students will make an presentation of master's thesis at the report meeting held in the course. |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 8   |
| Subject Title                    | Case Study II (Applied Biology and Food Science)  |
| Credit                           | 3   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will require ability to make a research plan from a view of returnees<br>Students will require ability to analyze data and conclude from the data.   |
| Outlines of Class                | Make a research plan from a view of returnees with deep discuaasion with advisers<br>Analyze data and conclude from the data  |
| Content                          | Research will be conducted in each laboratory under each adviser<br>In parallele with research, understand research ethics including appropriate references, fair management and general science ethics |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | Instruction will be given by supervisor   |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 8   |
| Subject Title                    | Case Study II (International Agriculture and Horticulture)  |
| Credit                           | 3   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students acquire the skills for experiments and basic research skills for playing active part as a reseracher in a life science field and complete their master's thesis.<br>Students acquire the ability to plan and carry out research from a practical perspective.<br>Students acquire the ability to collect and analyze the data obtained by experiments. |
| Outlines of Class                | Students plan and carry out experiments based on master's research topics related to the research of each supervisor.<br>Students plan the research from a practical point of view on the issues of each field, carry out experiments, discuss and consider the results, and finish their master's thesis or research report.                                   |
| Content                          | 1.Students will conduct research to understand the research theme and its background (e.g., read the relevant papers).<br>2.Students will set goals for research experiments in the year of the master's program and prepare a plan with your supervisor.<br>3.Students will check the progress of research through regular reporting meetings in a lab.        |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | The final grade will be decided by active participation in research, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 8  |
| Subject Title                    | Case Study II (Agricultural and Environmental Engineering)   |
| Credit                           | 3  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It puts on the sense of ethics as the researcher of a master for second year. It analyses the collecting data for making a report generation from a practicing point of view and gathers the results of study.   |
| Outlines of Class                | It performs the study guidance of the last stage for making the report generation by a guidance teacher.   |
| Content                          | It's learned about a way of thinking, an idea way, a conduct code and the sense of ethics for a researcher. It searches the book of reference for past study and data collection to consider the report generation. It analyses the collecting data for making a report generation and gathers the results of study. Method of experiment and research is advanced by consulting with a guidance teacher. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated overall to consider research situation by a guidance teacher (100%).  |
| Points of Attention              | It's essential to advance personally in case of research.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 9  |
| Subject Title                    | Advanced Seminars in Biology I   |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | In order to create a master's thesis from an academic point of view, students acquire the knowledge and methods necessary for establishing research policies and collecting data.<br>Students will learn and explain the latest knowledge by reading academic papers related to research topics.<br>Through Q and A sessions, students will present what they understand, and explore issues and find solutions. |
| Outlines of Class                | Students will learn the knowledge and techniques necessary to write their master's thesis.<br>Students will read and present academic papers related to research topics and understand them.<br>Students will conduct Q and A sessions and discussions on the content of the presentation, explore issues and solutions, deepen understanding, and move research to the next level.                              |
| Content                          | 1.The supervisor teaches the knowledge and methods necessary to make a dissertation.<br>2.Students will find papers related to research topics, summarize the content, and give presentations.<br>3.Students will discuss presentations, explore issues, and find solutions.   |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.  |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 9  |
| Subject Title                    | Advanced Seminars in Biochemistry and Molecular Biology I  |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will develop the ability to learn and explain the latest knowledge in the field of molecular life sciences from an academic point of view through scientific papers.  |
| Outlines of Class                | Students will read and give presentations on academic papers in the field of molecular life sciences.  |
| Content                          | Students will read academic papers related to each research topic in the field of molecular life science and give presentations from an academic point of view so that they can understand the background and significance of the paper. |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 9   |
| Subject Title                    | Advanced Seminars in Applied Biology and Food Science I   |
| Credit                           | 1   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Current topics must be reviewed with scientific journals<br>Graduate students should understand the related topics reviewed in peer reviewed journals.<br>Graduate students should know how to discuss current topics to apply these science information to each research |
| Outlines of Class                | This seminar will help each students how to summarize each research data under the correct research ethics.   |
| Content                          | Graduate students will read current topics and summarize the content as powerpoint and review to other students. Each students who are charged in each seminar must explain the topics presented and deeply discuss with other researchers.                               |
| Preparation, review of the class | Graduate students follow the instructions of each supervisor  |
| Text Book                        | Reviews and scientific papers involving to each research plan   |
| Evaluation Method                | Presentation skill and understanding of reviewed papers will be evaluated.  |
| Points of Attention              | Graduate students need knowledge of the latest research   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 9  |
| Subject Title                    | Advanced Seminars in International Agriculture and Horticulture I  |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | In order to create a master's thesis from an academic point of view, students acquire the knowledge and methods necessary for establishing research policies and collecting data.<br>Students will learn and explain the latest knowledge by reading academic papers related to research topics.<br>Through Q and A sessions, students will present what they understand, and explore issues and find solutions.<br>Students will learn about the specialized content of each education field required to write a master's thesis. In addition, students will conduct research under their supervisor and acquire the research ethics necessary to compile papers. |
| Outlines of Class                | Students will learn the knowledge and techniques necessary to write their master's thesis.<br>Students will read and present academic papers related to research topics and understand them.<br>Students will conduct Q and A sessions and discussions on the content of the presentation, explore issues and solutions, deepen understanding, and move research to the next level.  |
| Content                          | 1. The supervisor teaches the knowledge and methods necessary to make a dissertation.<br>2. Students will find papers related to research topics, summarize the content, and give presentations.<br>3. Students will discuss presentations, explore issues, and find solutions.  |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and consideration.<br>The result of the research will be evaluated too.<br>For more details, ask your supervisor.  |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 9  |
| Subject Title                    | Advanced Seminars in Agricultural and Environmental Engineering I  |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It puts on the sense of ethics as the researcher of a master for 1st year. It establishes a research policy and begins a data collection for making a doctoral thesis from a studying point of view.   |
| Outlines of Class                | It performs the study guidance of the first stage for making the doctoral thesis by a guidance teacher.  |
| Content                          | It's learned about a way of thinking, an idea way, a conduct code and the sense of ethics for a researcher. It searches the book of reference for past study and data collection to consider the doctoral thesis. A research policy for a report generation is established, and it's based on a research policy and a plan of experiment and search are drafted. A plan of experiment and search executes and the data is collected. Method of experiment and practice is advanced by consulting with a guidance teacher, and the advanced seminars in agricultural and environmental engineering I is being advanced concurrently. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated overall to consider research situation by a guidance teacher (100%).  |
| Points of Attention              | It's essential to advance personally in case of research.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 10   |
| Subject Title                    | Practical Seminars in Biology I  |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | In order to create a master's thesis from a practical point of view, students acquire the knowledge and methods necessary for establishing research policies and collecting data.<br>Students will learn and explain the latest knowledge by reading academic papers related to research topics.<br>Through Q and A sessions, students will present what they understand, and explore issues and find solutions. |
| Outlines of Class                | Students will learn the knowledge and techniques necessary to write their master's thesis.<br>Students will read and present academic papers related to research topics and understand them.<br>Students will conduct Q and A sessions and discussions on the content of the presentation, explore issues and solutions, deepen understanding, and move research to the next level.                              |
| Content                          | 1.The supervisor teaches the knowledge and methods necessary to make a dissertation.<br>2. Students will find literature related to research topics, summarize the content, and give presentations.<br>3.Students will discuss presentations, explore issues, and find solutions.  |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.<br>For more details, ask your supervisor.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 10   |
| Subject Title                    | Practical Seminars in Biochemistry and Molecular Biology I   |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will develop the ability to learn and explain the latest knowledge in the field of molecular life sciences from a practical point of view such as technology development and material production through scientific papers.     |
| Outlines of Class                | Students will read and give presentations on academic papers in the field of molecular life sciences.  |
| Content                          | Students will read academic papers related to each research topic in the field of molecular life science and give presentations from a practical point of view so that they can understand the background and significance of the paper. |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 10  |
| Subject Title                    | Practical Seminars in Applied Biology and Food Science I  |
| Credit                           | 1   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Current topics must be reviewed with scientific journals<br>Graduate students should understand the related topics reviewed in peer reviewed journals.<br>Graduate students should know how to discuss current topics to apply these science information to each research |
| Outlines of Class                | This seminar will help each students how to summarize each research data under the correct research ethics.   |
| Content                          | Graduate students will read current topics and summarize the content as powerpoint and review to other students. Each students who are charged in each seminar must explain the topics presented and deeply discuss with other researchers.                               |
| Preparation, review of the class | Graduate students follow the instructions of each supervisor  |
| Text Book                        | Reviews and scientific papers involving to each research plan   |
| Evaluation Method                | Presentation skill and understanding of reviewed papers will be evaluated.  |
| Points of Attention              | Graduate students need knowledge of the latest research   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 10   |
| Subject Title                    | Practical Seminars in International Agriculture and Horticulture I   |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | In order to create a master's thesis from a practical point of view, students acquire the knowledge and methods necessary for establishing research policies and collecting data.<br>Students will learn and explain the latest knowledge by reading academic papers related to research topics.<br>Through Q and A sessions, students will present what they understand, and explore issues and find solutions.<br>Students will learn about the specialized content of each education field required to write a master's thesis. In addition, students will conduct research under their supervisor and acquire the research ethics necessary to compile papers. |
| Outlines of Class                | Students will learn the knowledge and techniques necessary to write their master's thesis.<br>Students will read and present academic papers related to research topics and understand them.<br>Students will conduct Q and A sessions and discussions on the content of the presentation, explore issues and solutions, deepen understanding, and move research to the next level.  |
| Content                          | 1. The supervisor teaches the knowledge and methods necessary to make a dissertation.<br>2. Students will find literature related to research topics, summarize the content, and give presentations.<br>3. Students will discuss presentations, explore issues, and find solutions.  |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.<br>For more details, ask your supervisor.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 10   |
| Subject Title                    | Practical Seminars in Agricultural and Environmental Engineering I   |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It puts on the sense of ethics as the researcher of a master for 1st year. It establishes a research policy and begins a data collection for making a doctoral thesis from a practicing point of view.   |
| Outlines of Class                | It performs the study guidance of the first stage for making the doctoral thesis by a guidance teacher.  |
| Content                          | It's learned about a way of thinking, an idea way, a conduct code and the sense of ethics for a researcher. It searches the book of reference for past study and data collection to consider the doctoral thesis. A research policy for a report generation is established, and it's based on a research policy and a plan of experiment and search are drafted. A plan of experiment and search executes and the data is collected. Method of experiment and practice is advanced by consulting with a guidance teacher, and the advanced seminars in agricultural and environmental engineering I is being advanced concurrently. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated overall to consider Practical Research situation by a guidance teacher (100%).  |
| Points of Attention              | It's essential to advance personally in case of research.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 11   |
| Subject Title                    | Advanced Seminars in Biology II  |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will learn and explain the latest knowledge by reading academic papers related to research topics.<br>Through Q and A sessions, they will present what they understand, and explore issues and find solutions.<br>Students will present the data obtained from their research.                |
| Outlines of Class                | Students will read and present academic papers related to research topics and understand them.<br>Students will conduct Q and A sessions and discussions on the content of the presentation, explore issues and solutions, deepen understanding, and complete master's thesis.                         |
| Content                          | 1. Students will find literature related to research topics, summarize the content, and give presentations.<br>2. Students will discuss presentations, explore issues, and find solutions.<br>3. Students will present the data obtained from their research and receive advice from their supervisor. |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.<br>For more details, ask your supervisor.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 11   |
| Subject Title                    | Advanced Seminars in Biochemistry and Molecular Biology II   |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will develop the ability to learn and explain the latest knowledge in the field of molecular life sciences from an academic point of view through scientific papers.  |
| Outlines of Class                | Students will read and give presentations on academic papers in the field of molecular life sciences.  |
| Content                          | Students will read academic papers related to each research topic in the field of molecular life science and give presentations from an academic point of view so that they can understand the background and significance of the paper. |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 11  |
| Subject Title                    | Advanced Seminars in Applied Biology and Food Science II  |
| Credit                           | 1   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Current topics must be reviewed with scientific journals<br>Graduate students should understand the related topics reviewed in peer reviewed<br>Graduate students should know how to discuss current topics to apply these science information to each research |
| Outlines of Class                | This seminar will help each students how to summarize each research data under the correct research ethics.   |
| Content                          | Graduate students will read current topics and summarize the content as powerpoint and review to other students. Each students who are charged in each seminar must explain the topics presented and deeply discuss with other researchers.                     |
| Preparation, review of the class | Graduate students follow the instructions of each supervisor  |
| Text Book                        | Reviews and scientific papers involving to each research plan   |
| Evaluation Method                | Presentation skill and understanding of reviewed papers will be evaluated.  |
| Points of Attention              | Graduate students need knowledge of the latest research   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 11   |
| Subject Title                    | Advanced Seminars in International Agriculture and Horticulture II   |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | In order to create a master's thesis from an academic point of view, students acquire the knowledge and methods necessary for establishing research policies and collecting data.<br>Students will learn and explain the latest knowledge by reading academic papers related to research topics.<br>Through Q and A sessions, students will present what they understand, and explore issues and find solutions.<br>Students will learn about the specialized content of each education field required to write a master's thesis. In addition, students will conduct research under their supervisor and acquire the research ethics necessary to compile papers. |
| Outlines of Class                | Students will read and present academic papers related to research topics and understand them.<br>Students will conduct Q and A sessions and discussions on the content of the presentation, explore issues and solutions, deepen understanding, and complete master's thesis.   |
| Content                          | 1. Students will find literature related to research topics, summarize the content, and give presentations.<br>2. Students will discuss presentations, explore issues, and find solutions.<br>3. Students will present the data obtained from their research and receive advice from their supervisor.   |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.<br>For more details, ask your supervisor.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 11   |
| Subject Title                    | Advanced Seminars in Agricultural and Environmental Engineering II   |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It puts on the sense of ethics as the researcher of a master for 1st year. It establishes a research policy and begins a data collection for making a doctoral thesis from a studying point of view.   |
| Outlines of Class                | It performs the study guidance of the first stage for making the doctoral thesis by a guidance teacher.  |
| Content                          | It's learned about a way of thinking, an idea way, a conduct code and the sense of ethics for a researcher. It searches the book of reference for past study and data collection to consider the doctoral thesis. A research policy for a report generation is established, and it's based on a research policy and a plan of experiment and search are drafted. A plan of experiment and search executes and the data is collected. Method of experiment and practice is advanced by consulting with a guidance teacher, and the advanced seminars in agricultural and environmental engineering I is being advanced concurrently. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated overall to consider research situation by a guidance teacher (100%).  |
| Points of Attention              | It's essential to advance personally in case of research.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 12  |
| Subject Title                    | Practical Seminar in Biology II   |
| Credit                           | 1   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will learn and explain the latest knowledge by reading academic papers related to research topics.<br>Through Q and A sessions, they will present what they understand, and explore issues and find solutions.<br>Students will present the data obtained from their research.                     |
| Outlines of Class                | Students will read and present academic papers related to research topics and understand them.<br>Students will conduct Q and A sessions and discussions on the content of the presentation, explore issues and solutions, deepen understanding, and complete master's thesis.                              |
| Content                          | 1. Students will find academic papers related to research topics, summarize the content, and give presentations.<br>2. Students will discuss presentations, explore issues, and find solutions.<br>3. Students will present the data obtained from their research and receive advice from their supervisor. |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.<br>For more details, ask your supervisor.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 12  |
| Subject Title                    | Practical Seminars in Biochemistry and Molecular Biology II   |
| Credit                           | 1   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will develop the ability to learn and explain the latest knowledge in the field of molecular life sciences from an academic point of view through scientific papers.   |
| Outlines of Class                | Students will read and give presentations on academic papers in the field of molecular life sciences.   |
| Content                          | Students will read academic papers related to each research topic in the field of molecular life science and give presentations from a practical point of view such as technology development and material production so that they can understand the background and significance of the paper. |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.  |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 12  |
| Subject Title                    | Practical Seminar in Applied Biology and Food Science II  |
| Credit                           | 1   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Current topics must be reviewed with scientific journals<br>Graduate students should understand the related topics reviewed in peer reviewed journals.<br>Graduate students should know how to discuss current topics to apply these science information to each research |
| Outlines of Class                | This seminar will help each students how to summarize each research data under the correct research ethics.   |
| Content                          | Graduate students will read current topics and summarize the content as powerpoint and review to other students. Each students who are charged in each seminar must explain the topics presented and deeply discuss with other researchers.                               |
| Preparation, review of the class | Graduate students follow the instructions of each supervisor  |
| Text Book                        | Reviews and scientific papers involving to each research plan   |
| Evaluation Method                | Presentation skill and understanding of reviewed papers will be evaluated.  |
| Points of Attention              | Graduate students need knowledge of the latest research   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 12  |
| Subject Title                    | Practical Seminars in International Agriculture and Horticulture II   |
| Credit                           | 1   |
| Time                             | all year  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | <p>In order to create a master's thesis from an academic point of view, students acquire the knowledge and methods necessary for establishing research policies and collecting data.</p> <p>Students will learn and explain the latest knowledge by reading academic papers related to research topics.</p> <p>Through Q and A sessions, students will present what they understand, and explore issues and find solutions.</p> <p>Students will learn about the specialized content of each education field required to write a master's thesis. In addition, students will conduct research under their supervisor and acquire the research ethics necessary to compile papers.</p> |
| Outlines of Class                | <p>Students will read and present academic papers related to research topics and understand them.</p> <p>Students will conduct Q and A sessions and discussions on the content of the presentation, explore issues and solutions, deepen understanding, and complete master's thesis.</p>   |
| Content                          | <ol style="list-style-type: none"> <li>1. Students will find academic papers related to research topics, summarize the content, and give presentations.</li> <li>2. Students will discuss presentations, explore issues, and find solutions.</li> <li>3. Students will present the data obtained from their research and receive advice from their supervisor.</li> </ol>   |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | <p>The final grade will be decided by active participation in seminar, degree of understanding and the content of their presentation.</p> <p>For more details, ask your supervisor.</p>   |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 12   |
| Subject Title                    | Practical Seminars in Agricultural and Environmental Engineering II  |
| Credit                           | 1  |
| Time                             | all year   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It puts on the knowledge and method for analyzing a data for making a doctoral thesis from a practical point of view.  |
| Outlines of Class                | It performs the practice on the knowledge and method of the last stage for making the doctoral thesis by a guidance teacher.   |
| Content                          | It searches the book of reference for past study to analyze a data to consider the doctoral thesis. It obtains the book of researching reference and reads it, makes report generation. Method of practice is advanced by consulting with a guidance teacher, and the practical research in agricultural and environmental engineering II is being advanced concurrently. As reporting study progress to a guidance teacher periodically, it advances a study to the next stage. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated overall to consider Practical Research situation by a guidance teacher (100%).  |
| Points of Attention              | It's essential to advance personally in case of research.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 13  |
| Subject Title                    | Presentation Practice I   |
| Credit                           | 1   |
| Time                             | Summer Course   |
| Name of Teacher                  | Part time lecturer  |
| Specific Goals                   | Students will acquire the basic theory and technic of presentation to express what they want to tell in your own word.<br>Students will acquire the technic of presentaion to make the listeners understand , agree and act while adapting to the listener's interests and circumstances.   |
| Outlines of Class                | Students will acquire the basic theory and technic of presentation to express what they want to tell in your own word.<br>Students will acquire the technic of presentaion to make the listeners understand , agree and act while adapting to the listener's interests and circumstances.   |
| Content                          | 1st Interactual lectures—Guidance, Confirmation of evaluation methods, Practice of presentation and mutual evaluation<br>2nd Interactual lectures—Learn basic structure of presentaion, Practice of short presentaion and mutual evaluation<br>3rd Interactual lecture—How to build a storyy that is easy o understand, Practice of short presentaion and mutual evaluation<br>4th Practice—Preparation for the presentation based on assignment theme(team discussion and collecting information)<br>5th Practice—Effective and Efficient technic of conveying, Preparation of presentation (Scenario making, Theme discussion)<br>6th Practice—Preparation of presentation (Scenario making, Theme Rehearsal)<br>7th Practical test—Final presentation and mutual evaluation<br>8th Writing test, writing a report, Summary |
| Preparation, review of the class | Pre-reading the text book is required.  |
| Text Book                        | Perfect Presentation, Hiroshi Yahata  |
| Evaluation Method                | Comprehensively your final grade will decided by attitudes toward presentation, active participation in class, the performance in class and assignments.  |
| Points of Attention              | Pre-reading the text book is required.  |

|                                  |                          |
|----------------------------------|--------------------------|
| Subject No                       | 14                       |
| Subject Title                    | Presentation Practice II |
| Credit                           | 1                        |
| Time                             | Tuesday, 7-8 period      |
| Name of Teacher                  | undecided                |
| Specific Goals                   |                          |
| Outlines of Class                |                          |
| Content                          |                          |
| Preparation, review of the class |                          |
| Text Book                        |                          |
| Evaluation Method                |                          |
| Points of Attention              |                          |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 15  |
| Subject Title                    | Academic Presentation (Biology)   |
| Credit                           | 1   |
| Time                             | Follow your supervisor's instructions.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will increase their understanding by making a presentation about the results of their master's research at an academic conference in their own research field and they will make use of that experience to take their research to the next level and to write their thesis.        |
| Outlines of Class                | Students will assemble the results of their research results in order to make their presentation materials like power point or poster.<br>Students will practice presentation repeatedly.<br>Make a presentation at an academic conference in thier own research field.                     |
