**AGRICULTUREL BIOTECHNOLOGY PhD PROGRAMME**

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| **First Year** | | | | | | |
| **I. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 501011101 | [THE SCIENTIFIC RESEARCH METHODS AND ITS ETHICS](#C1) | 7.5 | 3+0 | 3 | **C** | Turkish |
| 506611501 | [CURRENT INNOVATIONS IN AGRICULTURAL BIOTECHNOLOGY](#C2) | 7.5 | 3+0 | 3 | **C** | Turkish |
|  | Elective Course-1 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-2 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Total of I. Semester | 30 |  | 12 |  |  |
| **II. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
|  | Elective Course-3 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-4 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-5 | 7.5 | 3+0 | 3 | E | Turkish |
| 506612001 | PhD Seminar | 7.5 | 0+1 | - | **C** | Turkish |
|  | Total of II. Semester | 30 |  | 9 |  |  |
|  | TOTAL OF FIRST YEAR | 60 |  | 21 |  |  |

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| **Second Year** | | | | | | |
| **III. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 506611801 | PhD PROFICIENCY | 30 | 0+1 | **-** | **C** | Turkish |
|  | Total of III. Semester | 30 |  |  |  |  |
| **IV. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 501011102 | THESIS PROPOSAL | 30 | 0+1 | **-** | **C** | Turkish |
|  | Total of IV. Semester | 30 |  |  |  |  |
|  | TOTAL OF SECOND YEAR | 60 |  |  |  |  |

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| **Third Year** | | | | | | |
| **V. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 506611802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 506611803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | **-** | **C** | Turkish |
|  | Total of V. Semester | 30 |  |  |  |  |
| **VI. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 506611802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 506611803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | - | **C** | Turkish |
|  | Total of VI. Semester | 30 |  |  |  |  |
|  | TOTAL OF THIRD YEAR | 60 |  |  |  |  |

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| **Fourth Year** | | | | | | |
| **VII. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 506611802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 506611803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | **-** | **C** | Turkish |
|  | Total of VII. Semester | 30 |  |  |  |  |
| **VIII. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 506611802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 506611803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | - | **C** | Turkish |
|  | Total of VIII. Semester | 30 |  |  |  |  |
|  | TOTAL OF FOURTH YEAR | 60 |  |  |  |  |

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| **Elective Courses** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 506611502 | [ENTOMOLOGICAL BIOTECHNOLOGY](#C9) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506611503 | [ETHICS AND BIOSAFETY IN AGRICULTURAL BIOTECHNOLOGY](#C10) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506611504 | [PCR BASED ANALYSIS](#C11) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506611505 | [EPIGENETICS](#C12) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506612506 | [NEXT GENERATION DNA SEQUENCING METHODS](#C13) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506611506 | [ABIOTIC STRESS AND GENE EXPRESSION IN PLANTS](#C8) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506612501 | [FREE RADICALS AND ANTIOXIDANTS](#C6) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506612502 | [ADVANCED MICROSCOPY TECHNIQUES](#C3) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506612503 | [RNA BIOLOGY](#C4) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506612504 | [PROTEOMIC ANALYSIS](#C5) | 7.5 | 3+0 | 3 | E | TurkIsh |
| 506612505 | [MOLECULAR TECH. USED IN ANIMAL BREEDING STUD.](#C7) | 7.5 | 3+0 | 3 | E | TurkIsh |

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | Joint Course for the Institute | **SEMESTER** | Fall-Spring |

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| **COURSE** | | | |
| **CODE** | 501011101 | **TITLE** | The Scientific Research Methods and Its Ethics |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| MSc-  Ph.D | 3 | | 0 | 0 | | | 3+0 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 1,5 | | 1,5 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Science, the scientific thought and other fundamental concepts, the scientific research process and its techniques, Methodology: Data Collecting-Analysis-Interpretation, Reporting the scientific research (Preparation of a thesis, oral presentation, article, project), Ethics, Ethics of scientific research and publication. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main objectives are: To examine the foundations of scientific research and the scientific research methods, to teach the principles of both the methodology and the ethics, to realize the process on a scientific research and to evaluate the results of research, to teach reporting the results of research (on a thesis, presentation, article). | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Applying the scientific research methods and the ethical rules in their professional life. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Gaining awareness on ethical principles at basic research methods, becoming skillful at analyzing and reporting the data obtained in scientific researches, being able to have researcher qualification with occupational sense of responsibility, having the scientific and vocational ethics’ understanding and being able to defend this understanding in every medium. | | | | | | | |