| Content                          | Students will assemble the results of their research results in order to make their presentation materials like power point or poster.<br>Students will practice a presentation and Q & A session repeatedly.<br>Make a presentation at an academic conference in thier own research field. |
| Preparation, review of the class | In advance of making materials of presentation, students arrange their research results to make their presentation get easily understood.<br>Students will proceed their own research based on the advise they received at an academic conference.  |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | Your final grade will be decided by the attitudes towards preparation of your presentation and the content of your presentation including the answers to the questions from listeners.  |
| Points of Attention              | It's important for students to make a presentation with a willingness to spread their research result's to the world.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 15   |
| Subject Title                    | Academic Presentation (Biochemistry and Molecular Biology)   |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will develop their abilities to make a presentation at a conference and to answer to the questions.   |
| Outlines of Class                | Students will participate in an academic conference and make a presentation in their research field  |
| Content                          | Students will plan, prepare and make a presentation at a specific academic conference after consulting their supervisors.  |
| Preparation, review of the class | In advance of making materials of presentation, students arrange their research results to make their presentation get easily understood.<br>Students will proceed their own research based on the advise they received at an academic conference. |
| Text Book                        | Nothing in particular  |
| Evaluation Method                | Planning, preparation, and execution of presentations will be evaluated.   |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 15  |
| Subject Title                    | Academic Presentation (Applied Biology and Food Science)  |
| Credit                           | 1   |
| Time                             | Follow your supervisor's instructions.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will learn the whole process of attending a conference or meeting (preparation, presentation, and discussion).<br>Students will understand deeply their research through this process.<br>The above helps to complete the master's thesis.   |
| Outlines of Class                | Students will prepare a presentation materials and practice presentation repeatedly.<br>Students will conduct oral or poster presentation at a (domestic) conference or meeting.<br>Students will review the whole process including questions and answers session in the conference.<br>Supervisors will give instruction and suggestions. |
| Content                          | Students will prepare a presentation materials based on their master's thesis research and practice presentation repeatedly.  |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | None  |
| Evaluation Method                | Evaluation is based on how students will address tasks described above.   |
| Points of Attention              | Instruction will be given by supervisor   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 15  |
| Subject Title                    | Academic Presentation (International Agriculture and Horticulture)  |
| Credit                           | 1   |
| Time                             | Follow your supervisor's instructions.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will increase their understanding by making a presentation about the results of their master's research at an academic conference in their own research field and they will make use of that experience to take their research to the next level and to write their thesis.        |
| Outlines of Class                | Students will assemble the results of their research results in order to make their presentation materials like power point or poster.<br>Students will practice presentation repeatedly.<br>Make a presentation at a academic conference in thier own research field.                      |
| Content                          | Students will assemble the results of their research results in order to make their presentation materials like power point or poster.<br>Students will practice a presentation and Q & A session repeatedly.<br>Make a presentation at an academic conference in thier own research field. |
| Preparation, review of the class | In advance of making materials of presentation, students arrange their research results to make their presentation get easily understood.<br>Students will proceed their own research based on the advise they received at an academic conference.  |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | Your final grade will be decided by the attitudes towards preparation of your presentation and the content of your presentation including the answers to the questions from listeners.  |
| Points of Attention              | It's important for students to make a presentation with a willingness to spread their research result's to the world.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 15   |
| Subject Title                    | Academic Presentation (Agricultural and Environmental Engineering)   |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It's used for progress of a master study and making of master thesis by understanding a research problem through an academic meeting presentation.   |
| Outlines of Class                | It summarizes the results of a master study and makes the presentation paper by PowerPoint or a poster. The presentation practice is performed and it presents the results of master study in the academic meetings. |
| Content                          | It makes the presentation paper by results of a master study. Presentation practice and practice of a question and answer are performed, and it presents the results of master study in actual academic meetings.    |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated by the preparations for presentation, the presentation contents and performance of a question and answer in the academic meetings (100%).   |
| Points of Attention              | In the case of academic meeting, it's essential to advance personally presentation to want to spread study results.  |

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|----------------------------------|--|
| Subject No                       | 16   |
| Subject Title                    | Science Communication in English (Biology)   |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Acquire the english skills necessary to advance academic research.   |
| Outlines of Class                | Read papers and scientific articles written in English, understand and explain the content.  |
| Content                          | Read papers and scientific articles written in English and explain them. Answer your opinions and thoughts to each supervisor in response to questions and comments.             |
| Preparation, review of the class | Translate the English materials in advance as a preparation. Review enough the part that you do not understand in the preparation.   |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | Attitudes for class  |
| Points of Attention              | Try to review basic English grammar on a daily basis and make an effort to increase the vocabulary.<br>English proficiency of the degree of high school graduation is necessary. |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 16  |
| Subject Title                    | Science Communication in English (Biochemistry and Molecular Biology)   |
| Credit                           | 1   |
| Time                             | Follow your supervisor's instructions.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students will develop the ability to understand scientific articles written in English quickly and accurately. Students will also develop the ability to express their writings about science in English.                                 |
| Outlines of Class                | Students will read papers and scientific articles written in English to explain the contents. In addition, translate scientific papers and articles written in Japanese into English. Students will express their experiments in English. |
| Content                          | 1. Read papers and scientific articles written in English to explain the contents.<br>2. Translate the articles and the thesis written in Japanese into English.  |
| Preparation, review of the class | Instruction will be given by supervisor   |
| Text Book                        | Instruction will be given by supervisor   |
| Evaluation Method                | Evaluate the degree and process of improving reading comprehension and expression skills in scientific English  |
| Points of Attention              | Instruction will be given by supervisor   |

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|----------------------------------|--|
| Subject No                       | 16   |
| Subject Title                    | Science Communication in English (Applied Biology and Food Science)  |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | The aim of this lecture is to gain skills to explain topics and results of your research in Master course in English.                      |
| Outlines of Class                | Students learn how to understand science topics in English via reading papers and textbooks provided by your supervisor.                   |
| Content                          | In this class, students introduce research papers of their own field, and answer to the questions from your supervisor and other students. |
| Preparation, review of the class | Contact to your supervisor for further information.  |
| Text Book                        | Papers and textbooks provided from your supervisor.  |
| Evaluation Method                | The final grade will be evaluated by attendance, presentations, and depth of understanding about the papers you presented.                 |
| Points of Attention              | Contact to your supervisor for further information.  |

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| Subject No                       | 16   |
| Subject Title                    | Science Communication in English (International Agriculture and Horticulture)  |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Acquire the english skills necessary to advance academic research.   |
| Outlines of Class                | Studetns will read papers and scientific articles written in English, understand and explain the content.  |
| Content                          | Studetns will papers and scientific articles written in English and explain them. Answer your opinions and thoughts to each supervisor in response to questions and comments.    |
| Preparation, review of the class | Translate the English materials in advance as a preparation.<br>Review enough the part that you do not understand in the preparation.  |
| Text Book                        | Provided by your supervisor.   |
| Evaluation Method                | Attitudes for class  |
| Points of Attention              | Try to review basic English grammar on a daily basis and make an effort to increase the vocabulary.<br>English proficiency of the degree of high school graduation is necessary. |

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| Subject No                       | 16   |
| Subject Title                    | Science Communication in English<br>(Agricultural and Environmental Engineering)   |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It's used for progress of a master study by understanding the contents to read a book of reference.  |
| Outlines of Class                | Each guidance teacher reads an English document related to the selected master study contents and understands the contents.  |
| Content                          | It's explained about a book of reference in English related to a master study. As receiving some comments from each teacher, it's answered an owner opinion and idea based on a book of reference information. |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | It's estimated overall by the understanding contents of reference and the normal point in a classroom (100%).  |
| Points of Attention              | As English is a worldwide language of the natural scientific field, it's very important to put on the English proficiency about the study.   |

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|----------------------------------|---|
| Subject No                       | 17  |
| Subject Title                    | Practical Study Seminars (Biology)  |
| Credit                           | 1   |
| Time                             | 4 period, Monday, 3semester and 4 semester  |
| Name of Teacher                  | Teachers of Biology Course  |
| Specific Goals                   | Students acquire the ability to scientifically explain the progress of research and results by presenting the purpose, research method, and results obtained so far. Through presentations, students will objectively understand the progress and meaning of research.<br>Through Q & A session between faculty members and students, students will deepen their understanding of research topics and use this experience to promote their master's research in the future. |
| Outlines of Class                | Students will do an oral presentations on what they have learned in the first year as summary (about 20 minutes per person), and all participants (supervisors and students) will have a debate about it. Each presenter will make a resume of their presentation and distribute it to all participants beforehand.   |
| Content                          | 1st to 8th: Presentation and Q and A session of the progress and results of master's research   |
| Preparation, review of the class | Student's final grade will be decided by attitudes toward preparation and the contents of their presentation and Q and A session.   |
| Text Book                        | Each presenter will make a resume of their presentation and distribute it to all participants beforehand.   |
| Evaluation Method                | Attitudes toward surveys, making materials for presentation, oral presentations and Q & A session.  |
| Points of Attention              | Follow your supervisor's instructions.  |

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|----------------------------------|--|
| Subject No                       | 17   |
| Subject Title                    | Practical Study Seminars (Biochemistry and Molecular Biology)  |
| Credit                           | 1  |
| Time                             | 4·5 period, Friday, 3semester and 4 semester   |
| Name of Teacher                  | Teachers of Biochemistry and Molecular Biology Course  |
| Specific Goals                   | Students will understand the flow of research planning and research execution (experiments) in practical research, and assess the prospects for research results.  |
| Outlines of Class                | Faculty members of this course will explain a specific research example, including recent topics, focusing on their specialized field.   |
| Content                          | 1st: Use of microbial functions for resources and environmental problems (Sonoki)<br>2nd: Development and use of useful carbohydrates (Yoshida)<br>3rd: Studies on the Structure and Function of ncRNA and its Mechanism of Action (Ushida)<br>4th: Recent Topics on Cancer and Immunity (Hatakeyama)<br>5th: Microbial ecology research methods (Tonouchi)<br>6th: Undecided (Tonouchi)<br>7th: Natural product chemistry for morphological control of vegetables (Takada)<br>8th: Biosynthesis and Utilization of Plant Storage Materials (Hamada) |
| Preparation, review of the class | Follow your supervisor's instructions.   |
| Text Book                        | Follow your supervisor's instructions.   |
| Evaluation Method                | Attitudes toward this lecture, Aggressive participation in class, report.  |
| Points of Attention              | Follow your supervisor's instructions.   |

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|----------------------------------|--|
| Subject No                       | 17   |
| Subject Title                    | Practical Study Seminars (Applied Biology and Food Science)  |
| Credit                           | 1  |
| Time                             | Intensive Course in Autumn term  |
| Name of Teacher                  | Teachers of Biochemistry and Molecular Applied Biology and Food Science Course   |
| Specific Goals                   | Understand research issues and the solutions through presentation about master's research. Introduce the outline of related research fields and the position of own research and explain scientifically about research results and progress.<br>Objectively understand the progress of their own researches, and utilize it to advance their future researches through discussion about the presentation.<br>Acquire a wide range of knowledge other than specialty and develop active discussion. |
| Outlines of Class                | This lecture aims to make steady progress in their researches by master course students.<br>This lecture is conducted as intensive seminars. Students give oral presentations on the outline, purpose, method, and results of their master's researches, and discussion about the presentation is conducted by students and supervisors.   |
| Content                          | This lecture is divided into two or three times as intensive seminars.<br>Students express their opinions in response to questions and comments from supervisors and other students based on literature information and results from their researches.   |
| Preparation, review of the class | Follow the instructions of each supervisor.  |
| Text Book                        | None   |
| Evaluation Method                | Evaluate from the following viewpoints (100%); the quality of the presentation report, oral presentation, and discussion.  |
| Points of Attention              | Follow the instructions of each supervisor.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 17   |
| Subject Title                    | Practical Study Seminars (International Agriculture and Horticulture)  |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will become interested in a wide range of research topics and acquire the ability to gather information and the analytical skill. |
| Outlines of Class                | Students will participate in a wide range of seminar, academic conference and learn the latest research.                                   |
| Content                          | Students will learn how to solve the problem given in each research field through this lecture.  |
| Preparation, review of the class | Instruction will be given by supervisor  |
| Text Book                        | Instruction will be given by supervisor  |
| Evaluation Method                | Instruction will be given by supervisor  |
| Points of Attention              | Instruction will be given by supervisor  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 17  |
| Subject Title                    | Practical Study Seminars (Agricultural and Environmental Engineering)   |
| Credit                           | 1   |
| Time                             | Intensive Course  |
| Name of Teacher                  | Akira Endo, Shigeoki Moritani   |
| Specific Goals                   | Students will learn about the material circulation mechanism of apple orchards and Chinese-yam fields.<br>Students will learn about agricultural facility specialized in cold and heavily snowing area.   |
| Outlines of Class                | In order to clarify the material circulation mechanism in the ordinary agricultural upland fields and orchards, learn basic and basic soil survey methods and soil analysis methods (Endo). Participants also learn about snow melting system and temperature control in greenhouses (Moritani) .   |
| Content                          | <ol style="list-style-type: none"> <li>1. Visit and practice to survey geothermal energy</li> <li>2. Theory and practice to measure ground temperature</li> <li>3. Theory and practice of groundwater survey</li> <li>4. Theory and practice to utilize geothermal energy</li> <li>5. Visit and practice of soil survey in the apple orchard</li> <li>6. Visit and practice of soil investigation in root vegetables planted field</li> <li>7. Theory and practice of soil analysis</li> <li>8. Analysis of investigated results</li> </ol> |
| Preparation, review of the class |   |
| Text Book                        |   |
| Evaluation Method                | Report for each lecture (100%)  |
| Points of Attention              | Necessary to attain expertise studied in undergraduate  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 18   |
| Subject Title                    | Seminars for Career Development  |
| Credit                           | 1  |
| Time                             | Intensive course in spring term  |
| Name of Teacher                  | Career advisers, OB•OG   |
| Specific Goals                   | The graduates of the Graduate School of Agriculture and Life sciences will talk about how they have been able to advance their careers as highly specialized professionals. Students understand how to make their future career by listening to the stories by the graduates.  |
| Outlines of Class                | The graduates of the Graduate School of Agriculture and Life sciences will talk about their current work, the skills needed to advance the career, etc.<br>And the experts will talk about the attitude and practical content in the job hunting   |
| Content                          | <ol style="list-style-type: none"> <li>1. Lecture and exercises by experts in job hunting (1)</li> <li>2. Lecture and exercises by experts in job hunting (2)</li> <li>3. Lecture and exercises by experts in job hunting (3)</li> <li>4. Lecture and exercises by experts in job hunting (4)</li> <li>5. Lecture by the graduates (1)</li> <li>6. Lecture by the graduates (2)</li> <li>7. Lecture by the graduates (3)</li> <li>8. Discussion</li> </ol> <p>Details will be announced later.</p> |
| Preparation, review of the class | Instruction will be given in class   |
| Text Book                        | Distribute as needed.  |
| Evaluation Method                | Report on what you have learned from this lecture.   |
| Points of Attention              | Nothing special  |

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| Subject No                       | 19   |
| Subject Title                    | Analytical Methodology A   |
| Credit                           | 1  |
| Time                             | Summer Course  |
| Name of Teacher                  | Shinji Akada   |
| Specific Goals                   | To learn some fundamentals of Molecular cloning, DNA sequencing  |
| Outlines of Class                | Molecular cloning, DNA sequencing, and construction of the recombinant vector for making transgenic plants.  |
| Content                          | <p>Part 1 : Extraction, purification, and quantification of plant DNA samples.</p> <p>Part 2 : PCR amplification of the DNA of interest and TA cloning of the PCR products.</p> <p>Part 3 : Extraction of the plasmid DNA harboring the DNA of interest.</p> <p>Part 4 : Preparing the sequencing reaction using plasmid DNA as a template and manipulation of the DNA sequencing apparatus.</p> <p>Part 5 : Data analysis of the sequencing results and primer designing for the vector construction.</p> <p>Part 6 : Construction of the vectors for introduction of the plant genes.</p> <p>Part 7 : Introduction of the plant genes with the Agrobacterium system.</p> <p>Part 8 : Data analysis and discussion.</p> |
| Preparation, review of the class | Will be announced in the first lesson.   |
| Text Book                        | None   |
| Evaluation Method                | <p>Every student has to submit a report paper on their experiments and their results, and also discuss their experimental results.</p> <p>Your final grade for the course will be decided based on the quality of report.</p>  |
| Points of Attention              | None   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 20  |
| Subject Title                    | Analytical Methodology B  |
| Credit                           | 1   |
| Time                             | Summer Course   |
| Name of Teacher                  | Masaki Kuro-o   |
| Specific Goals                   | From the various types of biological data, we learn the methods how construct the branching trees and the phylogenetic trees are guided, and the goal is to actually construct phylogenetic tree(s).  |
| Outlines of Class                | You will learn how to use data of different properties and how to construct phylogenetic trees using a computer program.  |
| Content                          | <p>Part 1. History of phylogenetic analyses</p> <p>Part 2. Scientific significance of phylogenetic analyses</p> <p>Part 3. What data is used to lead the phylogenetic relationships</p> <p>Part 4. Difference between branched trees and phylogenetic trees</p> <p>Part 5. How to lead a phylogenetic relationship</p> <p>Part 6. Select out groups</p> <p>Part 7. Construction of phylogenetic trees by free software MEGA (Tamura et al.)</p> <p>Part 8. General discussion</p> |
| Preparation, review of the class | Give timely instructions during class.  |
| Text Book                        | I don't specify it in particular, but I'll present if students need it.   |
| Evaluation Method                | <p>Attitude as a lecturers: 75%</p> <p>Understanding of contents: 25%</p> <p>The final grade evaluation is performed by combining the above.</p>  |
| Points of Attention              | None  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 21   |
| Subject Title                    | Analytical Methodology C   |
| Credit                           | 1  |
| Time                             | Summer Course  |
| Name of Teacher                  | Akira Yamawo   |
| Specific Goals                   | To learn some fundamentals of English presentation   |
| Outlines of Class                | English presentation about research of each student  |
| Content                          | Part 1. Preparing a manuscript for presentation of research in English<br>Part 2. Preparing a manuscript for presentation of research in English<br>Part 3. Preparing a manuscript for presentation of research in English<br>Part 4. Watch a video of a presentation by an native speaker.<br>Part 5. Watch a video of a presentation by an native speaker.<br>Part 6. Preparing a manuscript for presentation of research in English<br>Part 7. English presentation<br>Part 8. English presentation |
| Preparation, review of the class | Give timely instructions during class.   |
| Text Book                        | I don't specify it in particular, but I'll present if students need it.  |
| Evaluation Method                | Attitude as a lecturers: 75%<br>Understanding of contents: 25%<br>The final grade evaluation is performed by combining the above.  |
| Points of Attention              | none   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 22   |
| Subject Title                    | Analytical Methodology D   |
| Credit                           | 1  |
| Time                             | Summer Course  |
| Name of Teacher                  | Masaru Hashimoto and Kimitoshi Sakamoto  |
| Specific Goals                   | Understand the mechanisms of mass spectrometric analysis, and learn the fundamental techniques for both quantitative and qualitative analysis of organo- and bio-molecules with mass spectrometry.<br>Analyze sample molecules with mass spectrometers as the practice.  |
| Outlines of Class                | Since acquiring the fundamental mechanisms, and applications of mass spectral analysis is practical for the engineers with master's degree, these were lectured in the class. This class offers students to measure and analyze the mass spectra. These technologies are fundamental matters in the food and pharmaceutical companies in qualifying the products.  |
| Content                          | <ol style="list-style-type: none"> <li>1. What is "mass" ? How we measure that?<br/>Ionization methods and separation of the ions.<br/>High resolution measurement and information within.</li> <li>2. GC-MS, mechanism and specification<br/>LC-ESI-IT-TOF-MS, mechanism and specification<br/>CID fragmentation of peptides and its analysis<br/>Deconvolution analysis of proteins.<br/>nano- LC-ESI-IT-TOF-MS, incredible high sensitive analysis</li> <li>3. MALDI-TOF-MS, mechanism and specification</li> <li>4. Overview of the instruments (practice)</li> <li>5. Starting up the instruments, operation of the programs (practice)</li> <li>6. Basic measurements (practice)</li> <li>7. Application (practice)<br/>Students will choose the application practice from <ol style="list-style-type: none"> <li>① GC-MS: (volatile compounds)</li> <li>② LC-ESI-IT-TOF-MS (secondary metabolites, peptides)</li> <li>③ MALDI-TOF-MS (proteins)</li> </ol> </li> <li>8. Presentation</li> </ol> |
| Preparation, review of the class | Please confirm before the class.   |
| Text Book                        |  |
| Evaluation Method                | Attitude, Understanding (50%)<br>Report (50%)  |
| Points of Attention              | Bring a calculator   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 23  |
| Subject Title                    | Analytical Methodology E  |
| Credit                           | 1   |
| Time                             | Summer Course   |
| Name of Teacher                  | Hitoshi Yokoyama  |
| Specific Goals                   | <ul style="list-style-type: none"> <li>•To understand the principles of specific detection of biopolymer with an antibody.</li> <li>•To visualize the localization of a specific molecule in a tissue or in a cell by immunostaining with an antibody.</li> </ul>   |
| Outlines of Class                | To learn the principle of tissue/cell fixation, a practical protocol of immunostaining with an antibody and a method of detection of fluorescent-labeled antibody.  |
| Content                          | <p>(intensive course style)</p> <ol style="list-style-type: none"> <li>1. Merit and significance of immunohistochemistry. Principle of immunohistochemistry.</li> <li>2. Chemistry of antibody ( antigen-antibody reaction, specificity of antibody and type of antibodies)</li> <li>3. Detection method of antibody.</li> <li>4. Principles of specimen fixation.</li> <li>5. How to prepare specimens.</li> <li>6. Immunohistochemistry with a fluorescent microscope.</li> <li>7. How to analyze an image obtained by a fluorescent microscope.</li> <li>8. Limitation of immunohistochemistry.</li> </ol> |
| Preparation, review of the class | Review cellular & molecular biology and cell biology at undergraduate course.   |
| Text Book                        | We will prepare printed instructions.   |
| Evaluation Method                | 50% Attitude and attendance to the class; 50% report.   |
| Points of Attention              | Understand cellular & molecular biology and cell biology at undergraduate course sufficiently.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 24   |
| Subject Title                    | Analytical Methodology F   |
| Credit                           | 1  |
| Time                             | Summer Course  |
| Name of Teacher                  | ZHANG Shu-huai, Tomoo MAEDA, Hiroki KOBAYAKAWA   |
| Specific Goals                   | <p>To learn the techniques for analyzing and measuring physical properties and chemical components of agricultural products.</p> <ul style="list-style-type: none"> <li>-How to measure the color and spectral characteristics.</li> <li>-How to measure photosynthesis, chlorophyll, and anthocyanins.</li> <li>-How to measure the chemical components by high performance liquid chromatography.</li> <li>-Statistical method of data.</li> </ul>   |
| Outlines of Class                | Principles and measuring methods of high-performance liquid chromatography, gas chromatography, color and spectroscopic measurement technologies, and also introduce the statistical method.   |
| Content                          | <p>Part 1: Principles of high performance liquid chromatography</p> <p>Part 2: Measurement of chemical composition by high performance liquid chromatography</p> <p>Part 3: Principles of color and spectral characteristics</p> <p>Part 4: Measurement of color, spectral characteristics</p> <p>Part 5: Principles of gas chromatography</p> <p>Part 6: Measurement of photosynthesis, chlorophyll, anthocyanin</p> <p>Part 7: Statistical analysis</p> <p>Part 8: Statistical analysis and discussion</p> |
| Preparation, review of the class | Review the contents of related basic experiments and lectures.   |
| Text Book                        | Distribute reference papers.   |
| Evaluation Method                | Attitude, Understanding (70%),Report (30%)   |
| Points of Attention              | None   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 25   |
| Subject Title                    | Analytical Methodology G   |
| Credit                           | 1  |
| Time                             | Summer Course  |
| Name of Teacher                  | Kazushige Honda, Norimitsu Tanaka  |
| Specific Goals                   | Understand various concepts related to plant breeding of horticultural crop (DP1, DP2, DP3).<br>Aim to learn the basics of related technology (DP1, DP2).  |
| Outlines of Class                | Horticultural crops are cultivated plants that naturally grow in nature and have been improved by humans in various ways since ancient times.<br>Learn related knowledge involved in the breeding of horticultural crop such as cultivation, cultivation management, artificial crossing, plant tissue culture, and gene transfer.<br>Furthermore, actual work, observation, experiments and surveys will also be performed. |
| Content                          | 1. Cultivation and management of horticultural crops<br>2. Artificial crossing<br>3. Plant tissue culture 1. Culture media<br>4. Plant tissue culture 2. Aseptic manipulation<br>5. Plant tissue culture 3. Culture of ovules, anthers, apical meristems, cells<br>6. Cloning of gene<br>7. Transformation<br>8. Data analysis and discussion  |
| Preparation, review of the class | Review the contents of related basic experiments and lectures in the faculty.  |
| Text Book                        | None, give related documents.  |
| Evaluation Method                | A comprehensive evaluation is made based on the degree of participation in the class (50%) and the attitude toward the task (50%).   |
| Points of Attention              | Nothing in particular.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 26   |
| Subject Title                    | Analytical Methodology H   |
| Credit                           | 1  |
| Time                             | Summer Course  |
| Name of Teacher                  | Masatoshi Matsuzaki, Fuminori Kawabata, Hiroki KOBAYAKAWA  |
| Specific Goals                   | Learn about observation methods of animal tissues and cells. Learn the basics of microscopy and the latest bioimaging technology in an intensive lecture format.<br>Understand the characteristics of each observation technique in the lecture part, and understand the process from sample processing to observation in the practical part (DP1, DP3). |
| Outlines of Class                | (1) Learn intracellular calcium imaging techniques.<br>(2) Learn techniques for staining tissue sections, immunohistochemistry, and light microscopy.  |
| Content                          | Part 1: Principle of calcium imaging method<br>Part 2: Cell culture<br>Part 3: Load of calcium fluorescent indicator<br>Part 4: The practice of intracellular calcium imaging<br>Part 5: Staining method for tissue section<br>Part 6: Immunohistochemistry<br>Part 7: Optical microscope<br>Part 8: The practice of optical microscopy                  |
| Preparation, review of the class | We will impose assignment reports, so please review and respond after the class.<br>Also, prepare as needed.   |
| Text Book                        | Distribute the materials related to the lecture.   |
| Evaluation Method                | Participation in lectures / practice: 50%<br>Content in reports and presentations: 50%<br>We plan to judge the above for the final evaluation.   |
| Points of Attention              | Nothing special  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 27  |
| Subject Title                    | Internship  |
| Credit                           | 1   |
| Time                             |   |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | <p>○Through various on-site experiences in society, students establish their own ideas about how to think about employment and how to be a member of society.</p> <p>○Students will gather industry and job research information for job hunting.</p>   |
| Outlines of Class                | <p>Students go to various places of society and have work experiences.</p> <p>Supervisors provide prior and post-mortem guidance for students.</p>  |
| Content                          | <p>The content varies depending on the practice destination.</p> <p>The basic flow when the acceptance destination is decided is as follows.</p> <p>The work experience will proceed according to the instructions of the recipient.</p> <p>1) Advance guidance (conducted by supervisors)</p> <p>2) Work experience</p> <p>3) Post-mortem guidance (conducted by supervisors)</p>  |
| Preparation, review of the class | <p>During the practice, make a memo of the contents of the daily practice and collect materials used during work experience.</p>  |
| Text Book                        | <p>Please prepare if you have instructions from the recipient.</p>  |
| Evaluation Method                | <p>We make comprehensive decisions based on pre-and post-guidance and evaluation by the recipient.</p>  |
| Points of Attention              | <ul style="list-style-type: none"> <li>• Be punctual and follow the instructions of your instructor and act appropriately at the work place. In addition, if there is an accident or other problem during work experience, please contact your supervisor immediately.</li> <li>• In order to receive the practical training, it is mandatory to join insurance [Student Education, Research and Disaster Insurance]</li> </ul> |

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| Subject No                       | 28   |
| Subject Title                    | Special Lecture A (Biology)  |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | <p>Students will be able to understand the specifics of related lecture presentations and develop the ability to use them to progress their research.</p>                  |
| Outlines of Class                | <p>Students will listen to presentations held at academic conferences related to their research field and understand the contents.</p>                                     |
| Content                          | <p>Listen to presentations at academic conferences (including branch meetings, symposiums, and research meetings) and submit a report on the contents of the lectures.</p> |
| Preparation, review of the class | <p>It is important to examine beforehand to listen to presentation and to put together important things.</p>   |
| Text Book                        | <p>If necessary, you will be instructed by your supervisor.</p>  |
| Evaluation Method                | <p>Evaluate the contents of the submitted report and the post-mortem guidance of each supervisor.</p>  |
| Points of Attention              | <p>It is important to examine it beforehand and to put together important things.</p>  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 28  |
| Subject Title                    | Special Lecture A (Biochemistry and Molecular Biology)  |
| Credit                           | 1   |
| Time                             | Follow your supervisor's instructions.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Collecting information at academic societies is a valuable activity in the study of master's degrees. Listening to the lecture presentation at an academic conference and understand its contents is the most important for gathering information. In this lecture, students will understand the specifics of related lecture presentations and develop the ability to use them to progress their research. |
| Outlines of Class                | Participate in academic conferences, listen to lectures and presentations related to your research theme, and understand the contents of them.  |
| Content                          | Listen to presentations at academic conferences (including branch meetings, symposiums, and research meetings) and submit a report on the contents of the lectures.   |
| Preparation, review of the class | If necessary, you will be instructed by your supervisor.  |
| Text Book                        | nothing special   |
| Evaluation Method                | Report and the post-mortem guidance of each supervisor.   |
| Points of Attention              | nothing special   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 28  |
| Subject Title                    | Special Lecture A (Applied Biology and Food Science)  |
| Credit                           | 1   |
| Time                             | At the direction of each supervisor.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Gathering information at academic institutes etc. is an important tool in advancing master's research. Above all, it is the most necessary information gathering to listen to the lecture presentation held in a society etc. and to understand the contents. In this class, we will understand the specific content of relevant lectures and make use of it in our own research progress |
| Outlines of Class                | Listen to the lectures presented at the academic conferences representing your research field and understand the contents   |
| Content                          | Listen to the lecture presentations at academic meetings (including branch meetings, academic symposiums, research meetings, etc.) and submit a report on the contents  |
| Preparation, review of the class | At the direction of each supervisor   |
| Text Book                        |   |
| Evaluation Method                | Evaluate according to the content of the submitted report and the follow-up instruction of each instructor. (100%)  |
| Points of Attention              | At the direction of each supervisor.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 28   |
| Subject Title                    | Special Lecture A (International Agriculture and Horticulture)   |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will be able to understand the specifics of lecture presentations related to their research fields and to use them to progress their research. Understand the know-how to use advanced science and technology in society. |
| Outlines of Class                | Listen to lecture presentations held at academic conferences related to your research field and understand the contents.   |
| Content                          | Listen to presentations at academic conferences (including branch meetings, symposiums, and research meetings) and submit a report on the contents of the lectures.  |
| Preparation, review of the class | It is important to examine beforehand and to put together important things.  |
| Text Book                        | If necessary, you will be instructed by your supervisor.   |
| Evaluation Method                | Report and the post-mortem guidance of each supervisor.  |
| Points of Attention              | It is important to examine it beforehand and to put together important things.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 28   |
| Subject Title                    | Special Lecture A (Agricultural and Environmental Engineering)   |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | It understands basically the research approach and methodology in agricultural and environmental engineering.  |
| Outlines of Class                | Each teacher explains the how to wrestle to a study, research technique, research work of the field and future prospect covered by this course.  |
| Content                          | <ol style="list-style-type: none"> <li>1) Study guidance of agricultural and environmental engineering field (Course chief)</li> <li>2) Environmental measurement and mass transport analysis in agricultural land (Endo)</li> <li>3) Application of geothermal energy to agriculture (Moritani)</li> <li>4) Basic investigation methods for agricultural land (Sasaki)</li> <li>5) How to survey the residents' attitude (Fujisaki)</li> <li>6) Field monitoring methods for farmland (K, Kato)</li> <li>7) Finding and solving issues in a rural environment (Marui)</li> <li>8) Finite element analysis of earth structure (Mori)</li> <li>9) Function of supply of water facilities, an example of the study of fishway facilities (Izumi)</li> <li>10) Predicting soil moisture condition in agricultural lands by using soil physical properties database (C, Kato)</li> <li>11) An introduction on methodology of "Environment Planning on Mountainous area" (Tsou)</li> <li>12)-15) Field work (C, Kato and Fujisaki)</li> </ol> |
| Preparation, review of the class |  |
| Text Book                        |  |
| Evaluation Method                | Report on the averaged evaluation of each report problem submitted by each teacher (100%)  |
| Points of Attention              | The order is changed by teacher's study trips, so be careful about a notice.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 29  |
| Subject Title                    | Special Lecture B(Biology)  |
| Credit                           | 1   |
| Time                             | Follow your supervisor's instructions.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | By becoming interested in a wide range of research topics both inside and outside the field, and by deepening their understanding, students will broaden their master's research and develop originality. |
| Outlines of Class                | Students will listen to seminars on research inside and outside of their specialty and understand the contents.   |
| Content                          | Students will listen to research seminars organized by undergraduate and all-academic studies and seminars in other laboratories, and submit reports on the contents of them.                             |
| Preparation, review of the class | It is important to examine beforehand and to put together important things.   |
| Text Book                        | If necessary, you will be instructed by your supervisor.  |
| Evaluation Method                | Report and the post-mortem guidance of each supervisor.   |
| Points of Attention              | It is important to examine beforehand and to put together important things.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 29  |
| Subject Title                    | Special Lecture B (Biochemistry and Molecular Biology)  |
| Credit                           | 1   |
| Time                             | Follow your supervisor's instructions.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | By becoming interested in a wide range of research topics both inside and outside the field, and by deepening their understanding, students will broaden their master's research and develop originality. |
| Outlines of Class                | Students will listen to seminars on research inside and outside of their specialty and understand the contents.   |
| Content                          | Students will listen to research seminars organized by undergraduate and all-academic studies and seminars in other laboratories, and submit reports on the contents of them.                             |
| Preparation, review of the class | If necessary, you will be instructed by your supervisor.  |
| Text Book                        | nothing   |
| Evaluation Method                | Report and the post-mortem guidance of each supervisor.   |
| Points of Attention              | Nothing special   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 29  |
| Subject Title                    | Special Lecture B(Applied Biology and Food Science)   |
| Credit                           | 1   |
| Time                             | Follow your supervisor's instructions.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | Students need to study with interests in many research fields in this class. This class will improve students' research with a new perspective and a novelty. |
| Outlines of Class                | Lectures in various research fields are provided.   |
| Content                          | Students need to make reports for research seminars including these organized from the university, the faculty, and other laboratories.                       |
| Preparation, review of the class | Follow your supervisor's instructions..   |
| Text Book                        | Follow your supervisor's instructions..   |
| Evaluation Method                | Reports are required and will be scored. Besides, your supervisor will evaluate your attitude to backup instructions after lectures.                          |
| Points of Attention              | Follow your supervisor's instructions..   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 29  |
| Subject Title                    | Special Lecture B (International Agriculture and Horticulture)  |
| Credit                           | 1   |
| Time                             | Follow your supervisor's instructions.  |
| Name of Teacher                  | Supervisor  |
| Specific Goals                   | By becoming interested in a wide range of research topics both inside and outside the field, and by deepening their understanding, students will broaden their master's research and develop originality. |
| Outlines of Class                | Students will listen to seminars on research inside and outside of their specialty and understand the contents.   |
| Content                          | Students will listen to research seminars organized by undergraduate and all-academic studies and seminars in other laboratories, and submit reports on the contents of them.                             |
| Preparation, review of the class | It is important to examine beforehand and to put together important things.   |
| Text Book                        | If necessary, you will be instructed by your supervisor.  |
| Evaluation Method                | Report and the post-mortem guidance of each supervisor.   |
| Points of Attention              | Nothing special   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 29   |
| Subject Title                    | Special Lecture B (Agricultural and Environmental Engineering)   |
| Credit                           | 1  |
| Time                             | Follow your supervisor's instructions.   |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will understand the measures taken towards the stability and abolition of a bank of reservoir (conducted by Mori).<br>Students will understand the characteristics, problems, and countermeasures of farmland (paddy fields, orchards) (Conducted by Kato)  |
| Outlines of Class                | It consists of two parts: the first half and the second half.<br>In the first half, we will deepen our understanding of the stability and abolition of a bankbody of reservoir by conducting on-site surveys.<br>In the second half, students will understand the characteristics, problems, and countermeasures of farmland from the viewpoint of improving the physical and chemical properties of farmland and preserving soils. Students will deepen considerations through field surveys and physical properties tests in farmland. |
| Content                          | 1. the measures taken towards the stability and abolition of a bank of reservoir<br>2~4. Field survey and summary<br>5. the characteristics, problems, and countermeasures of farmland (paddy fields, orchards)<br>6~8. Field survey and summary   |
| Preparation, review of the class | In the first half, students review water supply engineering and read related articles obtained from the Web.<br>In the second half, students review soil physics and farmland engineering and read the pre-distributed materials.<br>In both the first and the second half of the class, students will submit the report after the 4th class.  |
| Text Book                        | If necessary, you will be instructed by your supervisor.   |
| Evaluation Method                | Evaluate the average score of the first half and the second half.<br>Active participation in class, homeworks 30%<br>Report 70%  |
| Points of Attention              | Nothing special  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 30   |
| Subject Title                    | Overseas internship  |
| Credit                           | 1  |
| Time                             |  |
| Name of Teacher                  | Supervisor   |
| Specific Goals                   | Students will be able to manage research abroad  |
| Outlines of Class                | Visiting overseas research organization or company related to each research theme  |
| Content                          | Contact with counterparts overseas and arrange the schedule. Then, visit and do research or collaborate on works. After the internship, each student submits a report as a summary of the experience to be evaluated by the adviser. |
| Preparation, review of the class | Increase English ability   |
| Text Book                        | None   |
| Evaluation Method                | Report   |
| Points of Attention              | None   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 31   |
| Subject Title                    | Nature of the Shirakami Mountains  |
| Credit                           | 1  |
| Time                             | Intensive course in spring term  |
| Name of Teacher                  | Nakamura Takeyuki and Yamagishi Hiroki   |
| Specific Goals                   | Learning ecosystem and biodiversity of the Shirakami Mountains (including the World Natural Heritage site) and understanding the present condition of the nature and the impact of environmental changes. Understanding the meaning and methodology of investigating natural history   |
| Outlines of Class                | After lectures on the characteristics of the Shirakami Mountains, you will actually visit some parts of the Mountains with guidance from three staff members of the Shirakami Center for Environmental Sciences, Hirosaki Univ.  |
| Content                          | 1 The Shirakami Mountains as a World Natural Heritage Site (Ishikawa) 2 Vegetations of the Shirakami Mountains (Ishikawa) 3 Changes in the nature of the Shirakami Mountains (Yamagishi) 4 Biodiversity in the Shirakami Mountains, and methods of field investigations (Nakamura) 5–8 Field work (1 biodiversity and methods of investigation) 9–12 Field work (2 vegetations and their changes) 13–16 Field work (3 environmental education) |
| Preparation, review of the class | You are expected to remember what you learned in the classes before the field work   |
| Text Book                        | Handout will be distributed when necessary   |
| Evaluation Method                | Small tests after lectures (20%), report (80%)   |
| Points of Attention              | Suitable clothing, gumboots (or mountain boots) and rainwear are necessary for the field work  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 32   |
| Subject Title                    | Forest Conservation Ecology  |
| Credit                           | 1  |
| Time                             | 4 period, Thursday, 3 semester   |
| Name of Teacher                  | Ishida Kiyoshi   |
| Specific Goals                   | The goal of this class is to review impacts of human activities on forest ecosystems and tree communities in order to understand current status and future of the ecosystems with respect to ecology and conservation biology.   |
| Outlines of Class                | I will give a lecture about impacts of human activities on forest communities and their ecosystems, focusing on consequences of (1) environmental modifications, (2) forestry, and (3) climate change. All participants will present related papers and discuss in terms of these issues.  |
| Content                          | <p>1: lecture: conservation biology</p> <p>2: lecture: impacts of environmental modification</p> <p>3: lecture: impacts of forestry</p> <p>4: lecture: impacts of climate change</p> <p>5: presentation about related papers by participants and discussion (1)</p> <p>6: presentation about related papers by participants and discussion (2)</p> <p>7: presentation about related papers by participants and discussion (3)</p> <p>8: presentation about related papers by participants and discussion (4)</p> |
| Preparation, review of the class | Participants had better to read books about forest ecology and conservation biology.   |
| Text Book                        | Original prints prepared for the class   |
| Evaluation Method                | Grades are evaluated on the basis of participant's presentations.  |
| Points of Attention              | Nothing Special  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 33  |
| Subject Title                    | Practice of Forest Conservation Ecology   |
| Credit                           | 1   |
| Time                             | Summer Course   |
| Name of Teacher                  | Ishida Kiyoshi and Yamao Akira  |
| Specific Goals                   | The goal of this practice is to understand ecological characteristics of forest ecosystems and impacts of human activities on the ecosystems in northern Japan through field observations on various aspects of forest communities such as structure and species composition as well as growth habits and regeneration pattern of tree species.   |
| Outlines of Class                | We will have one night and two days- and one day- excursions (three days in total) in northern Tohhoku district and southern Hokkaido in late August or September to learn ecological characteristics of forest ecosystems and impacts of human activities on the ecosystems in these areas. Participants have to pay expenses for the excursions. Participants are informed about detailed plans such as dates and expenses for the excursions in July.                |
| Content                          | <ol style="list-style-type: none"> <li>1: Lecture: methods of observation</li> <li>2: Tree species in natural forests</li> <li>3: Community structures of natural forests</li> <li>4: Tree species in semi-natural forests</li> <li>5: Community structures of semi-natural forests</li> <li>6: The northernmost beech forests</li> <li>7: Natural coniferous forests</li> <li>8: Lecture: Ecological characteristics of forest ecosystems in northern Japan</li> </ol> |
| Text Book                        | Original prints prepared for the practice   |
| Preparation, review of the class | Participopants had better to read books about forest ecology to prepare the practice.   |
| Evaluation Method                | Grades are evaluated by reports on the excursion.   |
| Points of Attention              | Nothing Special   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 34  |
| Subject Title                    | Community Ecology   |
| Credit                           | 1   |
| Time                             | 4 period, Friday, 1 semester  |
| Name of Teacher                  | Akira Yamao   |
| Specific Goals                   | Understunding the basic theories of community ecology                       |
| Outlines of Class                | To explain the basic theories of community of ecology with some examples    |
| Content                          | Plasentations on the basic theories of community ecology with some examples |
| Preparation, review of the class | None  |
| Text Book                        | Searse Community Ecology  |
| Evaluation Method                | By evaluating the quality of reports  |
| Points of Attention              | None  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 35  |
| Subject Title                    | Advanced Plant Molecular Physiology   |
| Credit                           | 1   |
| Time                             | 2 period, Wednesday, 1 semester   |
| Name of Teacher                  | Hiroshi Ohkawa  |
| Specific Goals                   | The goals of this course are :<br>1) to obtain basic knowledge about the technology and analytical methods used in plant science(targeted plants and micro-algae as photosynthetic organisms).<br>2) to be able to understand and explain these principles.                                   |
| Outlines of Class                | This course deals with the principles of analytical methods used in plant science (ex. physiology, biochemistry, biotechnology and molecularbiology). It also enhances the development of student's skills in making oral presentations (in Japanese or English) and self-regulated learning. |
| Content                          | 1) Guidance<br>2) Group discussions on the presenters' chosen topics<br>3-4) Material research and preparation for presentation<br>5-7) Presentation and discussion of technology and analytical methods used in plant science.<br>8) summary   |
| Text Book                        | Nothing Special   |
| Preparation, review of the class | Nothing Special   |
| Evaluation Method                | Class attendance and attitude in class and presentation reports (100%)  |
| Points of Attention              | It is desirable for students to have learned plant physiology or engaged in related research.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 36   |
| Subject Title                    | Plant Structure and Function A   |
| Credit                           | 1  |
| Time                             | Summer Course  |
| Name of Teacher                  | Hiroshi Ohkawa   |
| Specific Goals                   | At the end of the course, participants are expected to understand the relationship between function and morphology in plants, and acquire the fundamental skills for morphological and taxonomical analyses of plants. |
| Outlines of Class                | This course deals with the survey method of vegetation, classification of plant species and preparation of herbarium specimens through the field work and the laboratory experiment.                                   |
| Content                          | 1. Identification and classification of plants<br>2. Tissue observation (reproductive organs: flowers)<br>3. Tissue observation (leaves etc.)<br>4. Making of herbarium specimen<br>5. Review and Discussion           |
| Preparation, review of the class | Students need to check some related materials to write their reports.  |
| Text Book                        | Reading of reference materials and review of the field works.  |
| Evaluation Method                | Your overall grade in the class will be decided based on the following:<br>Quality of the students' experimental performance and Reports (100%)  |
| Points of Attention              | This lecture will be encouraged to take together with Plant Structure and Function B.  |

|                     |  |
|---------------------|--|
| Subject No          | 37   |
| Subject Title       | Techniques for Wildlife Investigations   |
| Credit              | 1  |
| Time                | Summer Course  |
| Name of Teacher     | Nobuyuki AZUMA   |
| Specific Goals      | Learning of observation, catching, measurement and analysis methods for investigation of wildlife and ecosystem.   |
| Outlines of Class   |  |
| Content             | <ol style="list-style-type: none"> <li>1. Fish capturing method: dip net</li> <li>2. Fish capturing method: electric shocker</li> <li>3. Fish capturing method: traps</li> <li>4. Rearing technique</li> <li>5. Bird capturing method and sample collection 1</li> <li>6. Bird capturing method and sample collection 2</li> <li>7. Environment measurement: chemical environment</li> <li>8. Environment measurement: physical environment</li> </ol> |
| Text Book           | none in particular   |
| Evaluation Method   | Report (100%)  |
| Points of Attention | Basic knowledge of field activity  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 38  |
| Subject Title                    | Ecological Engineering  |
| Credit                           | 1   |
| Time                             | 2period, Monday, 3semester  |
| Name of Teacher                  | Nobuyuki AZUMA  |
| Specific Goals                   | Learning of practice to nature conservation and restoration based on the knowledge of ecology. Incubation of approach and technology for SDGs.  |
| Outlines of Class                | Study about recent research of Conservation biology and Ecological engineering  |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Matter cycle in ecosystem</li> <li>3. Habitat selection in animals for conservation</li> <li>4. Habitat restoration</li> <li>5. Interaction between organisms; symbiosis</li> <li>6. Interaction between organisms; predator and prey relationships</li> <li>7. About SDGs</li> <li>8. Discussion</li> </ol> |
| Preparation, review of the class | Distribution of document  |
| Text Book                        | Distribution of research articles   |
| Evaluation Method                | Report (100%)   |
| Points of Attention              | Basic knowledge of ecology, conservation and nature restoration   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 39   |
| Subject Title                    | Cytogenetics   |
| Credit                           | 1  |
| Time                             | 5 period, Friday, 3 semester   |
| Name of Teacher                  | Masaki Kuro-o  |
| Specific Goals                   | The goal is to learn about the deep topics related to cytogenetics and the students' research fields related to genetics, and to deepen their understanding. |
| Outlines of Class                | Each student introduces the articles related to cytogenetics and students' research, and discusses it with all members.                                      |
| Content                          | First : guidance<br>The second to eighth : seminars will be presented by the students in turn.   |
| Preparation, review of the class | The presenter should be prepared enough.   |
| Text Book                        | Nothing in particular  |
| Evaluation Method                | As a general rule, we evaluate your approach to lectures, but in some cases you may be charged a report. (100%)  |
| Points of Attention              | Listen carefully to other students' presentations and try to understand them.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 40  |
| Subject Title                    | Molecular Development Biology   |
| Credit                           | 1   |
| Time                             | 3 period, Thursday, 3 semester  |
| Name of Teacher                  | Wataru Yoshida  |
| Specific Goals                   |   |
| Outlines of Class                |   |
| Content                          |   |
| Preparation, review of the class |   |
| Text Book                        | Developmental Biology 12th Ed. Barresi and Gilbert Oxford University press 2019 |
| Evaluation Method                |   |
| Points of Attention              |   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 41   |
| Subject Title                    | Practice of Aquaculture                        |
| Credit                           | 1  |
| Time                             | Summer Course                                  |
| Name of Teacher                  | Wataru Yoshida                                 |
| Specific Goals                   |  |
| Outlines of Class                |  |
| Content                          |  |
| Preparation, review of the class |  |
| Text Book                        | A Handbook of Fisheries Science ( in Japanese) |
| Evaluation Method                |  |
| Points of Attention              |  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 42  |
| Subject Title                    | A Compendium of Animal Behavior   |
| Credit                           | 1   |
| Time                             | 5 period, Tuesday, 4 semester   |
| Name of Teacher                  | Atsushi Sogabe  |