| **TEXTBOOK (Turkish)** | | | | | Karasar, N. (2015). Bilimsel Araştırma Yöntemi. Nobel Akademi Yayıncılık, Ankara. | | | | | | | |
| **OTHER REFERENCES** | | | | | **1-**Büyüköztürk, Ş., Çakmak, E. K., Akgün, Ö. E., Karadeniz, Ş., Demirel, F. (2012). Bilimsel Araştırma Yöntemleri. Pegem Akademi Yayınevi, Ankara.  **2-**Tanrıöğen, A. (Editör). (2014). Bilimsel Araştırma Yöntemleri. Anı Yayıncılık, Ankara.  **3-**Türkiye Bilimler Akademisi Bilim Etiği Komitesi. Bilimsel Araştırmada Etik ve Sorunları, Ankara: TÜBA Yayınları, (2002).  **4-**Ekiz, D. (2009). Bilimsel Araştırma Yöntemleri: Yaklaşım, Yöntem ve Teknikler. Anı Yayıncılık, Ankara.  **5-**Day, Robert A. (Çeviri: G. Aşkay Altay). (1996). Bilimsel Makale Nasıl Yazılır ve Nasıl Yayımlanır?, TÜBİTAK Yayınları, Ankara.  **6-**Özdamar, K. (2003). Modern Bilimsel Araştırma Yöntemleri. Kaan Kitabevi, Eskişehir.  **7-**Cebeci, S. (1997). Bilimsel Araştırma ve Yazma Teknikleri. Alfa Basım Yayım Dağıtım, İstanbul.  **8-**Wilson, E. B. (1990). An Introduction to Scientific Research. Dover Pub. Inc., New York.  **9-**Çömlekçi, N. (2001). Bilimsel Araştırma Yöntemi ve İstatistiksel Anlamlılık Sınamaları. Bilim Teknik Kitabevi, Eskişehir. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Science, scientific thought and other basic concepts (University, history of university, higher education, science, scientific thought and other related concepts) |
| 2 | Science, scientific thought and other basic concepts (University, history of university, higher education, science, scientific thought and other related concepts) |
| 3 | The scientific research and its types (Importance of the scientific research, types of science, scientific approach) |
| 4 | The scientific research process and its techniques (Access to the scientific knowledge, literature search, determining the research issue, definition of the problem, planning) |
| 5 | The scientific research process and its techniques (Access to the scientific knowledge, literature search, determining the research issue, definition of the problem, planning) |
| 6 | The scientific research process and its techniques (Access to the scientific knowledge, literature search, determining the research issue, definition of the problem, planning) |
| 7 | The method and the approach: Collecting, analysis and interpretation of the data (Data, data types, measurement and measurement tools, collecting data, organizing data, summarizing data, analysis and the interpretation of data) |
| 8 | The method and the approach: Collecting, analysis and interpretation of the data (Data, data types, measurement and measurement tools, collecting data, organizing data, summarizing data, analysis and the interpretation of data) |
| 9 | Finalizing the scientific research (Reporting, preparing the thesis, oral presentation, preparing an article and a project) |
| 10 | Finalizing the scientific research (Reporting, preparing the thesis, oral presentation, preparing an article and a project) |
| 11 | Finalizing the scientific research (Reporting, preparing the thesis, oral presentation, preparing an article and a project) |
| 12 | Ethics, scientific research and publication ethics (Ethics, rules of ethics, occupational ethics, non-ethical behaviors) |
| 13 | Ethics, scientific research and publication ethics (Ethics, rules of ethics, occupational ethics, non-ethical behaviors) |
| 14 | Ethics, scientific research and publication ethics (Ethics, rules of ethics, occupational ethics, non-ethical behaviors) |
| 15,16 | Mid-term exam, Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INSTITUTE’S GRADUATE PROGRAMME’S LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | | |
| **NO** | **LEARNING OUTCOMES (M.Sc.-Ph.D.)** | | | **3**  High | | **2**  Mid | **1**  Low | |
| **LO 1** | Having the scientific and vocational ethics’ understanding and being able to defend this understanding in every medium. | | |  | |  |  | |
| **LO 2** | Being able to have researcher qualification with occupational sense of responsibility. | | |  | |  |  | |
| **LO 3** | Becoming skillful at analyzing and reporting the data obtained in scientific researches. | | |  | |  |  | |
| **LO 4** | Gaining awareness on ethical principles at basic research methods. | | |  | |  |  | |