| Specific Goals                   | Ethology, which aims at scientific understanding of animal behavior, involves diverse research field. In this course, we will study modern behavioral sciences, which can be advanced using various methods proposed in the latest research articles. |
| Outlines of Class                | Students introduce research papers on animal behavior conducted using the latest methods, and discuss them on groups.   |
| Content                          | 1. Guidance<br>2. - 7. Article introduction and group discussion<br>8. Summary  |
| Preparation, review of the class | Preparations such as translating English into Japanese are essential for introducing articles to the class.   |
| Text Book                        | Distributed as needed.  |
| Evaluation Method                | The quality of presentation (70%) and active participation in group discussion (30%).   |
| Points of Attention              | Nothing special   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 43   |
| Subject Title                    | Practice of animal behavioral science  |
| Credit                           | 1  |
| Time                             | Summer Course  |
| Name of Teacher                  | Atsushi Sogabe   |
| Specific Goals                   | Through behavioral observation and experiments of marine animals, we aim to acquire basic research methods of behavioral science and cultivate eyes to scientifically understand animal behavior.  |
| Outlines of Class                | Using marine animals living around the Fukaura Laboratory, we observe their behavior and conduct experiments to examine the function of behavior.  |
| Content                          | Intensive lecture during the summer vacation at Fukaura Laboratory (3 days)<br>-Day1<br>1. Sampling of marine animals<br>2. Identification of species<br>3. Behavioral observation of marine animals in natural environment (Practice of individual marking)<br>-Day2<br>4. Captive or field experiment to examine the function of behavior. Data analysis and interpretation of results<br>5. Group discussions |
| Preparation, review of the class | Be sure to attend the guidance before deciding to attend this lecture. Learn in advance about animal behavioral science and marine biology, and review it after practice.  |
| Text Book                        | Distribute materials as necessary.   |
| Evaluation Method                | Scores are assessed based on active participation in practices (75%) and discussion (25%).   |
| Points of Attention              | It is necessary to enter the sea to collect living materials. In order to work safely, prepare swimming suits (e.g., lycra), marine shoes, gloves and diving mask yourself.<br>Please note that the contents of the class may change depending on the status of the COVID-19 epidemic.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 44  |
| Subject Title                    | Field study of Arthropods   |
| Credit                           | 1   |
| Time                             | 1 period, Monday, 2 semester  |
| Name of Teacher                  | Hiroshi Ikeda   |
| Specific Goals                   | To understand methods of field studies of Arthropods.   |
| Outlines of Class                | Introduction of several study methods, and doing experiments using some of these methods.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction of study methods</li> <li>2. Planning experiments</li> <li>3. Experiment 1-1</li> <li>4. Experiment 1-2</li> <li>5. Experiment 2-1</li> <li>6. Experiment 2-2</li> <li>7. Data analysis 1</li> <li>8. Data analysis 2</li> </ol> |
| Preparation, review of the class | Students need to check some related materials to write their reports.   |
| Text Book                        | Nothing special   |
| Evaluation Method                | Based on the quality of the reports   |
| Points of Attention              | Nothing special   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 45   |
| Subject Title                    | Reproductive Biology   |
| Credit                           | 1  |
| Time                             | 3 period, Tuesday, 1 semester  |
| Name of Teacher                  | Kazuya Kobayashi   |
| Specific Goals                   | Recent developments in molecular biology allowed the fusion of developmental biology and evolutionary biology, creating a new discipline called 'EvoDevo'. The evolutionary theory that began with Darwin's "The Origin of Species" is no longer a theory, but a study of solid facts. The objective evidence (commonality) engraved in the gene, which is the blueprint of life, certainly demonstrated that the organisms were given rise from a monophyletic evolution. When we consider the studies following the success of EvoDevo that unravels evolution from the genome, we can expect the era of molecular evolution ecology ('EvoEco') to unravel evolution from the behavior of the organism itself. In this course, students will understand the findings of recent research on evolution from the three perspectives of "ecology", "developmental biology" and "reproductive biology" and discuss next-generation biological research. |
| Outlines of Class                | Students have to find papers related to this lecture and introduce them in a seminar style. After that we discuss the presentation contents.   |
| Content                          | The 1st lecture: Guidance.<br>The 2nd–7th lectures: Presentation and discussion.<br>The 8th lecture: Retrospective assessment and criticism  |
| Preparation, review of the class | Students must select relevant papers and prepare a presentation in a seminar style.  |
| Text Book                        | Reading materials will be distributed as appropriate.  |
| Evaluation Method                | Students are evaluated on their active participation in class..  |
| Points of Attention              | Nothing special  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 46  |
| Subject Title                    | Practice of Reproductive Biology  |
| Credit                           | 1   |
| Time                             | Summer Course   |
| Name of Teacher                  | Kazuya Kobayashi  |
| Specific Goals                   | Students gain motivation for biological research through observation and experimentation of biological phenomena related to developmental and reproductive biology.           |
| Outlines of Class                | Students observe and perform experiments on biological phenomena related to developmental and reproductive biology using animals collected around the Fukaura Marine Station. |
| Content                          | Day 1: Observation of embryogenesis in Polyclads<br>Day 2: Collecting and observing 'radula' in Gastropoda  |
| Preparation, review of the class | Guidance will be given before the practice.   |
| Text Book                        | Reading materials will be distributed as appropriate.   |
| Evaluation Method                | Students are evaluated on their active participation in class..   |
| Points of Attention              | The training period will be decided and announced during May.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 47  |
| Subject Title                    | Research History in Biology   |
| Credit                           | 1   |
| Time                             | 2 period, Monday, 1 semester  |
| Name of Teacher                  | Atsuo Nishino   |
| Specific Goals                   | <p>Understanding the historical background of each student's research.<br/> Positioning their own research aims in the historical context of biology.<br/> Through studies in this class, participants are expected to become aware of the points listed below;</p> <ol style="list-style-type: none"> <li>1. What are your research aims, and what is the historical significance of your research aims?</li> <li>2. What kind of problems has your research field tried to resolve?</li> <li>3. What kind of premise is your research based on? How did such premise historically emerge?</li> <li>4. What is new in your research?</li> </ol>  |
| Outlines of Class                | <p>A long history of biological researches has accumulated a large amount of knowledge obtained by invaluable effort made by researchers in the past. Technology to gain and improve the knowledge has also developed much during the history. In this class, every participant is expected to gain experience in reinterpreting their own research aims from the historical point of view. After careful consideration on what is new and what is scientifically interesting in their own research, they would be expected to be able to persuade others to understand the significance of their research. In this class, participants would also learn some essential features of scientific writing.</p> |
| Content                          | <p>During the first 2 lessons at least, some lectures on scientific writing will be given. From the 4th lesson, every participant will give one 30-minute presentation to explain the historical background and significance of their own research.</p> <ol style="list-style-type: none"> <li>1. Guidance</li> <li>2. Science writing: fact and opinion</li> <li>3. Premises and conclusions</li> <li>4. Presentation and Discussion 1</li> <li>5. Presentation and Discussion 2</li> <li>6. Presentation and Discussion 3</li> <li>7. Presentation and Discussion 4</li> <li>8. Presentation and Discussion 5, Summarization</li> </ol>   |
| Preparation, review of the class | <p>Before their presentation turn, every presenter has to study by themselves the research history that has led them to their own research aims, and has to prepare to show what they understood in front of other participants.</p>  |
| Text Book                        | "Rikakei-no Sakubun-gijutsu" K. Kinoshita, Chuko-Shinsho. (In Japanese)   |
| Evaluation Method                | <p>Active participation and the quality of performance in presentation as well as in discussion are evaluated.</p>  |
| Points of Attention              | <p>Every participant is expected to make effort to understand other's research and show interest in it.</p>   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 48  |
| Subject Title                    | Marine Invertebrate Zoology Field Course  |
| Credit                           | 1   |
| Time                             | Summer Course   |
| Name of Teacher                  | Atsuo Nishino   |
| Specific Goals                   | Participants are expected to become aware of a wide diversity of animal body plans and physiological properties through this practical learning of marine invertebrate animals.   |
| Outlines of Class                | At Fukaura Marine Biological Station, which belongs to the Faculty of Agriculture and Life Science, Hirosaki Univ., participants will be engaged in collecting and classifying marine invertebrate animals. Using collected animals, some physiological experiments such as neuronal activity, fertilization, circadian rhythm, photosensing and locomotion will be planned and tried. A schedule and detailed programme will be given in "the class guidance".   |
| Content                          | <p>Participants will get into the sea (shallow water) to collect marine animals. After taking them back to Fukaura Station, they will observe the animals well and try to classify them. Using the animals collected some physiological experiments will be tried.</p> <ol style="list-style-type: none"> <li>1. Sample collection of marine invertebrates</li> <li>2. Classification</li> <li>3. Observation</li> <li>4. Measurement</li> <li>5. Preparation for physiological experiments</li> <li>6. Physiological experiments; quantification</li> <li>7. Discussion</li> </ol> |
| Preparation, review of the class | Indicated before or during the class (e.g., in the "class guidance")  |
| Text Book                        | If you have some guidebooks to marine invertebrate animals, read them in advance. Snokels or marine boots, etc. would be very useful.   |
| Evaluation Method                | Active participation and the quality of performance are evaluated.  |
| Points of Attention              | Every participant is expected to feel positive about touching marine invertebrates. For participants who are scared of doing so, this class will be just a too-tough/too-hard experience.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 49   |
| Subject Title                    | Molecular Cell Biology   |
| Credit                           | 1  |
| Time                             | 5 period, Thursday, 1 semester   |
| Name of Teacher                  | Michiko Sasabe   |
| Specific Goals                   | <p>The goals of this course are to help students</p> <ul style="list-style-type: none"> <li>- be able to understand and explain the characteristics and molecular mechanisms of cell division systems in animals and plants,</li> <li>- be able to understand and explain the relationship between cell division and differentiation during development,</li> <li>- be able to evaluate important studies in this field in terms of their methods, results and conclusions, and state their own opinions.</li> </ul> |
| Outlines of Class                | This course introduces the molecular mechanisms of cell division system in animals and plants with the latest knowledge.   |
| Content                          | <ol style="list-style-type: none"> <li>1. History of the study of cell division in plants and animals</li> <li>2-3. Molecular Mechanisms of replication and distribution of chromosome</li> <li>4-5. Mechanisms of M phase spindle formation and cytoskeletal dynamics</li> <li>6-7. Molecular mechanisms of cytokinesis in plants and animals</li> <li>8. Review and discussion</li> </ol>  |
| Preparation, review of the class | Reading reference materials and reviewing each lecture.  |
| Text Book                        | Reference materials for lectures will be distributed.  |
| Evaluation Method                | <p>Your overall grade for the course will be decided based on the following:</p> <ul style="list-style-type: none"> <li>- Continuous assessment: 50%</li> <li>- Reports: 50%</li> </ul>  |
| Points of Attention              | Need knowledge of the basics of cell biology.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 50   |
| Subject Title                    | Plant Structure and Function B   |
| Credit                           | 1  |
| Time                             | Summer Course  |
| Name of Teacher                  | Michiko Sasabe   |
| Specific Goals                   | At the end of the course, participants are expected to understand the relationship between morphology and function in plants, and acquire the fundamental skills in morphological and taxonomical analyses of plants.  |
| Outlines of Class                | This course deals with methods of vegetation surveys, classification of plant species and preparation of herbarium specimens through the field work and the laboratory experiment.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Identification and classification of plants</li> <li>2. Tissue observation (reproductive organs: flowers)</li> <li>3. Tissue observation (leaves etc.)</li> <li>4. Making of herbarium specimen</li> <li>5. Review and Discussion</li> </ol> |
| Preparation, review of the class | Reading of reference materials and review of the field works.  |
| Text Book                        | Reference materials for field work and lab training will be distributed.   |
| Evaluation Method                | Your overall grade for the course will be decided based on the following: <ul style="list-style-type: none"> <li>- Quality of your experimental performance: 50%</li> <li>- Reports: 50%</li> </ul>  |
| Points of Attention              | Students will be encouraged to take this course together with Plant Structure and Function A   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 51   |
| Subject Title                    | Fluorescent Protein  |
| Credit                           | 1  |
| Time                             | 3 period, Tuesday, 3 semester  |
| Name of Teacher                  | Sosuke Iwai (Faculty of Education)   |
| Specific Goals                   | The aim of this course is to understand the principles of fluorescent proteins, other light-emitting and -dependent proteins, and imaging techniques utilizing these proteins.   |
| Outlines of Class                | Fluorescent proteins such as GFP play important roles in bioimaging. This course first introduces the principles of some kinds of microscopy used for fluorescence imaging. Then, it deals with fluorescent proteins, other light-emitting and -dependent proteins, and various imaging techniques using these proteins.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Fluorescence and principle of fluorescence microscopy</li> <li>3. Fluorescent staining of cells</li> <li>4. Confocal laser scanning microscopy and other super resolution microscopy</li> <li>5. Fluorescent proteins (1) The discovery of GFP</li> <li>6. Fluorescent proteins (2) Fluorescent resonance energy transfer and its application</li> <li>7. Fluorescent proteins (3) Other applications</li> <li>8. Luminescent proteins, optogenetics</li> </ol> |
| Preparation, review of the class | To better understand, the students are expected to read the books introduced in the class.   |
| Text Book                        | Textbooks are not used. Handouts will be provided.   |
| Evaluation Method                | Grade will be calculated according to the following processes:<br>Usual performance score 30%, Final report 70%.   |
| Points of Attention              | Basic knowledge for biology and physics will ease the learning.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 52  |
| Subject Title                    | Intracellular symbiosis   |
| Credit                           | 1   |
| Time                             | 5 period, Monday, 3 semester  |
| Name of Teacher                  | Sosuke Iwai (Faculty of Education)  |
| Specific Goals                   | The aim of this course is to understand the evolution of the organelles originated from intracellular symbiosis and various intracellular symbioses that are widely distributed in nature.  |
| Outlines of Class                | Intracellular symbioses are one of driving forces of the evolution of eukaryotic cells; they are also widespread in nature and play important roles in ecosystems. This course first introduces the evolution of mitochondria and plastid, both of which were originated from intracellular symbiosis. Then, it deals with various intracellular symbioses that are found in nature today. Students are required to read concerned papers and to introduce them in the class. |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Origin of mitochondria</li> <li>3. Origin of plastid and its diversification</li> <li>4. Photosynthetic endosymbionts</li> <li>5. Chemosynthetic endosymbionts</li> <li>6. Mathematical models for evolution of endosymbioses (1)</li> <li>7. Mathematical models for evolution of endosymbioses (2)</li> <li>8. Review</li> </ol>   |
| Preparation, review of the class | The students who will introduce the papers in the class are required to read them carefully and to prepare for the presentation.  |
| Text Book                        | Textbooks are not used. Handouts and papers will be provided.   |
| Evaluation Method                | Grade will be calculated according to the following processes:<br>Presentation and discussion 50%, Final report 50%.  |
| Points of Attention              | Basic knowledge for cellular biology and mathematics will be demanded.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 53  |
| Subject Title                    | Advanced Animal Taxonomy  |
| Credit                           | 1   |
| Time                             | Summer Course   |
| Name of Teacher                  | Nakamura Takeyuki   |
| Specific Goals                   | <p>Students will recognize the needs of proper identification of species for scientific studies</p> <p>Students will understand how to identify specimens</p> <p>Students will understand the roles of specimens in Taxonomy, and to practice the way how to make and maintenance specimens</p>   |
| Outlines of Class                | <p>After short lectures on taxonomy, identification and specimens, you actually collect marine animals along the sea coast in front of the Marine Experiment Station, and learn the way to identify species, how to make specimens and how to maintain old specimens.</p>   |
| Content                          | <ol style="list-style-type: none"> <li>1 Taxonomy and identification</li> <li>2 Taxonomy and specimens, roles of collection</li> <li>3 Collecting</li> <li>4 Identification using literature</li> <li>5 Identification using reference collection</li> <li>6 Making specimens</li> <li>7 Maintenance of specimens</li> <li>8 Discussions</li> </ol> |
| Preparation, review of the class | You are expected to prepare for the class   |
| Text Book                        | Handouts will be distributed when necessary   |
| Evaluation Method                | Attitudes (20%), report (80%)   |
| Points of Attention              | Make contact with Nakamura and ask for guidance beforehand.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 54  |
| Subject Title                    | Plant Taxonomy  |
| Credit                           | 1   |
| Time                             | Summer Course   |
| Name of Teacher                  | Hiroki Yamagishi  |
| Specific Goals                   | <p>1. Students will understand the history of plant taxonomy and its significance from social background and botanist achievements.</p> <p>2. Students will understanding and practice about plant taxonomy; naming and describing, identifying, and classifying of plants.</p>   |
| Outlines of Class                | <p>In this course, we will use wild plants and specimens that actually grow in the Shirakami Mountains as much as possible. Moreover, we will observe the wild plants in the field, and make the plants specimen actually, to experience the diversity and evolution of wild plants.</p>  |
| Content                          | <ol style="list-style-type: none"> <li>1. History of plant taxonomy</li> <li>2. Nomenclature of plants, Classification system of plants</li> <li>3. Observation and classification of plants : Charophytes, Bryophyta, Pteridophyta</li> <li>4. Observation and classification of plants : Spermatophyta</li> <li>5. Making plants specimen (1) How to sampling</li> <li>6. Making plants specimen (2) How to forming, drying</li> <li>7. Making plant specimen (3) Making data label and maintenance of specimens</li> <li>8. Plant taxonomy and conservation ecology</li> </ol> |
| Preparation, review of the class | Students will be notified before lesson   |
| Text Book                        | Handouts will be distributed when necessary   |
| Evaluation Method                | Reports (100%)  |
| Points of Attention              | Make contact with Yamagishi and ask for guidance beforehand.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 55   |
| Subject Title                    | Biochemistry A   |
| Credit                           | 1  |
| Time                             | 2 period, Tuesday, 1 semester  |
| Name of Teacher                  | Kimitoshi Sakamoto   |
| Specific Goals                   | <ul style="list-style-type: none"> <li>○To memorize the single-letter amino acid code</li> <li>○To understand basic procedures for protein research</li> <li>○To understand the principles of general methods for protein purification</li> </ul>  |
| Outlines of Class                | The principles of basic procedures and analytical techniques for protein research will be studied.   |
| Content                          | <ul style="list-style-type: none"> <li>1: Structures of amino acids and proteins</li> <li>2: Methods and principles of protein determination</li> <li>3: Methods and principles of protein purification</li> <li>4: How to prepare protein sample for chromatography</li> <li>5: Column chromatography (1) ion exchanger, gel filtration</li> <li>6: Column chromatography (2) HPLC</li> <li>7: Protein analysis for its physical and chemical properties</li> </ul> |
| Preparation, review of the class | Look for any relevant information about what you learned in class.   |
| Text Book                        |  |
| Evaluation Method                | report (100%)  |
| Points of Attention              | Nothing Special  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 56   |
| Subject Title                    | Biochemistry B   |
| Credit                           | 1  |
| Time                             | 2 period, Tuesday, 2 semester  |
| Name of Teacher                  | Kimitoshi Sakamoto   |
| Specific Goals                   | <ul style="list-style-type: none"> <li>○To understand the production and purification methods of recombinant protein</li> <li>○To understand a variety of techniques for protein analysis</li> <li>○To understand a variety of techniques for enzyme activity measurement</li> </ul>   |
| Outlines of Class                | The principles of basic and applied procedures and analytical techniques for protein research will be studied from their principle.  |
| Content                          | <ul style="list-style-type: none"> <li>1: Protein sequencing</li> <li>2: Recombinant protein production</li> <li>3: Mutation introduction in recombinant protein</li> <li>4: Rapid protein purification by affinity chromatography</li> <li>5: How to analyze protein interactions</li> <li>6: Analysis of post translational modification</li> <li>7: A variety of enzyme activity measurement</li> </ul> |
| Preparation, review of the class | Look for any relevant information about what you learned in class.   |
| Text Book                        | Original prints prepared for the practice  |
| Evaluation Method                | report (100%)  |
| Points of Attention              | Nothing Special  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 57  |
| Subject Title                    | Molecular Biology A   |
| Credit                           | 1   |
| Time                             | 1 period, Friday, 3 semester  |
| Name of Teacher                  | Hyota Himeno  |
| Specific Goals                   | The aim of this course is to help students understand the progress in molecular biology through an introduction of recent literature on the subject.  |
| Outlines of Class                | Students will introduce research papers on molecular biology and discuss them.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Orientation</li> <li>2. Introduction of research papers on molecular biology and discussion (1) transcription</li> <li>3. Introduction of research papers on molecular biology and discussion (2) post-transcriptional modification</li> <li>4. Introduction of research papers on molecular biology and discussion (3) translation</li> <li>5. Introduction of research papers on molecular biology and discussion (4) post-translational modification</li> <li>6. Introduction of research papers on molecular biology and discussion (5) RNA</li> <li>7. Introduction of research papers on molecular biology and discussion (6) RNA complex</li> <li>8. Introduction of research papers on molecular biology and discussion (7) discussion</li> </ol> |
| Preparation, review of the class | Nothing Special   |
| Text Book                        | Nothing Special   |
| Evaluation Method                | Your final grade will be determined based on the quality of your presentation and your attitudes in class.  |
| Points of Attention              | Nothing Special   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 58   |
| Subject Title                    | Molecular Biology B  |
| Credit                           | 1  |
| Time                             | 1 period, Friday, 4 semester   |
| Name of Teacher                  | Hyota Himeno   |
| Specific Goals                   | The aim of this course is to help students understand the progress in the molecular biology through an introduction of recent literature on the subject.   |
| Outlines of Class                | Students should be able to understand research papers on molecular biology. This course will be taught in Japanese. However, all of the presentation slides are in English.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Orientation</li> <li>2. Introduction of research papers on molecular biology and discussion (1) transcription</li> <li>3. Introduction of research papers on molecular biology and discussion (2) post-transcriptional modification</li> <li>4. Introduction of research papers on molecular biology and discussion (3) translation</li> <li>5. Introduction of research papers on molecular biology and discussion (4) post-translational modification</li> <li>6. Introduction of research papers on molecular biology and discussion (5) RNA</li> <li>7. Introduction of research papers on molecular biology and discussion (6) RNA complex</li> </ol> |
| Preparation, review of the class | Nothing Special  |
| Text Book                        | Nothing Special  |
| Evaluation Method                | Your final grade will be determined based on the quality of your presentation and your attitudes in class.   |
| Points of Attention              | Nothing Special  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 59  |
| Subject Title                    | Structural Biology A  |
| Credit                           | 1   |
| Time                             | 1 period, Monday, 3 semester  |
| Name of Teacher                  | Daisuke Kurita  |
| Specific Goals                   | The aim of this course is to understand the structure-function relationship in biomacromolecules such as protein and RNA.   |
| Outlines of Class                | Students should be able to help students understand the research papers on their research fields. This course will be taught in Japanese. However all of the presentation slides are in English.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Orientation</li> <li>2. Introduction of research papers and Discussion</li> <li>3. Introduction of research papers and Discussion</li> <li>4. Introduction of research papers and Discussion</li> <li>5. Introduction of research papers and Discussion</li> <li>6. Introduction of research papers and Discussion</li> <li>7. Introduction of research papers and Discussion</li> <li>8. Introduction of research papers and Discussion</li> </ol> |
| Preparation, review of the class | I highly recommend students to prepare a presentation by reading original papers.   |
| Text Book                        | Nature, Science, Cell, Molecular Cell, Nature Structural & Molecular Biology, Structure, EMBO journal, Scientific journal   |
| Evaluation Method                | Your final grade will be decided based on your presentation and attitudes in class.   |
| Points of Attention              | Nothing Special   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 60  |
| Subject Title                    | Structural Biology B  |
| Credit                           | 1   |
| Time                             | 1 period, Monday, 4 semester  |
| Name of Teacher                  | Daisuke Kurita  |
| Specific Goals                   | The aim of this course is to help understand the structure-function relationship in biomacromolecules such as protein and RNA.  |
| Outlines of Class                | Students should be able to understand the research papers on their research field. This course will be taught in Japanese. But all of the presentation slides are in English.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Orientation</li> <li>2. Introduction of research papers and Discussion</li> <li>3. Introduction of research papers and Discussion</li> <li>4. Introduction of research papers and Discussion</li> <li>5. Introduction of research papers and Discussion</li> <li>6. Introduction of research papers and Discussion</li> <li>7. Introduction of research papers and Discussion</li> <li>8. Introduction of research papers and Discussion</li> </ol> |
| Preparation, review of the class | I highly recommend students to prepare a presentation by reading original papers.   |
| Text Book                        | Nature, Science, Cell, Molecular Cell, Nature Structural & Molecular Biology, Structure, EMBO journal, Scientific journal   |
| Evaluation Method                | Your final grade will be decided based on your presentation and attitudes in class.   |
| Points of Attention              | Nothing Special   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 61  |
| Subject Title                    | Regenerative Biology  |
| Credit                           | 2   |
| Time                             | 2 period, Thursday, 3 semester and 4 semester   |
| Name of Teacher                  | Hitoshi Yokoyama  |
| Specific Goals                   | Among vertebrates, amphibians can regenerate a whole limb or tail after amputation. By contrast, human beings still cannot regenerate an organ such as a limb even if we utilize iPS cells or other stem cells. In this class, we learn regenerative biology e.g., how stem cells are regulated in regenerative animals. We learn the current status of regenerative medicine as an application of regenerative biology from the latest textbook. We also learn how to write e-mails in English.  |
| Outlines of Class                | We will read the outstanding textbook, "Regenerative Biology and Medicine", second edition, by David Stocum. Each student will introduce one favorite chapter. In the final class, student will write an e-mail to Dr. Stocum in English referring to your interests and questions. To support it, I will show you how to write an e-mail in English.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Guidance, self-introduction, and etc.</li> <li>2. An Overview of Regenerative Biology (Chapter 1, introduced by Yokoyama)</li> <li>3. Repair of Skin by Fibrosis (Chapter 2, introduced by Yokoyama)</li> <li>4. Regeneration of Epidermal Structures (Chapter 3, introduced by Yokoyama)</li> <li>5. Regeneration of Neural Tissues (Chapter 4, introduced by a student)</li> <li>6. Regeneration of Digestive, Respiratory and Urinary Tissues (Chapter 5, introduced by a student)</li> <li>7. Regeneration of Musculoskeletal Tissues (Chapter 6, introduced by a student)</li> <li>8. Regeneration of Cardiac Muscle and Hematopoietic Tissues (Chapter 7, introduced by a student)</li> <li>9. Regeneration of Appendages (Chapter 8, introduced by a student)</li> <li>10. Strategies of Regenerative Medicine (Chapter 9, introduced by a student)</li> <li>11. Regenerative Medicine of Epidermal Structures (Chapter 10, introduced by a student)</li> <li>12. Regenerative Medicine of Neural Tissues (Chapter 11, introduced by a student)</li> <li>13. Retrospect and Prospect (The last chapter, introduced by Yokoyama)</li> <li>14. Guidance: how to write e-mail in English</li> <li>15. Writing a letter to Dr. Stocum as e-mail in English. If writing is not completed in this class, it will be homework.</li> </ol> <p>When the content of the class is different from this syllabus, because of slow progress in teaching schedule, for instance, I will explain why so each time.</p> |