| **Prepared by :** | | |  | **Date:** | |  | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506611501 | **TITLE** | Current Innovations in Agricultural Biotechnology |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | To examine the topics that are currently applied and could be applied in agricultural biotechnology in detail. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is aimed that the students participating in the doctoral program will have knowledge of current issues and develop their ability to generate ideas for doctoral studies. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | It will contribute to the preparation of the students for professional life by enabling them to comprehend the current issues in agricultural biotechnology. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To be able to comprehend the current issues in agricultural biotechnology.  To have knowledge about biotechcnology applications  To gain the ability to review scientific articles and create project ideas. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | Scientific papers | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Agricultural Biotechnology |
| 2 | History and Development of Agricultural Biotechnology |
| 3 | Transgenic plant biotechnology |
| 4 | Stress physiology and biotechnological approaches |
| 5 | Microbial applications in agricultural biotechnology |
| 6 | Plant factories for products |
| 7 | Biofuel production technology from biomass |
| 8 | Midterm |
| 9 | Bioremediation |
| 10 | Biofertilizers and its applications |
| 11 | Bionformatics in Agricultural Biotechnology |
| 12 | Importance of Artificial Intelligence in Agricultural Biotechnology |
| 13 | Global Warming and Agricultural Biotechnology |
| 14 | Biotechnology and Gıda Üretimi |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506612502 | **TITLE** | Advanced Microscopy Techniques |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Advance microscopy techniques for both light and electron microscopy will be taught in detail. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To learn advanced microscopy techniques used in scientific studies | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To teach advance microscopy techniques that students can use in their graduate and postgraduate studies. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students who successfully complete this course:  1. Obtains information about advance microscopy techniques that are frequently used in scientific studies.  2. Understands advance microscopy techniques.  3. Be competent in areas such as collecting, processing and organizing data for scientific study using advanced microscopy techniques. | | | | | | | |
| **TEXTBOOK** | | | | | Microscopy Techniques (Advances in Biochemical Engineering/Biotechnology, 95) 2005th Edition, Jens Rietdorf, ISBN-13: 978-3540236986 | | | | | | | |
| **OTHER REFERENCES** | | | | | Scientific papers | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to advanced microscopy techniques |
| 2 | Overview of advanced microscopy techniques |
| 3 | Advanced light microscopy techniques |
| 4 | Advanced fluorescent microscopy techniques |
| 5 | Advanced confocal microscopy techniques |
| 6 | Examples of advance microscopy techniques in science-1 |
| 7 | Examples of advance microscopy techniques in science-2 |
| 8 | Midterm |
| 9 | Sample preparation for electron microscopy |
| 10 | Ultramicrotomy |
| 11 | Introduction to electron microscopy techniques |
| 12 | Scanning electron microscopy |
| 13 | Transmission electron microscopy |
| 14 | Examples of advance electron microscopy techniques in science |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506612503 | **TITLE** | RNA Biology |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 25 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | RNA structure, RNA types and their functions, RNA splicing and alternative splicing mechanisms, RNA biogenesis and understanding the importance of the nucleolus, non-coding RNAs and mechanisms of gene silencing. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim and objectives of the course are to learn about RNA structure and types, to comprehend RNA functions and to understand RNA analysis methods | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students gain the ability to comprehend RNA types, functions and current applications related to RNA. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students who successfully complete this course;  Understand the role of RNA in regulating gene expression,  Learn about the isolation and analysis of RNA.  Recognize the types of RNA not related to protein coding  Understand the RNA processing mechanism. | | | | | | | |
| **TEXTBOOK** | | | | | The RNA World, Third Edition (Cold Spring Harbor Monograph Series), by Raymond F. Gesteland- Genes IX 9th Edition by Benjamin Lewin.RNA Regulation, Advances in Molecular Biology and Medicine. Robert A. Meyers, Wiley-Blackwell 2014 | | | | | | | |