| Preparation, review of the class | In order to give a successful presentation, each student needs to read their chosen chapter carefully in advance. Each student needs to check all figures in the scheduled chapter in advance. Each student needs to review and learn uncertain points after class.   |
| Text Book                        | Regenerative Biology and Medicine, second edition (David L. Stocum) Elsevier 2012 Each student does not have to purchase it.  |
| Evaluation Method                | Active presentation in class(30%); the quality of the presentation (40 %); the email writing(30 %)  |
| Points of Attention              | Basic knowledge of developmental biology is desirable.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 62  |
| Subject Title                    | Bioorganic Chemistry A  |
| Credit                           | 1   |
| Time                             | 5 period, Monday, 1 semester  |
| Name of Teacher                  | Masaru Hashimoto  |
| Specific Goals                   | To understand the mechanisms of mass spectrometric analysis, and learn the fundamental techniques for both quantitative and qualitative analysis of organo- and bio-molecules with mass spectrometry.<br>Practice analyzing sample molecules with mass spectrometers.   |
| Outlines of Class                | Alkylation and Conjugate addition reactions of enolates and enamines<br>Asymmetric methodology with enolates and enamines<br>Organolithium, organomagnesium and Organozinc. reagents  |
| Content                          | 1: Alkylation and Conjugate addition reactions of enolates and enamines<br>2: Asymmetric methodology with enolates and enamines<br>3: Organolithium, organomagnesium and Organozinc. reagents<br>4: Allylic organometallics of boron, silicon, and tin.<br>5: Elimination reactions<br>6: The Wittig and Related reactions<br>7: Alkene metathesis reactions<br>8: Pericyclic reactions |
| Preparation, review of the class | Please read the textbook before the class.  |
| Text Book                        | Iain Coldha, "Modern Methods of Organic Synthesis", Cambridge University Press; 4版  |
| Evaluation Method                | Attitudes (80%)<br>Understanding (20%)  |
| Points of Attention              | Fundamental knowledge of Organic Chemistry is required.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 63  |
| Subject Title                    | Bioorganic Chemistry B  |
| Credit                           | 1   |
| Time                             | 5 period, Monday, 2 semester  |
| Name of Teacher                  | Masaru Hashimoto  |
| Specific Goals                   | Epoch-making natural product syntheses are introduced.  |
| Outlines of Class                | Natural products syntheses involve structural confirmation, quantitative supply for biological and medicinal experiments, challenging to develop new chemistry, and so on. This class introduces epoch-making natural product syntheses.  |
| Content                          | 1: Prostaglandins (E. J. Corey, 1969)<br>2: Vitamin B12 (R. B. Woodward and A. Eschenmoser, 1973)<br>3: Strychnine (R. B. Woodward, 1954)<br>4: Strychnine (L. E. Overman, 1993)<br>5: Reserpine (R. B. Woodward, 1958)<br>6: Periplanone B (W. C. Still, 1979)<br>7: Monensin (W. C. Still, 1980)<br>8: Thienamycin (Merck Co, 1980) |
| Preparation, review of the class | Please read the textbook before the class.  |
| Text Book                        | E. J. Sorensen, "Classics in Total Synthesis: Targets, Strategies, Methods", Wiley-VCH (1996/1/31)  |
| Evaluation Method                | Attitudes (80%)<br>Understanding (20%)  |
| Points of Attention              | Fundamental knowledge of Organic Chemistry is required.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 64  |
| Subject Title                    | Natural Products Chemistry A  |
| Credit                           | 1   |
| Time                             | 4 period, Tuesday, 1 semester   |
| Name of Teacher                  | Noboru Takada   |
| Specific Goals                   | In order to understand activities of natural products, it is essential to understand the mechanisms of organic reactions. Students will understand molecular mechanisms in organic reactions.   |
| Outlines of Class                | The mechanisms of various organic reactions mechanisms will be discussed using practice problems.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Functional Group Transformations 1</li> <li>3. Functional Group Transformations 2</li> <li>4. Carbon Framework Constructions 1</li> <li>5. Carbon Framework Constructions 2</li> <li>6. Regio- and Stereo-selective Reactions 1</li> <li>7. Regio- and Stereo-selective Reactions 2</li> <li>8. Regio- and Stereo-selective Reactions 3</li> </ol> |
| Preparation, review of the class | Practice problems must be solved before the class.  |
| Text Book                        | Practice problems will be distributed.  |
| Evaluation Method                | Active participation in class (50%) and the accuracy of answers (50%)   |
| Points of Attention              | Nothing Special   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 65   |
| Subject Title                    | Natural Products Chemistry B   |
| Credit                           | 1  |
| Time                             | 4 period, Tuesday, 2 semester  |
| Name of Teacher                  | Noboru Takada  |
| Specific Goals                   | In order to understand properties of natural products, it is essential to clarify their structure. Students will understand how to determine the structures of organic compounds.  |
| Outlines of Class                | Structure determination analyses will be discussed using practice problems.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Structure determination of aliphatic compounds (1)</li> <li>3. Structure determination of aliphatic compounds (2)</li> <li>4. Structure determination of aliphatic compounds (3)</li> <li>5. Structure determination of aromatic compounds (1)</li> <li>6. Structure determination of aromatic compounds (2)</li> <li>7. Structure determination of aromatic compounds (3)</li> <li>8. Structure determination of aromatic compounds (4)</li> </ol> |
| Preparation, review of the class | Practice problems must be solved before the class.   |
| Text Book                        | Practice problems will be distributed.   |
| Evaluation Method                | Positiveness to lecture (50%) and accuracy of answers (50%)  |
| Points of Attention              | Nothing Special  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 66  |
| Subject Title                    | Environmental Microbiology  |
| Credit                           | 2   |
| Time                             | 5 period, Thursday, 3 semester and 4 semester   |
| Name of Teacher                  | Akio Tonochi  |
| Specific Goals                   | Understand the functional and phylogenetic diversity of microorganisms, which is important for studying environmental microbiology  |
| Outlines of Class                | Microorganisms inhabit various biospheres on Earth. It is necessary to learn about functional analysis and phylogenetic analysis in order to know what microorganisms inhabit what environment and what functions they perform. For this purpose, this class will focus on the analysis of environmental microorganisms.  |
| Content                          | <p>1: Guidance: Installation of free software R and its basic packages; Overview of microbial diversity.</p> <p>2: Culture-dependent microbial analysis.</p> <p>3: Non-culture-dependent microbial analysis.</p> <p>4: Microbial function analysis.</p> <p>5: Molecular phylogenetic analysis (I): Basics of molecular phylogenetic analysis</p> <p>6: Molecular phylogenetic analysis (II): Practicas of molecular phylogenetic analysis</p> <p>7: Basics of microbial diversity assesment.</p> <p>8: Practicas of microbial diversity assesment.</p> <p>9: Overview of microorganisms living in nature.</p> <p>10: Habitats of microorganisms.</p> <p>11: Microorganisms that inhabit forests (I): Microorganisms involved in substance metabolism in forests.</p> <p>12: : Microorganisms that inhabit forests (II): Microorganisms live symbiotically or parasitcaly with organisms living in forests.</p> <p>13: Microorganisms that inhabit sea (I): Microorganisms live in shelf seas or ocean.</p> <p>14: Microorganisms that inhabit sea (II): Microorganisms live in hydrothermal vents.</p> <p>15: Microorganisms that inhabit agricultural lands.</p> |
| Preparation, review of the class | No special preparation needed. A general knowlledge of microorganisms will help you understand the class.   |
| Text Book                        | No teachng materials or textbooks are used.   |
| Evaluation Method                | Grades are decided based on the class activities and the quality of the end-of-term report.   |
| Points of Attention              | No special preparation needed. Knowlledge of microorganisms will help you understand the class.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 67   |
| Subject Title                    | Cell Technology A  |
| Credit                           | 1  |
| Time                             | 4 period, Tuesday, 1 semester  |
| Name of Teacher                  | Eiji Morita  |
| Specific Goals                   | The aim of this course is learning basic science and applied science in the field of cell biology and cell technology that is developed by genetic engineering.  |
| Outlines of Class                | This lecture is focusing on the generality and specificity of the structures, functions, the regulation of gene expression in the cells, which is diverse from microorganism to higher eucaryote. This lecture also explains how to alter cell structures and functions artificially, to learn about the foundation and application of cell engineering.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Basics of cell engineering technology (1): Structure of the cell, organelle, and method of microscopic observations.</li> <li>2. Basics of cell engineering technology (2): The mechanisms of cell division, cell growth, cell senescence.</li> <li>3. Mechanisms of the gene expression in animal cell (1): Gene expression in an animal cell.</li> <li>4. Mechanisms of the gene expression in animal cell (2): The method of transfection, and detection of gene expression.</li> <li>5. Mechanisms of the gene expression in animal cell (3): The method of gene transduction by recombinant virus vectors.</li> <li>6. Cell engineering (1): Oncogenesis and characteristics of a cancer cell.</li> <li>7. Cell engineering (2): Cell fusion, and development of hybridoma (the technology of the monoclonal antibody).</li> <li>8. conclusion</li> </ol> |
| Preparation, review of the class | we will provide instructions in each time.   |
| Text Book                        | None   |
| Evaluation Method                | attendance, attitude, motivation   |
| Points of Attention              | You have to take a course "cell technology B".   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 68   |
| Subject Title                    | Cell Technology B  |
| Credit                           | 1  |
| Time                             | 4 period, Tuesday, 2 semester  |
| Name of Teacher                  | Eiji Morita  |
| Specific Goals                   | The aim of this course is learning basic science and applied science in the field of cell biology and cell technology that is developed by genetic engineering.  |
| Outlines of Class                | This lecture is focusing on the generality and specificity of the structures, functions, the regulation of gene expression in the cells, which is diverse from microorganism to higher eucaryote. This lecture also explains how to alter cell structures and functions artificially, to learn about the foundation and application of cell engineering.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Guidance</li> <li>2. Introduction of research paper for cell biology and discussion</li> <li>3. Introduction of research paper for cell biology and discussion</li> <li>4. Introduction of research paper for cell biology and discussion</li> <li>5. Introduction of research paper for cell biology and discussion</li> <li>6. Introduction of research paper for cell biology and discussion</li> <li>7. Introduction of research paper for cell biology and discussion</li> <li>8. Introduction of research paper for cell biology and discussion</li> </ol> |
| Preparation, review of the class | We will provide instructions in each time.   |
| Text Book                        | None   |
| Evaluation Method                | attendance, attitude, motivation   |
| Points of Attention              | You have to take a course "cell technology A".   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 69  |
| Subject Title                    | Genome Science A  |
| Credit                           | 1   |
| Time                             | 1 period, Wednesday, 1 semester   |
| Name of Teacher                  | Chisato Ushida  |
| Specific Goals                   | <p>By the end of this course students should be able to</p> <ul style="list-style-type: none"> <li>* Describe the background, objectives and content of the genome project</li> <li>* Describe DNA sequencing techniques</li> <li>* Describe the genome project data</li> <li>* Examine the future challenges of the genome project</li> </ul>  |
| Outlines of Class                | <p>This course is designed to help students to figure out the genome science by understanding the background, objectives and contents of genome projects. They will learn the recent DNA sequencing techniques and their outcomes as well as the methods of analysing the gene products and the cis-elements of gene regulation by reading papers related to the genome projects and their outcomes. The future issues about the genome projects will be discussed afterward.</p>   |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Presentation and discussion by students about papers related to the genome projects or study using the outcomes of genome project 1</li> <li>3. Presentation and discussion by students about papers related to the genome projects or study using the outcomes of genome project 2</li> <li>4. Presentation and discussion by students about papers related to the genome projects or study using the outcomes of genome project 3</li> <li>5. Presentation and discussion by students about papers related to the genome projects or study using the outcomes of genome project 4</li> <li>6. Presentation and discussion by students about papers related to the genome projects or study using the outcomes of genome project 5</li> <li>7. Presentation and discussion by students about papers related to the genome projects or study using the outcomes of genome project 6</li> <li>8. Discussion about the future issues of genome projects</li> </ol> |
| Preparation, review of the class | <p>Reading papers and handouts.<br/>Preparation for your presentation on the papers.</p>  |
| Text Book                        | Handouts and papers   |
| Evaluation Method                | <p>Presentation (50%)<br/>Discussion (50%)</p>  |
| Points of Attention              | Basic knowledge about Molecular Biology   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 70   |
| Subject Title                    | Genome Science B   |
| Credit                           | 1  |
| Time                             | 1 period, Wednesday, 2 semester  |
| Name of Teacher                  | Chisato Ushida   |
| Specific Goals                   | By the end of this course students should be able to<br>* Describe modENCODE and ENCODE projects<br>* Describe OMICS studies<br>* Describe the systematic analyses of genetic networks   |
| Outlines of Class                | This course is designed to help students figure out the complex genetic networks with the omics analyses by reading and discussing the related papers.   |
| Content                          | 1. Introduction<br>2. Paper reading and discussion, modENCODE project<br>3. Paper reading and discussion, ENCODE project<br>4. Paper reading and discussion, OMICS 1<br>5. Paper reading and discussion, OMICS 2<br>6. Paper reading and discussion, OMICS 3<br>7. Paper reading and discussion, OMICS 4<br>8. Summary of the course |
| Preparation, review of the class | Reading papers and handouts.   |
| Text Book                        | handouts and papers  |
| Evaluation Method                | Presentation (50%)<br>Discussion (50%)   |
| Points of Attention              | Basic knowledge about Molecular Biology  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 71  |
| Subject Title                    | Applied Microbiology (Advanced) I   |
| Credit                           | 1   |
| Time                             | 1 period, Tuesday, 3 semester   |
| Name of Teacher                  | Tomonori Sonoki   |
| Specific Goals                   | <ul style="list-style-type: none"> <li>○ Understand the difference of the use of microbial function in traditional microbial technology and white biotechnology.</li> <li>○ Understand the characteristics and functions of microorganisms for useful materials production.</li> </ul>  |
| Outlines of Class                | <ul style="list-style-type: none"> <li>○ The characteristics of the microorganisms used in the industries will be explained.</li> <li>○ The researches on the improvements of the productivity will be introduced.</li> </ul>   |
| Content                          | <p>The students taking this course will learn the characteristics the industrial microorganisms such as Escherichia coli and Saccharomyces cerevisiae, and the improvement of metabolic pathway for the materials production. The students will also understand the metabolic engineering effective to materials production through the introduction of examples and discussion.</p> <ol style="list-style-type: none"> <li>1st. The background of white biotechnology.</li> <li>2nd. The materials production with yeasts (I).</li> <li>3rd. The materials production with yeasts (II).</li> <li>4th. The materials production with Escherichia coli (I).</li> <li>5th. The materials production with Escherichia coli (II).</li> <li>6th. The materials production with Escherichia coli (III).</li> <li>7th. The characteristics of other industrial microorganisms.</li> <li>8th. Free discussion to conclude this course.</li> </ol> |
| Preparation, review of the class |   |
| Text Book                        | Not specified   |
| Evaluation Method                | The assignment will be set individually at the last class in this course. The students are required to make a report based the the results of the survey and discussion on the results, and submit it until the due date. Evaluate the credit by the report.  |
| Points of Attention              | <p>Students who take this course are required to have interests in the application of microbial function to useful chemicals production.</p> <p>The credit of this course are essential to take the applied microbiology (advanced) II.</p>   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 72  |
| Subject Title                    | Applied Microbiology (Advanced) II  |
| Credit                           | 1   |
| Time                             | 1 period, Tuesday, 4 semester   |
| Name of Teacher                  | Tomonori Sonoki   |
| Specific Goals                   | <ul style="list-style-type: none"> <li>○ Understand fundamental methods for analysing microbial function</li> <li>○ Understand the relationship between the analyses and applications of microbial function</li> </ul>  |
| Outlines of Class                | ○ The analytical methods for microbial function are explained with the examples of non-edible biomass-degrading microorganisms, and the applications of those function are introduced.  |
| Content                          | <p>The students will learn the methods for analyzing the microbial function, and also learn how to apply those function to useful materials production.</p> <p>1st. Introduction.</p> <p>2nd. Analysis of microbial function based on mutagenesis.</p> <p>3rd. Analysis of microbial function based on genetic information.</p> <p>4th. Analysis of microbial function and those application to materials production (I).</p> <p>5th. Analysis of microbial function and those application to materials production (II).</p> <p>6th. Free discussion on recently published scientific papers (I)</p> <p>7th. Free discussion on recently published scientific papers (II)</p> <p>8th. Free discussion on recently published scientific papers (III)</p> |
| Preparation, review of the class | Review the contents of Applied Microbiology (advanced) I carefully before taking this course.   |
| Text Book                        | Not specified   |
| Evaluation Method                | In the classes of free discussion on recent published scientific papers, the students are required to introduce the publication on recent white biotechnology topics in a seminar style. The evaluation for the credit will be done based on the level of the presentation and their attitude to the discussion. (100%)   |
| Points of Attention              | <p>Students who take this course are required to have interests in the application of microbial function to useful chemicals production.</p> <p>The credit of this course are essential to take the applied microbiology (advanced) II.</p>   |

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|----------------------------------|--|
| Subject No                       | 73   |
| Subject Title                    | Information Science for Biology A  |
| Credit                           | 1  |
| Time                             | 3 period, Monday, 3 semester   |
| Name of Teacher                  | Hatakeyama Koki  |
| Specific Goals                   | ○A purpose of this lecture is to understand formats and related technology of the digital image data (still image and video).<br>○It is an aim that allows you to apply image and video analysis for a bioscientific study.  |
| Outlines of Class                | In this class, students will learn how to convert file formats and image analysis using micrographs of cells and pathological tissues.   |
| Content                          | #1 Introduction<br>#2 Image processing (1):Image file formats<br>#3 Image processing (2):Image data conversion<br>#4 Image processing (3):Image analysis<br>#5 Video conversion (1):Hardware and software<br>#6 Video conversion (2):data format and codec<br>#7 Video conversion (3):encoding and transcoding<br>#8 Review (Submission of the report) |
| Preparation, review of the class | I will order it in a lecture about preparations for lessons.   |
| Text Book                        | not specified  |
| Evaluation Method                | Your overall grade in the class will be decided based on the following:<br>- Class attendance and attitude in class: 20%<br>- Reports: 80%   |
| Points of Attention              | This class offer in the third exercise room (3F of Information Technology Center)  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 74   |
| Subject Title                    | Information Science for Biology B  |
| Credit                           | 1  |
| Time                             | 3 period, Monday, 4 semester   |
| Name of Teacher                  | Hatakeyama Koki  |
| Specific Goals                   | By the end of the course, students should be able to do the following:<br>○ Obtain basic knowledge about LINUX.<br>○ Understand about basic operations for statistical analysis software PSPP.   |
| Outlines of Class                | (1) You will learn about basic operation of LINUX. (2) You will learn about basic usage of statistical analysis software PSPP.   |
| Content                          | #1 Introduction of LINUX : What is LINUX?<br>#2 Basic operation of LINUX : comands, arguments<br>#3 Biostatistics (1): evidence level, distribution, etc.<br>#4 Biostatistics (2): the validity of the hypothesis<br>#5 PSPP(1): Introduction for PSPP<br>#6 PSPP (2): Basic operation<br>#7 PSPP (3): Statistical method for analysis<br>#8 Review (Submission of the report) |
| Preparation, review of the class | I will order it in a lecture about preparations for lessons.   |
| Text Book                        | not specified  |
| Evaluation Method                | Your overall grade in the class will be decided based on the following:<br>- Class attendance and attitude in class: 10%<br>- Reports: 90%   |
| Points of Attention              |  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 75   |
| Subject Title                    | Biochemistry of carbohydrates A  |
| Credit                           | 1  |
| Time                             | 5 period, Tuesday, 3 semester  |
| Name of Teacher                  | Takashi Yoshida  |
| Specific Goals                   | <ul style="list-style-type: none"> <li>○ Graduate students should acquire the usage of special English terms in the field of carbohydrate chemistry.</li> <li>○ Graduate students should understand the property and structure of various sugars as well as their chemical application.</li> <li>○ Graduate students should understand the recent progress in carbohydrate research.</li> </ul>  |
| Outlines of Class                | Current English reviews on carbohydrate chemistry will be read and translated into Japanese in turns.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Guidance and introduction.</li> <li>2. Hypothesis on the sweetness of sugars; (1) monosaccharides.</li> <li>3. Hypothesis on the sweetness of sugars; (2) natural products.</li> <li>4. Natural sweet glycosides.</li> <li>5. Supersweet molecule; (1) derivatives of monosaccharides.</li> <li>6. Supersweet molecule; (2) Synthetic sweetener</li> <li>7. Synthesis of oligosaccharides by glycosyltransferases.</li> <li>8. Synthesis of oligosaccharides by glycosidases.</li> </ol> |
| Preparation, review of the class | Students should prepare for each lesson.   |
| Text Book                        | <p>"Essentials of Carbohydrate Chemistry" John F. Robyt (ISBN0-387-94951-8)</p> <p>"Carbohydrate Chemistry" B. G. Davis &amp; A. J. Fairbanks (ISBN0-19-855833-3)</p>  |
| Evaluation Method                | Student's activity at each class will be evaluated.  |
| Points of Attention              | Dictionaries allowed.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 76   |
| Subject Title                    | Biochemistry of carbohydrates B  |
| Credit                           | 1  |
| Time                             | 5 period, Tuesday, 4 semester  |
| Name of Teacher                  | Takashi Yoshida  |
| Specific Goals                   | <ul style="list-style-type: none"> <li>○ Graduate students should acquire the usage of special English terms in the field of carbohydrate chemistry.</li> <li>○ Graduate students should understand the property and structure of various sugars as well as their chemical application.</li> <li>○ Graduate students should have knowledges of various natural glycans and enzymes related to them.</li> </ul> |
| Outlines of Class                | English reviews on biochemistry of carbohydrates will be read and translated in turn.  |
| Content                          | English reviews on the topics such as "Structure of glycan", "Biosynthesis of carbohydrates" and "Glycan-related enzymes" will be read and translated into Japanese at every class. Detailed information as to the topic will be given at the first guidance.  |
| Preparation, review of the class | Students should prepare for each lesson.   |
| Text Book                        |  |
| Evaluation Method                | Student's activity at each class will be evaluated.  |
| Points of Attention              | Dictionaries allowed.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 77  |
| Subject Title                    | Plant Biochemistry A  |
| Credit                           | 1   |
| Time                             | 2 period, Monday, 3 semester  |
| Name of Teacher                  | Shigeki Hamada  |
| Specific Goals                   | ○ Understanding the plant biomass and productivity<br>○ Understanding the outline of plant functions  |
| Outlines of Class                | This course offers informations on plant biomass and plant biotechnology.   |
| Content                          | lecture 1, Plant biomass and cultivar improvement 1<br>lecture 2, Plant biomass and cultivar improvement 2<br>lecture 3, Plant biomass and cultivar improvement 3<br>lecture 4, Plant biotechnology 1<br>lecture 5, Plant biotechnology 2<br>lecture 6, Plant biotechnology 3<br>lecture 7, Plastid, Chloroplast 1<br>lecture 8, Plastid, Chloroplast 2 |
| Preparation, review of the class | Please always review what you learned in the lesson.  |
| Text Book                        | Without textbooks   |
| Evaluation Method                | Your attitudes in class and the quality of your term paper will be evaluated.   |
| Points of Attention              |   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 78   |
| Subject Title                    | Plant Biochemistry B   |
| Credit                           | 1  |
| Time                             | 2 period, Monday, 4 semester   |
| Name of Teacher                  | Shigeki Hamada   |
| Specific Goals                   | ○ Understanding the outline of photosynthesis and saccharometabolism   |
| Outlines of Class                | In plants, CO <sub>2</sub> is fixed using solar energy in chloroplast, and the fixed carbon was converted to carbohydrates. This course offers information on plant photosynthesis and subsequent carbohydrate metabolism.   |
| Content                          | lecture 1, Photochemical process in photosynthesis 1<br>lecture 2, Photochemical process in photosynthesis 2<br>lecture 3, Carbon-fixing reaction in photosynthesis 1<br>lecture 4, Carbon-fixing reaction in photosynthesis 2<br>lecture 5, C <sub>4</sub> plants<br>lecture 6, Sucrose synthesis as photosynthetic products<br>lecture 7, Translocation of photosynthetic products<br>lecture 8, Starch biosynthesis |
| Preparation, review of the class | Please always review what you learned in the lesson.   |
| Text Book                        | Without textbooks  |
| Evaluation Method                | Your attitudes in class and the quality of your term paper will be evaluated.  |
| Points of Attention              |  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 79  |
| Subject Title                    | Plant Molecular Breeding I  |
| Credit                           | 1   |
| Time                             | 3 period, Friday, 3 semester  |
| Name of Teacher                  | Katsunori TANAKA  |
| Specific Goals                   | Plant science has been developing by combining with plant tissue culture, molecular biology and genome science. Research findings generated in plant science have lead to their practical uses such as crop improvement which attracted many researchers. In this course, we aim to study the elements and application of molecular biology in plant breeding.  |
| Outlines of Class                | Rapid development in molecular biology and genome science has a major impact on plant breeding. Breeding of crop varieties used to be performed by using hybridization between varieties, but now gene introduction is used more from plant, microbe, animal and virus, leading to improving their agronomic traits and sharing new traits. In this course, gene function related to useful agronomic traits and their genetics would be discussed. |
| Content                          | 1st: Plant genome<br>2nd: Genetic engineering<br>3rd: Gene isolation<br>4th: Gene analysis<br>5th: Gene expression analysis<br>6th: Gene expression control<br>7th: Application of genetic fusion   |
| Preparation, review of the class | Review what you have learned in each lecture and read reference papers recommended  |
| Text Book                        | Reference papers may be provided in every lecture.  |
| Evaluation Method                | A report to be submitted after every lecture: 30%<br>A test during every lecture: 70%<br>Your final grade for the course will be decided according to these two factors.  |
| Points of Attention              | Basic knowledge in genetics, molecular genetics and plant breeding is needed.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 80  |
| Subject Title                    | Plant Molecular Breeding II   |
| Credit                           | 1   |
| Time                             | 3 period, Friday, 4 semester  |
| Name of Teacher                  | Katsunori TANAKA  |
| Specific Goals                   | Plant science has been developing by combining with plant tissue culture, molecular biology and genome science. Research findings generated in plant science have lead to their practical uses such as crop improvement which is attracted many researchers. In this course, we aim to study the elements and application of molecular biology in plant breeding.   |
| Outlines of Class                | Rapid development in molecular biology and genome science has a major impact on plant breeding. Breeding of crop varieties used to be performed by using hybridization between varieties, but how gene introduction from plant, microbe, animal and virus, leading to improving their agronomic traits and share new traits. In this lecture, gene function related to useful agronomic traits and their genetics would be discussed. |