| **OTHER REFERENCES** | | | | | RNA Dünyasından Yaşam, İçimizdeki Ata, Michael Yarus, Boğaziçi Üniversitesi yayınev | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Molecular structure of RNA |
| 2 | Molecular structure of RNA |
| 3 | RNA world and abiogenesis |
| 4 | Introns and non-coding RNAs |
| 5 | Xist RNA and chromatin |
| 6 | Long non-coding RNA types |
| 7 | Long non-coding RNA types |
| 8 | Midterm exam |
| 9 | Long non coding RNAs |
| 10 | RNA-mediated gene silencing |
| 11 | snoRNA |
| 12 | Post transcriptional gene silencing |
| 13 | RNA isolation and RNA\_Seq analysis |
| 14 | RNA stability and degregation |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506611504 | **TITLE** | PROTEOMIC ANALYSIS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Basic structure and properties of proteins,  Basic structure and functions of proteomics,  Protein isolation methods,  Protein quantification methods,  One-dimensional gel electrophoresis,  Two-dimensional gel electrophoresis,  Comparative analysis of protein profile maps,  Western Blot analysis | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is aimed that to teach proteomic analysis. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students will have basic knowledge about proteomics studies. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Upon successful completion of this course, students will have the following abilities:  1. Knows protein isolation methods,  2. Knows protein quantification methods,  3. Have competence in protein separation and purification. | | | | | | | |
| **TEXTBOOK** | | | | | Lucio C., Jonathan K.,Parag M. Proteomics: Methods and Protocols, Humana Press, 2017. | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Identification of proteins |
| 2 | Basic structure and properties of proteins |
| 3 | Omics technologies |
| 4 | Basic structure and functions of proteomics |
| 5 | Basic strategies in proteomics |
| 6 | Protein isolation methods |
| 7 | Protein quantification methods |
| 8 | Mid-Term Exam |
| 9 | One-dimensional gel electrophoresis |
| 10 | Two-dimensional gel electrophoresis |
| 11 | Comparative analysis of protein profile maps |
| 12 | Mass spectrometry analyzes |
| 13 | Protein secondary structure analyzes by infrared spectroscopy |
| 14 | Western Blot Analysis |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506612501 | **TITLE** | Free Radicals and Antioxidants |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 1 | | 1 | | | | 1 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | It is aimed to analyze the chemical and biochemical properties of antioxidants and free radicals, as well as to examine biocompatibility and the main important working mechanisms. How are free radicals produced? The effects of free radicals on biological molecules will be explained. In addition, information about the properties of antioxidants, natural and artificial antioxidants, mechanism of action of antioxidants and antioxidant defense system will be given. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To give basic information about free radicals and antioxidants. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learns the relationship between free radicals, oxidative stress and antioxidants. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | - Learns the formation mechanisms of free radicals.  - Explains reasons of the oxidative stress.  - Relate antioxidants with each other, whic can overcome the free radilacs. Explains reasons of the oxidative stress. | | | | | | | |
| **TEXTBOOK** | | | | | - Rao M. Uppu, Subramanyam N. Murthy, William A. Pryor, Narasimham L. Parinandi eds), Free Radicals and Antioxidant Protocols, Springer, 480 p. 2010. | | | | | | | |
| **OTHER REFERENCES** | | | | | - Oxidative Stress Biomarkers and Antioxidant Protocols, Sigma&Aldrich-Inze, D. (ed.), Oxidative Stress in Plants, Taylor&Francis, 321p., 2002.-Mammadov, R. Serbest Radikaller ve Antioksidanlar, Akademizyen Kitabevi. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Free Radicals |
| 2 | Structure and Sources of the Free Radicals |
| 3 | Sources of Reactive Oxygen and Nitrogen Species |
| 4 | Oxidative Stress |
| 5 | Mitochondrial DNA Damage |
| 6 | Lipid Peroxidation |
| 7 | Effects of Free Radicals to Proteins |
| 8 | Midterm Examination |
| 9 | Effects of Free Radicals to Carbonhydrates |
| 10 | Enzymatic Antioxidants: Superoxide Dismutase, Catalaze |
| 11 | Enzymatic Antioxitants: Proxidases |
| 12 | Non-enzymatic Antioxidants:Vitamin C, Vitamin E |
| 13 | Non-enzymatic Antioxidants:Glutathione, Coenzyme Q10 |
| 14 | Non-enzymatic Antioxidants:Plant Phenols |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506612505 | **TITLE** | Molecular Techniques Used in Animal Breeding Studies |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | |  | | | | 0 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Molecular approach to breeding studies, gamete formation and crossing over, Linkage maps, Genetic polymorphism, DNA marker types, SSR, SNP, Marker-assisted selection, Quantitative trait approach, Candidate genes identification, Gene mapping, and breeding with recombinant DNA technology | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course the students will be able to understand molecular methods used in animal breeding studies, and molecular markers commonly used in studies such as phylogenetic analysis, gene mapping, MAS, QTL, genetic diseases. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | In this course, the student will be able to understand molecular markers, to carry out marker analysis methods, and to design these methods when marker experiments are required for their own research. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students learn molecular marker techniques in detail and understand the use of molecular markers in animal breeding studies. Students learn different types of markers and genetic analysis methods. Information about MAS and QTL applications comprehend current literature information | | | | | | | |
| **TEXTBOOK** | | | | | Brooker R., Genetics Analysis and Principles, McGraw-Hill Science, 4th Edition, 2011. | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | DNA and genetic polymorphism |
| 2 | DNA and genetic polymorphism |
| 3 | Molecular Markers |
| 4 | RFLP |
| 5 | PCR-RFLP |
| 6 | RAPD, AFLP |
| 7 | SSR |
| 8 | Midterm exam |
| 9 | SNP |
| 10 | RNA markers |
| 11 | Microarrays |
| 12 | MAS |
| 13 | QTL |
| 14 | Examples of molecular genetic breeding |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506611506 | **TITLE** | Abiotic Stress and Gene Expression in Plants |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition of abiotic stress and abiotic stress factors,  Genes and gene regulation in low temperature tolerance,  Genes and gene regulation in high temperature tolerance,  Genes and gene regulation in drought tolerance,  Genes and gene regulation in salt tolerance,  Genes and gene regulation in tolerance to heavy metals,  Studies on developing stress resistant biotechnological products through molecular methods. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is aimed that to teach the genes responsible for stress and their functions in plants. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Responses of plants to stress conditions depending on changing environmental conditions, genes and gene regulation in stress tolerance, genetic approaches in increasing stress tolerance. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Upon successful completion of this course, students will be able to:  1. Knows the defense mechanisms developed against abiotic stress in plants  2. Gain knowledge about stress-related genes and gene functions in plants.  3. Gains competence in developing stress resistant biotechnological products through special molecular methods such as gene transfer or gene silencing. | | | | | | | |
| **TEXTBOOK** | | | | | Levitt J. Responses of plants to environmental Stresses. New York, London: Academic Press, 1972: 697. | | | | | | | |
| **OTHER REFERENCES** | | | | | McKersie BD, Leshem Y. Stress and stress coping in cultivated plants. Netherlands: Kluwer Academic Publishers, 1994 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Abiotic stress and abiotic stress factors |
| 2 | Low temperature stress |
| 3 | Low temperature stress genes and gene regulation |
| 4 | High temperature stress |
| 5 | High temperature stress genes and gene regulation |
| 6 | Drought stress |
| 7 | Drought stress genes and gene regulation |
| 8 | Mid-Term Exam |
| 9 | Salt stress |
| 10 | Salt stress genes and gene regulation |
| 11 | Heavy metal stress |
| 12 | Heavy metal stress genes and gene regulation |
| 13 | Studies on developing stress-tolerant biotechnological plants through molecular methods |
| 14 | Studies on developing stress-tolerant biotechnological plants through molecular methods |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506611502 | **TITLE** | Entomological Biotechnology |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Which biotechnological methods are used in Agricultural Entomological studies and how molecular results can be interpreted will be discussed. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | With the use of molecular methods in the field of entomology, access to more precise and more countable information is provided. The aim of this course; Explaining biotechnological methods and examining the possibilities of using purpose-oriented molecular methods in the field of Entomology in the light of current developments. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Biotechnological learning of entomological pests and beneficials and the relationships between them | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Benefits of biotechnological applications  Gaining knowledge about entomological biotechnology methods  Gaining information on the use of molecular methods used in entomological biotechnology studies in the field of agriculture | | | | | | | |