| Content                          | 1st: Analysis of gene function<br>2nd: Genetically modified plant<br>3rd: RNA interference<br>5th: DNA marker<br>6th: Application of plant genetic resources<br>7th: Further outlook of plant molecular breeding<br>8th: Discussion   |
| Preparation, review of the class | Review what you have learned in each lecture and read reference papers recommended  |
| Text Book                        | Reference papers may be provided in every lecture.  |
| Evaluation Method                | A report to be submitted after every lecture: 30%<br>A test during every lecture: 70%<br>Your final grade for the course will be decided according to these two factors.  |
| Points of Attention              | Basic knowledge in genetics, molecular genetics and plant breeding is needed.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 81  |
| Subject Title                    | Analysis of gene function in Crop I   |
| Credit                           | 1   |
| Time                             | 1 period, Thursday, 3 semester  |
| Name of Teacher                  | Ryuji Ishikawa  |
| Specific Goals                   | Vairous methodologies have been adopted to analyze gene function in crops. This lecture will teach you methods and examples from published papers. Lectures on gene tagging methods are a major part of the course. the process of cloning and how to analyze each gene would be talked. Students will understand how to analyze valuable genes from various genetic resources in crops.    |
| Outlines of Class                | Published papers are selected to explain the methodologies.   |
| Content                          | 1. Gene tagging : General of Transposon<br>2. Gene tagging : Retrotransposable elements<br>3. Gene tagging; DNA transposable elements<br>4. Clavata gene involving yields by Mu-tagging<br>5. Mapbased cloning: G protein and dwarf<br>6. Mapbased cloning ; Brassiolide mutant involving yields<br>7. Genes related to gibberellin and semi-dwarf crops<br>8. Summary of all methodologies |
| Preparation, review of the class | You should have enough knowledge of molecular biology and genetics  |
| Text Book                        | Will be ditribute in class  |
| Evaluation Method                | Based on the quality of a report of a report after each lesson  |
| Points of Attention              | Students woud be better being interested in crop breeding   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 82  |
| Subject Title                    | Analysis of gene function in Crop II  |
| Credit                           | 1   |
| Time                             | 1 period, Thursday, 4 semester  |
| Name of Teacher                  | Ryuji Ishikawa  |
| Specific Goals                   | Vairous methodologies have been adopted to analyze gene function in crops. This lecture will teach you methods and examples from published papers. Lectures on gene tagging methods are a major part of the lecture. The process of cloning and how to analyze each gene would be lectured. Students will understand how to analyze valuable genes from various genetic resources in crops.   |
| Outlines of Class                | Published papers are selected to explain the methodologies.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Submergence tolerance gene : SUB1</li> <li>2. Floating rice and the causal genes : SNKR</li> <li>3. Tillering genes : MOC1, Lax1, Lax2</li> <li>4. ABC models in rice</li> <li>5. Awn formation and causal genes</li> <li>6. Blast resistant genes</li> <li>7. Genes involving to domestication</li> <li>8. Summary of all methodologies</li> </ol> |
| Preparation, review of the class | You should have enough knowledge of molecular biology and genetics  |
| Text Book                        | Will be distributed in class  |
| Evaluation Method                | Based on the quality of a report of a report after each lesson  |
| Points of Attention              | Students would be better being interested in crop breeding  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 83  |
| Subject Title                    | Methods for Bioengineering I  |
| Credit                           | 1   |
| Time                             | 2 period, Thursday, 1 semester  |
| Name of Teacher                  | Mineo Senda   |
| Specific Goals                   | Methods for bioengineering are essential techniques in biological researches. The aim of this class is to learn these methods from a scientific viewpoint.  |
| Outlines of Class                | In this class, each student gives a presentation on a method for bioengineering, especially DNA, RNA and protein researches. After a presentation, problems and applications are carefully discussed.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Guidance</li> <li>2. DNA research (1) PCR</li> <li>3. DNA research (2) Southern blot analysis</li> <li>4. DNA research (3) DNA sequencing</li> <li>5. RNA research (1) RNA gel blot analysis</li> <li>6. RNA research (2) RT-PCR</li> <li>7. Protein research (1) Protein expression using E.coli</li> <li>8. Protein research (2) Western blot analysis</li> </ol> |
| Preparation, review of the class | None  |
| Text Book                        | None  |
| Evaluation Method                | Evaluation of the presentation  |
| Points of Attention              | In this lecture, presentations are conducted in Japanese.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 84   |
| Subject Title                    | Methods for Bioengineering II  |
| Credit                           | 1  |
| Time                             | 2 period, Thursday, 2 semester   |
| Name of Teacher                  | Mineo Senda  |
| Specific Goals                   | Methods for bioengineering are essential techniques in biological researches. The aim of this class is to learn these methods from a scientific viewpoint.   |
| Outlines of Class                | In this class, each student gives a presentation to others about a method for bioengineering, especially histochemical and tissue/cell culture researches. After a presentation, problems and applications are carefully discussed.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Guidance</li> <li>2. Histochemical research (1) in situ hybridization</li> <li>3. Histochemical research (2) Confocal microscopy</li> <li>4. Tissue/cell culture research (1) Plant tissue/cell culture</li> <li>5. Tissue/cell culture research (2) Animal tissue/cell culture</li> <li>6. Tissue/cell culture research (3) Transgenic plants</li> <li>7. Tissue/cell culture research (4) Transgenic animals</li> <li>8. Tissue/cell culture research (5) ES cells, iPS cells</li> </ol> |
| Preparation, review of the class | None   |
| Text Book                        | None   |
| Evaluation Method                | Evaluation of the presentation   |
| Points of Attention              | In this lecture, presentations are conducted in Japanese.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 85   |
| Subject Title                    | Constructive Ecology I   |
| Credit                           | 1  |
| Time                             | 5 period, Thursday, 1 semester   |
| Name of Teacher                  | Akiko Kashiwagi  |
| Specific Goals                   | <ul style="list-style-type: none"> <li>• Students will understand the importance of an ecosystem in a lab designed by researchers, where some living organisms will interact with each other.</li> <li>• Students will understand how to construct an ecosystem in a lab.</li> </ul> |
| Outlines of Class                | In this course, students will understand the importance of an ecosystem in a lab for analyzing the factors that are crucial to maintaining the ecosystem quantitatively.   |
| Content                          | 1. Lecture   |
| Preparation, review of the class | Students should find and read more literature which is related to what they have learned in the course in order to deepen their understanding of the topic.  |
| Text Book                        | None   |
| Evaluation Method                | Report (70%), degree of active participation in discussion (30%)   |
| Points of Attention              | Students should have basic knowledge of microorganisms.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 86   |
| Subject Title                    | Constructive Ecology II  |
| Credit                           | 1  |
| Time                             | 5 period, Thursday, 2 semester   |
| Name of Teacher                  | Akiko Kashiwagi  |
| Specific Goals                   | <ul style="list-style-type: none"> <li>• Students will understand the importance of an ecosystem in a lab designed by researchers, where some living organisms will interact with each other.</li> <li>• Students will understand the recent research progress in this field.</li> </ul> |
| Outlines of Class                | <p>In this course, students will understand the importance of an ecosystem in a lab for analyzing the factors that are crucial to maintaining the ecosystem quantitatively.</p> <p>Students will understand the latest research finding by reading the latest papers.</p>                |
| Content                          | <ol style="list-style-type: none"> <li>1. lecture</li> <li>2. Presentation by students</li> </ol>  |
| Preparation, review of the class | Students should read more of the latest articles related to the topic and prepare a presentation using PowerPoint slides.  |
| Text Book                        | Some articles and books will be shown in the lecture   |
| Evaluation Method                | Presentation (60%), degree of active participation in discussion (40%)   |
| Points of Attention              | Students who have taken "Constructive Ecology I" can only join this course.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 87  |
| Subject Title                    | Comparative Endocrinology I   |
| Credit                           | 1   |
| Time                             | 1 period, Monday, 1 semester  |
| Name of Teacher                  | Yu Kaneko   |
| Specific Goals                   | At the end of this course, participants are expected to be able to explain hormonal regulations of metamorphosis and other phenomena of insects and amphibians.   |
| Outlines of Class                | <p>In this course, in order to understand the basic concepts and molecular mechanisms of regulation of development and homeostasis, especially metamorphosis, the students have to read papers and textbooks in the fields of hormonal regulations of life events of insects and amphibians in English. They have to introduce these papers and textbooks, and answer the questions from the instructor and other students.</p> |
| Content                          | <ol style="list-style-type: none"> <li>1 Anatomy of the insect endocrine system</li> <li>2 Mechanisms of hormone action and experimental methods</li> <li>3 Metabolism and homeostasis</li> <li>4 Growth, molting and metamorphosis</li> <li>5 Endocrine control of molting and metamorphosis</li> <li>6 Endocrine cascade in insect metamorphosis</li> <li>7 Diapause</li> <li>8 discussion</li> </ol>                         |
| Preparation, review of the class | Highly recommended to prepare each lesson by reading corresponding papers referred to in each chapter of the textbook.  |
| Text Book                        | Copies of the textbooks will be provided in class   |
| Evaluation Method                | Your final grade for the course will be decided based on the attendance rate (40%), and presentations and the depth of understanding of the papers you presented (60%).   |
| Points of Attention              | none  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 88  |
| Subject Title                    | Comparative Endocrinology II  |
| Credit                           | 1   |
| Time                             | 1 period, Monday, 2 semester  |
| Name of Teacher                  | Yu Kaneko   |
| Specific Goals                   | At the end of this course, participants are expected to be able to explain hormonal regulations of metamorphosis and other phenomena of insects and amphibians.   |
| Outlines of Class                | In this course, in order to understand the basic concepts and molecular mechanisms of regulation of development and homeostasis, especially metamorphosis, the students have to read papers and textbooks in the fields of hormonal regulations of life events of insects and amphibians in English. They have to introduce these papers and textbooks, and answer to the questions from the instructor and other students.   |
| Content                          | <ul style="list-style-type: none"> <li>1 Polyphenism and polymorphism</li> <li>2 Evolution of insect metamorphosis</li> <li>3 Molecular aspect of ecdysone action</li> <li>4 Molecular aspect of juvenile hormone</li> <li>5 Endocrinology of Amphibian metamorphosis</li> <li>6 Thyroid hormone and Amphibian metamorphosis</li> <li>7 Programmed cell death during Amphibian metamorphosis</li> <li>8 discussion</li> </ul> |
| Preparation, review of the class | Highly recommended to prepare each lesson by reading corresponding papers referred to in each chapter of the textbook.  |
| Text Book                        | Copies of the textbooks will be provided in class   |
| Evaluation Method                | Your final grade for the course will be decided based on the attendance (40%), and presentations and the depth of understanding of the papers you presented (60%).  |
| Points of Attention              | none  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 89   |
| Subject Title                    | Botany & Mycology I  |
| Credit                           | 1  |
| Time                             | 5 period, Monday, 3 semester   |
| Name of Teacher                  | Kazuaki Tanaka   |
| Specific Goals                   | To be able to explain the evolution of plant pathogenic fungi.<br>To be able to explain the main taxonomic groups of plant pathogenic fungi.<br>To be able to explain the ecological role of plant pathogenic fungi in nature.<br>To be able to understand the relationship between fungi and other research areas.  |
| Outlines of Class                | This course deals with the evolution, ecology and classification of plant pathogenic fungi by comparing their previous understanding of them and recent findings. Students are required to read a paper on fungi related to their study areas, give presentations and submit reports on the paper.   |
| Content                          | 1. Old classification of plant pathogenic fungi<br>2. New classification of plant pathogenic fungi<br>3. Reproduction of plant pathogenic fungi<br>4. Evolution of plant pathogenic fungi<br>5. Ecology of plant pathogenic fungi<br>6. Student presentation (Example: Insect parasitic fungi)<br>7. Student presentation (Example: Food mycology)<br>8. Student presentation (Example: Animal pathogenic fungi) |
| Preparation, review of the class | It is necessary for students to find an English paper on Mycology, read it carefully, present its contents using PowerPoint, and submit a report of the paper.   |
| Text Book                        | None. Using handout.   |
| Evaluation Method                | Oral presentation 50%, Report 50%  |
| Points of Attention              | It is required that students have learned "Mycology" during their undergraduate years  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 90  |
| Subject Title                    | Botany & Mycology II  |
| Credit                           | 1   |
| Time                             | 5 period, Monday, 4 semester  |
| Name of Teacher                  | Kazuaki Tanaka  |
| Specific Goals                   | To be able to explain the morphological features of main fungal taxa.<br>To be able to explain the ecological characteristics of main fungal taxa.<br>To be able to explain the relationships between fungal pathogens and plant diseases.  |
| Outlines of Class                | Students are required to read "Introduction to Fungi" and present its content. By discussing the content of each presentation given, students should try to understand the relationships between main fungal groups and plant diseases.   |
| Content                          | 1. Main taxa of plant pathogenic fungi.<br>2. Plant diseases caused by Chytridiomycota.<br>3. Plant diseases caused by Zygomycota.<br>4. Plant diseases caused by Ascomycota 1.<br>5. Plant diseases caused by Ascomycota 2.<br>6. Plant diseases caused by Basidiomycota 1.<br>7. Plant diseases caused by Basidiomycota 2.<br>8. Phylogeny and evolution of plant pathogenic fungi. |
| Preparation, review of the class | Students are required to read the textbook in advance and to make a presentation file (Powerpoint) for a presentation.  |
| Text Book                        | Webster and Weber, 2007. Introduction to Fungi. Cambridge University Press  |
| Evaluation Method                | Oral presentation 50%, Report 50%   |
| Points of Attention              | It is desirable that students have already taken "Botany & Mycology I".   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 91   |
| Subject Title                    | Edaphology I   |
| Credit                           | 1  |
| Time                             | 5 period, Tuesday, 1 semester  |
| Name of Teacher                  | Nobuhiko Matsuyama   |
| Specific Goals                   | Students will be able to understand a soil survey method, which is the basis of food production.   |
| Outlines of Class                | Students learn a soil survey method, which is the basis for investigating soil productivity. After understanding it, students will actually conduct a soil survey at Chitose farm, Hirosaki Univ.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Purpose of a soil survey</li> <li>2. Soil profile and Soil horizon</li> <li>3. Composition of soil profile and Soil color</li> <li>4. Particle size distribution and Soil texture</li> <li>5. Soil structure and Consistency</li> <li>6 and 7. A soil survey at Chitose farm, Hirosaki Univ.(A soil survey is scheduled for 3 hours on a Saturday morning)</li> <li>8. Discussion about the soil survey</li> </ol> <p>(If the syllabus and the actual content differ depending on the progress of the class, I will explain each time)</p> |
| Preparation, review of the class | <p>Preparation: please always keep the topic of each lecture in mind and attend the lectures regularly.</p> <p>Review: the content of the course with eight lectures forms a coherent whole and regular review of each lecture is always important.</p>  |
| Text Book                        | Textbooks are not used   |
| Evaluation Method                | Evaluation of grades :presentation (50%) and final paper (50%).  |
| Points of Attention              | It is desirable that students have basic knowledge of soil science.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 92   |
| Subject Title                    | Edaphology II  |
| Credit                           | 1  |
| Time                             | 5 period, Tuesday, 2 semester  |
| Name of Teacher                  | Nobuhiko Matsuyama   |
| Specific Goals                   | Students will be able to understand the formation mechanism of Andosols and Alluvial soil. Students will be able to comprehensively understand the characteristics of these soils through research.  |
| Outlines of Class                | Students learn the characteristics of Andosols and Alluvial soil that are extremely important in food production in Japan.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Crop cultivation experiment by pot</li> <li>2. Soil genesis of alluvial soil and Characteristics of paddy soil</li> <li>3. Survey of crop growth</li> <li>4. Behavior of cesium in soil</li> <li>5. New aquatic crop</li> <li>6. Soil genesis of Andosols</li> <li>7. Problems on soil management in allophanic and non-allophanic Andosols</li> <li>8. Fertilizer response in paddy rice and corn</li> </ol> (If the syllabus and the actual content differ depending on the progress of the class, I will explain each time) |
| Preparation, review of the class | Preparation: please always keep the topic of each lecture in mind and attend the lectures regularly.<br>Review: the content of the course with eight lectures forms a coherent whole and regular review of each lecture is always important.   |
| Text Book                        | Textbooks are not used   |
| Evaluation Method                | Evaluation of grades :presentation (50%) and final paper (50%).  |
| Points of Attention              | It is desirable that students have basic knowledge of soil science.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 93  |
| Subject Title                    | Insect adaptations to environmental changes I   |
| Credit                           | 1   |
| Time                             | 2 period, Wednesday, 1 semester   |
| Name of Teacher                  | Sugahara Ryohei   |
| Specific Goals                   | <ul style="list-style-type: none"> <li>○Students will be able to explain the adaptation of insects to environmental adversity.</li> <li>○Students will learn research methods for entomology.</li> <li>○Students will learn tolerance mechanisms of insects against environmental adversities.</li> </ul>   |
| Outlines of Class                | Many insects survive under environmental adversity. Students will learn how the insects adapt to the difficulties.  |
| Content                          | <ol style="list-style-type: none"> <li>1st: Insect tolerance to various stresses</li> <li>2nd: Adaptations to the cold</li> <li>3rd: Adaptions to the heat</li> <li>4th: Adaptions to water conditions and drying</li> <li>5th: Adaptions to food shortage</li> <li>6th: Adaptations to crowding</li> <li>7th: Adaptions to bacteria and fungi</li> <li>8th: Tolerances to artificial stresses</li> </ol> |
| Preparation, review of the class | Take notes and review mistaken parts in each test.  |
| Text Book                        | -   |
| Evaluation Method                | A test in every class (100%)  |
| Points of Attention              | -   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 94   |
| Subject Title                    | Insect adaptations to environmental changes II   |
| Credit                           | 1  |
| Time                             | 2 period, Wednesday, 2 semester  |
| Name of Teacher                  | Sugahara Ryohei  |
| Specific Goals                   | <input type="radio"/> Students will be able to explain insect diapause in relation to seasonal adaptation.<br><input type="radio"/> Students will learn geographical variation in insects.<br><input type="radio"/> Student will learn how to research on diapause mechanisms of insects.  |
| Outlines of Class                | Many insects diapause in consequence of environmental adaptation. Students will learn a variety of diapause mechanisms of each insect.   |
| Content                          | 1st: Studies on insect diapause<br>2nd: Season and diapause I<br>3rd: Season and diapause II<br>4th: Diapause in relation to climate I<br>5th: Diapause in relation to climate II<br>6th: Survival under hard conditions in seasonal climate<br>7th: Sensing mechanism for season<br>8th: Hormonal mechanism in diapause and artificial hatching |
| Preparation, review of the class | Take notes and review mistaken parts in every test.  |
| Text Book                        | -  |
| Evaluation Method                | A test in every class (100%)   |
| Points of Attention              | -  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 95   |
| Subject Title                    | Physiology and Ecology of Fruit Tree I   |
| Credit                           | 1  |
| Time                             | 2 period, Friday, 3 semester   |
| Name of Teacher                  | TANAKA Norimitsu   |
| Specific Goals                   | Producing fruits is the most important thing in fruit cultivation, and we know that the various organs that make up the tree are constructed by the interaction of various genes. This course mainly aims to help students to understand mainly what has been elucidated in model plants, and acquire the ability to think about and apply what they have learned to fruit trees, especially apple trees.  |
| Outlines of Class                | This is a seminar course in which you read the textbook and summarize your part to give a presentation.<br>You will deepen your understanding of the genetic control mechanism that governs plant morphogenesis and discuss and explain some of the phenomena that have been elucidated so far regarding gene control mechanism in fruit trees.  |
| Content                          | Understand the control mechanism of genes by making a presentation and asking questions about the following:<br><br><ol style="list-style-type: none"> <li>1. Guidance</li> <li>2. Evolution of flower organs and MADS-box gene</li> <li>3. Molecular mechanism and intercellular transfer of post-transcriptional gene silencing</li> <li>4. Developmental pattern formation of the dicotyledon embryo</li> <li>5. Shoot apical meristem-its construction and function-</li> <li>6. Root formation</li> <li>7. Molecular mechanism of stem elongation</li> <li>8. Conclusion</li> </ol><br>After each presentation, I will give an explanation of each topic and also an explanation applicable to the fruit trees. |
| Preparation, review of the class | You will gather relevant information in advance about what you have to present.<br>You will read each part of the textbook in advance to think of questions you may wish to ask after each presentation.<br>You should review Pomology that you took at the undergraduate level.   |
| Text Book                        | Molecular mechanisms that determine the shape of plants  |
| Evaluation Method                | I will comprehensively evaluate students' performance, such as resume preparation (50%), presentation on issues (30%), and questions and answers (20%).  |
| Points of Attention              | nothing  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 96   |
| Subject Title                    | Physiology and Ecology of Fruit Tree II  |
| Credit                           | 1  |
| Time                             | 2 period, Friday, 4 semester   |
| Name of Teacher                  | TANAKA Norimitsu   |
| Specific Goals                   | Producing fruits is the most important thing in fruit cultivation, and we know the various organs that make up the tree are constructed by the interaction of various genes. This course mainly aims to help students understand understand mainly what has been elucidated in model plants, acquire the ability to think about and apply what they have learned to fruit trees, especially apple trees.   |
| Outlines of Class                | This is a seminar course in which you read the textbook and summerize your part to give a presentation.<br>You will deepen your understanding of the genetic control mechanism that governs plant morphogenesis and discuss and explain some of the phenomena that have been elucidated so far regarding gene control mechanism in fruit trees.  |
| Content                          | Understand the control mechanism of genes by making a presentation and asking questions about the following:<br><br><ol style="list-style-type: none"> <li>1. Guidance</li> <li>2. Leaf formation in dicotyledonous plants</li> <li>3. Genetic framework of flowering control</li> <li>4. Molecular genetics of floral morphogenesis</li> <li>5. Differentiation mechanism of male and female flowers in angiosperms</li> <li>6. Gametophyte and pollen tube guidance-from genetics to development and evolution</li> <li>7. Differentiation of vascular bundles</li> <li>8. Conclusion</li> </ol><br>After each presentation, I will give an explanation of each topic and also an explanation applicable to the fruit trees. |
| Preparation, review of the class | You will gather rerevant information in advance what you have to present.<br>You will read each point of the textbook in advance to think of questions you may wish to ask after each presentation.<br>You should review Pomology that you took at the undergraduate level.  |
| Text Book                        | Molecular mechanisms that determine the shape of plants  |
| Evaluation Method                | I will comprehensively evaluate students' performance, such as resume preparation (50%), presentation on issues (30%), and questions and answers (20%).  |
| Points of Attention              | none   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 97   |
| Subject Title                    | Development of Floricultural Resources A   |
| Credit                           | 1  |
| Time                             | 2 period, Friday, 1 semester   |
| Name of Teacher                  | Kazushige Honda  |
| Specific Goals                   | <ul style="list-style-type: none"> <li>•To understand the features required for floricultural plant resources and the basic concepts related to their utilization and development.</li> <li>•To gain some hands-on experience and related practice of flower resource development.</li> </ul>  |
| Outlines of Class                | <p>At present, a vast number of different plants are used for ornamental purposes, which are several tens to several hundred times as many as food crops. Until now, efforts to introduce new species and cultivate new varieties have been continued. In the process of introducing and developing new floricultural plant resources in recent years, the concept of sustainable use “conservation” has also been indispensable. In this course, students will understand the basic knowledge and concepts which are necessary when introducing and using new floricultural plant resources (including new varieties produced by breeding).I also outline the current status of floricultural plant resources development and surrounding topics.</p> |
| Content                          | <p>Schedule</p> <p>1st Features of floricultural crops</p> <p>2nd Floricultural plant resources, Part 1 Breeding and its history</p> <p>3rd Floricultural plant resources, Part 2 Genetic resources</p> <p>4th Cross Breeding Part 1 Pollen</p> <p>5th Cross Breeding Part 2 Artificial pollination</p> <p>6th Cross Breeding Part 3 Cross Compatibility and confirmation of hybridity</p> <p>7th Mutation Breeding</p> <p>8th Summary</p>   |
| Preparation, review of the class | Students who have taken the undergraduate course “Floriculture” should review its content.   |
| Text Book                        | Relevant materials will be distributed in the lecture as needed.   |
| Evaluation Method                | <p>Students have to prepare a report on a specified issue and present it within the lecture time.</p> <p>A comprehensive and continuous evaluation will also be made of active participation and positive attitudes in class.</p>  |
| Points of Attention              | Lectures will also be held outdoors, such as in on-campus greenhouses and farm fields.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 98  |
| Subject Title                    | Development of Floricultural Resources B  |
| Credit                           | 1   |
| Time                             | 2 period, Friday, 2 semester  |
| Name of Teacher                  | Kazushige Honda   |
| Specific Goals                   | <ul style="list-style-type: none"> <li>• As in the " Development of Floricultural Resources A", students will understand the basic features of floricultural plant resources and the concepts related to resource utilization and development. They will also gain some hands-on experience and related practice of flower resource development. experience actual efforts and related matters.</li> <li>• This course particularly aims at deepening students' understanding of the sustainable use of plant genetic resources.</li> </ul>   |
| Outlines of Class                | We will review familiar floricultural plants, outline their current issues and future prospects, and consider their sustainable use. I will explain the concepts of understanding, conservation and protection of plants, which are indispensable for promoting sustainable use. In this course, related experiments and observations will also be conducted.   |
| Content                          | <p>Schedule</p> <p>1st Life history of plant</p> <p>2nd Plant Reproduction Part 1 Seed (Sexual) and vegetative (asexual) reproduction</p> <p>3rd Plant Reproduction Part 2 Mating system</p> <p>4th Utilization and Conservation of floricultural plant resources Part 1 Current Status and Issues in the World</p> <p>5th Utilization and Conservation of floricultural plant resources Part 2 Current Status and Issues in Japan</p> <p>6th Utilization and Conservation of floricultural plant resources Part 3 Future possibilities</p> <p>7th Diversity, evolution and adaptation in Plants</p> <p>8th Summary</p> |
| Preparation, review of the class | Students who have taken the undergraduate lecture "Floriculture" should review its contents   |
| Text Book                        | Relevant materials will be distributed in the lecture as needed.  |
| Evaluation Method                | <p>Students have to prepare a report on a specified issue and present it within the lecture time.</p> <p>A comprehensive and continuous evaluation will also be made of active participation and positive attitudes in class.</p>   |
| Points of Attention              | Lectures will also be held outdoors, such as in on-campus greenhouses and farm fields.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 99   |
| Subject Title                    | Physiology of Vegetable Crop I   |
| Credit                           | 1  |
| Time                             | 1 period, Wednesday, 3 semester  |
| Name of Teacher                  | MAEDA Tomoo  |
| Specific Goals                   | To understand physiology, ecology and the role of plant hormones from germination to harvest   |
| Outlines of Class                | I will explain the growth of vegetables from the physiological aspect. In Vegetable Physiology and Ecology I, students mainly learn the types of plant hormones and biosynthetic and physiological functions in a lecture format. The lecture is composed of a lecture and student's presentations and discussions on the content of the previous week's lecture |
| Content                          | <ol style="list-style-type: none"> <li>1. Guidance</li> <li>2. Plant hormones</li> <li>3. Seed germination</li> <li>4. Dormancy</li> <li>5. Flower bud differentiation</li> <li>6. Flowering and fruiting</li> <li>7. Organism differentiation</li> <li>8. General discussion and conclusion</li> </ol>  |