| **TEXTBOOK** | | | | | Molecular Entomolgy Oxford uni press. | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Conventional Molecular Methods, Classification of molecular methods, Properties of ideal molecular markers |
| 2 | RFLP(Restriction fragment length polymorphism), AFLP(Amplified Fragment Length Polymorphism), RAPD: Randomly Replicated Polymorphic DNA |
| 3 | Microsatellites, Microarray: Gene chip, Biochip |
| 4 | Applications of Molecular Methods in Entomology Mating systems, Pattern determination |
| 5 | Insect-Pathogen relationships |
| 6 | I. Midterm Exam |
| 7 | Prey-Prey, Parasitoid relations |
| 8 | Insecticide Resistance |
| 9 | Behavioral Studies |
| 10 | Population Genetics |
| 11 | Phylogenetic systematic |
| 12 | Phylogenetic systematic |
| 13 | Phylogenetic systematic |
| 14 | Biodiversity |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506611503 | **TITLE** | Ethics and Biosafety in Agricultural Biotechnology |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 1 | | 1 | | | | 1 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The definition of biosafety and its content, R&D activities and legal regulations related to biosafety, biorisks and ethical issues, concepts of ethics, bioethics, environmental ethics, engineering ethics and their importance in science, ethical issues and philosophical and sociological dimensions of current ethical issues, the ethical rules that must be followed in agricultural biotechnology studies will be explained. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Within the scope of this course, besides methodical information and legal regulations related to biosafety, it is aimed to provide information about engineering ethics concepts and their importance in science, ethical issues experienced and philosophical and sociological dimensions of ethical issues, and researchers' ethical problems in scientific research. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | It will contribute to the training of individuals who understand the importance of biosafety and bioethical rules in the field of agricultural biotechnology. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | - Having detailed knowledge about biosafety  - Demonstrating professionalism and ethical behavior responsibility  -To be able to interpret and solve solutions to ethical problems related to the field of agricultural biotechnology. | | | | | | | |
| **TEXTBOOK** | | | | | Medicine and National Research Council of the National Academies, National Academies press, 2006.-Tom L. Beauchamp, LeRoy Walters, Jeffey p. Kahn, Mastroianni “Contemporary Issues in Bioethics” Wadsworth Publishing Company, 7th edition, 2007 | | | | | | | |
| **OTHER REFERENCES** | | | | | - Biyoetik Araştırmaları, Edit:, Ülman, Y.I., Genç, S.V. Türkiye Biyoetik Derneği Yayını No: XV-Değişen Dünyada Biyoetik, Edit: Ülman, Y.I, Artvinli, F. Türkiye Biyoetik Derneği Yayını No: XVIII, İstanbul, 2012.-Laboratory Biosecurity Handbook-Reynolds M. Salerno, Jennifer Gaudioso, CRC Press; 1 edition, 2007. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition of biosafety, its importance in terms of human, food, plant and animal health |
| 2 | National and international policies and legal regulations regarding biosafety |
| 3 | The relationship between agricultural biotechnology and biosafety |
| 4 | Modern biotechnology applications for agricultural purposes |
| 5 | Biosafety related R& D studies, transgenic applications |
| 6 | European Food Safety Agency EFSA and scientific risk assessment of genetically modified organisms (GMOs) in EU |
| 7 | Consumer reactions to GMO foods, traceability and application of labeling rules |
| 8 | Midterm Examination |
| 9 | Ethics, bioethics, environmental ethics, engineering ethics and their importance in science |
| 10 | Ethical problems experienced and the philosophical and sociological dimension of current ethical problems |
| 11 | Ethical rules to be followed in protecting nature, human and animal health in agricultural biotechnology studies |
| 12 | Bioriscs and ethical issues |
| 13 | Developments related to legal structuring studies on international platforms and National Front in terms of biosafety |