| Preparation, review of the class | Preparation for the lesson and reviewing the content of each lecture   |
| Text Book                        | Distribute when necessary  |
| Evaluation Method                | Your performance will be evaluated comprehensively according to the following:<br>:active participation in class;:preparation for the lessons;:short presentation  |
| Points of Attention              | nothing  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 100  |
| Subject Title                    | Physiology of Vegetable Crop II  |
| Credit                           | 1  |
| Time                             | 1 period, Wednesday, 4 semester  |
| Name of Teacher                  | MAEDA Tomoo  |
| Specific Goals                   | To understand physiology, ecology and the role of plant hormones from germination to harvest   |
| Outlines of Class                | I will explain the growth of vegetables from the physiological aspect. In Vegetable Physiology and Ecology II, students mainly learn the types of plant hormones and biosynthetic and physiological functions in a lecture format. The lecture is composed of a lecture and student's presentations and discussions on the content of the previous week's lecture  |
| Content                          | <ol style="list-style-type: none"> <li>1. Guidance</li> <li>2. Secondary metabolism</li> <li>3. Secondary metabolisms in vegetables</li> <li>4. Secondary metabolism and biological protection</li> <li>5. Environment and secondary metabolism in vegetables</li> <li>6. Vegetable secondary metabolism and bioactivity on human</li> <li>7. Research method on physiology in vegetables</li> <li>8. General discussion and conclusion</li> </ol> |
| Preparation, review of the class | Preparation and review the contents of the lecture   |
| Text Book                        | Distributed when necessary   |
| Evaluation Method                | Your performance will be evaluated comprehensively according to the following:<br>:active participation in class;:preparation for the lesson;:short presentation   |
| Points of Attention              | nothing  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 101  |
| Subject Title                    | Agricultural Machinery A   |
| Credit                           | 1  |
| Time                             | 2 period, Tuesday, 3 semester  |
| Name of Teacher                  | Ye Xujun   |
| Specific Goals                   | The goal of the course is to enable the students to understand the structure of major agricultural machinery and to be able to explore the ways and methods of improving the machinery.  |
| Outlines of Class                | This course has been designed to provide a broad introduction to modern agriculture machinery. The topics include a thorough explanation on the structures and methods of effective utilization of agricultural machinery.   |
| Content                          | <ol style="list-style-type: none"> <li>(1) The history of agricultural mechanization</li> <li>(2) Structure and utilization of tillage machines</li> <li>(3) Structure and utilization of fertilizing and seeding machines</li> <li>(4) Structure and utilization of transplanters</li> <li>(5) Structure and utilization of cultivator and weeding machines</li> <li>(6) Structure and utilization of pest and disease control machines</li> <li>(7) Structure and utilization of harvester machines</li> <li>(8) General discussion</li> </ol> |
| Preparation, review of the class | Instructions on preparation for each lecture will be provided at the first lecture.  |
| Text Book                        | <ol style="list-style-type: none"> <li>(1) Agricultural Machinery Research Association edition: Bioproduction Machinery Handbook, Corona Company.</li> <li>(2) Ikeda et al.: Agricultural Machinery, 3rd Edition, Bunyakudo.</li> <li>(3) Haruna et al.: High-tech Era of Agricultural Measurement, Agriculture and Forestry Statistics Association.</li> </ol>  |
| Evaluation Method                | <p>Regular evaluation based on responses to questions during class, participation in discussions, etc: 40% of all evaluation.</p> <p>Evaluation based on the presentation and report: 60% of overall evaluation.</p> <p>Your final grade evaluation will be decided based on the above two factors.</p>  |
| Points of Attention              | Nothing in particular.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 102   |
| Subject Title                    | Agricultural Machinery B  |
| Credit                           | 1   |
| Time                             | 2 period, Tuesday, 4 semester   |
| Name of Teacher                  | Ye Xujun  |
| Specific Goals                   | The goal of the course is to enable the students to master the basic knowledge of the latest smart agriculture technologies.  |
| Outlines of Class                | This course has been designed to provide a broad introduction to modern agriculture machinery. The topics include: (1) the principles and methods for measuring physical and chemical characteristics of crops and soils from the viewpoint of mechanization, automation and labor-saving of agricultural production; (2) a comprehensive introduction to the latest advances and emerging technologies in automation, precision agriculture, plant factory, robotics, etc.   |
| Content                          | <ol style="list-style-type: none"> <li>(1) Labor-saving effect by mechanization of agricultural production</li> <li>(2) Physical properties of agricultural products and the measuring methods</li> <li>(3) Post-harvest facilities and machinery</li> <li>(4) Remote sensing, GPS, GIS</li> <li>(5) Precision agriculture, smart agriculture, plant factory</li> <li>(6) Present conditions and future prospects of agricultural robots</li> <li>(7) Farm security and safety</li> <li>(8) General discussion</li> </ol> |
| Preparation, review of the class | Instructions on preparation for each lecture will be provided at the first lecture.   |
| Text Book                        | <ol style="list-style-type: none"> <li>(1) Agricultural Machinery Research Association edition: Bioproduction Machinery Handbook, Corona Company.</li> <li>(2) Ikeda et al.: Agricultural Machinery, 3rd Edition, Bunyakudo.</li> <li>(3) Haruna et al.: High-tech Era of Agricultural Measurement, Agriculture and Forestry Statistics Association.</li> </ol>   |
| Evaluation Method                | <p>Regular evaluation (responses to questions during class, participation in discussions, etc., accounting for 40% of the overall evaluation)</p> <p>Final evaluation (presentation and report, accounting for 60% of overall evaluation)</p> <p>The overall grade evaluation will be performed based on the above grade evaluations.</p>   |
| Points of Attention              | Nothing in particular.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 103  |
| Subject Title                    | Measurement and Control of Production Circumstace I  |
| Credit                           | 1  |
| Time                             | 2 period, Wednesay, 1 semester   |
| Name of Teacher                  | ZHANG Shu-huai   |
| Specific Goals                   | <ul style="list-style-type: none"> <li>O To understand the concept and application of precision agriculture</li> <li>O To understand the concept and application of plant factory</li> <li>O To understand the concept and application of image processing technology</li> </ul>                                     |
| Outlines of Class                | Nowadays, information technology, control technology, measurement technology play an important role in agricultural production. The principles and applications of these technologies will be introduced.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Precision agriculture (1)</li> <li>3. Precision agriculture (2)</li> <li>4. Plant factory</li> <li>5. Smart agriculture</li> <li>6. Image processing technology (1)</li> <li>7. Image processing technology (2)</li> <li>8. Discussion</li> </ol> |
| Preparation, review of the class | Students have to read materials of each topic in advance.  |
| Text Book                        | nothing  |
| Evaluation Method                | Attitudes in class (60%) and reports (40%)   |
| Points of Attention              | nothing  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 104  |
| Subject Title                    | Measurement and Control of Production Circumstace II   |
| Credit                           | 1  |
| Time                             | 2 period, Wednesay, 2 semester   |
| Name of Teacher                  | ZHANG Shu-huai   |
| Specific Goals                   | <ul style="list-style-type: none"> <li>O To understand the concept and application of spectroscopy</li> <li>O To understand the concept and application of remote sensing</li> <li>O To understand the concept and application of non-destructive measurement</li> </ul>                         |
| Outlines of Class                | Nowadays, information technology, control technology, measurement technology play an important role in agricultural production. The principles and applications of these technologies will be introduced.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Spectroscopy</li> <li>3. Remote sensing</li> <li>4. Non-destructive measurement (1)</li> <li>5. Non-destructive measurement (2)</li> <li>6. Data analysis (1)</li> <li>7. Data analysis (2)</li> <li>8. Discussion</li> </ol> |
| Preparation, review of the class | Students have to read materials of each topic in advance.  |
| Text Book                        | nothing  |
| Evaluation Method                | Attitudes in class (60%) and reports (40%)   |
| Points of Attention              | nothing  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 105   |
| Subject Title                    | Functional Anatomy of Domestic Animals A  |
| Credit                           | 1   |
| Time                             | 4 period, Monday, 3 semester  |
| Name of Teacher                  | Fuminori Kawabata   |
| Specific Goals                   | The goal of this class is to help students to understand the functional anatomy of domestic animals, especially that of chickens.   |
| Outlines of Class                | To understand the functional anatomy of domestic animals, it is needed to learn about analytical methods for conducting in vitro and in vivo experiments. In this class, we will learn these analytical methods and their related scientific findings by using textbooks and scientific articles. |
| Content                          | 1st: Taste mechanisms of chickens<br>2nd: Cloning of gene<br>3rd: Patch clamp test<br>4th: Calcium imaging<br>5th: Immunohistochemistry<br>6th: Respiratory gas analysis<br>7th Behavioral analysis<br>8th: Statistical analysis  |
| Preparation, review of the class | There are instructions during the class.  |
| Text Book                        | Copies of textbooks and scientific articles are distributed as needed.  |
| Evaluation Method                | Participation in class: 50%<br>The quality of the presentation and discussion in class: 50%   |
| Points of Attention              | Basic knowledge of animal science, molecular biology, physiology, and neuroscience are desirable.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 106  |
| Subject Title                    | Functional Anatomy of Domestic Animals B   |
| Credit                           | 1  |
| Time                             | 4 period, Monday, 4 semester   |
| Name of Teacher                  | Fuminori Kawabata  |
| Specific Goals                   | The goal of this class is to help students to deeply understand the functional anatomy of domestic animals, especially the taste system of chickens.   |
| Outlines of Class                | The taste system of chickens will be lectured in this class. The class is conducted in English and students are also expected to speak in English in their discussion.   |
| Content                          | 1st: Research history of chicken taste systems<br>2nd: Taste organs of chickens<br>3rd: Sweet taste systems in chickens<br>4th: Umami taste systems in chickens<br>5th: Bitter taste systems in chickens<br>6th: Sour taste systems in chickens<br>7th Salty taste systems in chickens<br>8th: Kokumi flavor systems in chickens |
| Preparation, review of the class | There are instructions during the class.   |
| Text Book                        | Copies of textbooks and scientific article are distributed as needed.  |
| Evaluation Method                | Participation in class: 50%<br>The quality of presentation and discussion in class: 50%  |
| Points of Attention              | It is desirable for students to have attended Functional Anatomy of Domestic Animals A.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 107  |
| Subject Title                    | Animal Nutritional Physiology A  |
| Credit                           | 1  |
| Time                             | 5 period, Monday, 1 semester   |
| Name of Teacher                  | Masatoshi Matsuzaki  |
| Specific Goals                   | To understand the mechanism and features of nutritional physiology of producing livestock animals in contrast with those of humans.  |
| Outlines of Class                | Learnig anatomy and functional mechanism of digestive tracts of livestock, chemistry and metabolism of nutrients.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Comparative physiology of digestive tracts of animals.</li> <li>2. Digestion and absorption.</li> <li>3. Chemistry of nutrients.</li> <li>4. Carbohydrate.</li> <li>5. Lipids.</li> <li>6. Protein.</li> <li>7. Energy metabolism.</li> <li>8. Regulatory mechanism of nutrient metabolism.</li> </ol> |
| Preparation, review of the class | Students should collect related information about the above topics and also regularly review what they learned in the lessons.   |
| Text Book                        | Provides during lectures   |
| Evaluation Method                | <p>Active participation in class discussion</p> <p>Written assignments</p> <p>The quality of presentations</p>   |
| Points of Attention              | A basic knowledge of Animal Production will be helpful.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 108   |
| Subject Title                    | Animal Nutritional Physiology B   |
| Credit                           | 1   |
| Time                             | 5 period, Monday, 2 semester  |
| Name of Teacher                  | Masatoshi Matsuzaki   |
| Specific Goals                   | To understand feeding management practices of livestock animals in relation to quality of animal products.  |
| Outlines of Class                | Learnig practical feeding management and nutrition disorders.   |
| Content                          | <ol style="list-style-type: none"> <li>1. How feeding management affects egg-laying hen production.</li> <li>2. How feeding management affects broiler chicken production.</li> <li>3. How feeding management affects pig production.</li> <li>4. How feeding management affects dairy production.</li> <li>5. How feeding management affects beef species production.</li> <li>6. How feeding management impacts reproduction.</li> <li>7. Productive diseases of cattle.</li> </ol> |
| Preparation, review of the class | Students should collect related information about the above topics and also regularly review what they learned in the lessons.  |
| Text Book                        | Provides during lectures  |
| Evaluation Method                | <p>Active participation in class discussion</p> <p>Written assignments</p> <p>The quality of presentations</p>  |
| Points of Attention              | A basic knowledge of Animal Production will be helpful.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 109  |
| Subject Title                    | Crop Production Ecology I  |
| Credit                           | 1  |
| Time                             | 1 period, Tuesday, 1 semester  |
| Name of Teacher                  | Daiyu ITO  |
| Specific Goals                   | 1 To understand the basics of crop production ecology through reading Japanese textbooks concerning plant ecology.<br>2 To understand the outline of the current studies on crop production ecology, especially those related to the light environment.  |
| Outlines of Class                | We will study the relationship between the plant growth/reproduction and various environmental factors through reading textbooks in turn, taking the interest of the participants into account. Moreover, light intercepting characteristics, photosynthesis and carbon budget of an agricultural ecosystem will be lectured on based on the teacher's own research.   |
| Content                          | How many of the teacher's researchers being introduced and the number of presentations students have to give vary, depending on the number of participants. The following is an example when there are only two participants and each presents twice during the course. Students can choose any chapters and textbooks shown in (20) for their presentations.<br>1st Guidance<br>2nd Research Introduction (Light interception characteristics)<br>3rd Research Introduction (Photosynthesis)<br>4th Reading a textbook in turn (Presented by the student A )<br>"Plant Ecology" Chapter 1<br>5th Reading a textbook in turn (Presented by the student B)<br>"Plant Ecology" Chapter 5<br>6th Research Introduction (Carbon budget)<br>7th Reading a textbook in turn (Presented by the student A )<br>"Plant Ecology" Chapter 2<br>8th Reading a textbook in turn (Presented by the student B)<br>"Biology of familiar weeds" Chapter 3 |
| Preparation, review of the class | All the participants should read through the assigned chapters of the textbooks before the class. In case of research introduction, thorough reviewing is required using the materials distributed in the class.   |
| Text Book                        | "Shokubutu Seitai-gaku (Plant Ecology)" Edited by Ichiro Terashima, published by Asakura Shoten<br>"Mijika na Zassou no Seibutsugaku (Biology of familiar weeds)" Edited by Masayuki Nemoto and Toru Tominaga, published by Asakura Shoten   |
| Evaluation Method                | All participants must give presentations twice or more and in order to do so, they have to prepare summary papers. Their final grades will be decided based on their presentations, summary papers and the enthusiasm during the class. Written examination will not be given.   |
| Points of Attention              | The teacher presumes that participants have already learned the fundamentals of this field at university. However, if participants are small in number, adjustment is possible according to the participants' level. Among the textbooks, "Plant Ecology" is written for undergraduate and graduate students, whereas "Biology of familiar weeds" for beginners.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 110   |
| Subject Title                    | Crop Production Ecology II  |
| Credit                           | 1   |
| Time                             | 1 period, Tuesday, 2 semester   |
| Name of Teacher                  | Daiyu ITO   |
| Specific Goals                   | 1 To understand the basics of crop production ecology through reading English textbooks concerning plant ecology, and to build up the ability to read scientific English..<br>2 To understand the outline of the current studies on crop production ecology, especially those related to the soil, water and pest environment.  |
| Outlines of Class                | We will read English textbooks related to the crop production ecology in turn, taking the interest of the participants into account. Moreover, soil respiration, water budget and ecological pest management of an agricultural ecosystem will be lectured on based on the teacher's own research.  |
| Content                          | How many of the teacher's researchers being introduced and the number of presentations students have to give vary, depending on the number of participants. The following is an example when there are only two participants and each presents twice during the course. Students can choose any chapters and textbooks shown in (20) for their presentation.<br>1st Guidance<br>2nd Research Introduction (Soil respiration)<br>3rd Research Introduction (Water budget, Evapotranspiration)<br>4th Reading English textbook in turn (Presented by the student A )<br>"Apple Grower" Chapter 1<br>5th Reading English textbook in turn (Presented by the student B)<br>"Soil Respiration and the Environment" Chapter 5<br>6th Research Introduction (Organic culture)<br>7th Reading English textbook in turn (Presented by the student A )<br>"Apple Grower" Chapter 3<br>8th Reading English textbook in turn (Presented by the student B)<br>"Crop Ecology" Chapter 9 |
| Preparation, review of the class | All the participants should read through the assigned chapters of the textbook before the class. In case of research introduction, thorough reviewing is required using the materials distributed in the class.   |
| Text Book                        | 1) "The Apple Grower -A Guide for the Organic Orchardist-" (Chelsea Green Publishing) A Guidebook for the organic apple culture in USA. Recommended to whom interested in apple cultivation.<br>2)"Soil Respiration and the Environment"(Academic Press) The review of soil respiration research. Recommended to whom interested in soil environment, soil micro-organism and carbon budget.<br>3)"Ecological Climatology"(Cambridge Univ. Press) Recommended to whom interested in agricultural meteorology and bio-environmental physics.<br>4)"Crop Ecology"(Cambridge Univ. Press) Chapters related to social science also included.  |
| Evaluation Method                | All participants must give presentations twice or more and in order to do so, they have to prepare summary papers. Their final grades will be decided based on their presentations, summary papers and the enthusiasm during the class.<br>Written examination will not be given.   |
| Points of Attention              | The Japanese participants should already have taken the course, Crop Production Ecology I in the 1st semester. Among the textbooks, "The Apple Grower" is written for actual apple growers in USA, whereas "Soil Respiration and the Environment", "Ecological Climatology" and "Crop Ecology" for undergraduate and graduate students.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 111   |
| Subject Title                    | Crop Environmental Stress Science I   |
| Credit                           | 1   |
| Time                             | 2 period, Wednesday, 3 semester   |
| Name of Teacher                  | Dong-Jin KANG   |
| Specific Goals                   | <p>The goals of this class are to:</p> <ul style="list-style-type: none"> <li>○ Understand the severity of food crises that may occur shortly due to declining crop production caused by global climate changes and think about new countermeasures against them (DP1).</li> <li>○ Learn the importance of exploring and developing genetic resources that tolerate environmental stress in crops by studying resistance mechanisms (DP1).</li> <li>○ Develop the ability to express and understand through student presentations and class discussions focused on various environmental stresses (DP2).</li> </ul>   |
| Outlines of Class                | <p>In recent years, global climate change has led to natural disasters worldwide, threatening the safety of crop supply. Stress tolerance varies across crop species and understanding the mechanism for considering stable crop production is crucial. In this class, students will learn the mechanism of natural disasters (environmental stress) caused by climate change and the plant response to environmental stress from a general perspective.</p>  |
| Content                          | <p>1: Introduce outlines of the class/ The mechanism of the occurrence of natural disasters associated with climate change and agricultural production trends.<br/> 2: Importance and applicability of crop genetic resources.<br/> 3: Crop resistance mechanisms for low and high-temperature stress (General remarks).<br/> 4: Crop resistance mechanisms for drought stress (General remarks).<br/> 5: Crop resistance mechanisms for submergence or flooding stress (General remarks).<br/> 6: Crop resistance mechanisms for acidic soil stress (General remarks).<br/> 7: Crop resistance mechanisms for saline stress (General remarks).<br/> 8: Presentation by students and class discussion</p> |
| Preparation, review of the class | <p>Lesson preparation will be announced in class. Reviewing the contents of each class is required for off-class studies.</p>   |
| Text Book                        | <p>No textbooks. Handouts will be provided as necessary in class.</p>   |
| Evaluation Method                | <p>Your overall score for this class will be determined as follows:</p> <ul style="list-style-type: none"> <li>○ Class attitude and participation according to the feedback document: 20%</li> <li>○ Mid-term examination by a report: 30%</li> <li>○ Final examination: Oral presentation by students at the end of the semester: 50%</li> </ul>   |
| Points of Attention              | <p>This class will be conducted in Japanese. All handouts are written in Japanese as well. It will be easy to understand if you have a basic knowledge of crop production, especially rice.</p>   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 112   |
| Subject Title                    | Crop Environmental Stress Science II  |
| Credit                           | 1   |
| Time                             | 2 period, Wednesday, 4 semester   |
| Name of Teacher                  | Dong-Jin KANG   |
| Specific Goals                   | <p>The goals of this class are to:</p> <ul style="list-style-type: none"> <li>○ Understand the severity of food crises that may occur shortly due to declining crop production caused by global climate changes and think about new countermeasures against them (DP1).</li> <li>○ Learn the importance of exploring and developing genetic resources that tolerate environmental stress in crops by studying resistance mechanisms (DP1).</li> <li>○ Develop the ability to express and understand through student presentations and class discussions focused on various environmental stresses (DP2).</li> </ul> |
| Outlines of Class                | In recent years, global climate change has led to natural disasters worldwide, threatening the safety of crop supply. Stress tolerance varies across crop species and understanding the mechanism for considering stable crop production is crucial. In this class, students will learn the plant response to each environmental stress from a specific perspective.  |
| Content                          | <ol style="list-style-type: none"> <li>1: Introduce outlines of the class/ Plant responses for drought stress (water transport).</li> <li>2: Plant responses for drought stress (resistance mechanism).</li> <li>3: Plant responses for submergence stress.</li> <li>4: Plant responses for saline stress.</li> <li>5: Plant responses for acid soil stress.</li> <li>6: Plant responses for high-temperature stress.</li> <li>7: Plant responses for low-temperature stress.</li> <li>8: Presentation by students and class discussion.</li> </ol>   |
| Preparation, review of the class | Lesson preparation will be announced in class. Reviewing the contents of each class is required for off-class studies.  |
| Text Book                        | No textbooks. Handouts will be provided as necessary in class.  |
| Evaluation Method                | <p>Your overall score for this class will be determined as follows:</p> <ul style="list-style-type: none"> <li>○ Class attitude and participation according to the feedback document: 20%</li> <li>○ Mid-term examination by a report: 30%</li> <li>○ Final examination: Oral presentation by students at the end of the semester: 50%</li> </ul>   |
| Points of Attention              | This class will be conducted in Japanese. All handouts are written in Japanese as well. It will be easy to understand if you have a basic knowledge of crop production, especially rice.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 113   |
| Subject Title                    | Wood Processing I   |
| Credit                           | 1   |
| Time                             | 3 period, Thursday, 1 semester  |
| Name of Teacher                  | Takashi Hirose (Faculty of Education)   |
| Specific Goals                   | In learning a physical and organized property of the wood as materials, it is to understand those applied technologies deeply.  |
| Outlines of Class                | It is necessary to learn the knowledge about the physical and organized property to understand wood. By this class, I give an outline about the basics about them and an applied technology.  |
| Content                          | <p>The first Introduction of wood used in industry</p> <p>The second About physical property of wood (1) Density, moisture content, the shrinkage and swelling</p> <p>The third About physical property of wood (2) Strength, hardness, heat, electricity</p> <p>The fourth About organized property of wood (1) Organizations</p> <p>The fifth About organized property of the wood (2) Appearance</p> <p>The sixth About wood processing tool (hand tool)</p> <p>The seventh About wood processing technique using the hand tool</p> <p>The eighth Discussion</p> |
| Preparation, review of the class | In consultation with a distribution document, please perform preparations for lessons and a review of the latest study information.   |
| Text Book                        | No need   |
| Evaluation Method                | I evaluate the results by the participation in report (50%), question application, argument in class (50%)  |
| Points of Attention              | No need   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 114  |
| Subject Title                    | Wood Processing II   |
| Credit                           | 1  |
| Time                             | 3 period, Thursday, 2 semester   |
| Name of Teacher                  | Takashi Hirose (Faculty of Education)  |
| Specific Goals                   | In learning a physical and organized property of the wood as materials, it is to understand those applied technologies deeply.   |
| Outlines of Class                | The aim of this course is to help students acquire an understanding the occurrence mechanism of abiotic stresses, importance of genetic resources having environmental stress tolerance, and resistant mechanism of crop species to various stressful environments to students taking this course.   |
| Content                          | The first Introduction of wood used in industry<br>The second About physical property of wood (1) Density, moisture content, the shrinkage and swelling<br>The third About physical property of wood (2) Strength, hardness, heat, electricity<br>The fourth About organized property of wood (1) Organizations<br>The fifth About organized property of the wood (2) Appearance<br>The sixth About wood processing tool (hand tool)<br>The seventh About wood processing technique using the hand tool<br>The eighth Discussion |
| Preparation, review of the class | In consultation with a distribution document, please perform preparations for lessons and a review of the latest study information.  |
| Text Book                        | No need  |
| Evaluation Method                | I evaluate the results by the participation in report (50%), question application, argument in class (50%)   |
| Points of Attention              | No need  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 115  |
| Subject Title                    | Physiology of Crop Production A  |
| Credit                           | 1  |
| Time                             | 2 period, Tuesday, 3 semester  |
| Name of Teacher                  | Hiroki Kobayakawa  |
| Specific Goals                   | To understand the relationship between crop production and crop physiology such as photosynthesis, environmental stress, and plant hormone.  |
| Outlines of Class                | I will explain the crop physiology such as photosynthesis, environmental stress, and plant hormone. This is very important for crop production. Moreover, the students make a presentation on the relationship between crop physiology and crop production.  |
| Content                          | 1. Guidance and Introduction (Basis of photosynthesis).<br>2. Photosynthesis and photosynthesis-related metabolism.<br>3. Antioxidant metabolism and plant stress.<br>4. Environmental stress of crop (1).<br>5. Environmental stress of crop (2).<br>6. Plant hormone and crop (1).<br>7. Plant hormone and crop (2).<br>8. Presentation. |
| Preparation, review of the class | Preparation and review the contents of the lecture   |
| Text Book                        | Distributed when necessary   |
| Evaluation Method                | Participation in class: 50%<br>The quality of presentation and discussion in class: 50%  |
| Points of Attention              | No need  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 116   |
| Subject Title                    | Physiology of Crop Production B   |
| Credit                           | 1   |
| Time                             | 2 period, Tuesday, 4 semester   |
| Name of Teacher                  | Hiroki Kobayakawa   |
| Specific Goals                   | To understand the relationship between crop production and crop physiology, such as leaf senescence and environmental stress.   |
| Outlines of Class                | I will explain the crop physiology such as leaf senescence, high-yielding ability of crop and valuable plant resource. Moreover, the students make a presentation on the leaf senescence or plant resource.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Guidance and Introduction.</li> <li>2. Leaf senescence and metabolism (photosynthesis and nitrogen metabolism).</li> <li>3. Leaf senescence and plant hormone (1).</li> <li>4. Leaf senescence and plant hormone (2).</li> <li>5. Ozone stress of crop.</li> <li>6. High-yielding ability of crop and valuable plant resource.</li> <li>7. Presentation (1).</li> <li>8. Presentation (2).</li> </ol> |
| Preparation, review of the class | Preparation and review the contents of the lecture  |
| Text Book                        | Distributed when necessary  |
| Evaluation Method                | Participation in class: 50%<br>The quality of presentation and discussion in class: 50%   |
| Points of Attention              | No need   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 117  |
| Subject Title                    | Agricultural Land Engineering A  |
| Credit                           | 1  |
| Time                             | 1 period, Thursday, 2 semester   |
| Name of Teacher                  | Choichi Sasaki   |
| Specific Goals                   | This series of lectures aims to help students understand the characteristics of soil and the influence of percolation patterns on several phenomena in paddy soil. It is especially designed to help them understand that percolation patterns have an influence on removal of soil solution and several concentrations of soil air.   |
| Outlines of Class                | This series of lectures includes talks on the characteristic of soil and the influence of percolation patterns on redox potential and several phenomena in paddy soil by using reference papers and experimental models.   |
| Content                          | <ol style="list-style-type: none"> <li>1) Introduction: soil percolation in paddy field</li> <li>2) Characteristics of paddy soil</li> <li>3) Redox potential of soil and velocity of soil water</li> <li>4) Redox potential of soil and soil solution of in percolation water</li> <li>5) Fluctuation of oxygen concentration in stratified paddy field</li> <li>6) Fluctuation of carbon dioxide concentration in stratified paddy field</li> <li>7) Land reclamation and soil environment</li> <li>8) Discussion and summary</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | Report (80%) and discussion (20%)  |
| Points of Attention              | It would be better if students understand agricultural land engineering and soil physics.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 118  |
| Subject Title                    | Agricultural Land Engineering B  |
| Credit                           | 1  |
| Time                             | 1 period, Thursday, 3 semester   |
| Name of Teacher                  | Choichi Sasaki   |
| Specific Goals                   | This series of lectures aims to help students understand soil structure and its influence on growth and yields of rice plants and uptake of pollutants in paddy soil. It is especially designed to help them understand the influence of cadmium on growth and yields of rice plants and concentration of seeds.   |
| Outlines of Class                | This series of lectures includes X-ray stereo-radiograph of undisturbed soil structure image and its method of taking pictures, stratified soil layer of paddy field influence on the characteristic of cadmium uptake.  |
| Content                          | <ol style="list-style-type: none"> <li>1) Introduction: soil structure</li> <li>2) Procedure and the theory of soil structure images by X-ray stereo-radiography</li> <li>3) Root formed pores in Yayoi era paddy fields and meanings of those photos</li> <li>4) Growth and yields of rice plants and cadmium concentration in grains in the cadmium contaminated paddy field</li> <li>5) Countermeasure of soil dressing in cadmium contaminated paddy fields</li> <li>6) Influence of groundwater level on the growth, yields and concentration of seeds of soybean</li> <li>7) Relation between difference of cadmium concentration in soil and growth and yields, and concentration of soybean seeds.</li> <li>8) Discussion and summary</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | Report (80%) and discussion (20%)  |
| Points of Attention              | It would be better if students understand agricultural land engineering and soil physics.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 119   |
| Subject Title                    | Agricultural Land Environmental Physics A   |
| Credit                           | 1   |
| Time                             | 1 period, Monday, 1 semester  |
| Name of Teacher                  | Akira Endo  |
| Specific Goals                   | To help students understand the basic concepts of agricultural land development and maintenance in agricultural land soil (especially ordinary upland fields, orchards and grasslands), the concepts of material and energy transfer in farmland soil and the characteristics of substance circulation (especially focusing on nitrogen and phosphorus)   |
| Outlines of Class                | This course provides an overview of mass and energy transport phenomena in agricultural soil and material recycling surrounding agricultural land. In addition, in order to improve students' understanding of transport of mass and energy in agricultural soil, a simple simulation model created by the instructor in charge is used as part of his teaching materials.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Characteristics of physical and chemical properties of agricultural upland soils in Japan</li> <li>2. Differences in water quality and hydrological characteristics of paddy fields and uplandfield fields and characteristics of mass and energy transport phenomena</li> <li>3. Characteristics of material circulation in ordinary uplandfields I (Agricultural land development and maintenance)</li> <li>4. Characteristics of material circulation in ordinary uplandfields II (Characteristics of material circulation)</li> <li>5. Characteristics of material circulation in the orchard I (Agricultural land development and maintenance)</li> <li>6. Characteristics of material circulation in the orchard II (Characteristics of material circulation)</li> <li>7. Relation between difference of cadmion concentration in soil and growth and yield,and concentration of soybeen seeds.</li> <li>8. Summary and General Discussion</li> </ol> |
| Preparation, review of the class | Bring a scientific calculator.  |
| Text Book                        | Will be introduced in the class.  |
| Evaluation Method                | Based on the content of the report, plus the atendance rate.  |
| Points of Attention              | It is necessary for students to have a sound knowledge of soil physics and agricultural land engineering.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 120  |
| Subject Title                    | Agricultural Land Environmental Physics B  |
| Credit                           | 1  |
| Time                             | 1 period, Monday, 2 semester   |
| Name of Teacher                  | Akira Endo   |
| Specific Goals                   | Students will be understand the principles of methods for measureing physical and chemical properties of agricultural land soil (especially in-situ soil) and basic matters necessary for elucidating the phenomena of mass and energy transport in the agricultural land soil and the material cycling mechanism.   |
| Outlines of Class                | This course provides an explanation of basic methods for measuring soil environment in agricultural land that are necessary to clarify the transport phenomena of mass and energy in agricultural soil and the material cycling mechanism surrounding farmland. In addition, in order to improve the level of students' understanding of the content of this class, field measurement and analysis using various measuring instruments will be conducted.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Methods for measuring physical and chemical properties of agricultural soil (general physical and chemical properties of soil)</li> <li>2. Methods for measuring agricultural soil moisture (weight method, tensiometer method, time domain reflectometry method)</li> <li>3. Methods for measuring agricultural soil salinity (electrical conductivity method, time domain reflectometry)</li> <li>4. Methods for measuring nutrients in agricultural land soil (ion electrode method, ion chromatography method, spectroscopy method)</li> <li>5. Methods for measuring thermal properties (temperature diffusivity, volumetric heat capacity) in agricultural soil (dual-probe heat-pulse method, QPHP method)</li> <li>6. Methods for measuring water flux density vector in agricultural soil (quintuple-probe heat-pulse method (QPHP method))</li> <li>7. Methods for measuring nondestructive continuous measurement technology of agricultural soil in recent years</li> <li>8. Summary and General Discussion</li> </ol> |
| Preparation, review of the class | Bring a scientific calculator.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | Based on the content of the report, plus the attendance rate.  |
| Points of Attention              | It is necessary for students to have a sound knowledge of soil physics and agricultural land engineering.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 121   |
| Subject Title                    | Agricultural Facilities Engineering I   |
| Credit                           | 1   |
| Time                             | 2 period, Tuesday, 1 semester   |
| Name of Teacher                  | Hiroshi Mori  |
| Specific Goals                   | To understand the basics of the finite element method which is useful for understanding the behavior of the structure of agricultural facilities  |
| Outlines of Class                | A series of lectures on the basics of the FEM.  |
| Content                          | <ol style="list-style-type: none"> <li>1) Continuum mechanics</li> <li>2) Stiff matrix</li> <li>3) Plane truss</li> <li>4) Stress - strain relation</li> <li>5) Principle of a virtual work</li> <li>6) Triangular element</li> <li>7) Linear simultaneous equation</li> <li>8) Inverse matrix</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.  |
| Text Book                        | Will be introduced in the class.  |
| Evaluation Method                | Report (70%) and Continuous assessment (30%)  |
| Points of Attention              | It would be better if students have some knowledge of structural mechanics, soil mechanics and geotechnical engineering.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 122   |
| Subject Title                    | Agricultural Facilities Engineering II  |
| Credit                           | 1   |
| Time                             | 2 period, Tuesday, 2 semester   |
| Name of Teacher                  | Hiroshi Mori  |
| Specific Goals                   | To acquire the practical skills of the finite element method.   |
| Outlines of Class                | Using a computer, students will learn how to apply the FEM to analyse the behavior of the structure of agricultural facilities.   |
| Content                          | <ol style="list-style-type: none"> <li>1) Basic knowledge of Fortran</li> <li>2) Programming 1 by Fortran</li> <li>3) Programming 2 by Fortran</li> <li>4) Operations check (Error handling)</li> <li>5) Improvement of a program</li> <li>6) Preliminary analysis of a cantilever</li> <li>7) Analysis 1 in a concrete dam</li> <li>8) Analysis 2 in a concrete dam</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.  |
| Text Book                        | Will be introduced in the class.  |
| Evaluation Method                | Report (70%) and Continuous assessment (30%)  |
| Points of Attention              | It's desirable that students should be able to use a computer and also know the Fortran language.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 123   |
| Subject Title                    | Management of Rural Environmental System I  |
| Credit                           | 1   |
| Time                             | 3 period, Tuesday, 3 semester   |
| Name of Teacher                  | Ko Kato   |
| Specific Goals                   | This course aims to help students understand the use of information in the rural environment and agriculture, and learn about ICT connected with farm products, farmlands and hydraulic structures.   |
| Outlines of Class                | In this course, students will learn about the field monitoring system and some numerical analysis methods for agricultural and environmental engineering.   |
| Content                          | Lec.1 Rural environment and information<br>Lec.2 Rural information and Food<br>Lec.3 Field monitoring for Agriculture<br>Lec.4 Hydraulic structure and Information<br>Lec.5 Numerical Analysis 1 (Structure)<br>Lec.6 Numerical Analysis 2 (Seepage)<br>Lec.7 Numerical Analysis 3 (Conduction of heat)<br>Lec.8 Summary of all lectures. |
| Preparation, review of the class | Will be introduced in the class.  |
| Text Book                        | Will be introduced in the class.  |
| Evaluation Method                | The final evaluation will be made based on the reports (100%)   |
| Points of Attention              | This course needs a PC in all the lectures.   |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 124   |
| Subject Title                    | Management of Rural Environmental System II   |
| Credit                           | 1   |
| Time                             | 3 period, Tuesday, 4 semester   |
| Name of Teacher                  | Ko Kato   |
| Specific Goals                   | This course aims to help students understand the practical use of information in the rural environment and agriculture, and study about ICT connected with agricultural products, farmlands and hydraulic structures.   |
| Outlines of Class                | In this course, students learn about field monitoring systems and survey practical uses of ICT on various sites.  |
| Content                          | Lec.1 Field monitoring 1 (structure and mechanism).<br>Lec.2 Field monitoring 2 (using methods on sites).<br>Lec.3 Utilization of field data 1 (data processing).<br>Lec.4 Utilization of field data 2 (data analysis).<br>Lec.5 Practical use of field monitoring system 1 (Hydrological structure).<br>Lec.6 Practical use of field monitoring system 2 (Rural system).<br>Lec.7 Practical use of field monitoring system 3 (farmland).<br>Lec.8 Summary of all lectures. |
| Preparation, review of the class | Will be introduced in the class.  |
| Text Book                        | Will be introduced in the class.  |
| Evaluation Method                | The final evaluation will be made based on the reports(100%).   |
| Points of Attention              | We go to some sites for learning about practical uses of monitoring systems.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 125  |
| Subject Title                    | Regional Environmental Planning A  |
| Credit                           | 1  |
| Time                             | 1period, Tuesday, 3 semester   |
| Name of Teacher                  | Hiroyuki Fujisaki  |
| Specific Goals                   | This course will deal with "community development".<br>(1) Students will understand what community development is and its background.<br>(2) Students will understand mechanisms and techniques for community development.<br>(3) Students will develop their ability to think how to solve each community issues.   |
| Outlines of Class                | A close partnership and collaboration among residents, local governments, companies, etc, is attracting attention in community development. They work together in order to design sustainable communities. We will learn basic ideas of community development and consider possible ways of developing communities by looking at some case studies.  |
| Content                          | <ol style="list-style-type: none"> <li>1. What is community development?</li> <li>2. Background to community development</li> <li>3. Mechanisms for community development</li> <li>4. Workshop technique for community development</li> <li>5. Case study 1: an improvement in a community's living of living environment</li> <li>6. Case study 2: safety and security of a community</li> <li>7. Case study 3: community development in an underpopulated area</li> <li>8. General discussion about community development</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | Reports submitted before each lecture (50%) and final report (50%)   |
| Points of Attention              | Nothing special  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 126  |
| Subject Title                    | Regional Environmental Planning B  |
| Credit                           | 1  |
| Time                             | 1period, Tuesday, 4semester  |
| Name of Teacher                  | Hiroyuki Fujisaki  |
| Specific Goals                   | <p>This course will deal with "rural development".</p> <p>(1) Students will understand the changes in rural development after World War II.</p> <p>(2) Students will understand the significance of "sixth industrialization of agriculture".</p> <p>(3) Students will develop their ability to think how to develop the sustainability of rural areas.</p>  |
| Outlines of Class                | <p>"Sixth industrialization of agriculture" means that farmers manage not only agriculture but also business related to agriculture, for example, food processing, direct sales, and agricultural tourism.</p> <p>It is difficult to develop rural areas only by agriculture in an urbanized country like Japan, so sixth industrialization of agriculture plays an important part in developing rural areas, and also in increasing the understanding of agriculture and rural areas.</p> <p>We will learn the changes in rural development and consider how to develop rural areas by looking at various cases of sixth industrialization.</p> |
| Content                          | <ol style="list-style-type: none"> <li>1. Changes in rural development after World War II (first half)</li> <li>2. Changes in rural development after World War II (second half)</li> <li>3. Farmers' market</li> <li>4. Food processing</li> <li>5. Farmers' restaurant</li> <li>6. Farm-inn</li> <li>7. Rural environmental conservation volunteer</li> <li>8. General discussion about rural development</li> </ol>   |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | Reports submitted before each lecture (50%) and final report (50%)   |
| Points of Attention              | Nothing special  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 127   |
| Subject Title                    | Conservation of Mountain Watersheds I   |
| Credit                           | 1   |
| Time                             | 2 period, Thursday, 1 semester  |
| Name of Teacher                  | Ching - Ying Tsou   |
| Specific Goals                   | This course aims to provide students with a basic and practical knowledge of the topics, including mountain watershed environment, sediment disaster, and watershed conservation.   |
| Outlines of Class                | The majority of the topics as mentioned below will be covered by lectures on the important concepts of each topic, and presentation of related papers.  |
| Content                          | <ol style="list-style-type: none"> <li>1: The meaning of watershed conservation</li> <li>2: Sediment production and the process of sediment movement</li> <li>3: Geomorphologic classification using aerial photos and topographic maps</li> <li>4: Reading and presentation papers related to the sediment disaster in mountain watersheds (1)</li> <li>5: Reading and presentation papers related to the sediment disaster in mountain watersheds (2)</li> <li>6: Reading and presentation papers related to mountain watershed conservation and usage (1)</li> <li>7: Reading and presentation papers related to mountain watershed conservation and usage (2)</li> <li>8: In-class student research presentations/discussion</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.  |
| Text Book                        | Will be introduced in the class.  |
| Evaluation Method                | In-Class discussion, assignments/Paper Critiques (50%) , Report (50%)   |
| Points of Attention              | The course will require reading, especially of research literature, in-class participation and discussions. One student will be responsible for presenting two papers. In addition, all students are required to read the paper(s) they present very carefully before the class. Several additional papers will be recommended for reading.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 128  |
| Subject Title                    | Conservation of Mountain Watersheds II   |
| Credit                           | 1  |
| Time                             | 2 period, Thursday, 2 semester   |
| Name of Teacher                  | Ching-Ying Tsou  |
| Specific Goals                   | This course aims to provide students with a basic knowledge of the topics, including conservation of mountain watershed environment and landslide investigation and prevention. Landslides are widespread in the Shirakami Mountains in the northern part of the Honshu Island of Japan and their related phenomena will be introduced.  |
| Outlines of Class                | This course will introduce case studies of landslides in the Shirakami Mountains.  |
| Content                          | <ol style="list-style-type: none"> <li>1: The causes of widespread landslides</li> <li>2: Identification methods of potential sites of landslides</li> <li>3: Methods to reveal the landslide activity</li> <li>4: Landslide hazard zoning</li> <li>5 and 6: Field work: Landslide survey</li> <li>7: Data analysis from the field work</li> <li>8: Conservation of mountain watersheds in the Shirakami Mountains (Group discussion)</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | Mid-term and final reports (100%)  |
| Points of Attention              | Students are required to take "Conservation of Mountain Watersheds I" before taking this course  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 129   |
| Subject Title                    | Irrigation and Water Use Engineering I  |
| Credit                           | 1   |
| Time                             | 4 period, Thursday, 1 semester  |
| Name of Teacher                  | Atsushi Marui   |
| Specific Goals                   | Student will understand (1) how to use agricultural water in paddy fields and upland fields, (2) water movement such as evapotranspiration and percolation, (3) how to plan the amount of nessesary for agriculture.  |
| Outlines of Class                | I will explain how to use agricultural water in paddy fields and upland fields, and how to calculate the amount of nessesary for the prupose, and to do so, irrigation systems and physical water dynamics will also be explained. In the field survey, we will visit the irriigation and drainage channel in Tsugaru plains.   |
| Content                          | 1: Outline explanation of irrigation water use engineering<br>2: Paddy field irrigation system and water quantity<br>3: Water consumption and irrigation system for upland irrigation<br>4: Calculation of wide area water requirement for agriculture<br>5: Design of agricultural water quantity in paddy field (field survey)<br>6: Irrigation efficiency and agricultural water plan (field survey)<br>7: Agricultural water use facility (field survey)<br>8: Discussion on planning of agricultural water |
| Preparation, review of the class | Will be introduced in the class.  |
| Text Book                        | Will be introduced in the class.  |
| Evaluation Method                | A report for each lecture   |
| Points of Attention              | Knowledge of mathematics and soil physics is required.Please wear clothes you don't mind getting dirty on field survey.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 130  |
| Subject Title                    | Irrigation and Water Use Engineering II  |
| Credit                           | 1  |
| Time                             | 4 period, Thursday, 2 semester   |
| Name of Teacher                  | Atsushi Marui  |
| Specific Goals                   | Student will understand (1) the history of irrigation drainage in the world and its current projects, (2) the relationship between the water use environment of agricultural water and crop yields, (3)the advantages and disadvantages of irrigation.   |
| Outlines of Class                | The history and significance of irrigation in the world, and the regional differences and problems of irrigation projects in recent years will be explained. To deepen the understanding of the benefits and issues arising from irrigation technology, I will talk about the cases of agricultural water environment in Tsugaru region and irrigation projects in developing countries.   |
| Content                          | 1: The world's irrigation and its history<br>2: Irrigation projects in arid land<br>3: Irrigation projects in Asia monsoon area<br>4: Water resources survey method (field survey)<br>5: Agricultural water intake at head work (field survey)<br>6: Water quality of agricultural water in paddy field area (field survey)<br>7: Crop yield and water quality water quality for agriculture<br>8: Discussion on agricultural water issues |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | Report for each lecture  |
| Points of Attention              | Knowledge of hydrology is required. Please wear clothes you don't mind getting dirty on field survey.  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 131  |
| Subject Title                    | Rural Energy Engineering I   |
| Credit                           | 1  |
| Time                             | 5 period, Thursday, 1 semester   |
| Name of Teacher                  | Shigeoki Moritani  |
| Specific Goals                   | Students will understand the use of agricultural facility and snow melting system specially designed for cold and heavily snowing areas. Some basic principles of thermodynamics will also be talked about in order to clarify the mechanism of a heat pump.   |
| Outlines of Class                | This course will provide several methods for solving problems in cold and snowy areas using with various forms of renewable energy. Published papers are selected and used to explain these methods.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Problems of cold weather and snow in Aomori</li> <li>2. Introduction of renewable energy</li> <li>3. Conventional snow melting system</li> <li>4. Theory of Carnot cycle and heat pump cycle</li> <li>5. Thermodynamics of heat pump</li> <li>6. System of snow melting and heating facilities with geothermal energy</li> <li>7. System of snow melting and heating facilities with biomass energy</li> <li>8. Summary of all the topics</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | A report after each lecture  |
| Points of Attention              | Student should be interested in renewable energy   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 132  |
| Subject Title                    | Irrigation, Drainage and Water Use Engineering II  |
| Credit                           | 1  |
| Time                             | 5 period, Thursday, 2 semester   |
| Name of Teacher                  | Shigeoki Moritani  |
| Specific Goals                   | Heat pumps have recently been used in greenhouses due to their wide range of useful functions such as heating and chilling. Students will understand the mechanism of a heat pump based on the use of thermodynamics.  |
| Outlines of Class                | This course will provide some mathematical methods for explaining the mechanism of thermodynamics. Published papers are selected and used to explain these methods.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Basics of thermodynamics</li> <li>2. Equation of state</li> <li>3. First law of thermodynamics</li> <li>4. Second law of thermodynamics</li> <li>5. Enthalpy and Entropy</li> <li>6. Various heat engines</li> <li>7. Heat pump cycle</li> <li>8. Summary of all the topics</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | A report after each lecture  |
| Points of Attention              | Student should be interested in mathematics  |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 133  |
| Subject Title                    | Agricultural land conservation A   |
| Credit                           | 1  |
| Time                             | 3 period, Momday, 3 semester   |
| Name of Teacher                  | Chihiro Kato   |
| Specific Goals                   | Analyzing water transport in soil and predicting soil moisture condition are important and useful for agricultural, environmental and engineering objectives. This course will teach you the methods and application of numerical simulation of water transport phenomena in soil. Students will understand the basics of the soil hydraulic properties such as water reteniton and hydraulic conductivity, the governing equation of soil water transport and the outline of numerical simulation.                  |
| Outlines of Class                | The software package (HYDRUS 1D) will be used to explain the phenomena and numerical simulation of soil water trasnport.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction: Soil water tranpsort phenomena relating to agricultural and environmental issues</li> <li>2. The outline of numerical simulation of soil water transport</li> <li>3. Soil water retention</li> <li>4. Soil hydraulic conductivity</li> <li>5. Initial and boundary conditions</li> <li>6. Predicting soil moisture in agricultural lands (Exercise 1)</li> <li>7. Predicting soil moisture in agricultural lands (Exercise 2)</li> <li>8. Summary</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | Attitudes(20%) and Reports (80%)   |
| Points of Attention              | It would be better if studetns have a good knowledge of soil physics.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 134   |
| Subject Title                    | Agricultural land conservation B  |
| Credit                           | 1   |
| Time                             | 3 period, Monday, 4 semester  |
| Name of Teacher                  | Chihiro Kato  |
| Specific Goals                   | Analyzing solute transport in soil and predicting soil moisture condition are important and useful for agricultural, environmental and engineering objectives. This course will teach you the methods and application of numerical simulation of solute transport phenomena in soil. Students will understand the mechanisms and the models of solute transport in soil.  |
| Outlines of Class                | The software package (HYDRUS 1D) will be used to explain the phenomena and numerical simulation of soil solute trasnport.   |
| Content                          | <ol style="list-style-type: none"> <li>1. Introduction: Soil solute tranpsort phenomena relating to agricultural and environmental issues</li> <li>2. The mechanisms of soil solute transport</li> <li>3. The governing equation and the models of soil solute transport</li> <li>4. The parameters of soil solute transport and reaction parameters</li> <li>5. Initial and boundary conditions</li> <li>6. Predicting soil solute transport in agricultural lands (Exercise 1)</li> <li>7. Predicting soil solute transport in agricultural lands (Exercise 2)</li> <li>8. Summary</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.  |
| Text Book                        | Will be introduced in the class.  |
| Evaluation Method                | Attitudes(20%) and Reports (80%)  |
| Points of Attention              | It would be better if studetns have a good knowledge of soil physics.   |

|                                  |  |
|----------------------------------|--|
| Subject No                       | 135  |
| Subject Title                    | The Water Utilization Facilities Engineering I   |
| Credit                           | 1  |
| Time                             | 2 period, Thursday, 3 semester   |
| Name of Teacher                  | Yataya Kenichi   |
| Specific Goals                   | Student will understand (1) theory and practice of runoff analysis, (2) theory and practice for planning open channel cross-section.   |
| Outlines of Class                | This course provides hydraulics expertise in irrigation, drainage and rural engineering. You will learn the technology for planning of the water utilization facilities while moving your hands using a personal computer by yourself.   |
| Content                          | <ol style="list-style-type: none"> <li>1. How to plan open channel cross-section</li> <li>2. Basic operations of QGIS</li> <li>3. Setting catchment area and runoff coefficient using QGIS</li> <li>4. Runoff calculation using the Rational equation</li> <li>5. Organizing specifications of the planning channel</li> <li>6. Open channel cross-section planning using Manning formula</li> <li>7. Drawing of channel cross-sections using CAD</li> <li>8. Guidance on writing technical reports</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.   |
| Text Book                        | Will be introduced in the class.   |
| Evaluation Method                | Mid-term and final reports (100%)  |
| Points of Attention              | Please prepare a mobile PC.  |

|                                  |   |
|----------------------------------|---|
| Subject No                       | 136   |
| Subject Title                    | The Water Utilization Facilities Engineering II   |
| Credit                           | 1   |
| Time                             | 2 period, Thursday, 4 semester  |
| Name of Teacher                  | Yataya Kenichi  |
| Specific Goals                   | Student will understand (1) theory of standard step method of non uniform flow, (2) algorithm and source code of standard step method.  |
| Outlines of Class                | In this course, you will learn the theory of calculation method for non uniform flow, which is frequently used in analyzing the flow of open channels. And practice the calculation method using Excel and Python.  |
| Content                          | <ol style="list-style-type: none"> <li>1. Characteristics of water flow</li> <li>2. Theory about standard step method of non uniform flow(1)</li> <li>3. Theory about standard step method of non uniform flow(2)</li> <li>4. Modeling of standard step method using Excel</li> <li>5. Basic knowledge of Python</li> <li>6. Programming by Python</li> <li>7. Understanding of standard step method source code by Python(1)</li> <li>8. Understanding of standard step method source code by Python(2)</li> </ol> |
| Preparation, review of the class | Will be introduced in the class.  |
| Text Book                        | Will be introduced in the class.  |
| Evaluation Method                | Mid-term and final reports (100%)   |
| Points of Attention              | Please prepare a mobile PC.   |