| 14 | Issues that researchers should pay attention to ethical issues in scientific studies |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506611504 | **TITLE** | PCR Based Analysis |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | PCR and general usage areas, PCR Fundamentals and Components, PCR optimization, PCR types, Primer-Probe design, PCR based techniques, DNA Sequence analysis, Real-Time PCR techniques fundamentals and design, Probe types used in Realtime PCR, Fragment analysis, Detection of gene copy number and gene expression analysis | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The Polymerase Chain Reaction (PCR) developed in the 1980s, there have been great developments in genetic analysis techniques. Many new techniques used in genetic studies are PCR-based assays. Within the scope of this course, basics of PCR technique, design of PCR reactions, PCR types, properties and genetic analysis methods used, DNA Sequence Analysis; Fragment analysis for phylogenetic and identification studies and the basics and design of real-time PCR techniques used to determine gene copy number and gene expression will be explained. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | In this course, the student will learn optimization with PCR components, designing primer-probes for PCR and/or RT-PCR, and designing these PCR experiments when genetic analysis experiments are required for their own research. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students learn the details of the PCR technique and its use in molecular genetics studies.  Students learn about different types of PCR and genetic analysis methods. | | | | | | | |
| **TEXTBOOK** | | | | | Understanding PCR. A Practical Bench, Sarah Maddocks, Rowena Jenkins.Academic Press, 2016.PCR: Methods and Protocols, Lucília Domingues (eds.), Springer-Verlag New York, Year: 2017 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | PCR definition and usage |
| 2 | PCR components and optimization |
| 3 | PCR varieties |
| 4 | PCR varietie |
| 5 | Primer-Probe kinds and design |
| 6 | Primer-Probe kinds and design |
| 7 | Elecrophoresis |
| 8 | Midterm exam |
| 9 | PCR-RFLP |
| 10 | DNA sequencing |
| 11 | SNP arrays |
| 12 | Qualitative RT-PCR |
| 13 | Quantitative RT-PCR |
| 14 | cDNA |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506611505 | **TITLE** | Epigenetics |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 1 | | 2 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 20 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In this course, the concept of epigenetics and how epigenetic mechanisms work is explained to students. The content of the course will cover the topics of DNA methylation, histone modifications, chromatin remodeling and non-coding RNA. Molecular techniques and model organisms commonly used in epigenetic research will also be discussed. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to educate students in the fields of chromatin biology, epigenome structure, and nuclear organization to address fundamental issues in epigenetics and gene regulation. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Epigenetics is the change in gene function without changing the DNA sequence. Understanding the mechanisms of epigenetic forms the basis of biotechnological applications. At the end of this course, students will increase their knowledge about epigenetic mechanisms and be able to find solutions to problems they may encounter with related issues | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students who successfully complete this course;  acquire basic theoretical knowledge about complex epigenetic events, comprehend the latest methodological approaches in current epigenetic and chromatin research,  learn about chromatin biology,  comprehend chromatin and DNA modifications. | | | | | | | |
| **TEXTBOOK** | | | | | Handbook of Epigenetics: The New Molecular and Medical Genetics, 2011, Edited by: Trygve Tollefsbol, ISBN: 978-0-12-375709-8 2.Epigenetics, Lyle Armstrong. Pub date: Nov 25,2013, ISBN:9780815365112, 1st edition3. Epigenetics, 2008, Edited by: Jörg Tost, ISBN: 978-1-904455-23-3Epigenetics C. David Allis, Thomas Jenuwein (Author), Danny Reinberg, Marie-Laure Caparros Publisher: Cold Spring Harbor Laboratory Press; 1st edition (2007) | | | | | | | |
| **OTHER REFERENCES** | | | | | Eva Jablonka, Marion J. Lamb Evrimin Dört Boyutu Boğaziçi Üniversitesi Yayın evi | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Understanding the basis of genetic inheritance, historical overview of the concept of epigenetic |
| 2 | Chromatin structure and its function |
| 3 | Structure and functions of nucleosomes, ATP dependent nucleosome remodeling complexes |
| 4 | Role of histone modifications in transcription and replication processes |
| 5 | DNA modifications |
| 6 | DNA modifications |
| 7 | Epigenetic control of gene expression |
| 8 | Midterm exam |
| 9 | RNA-mediated gene silencing |
| 10 | RNA-mediated gene silencing |
| 11 | RNA-mediated gene silencing |
| 12 | Molecular methods in epigenetic research |
| 13 | Molecular methods in epigenetic research |
| 14 | Molecular methods in epigenetic research |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | To acquire an Agricultural Biotechnology expertise that will provide permanent solutions to current problems and serve different sectors by using the knowledge on the subjects covered by the agricultural biotechnology discipline, having grasped current knowledge and techniques in the field of agricultural biotechnology. |  |  |  |
| **LO 2** | Identifying and defining complex agricultural problems, creating algorithms and using analysis tools, and developing appropriate models and analyses for this purpose. |  |  |  |
| **LO 3** | To gain the skills of coordinating the tools and equipment in laboratory studies, together with designing solutions for bottlenecks and problems that cannot be foreseen at the beginning, in field studies. |  |  |  |
| **LO 4** | Despite the problems that may be encountered, to be able to collect data, diagnose the collected data with experimental methods, determine these problems and design experiments to solve them. |  |  |  |
| **LO 5** | To be able to take project responsibility in the light of the knowledge learned in the field of agriculture and biotechnology, to anticipate the risks to be encountered and to bring solutions, to ensure sustainability by renewing oneself in the profession, to synthesize in the face of problems. |  |  |  |
| **LO 6** | To be able to access up-to-date information in the field of agricultural biotechnology and gain the ability to develop oneself by following the technological developments in the field. |  |  |  |
| **LO 7** | Having knowledge about the necessary standards in all professional activities and considering ethical values. |  |  |  |
| **LO 8** | To be able to acquire sufficient knowledge and techniques about agricultural biotechnology, to be able to successfully use the knowledge individually and in collaborative work teams. |  |  |  |
| **LO 9** | To be able to prepare and transfer an evaluation report about the design and experiment results in the field of agricultural biotechnology, and to acquire the ability to take/give instructions in cases that may arise in this process. |  |  |  |
| **LO 10** | To develop appropriate modern techniques for the detection and solution of complex problems encountered in agricultural biotechnology applications and to gain the ability to use information technologies effectively. |  |  |  |
| **LO 11** | To be able to evaluate the effects of agricultural biotechnology applications with their health, ecological, social and legal dimensions and to be able to realize their effects on engineering applications. |  |  |  |

**Prepared by:** **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | AGRICULTURAL BIOTECHNOLOGY **(PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 506612506 | **TITLE** | Next Generation DNA Sequencing Methods |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Information about Next Generation Sequencing (NGS) methods such as GBS, RADseq, ddRADSeq will be given to students. Also, will be given knowledge about SNP chip technologies. In this regard, information about the NGS and SNP chips methods mentioned above and application fields used in animal and plant production will be given within the context of proposed lecture. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | In this proposed lecture context; it is aimed that the PhD students of the Faculty of Agriculture acquire basic information about NGS methods and their usage fields. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | At the end of this course, students can acquire basic information about NGS methods and their usage fields. Also, they can use the information obtained from course for breeding practises with sustainable use of animal or plant populations. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | At the end of this course, studens;  1- will have knowledge about the NGS methods and their usage fields  2- will have knowledge SNP chip technologies used especially in animal husbandry  3- can plan their doctorate or different projects in the future by acquiring basic information about these methods, which are quite popular in recent years. | | | | | | | |
| **TEXTBOOK** | | | | | 1-) Stuart M. Brown (editor), 2015. Next-Generation DNA Sequencing Informatics. Second Edition, Cold Spring Harbor Laboratory Press, 350p, ISBN: 978-16218212362-) T. A. Brown, Gen Klonlama ve DNA Analizi: Giriş, Nobel Akademik Yayıncılık | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | DNA structure and functions |
| 2 | Historical evolution of DNA Sequence analysis |
| 3 | Next Generation Sequencing methods (GBS-Genotyping By Sequencing) |
| 4 | Next Generation Sequencing methods (GBS-Genotyping By Sequencing) |
| 5 | Next Generation Sequencing methods (RAD-seq-Restriction site-associated DNA sequencing) |
| 6 | Next Generation Sequencing methods (RAD-seq-Restriction site-associated DNA sequencing) |
| 7 | Next Generation Sequencing methods (ddRAD-seq-double digest RAD-Seq) |
| 8 | Mid-term exam |
| 9 | SNP chip technologies |
| 10 | SNP chip technologies |
| 11 | Use of NGS methods in breeding studies |
| 12 | Use of NGS methods in determine of genetic diversity and phylogenetic analysis |
| 13 | Use of NGS methods in conservation studies |
| 14 | Use of SNP chip technologies in livestock |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE** AGRICULTURAL BIOTECHNOLOGY **PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
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