**BIOTECHNOLOGY AND BIOSAFETY 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](#EN25) | 7.5 | 3+0 | 3 | **C** | Turkish |
| 505311606 | [INSTRUMENTAL ANALYSIS IN BIOTECHNOLOGY](#EN33) | 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 |
| 505312001 | 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 | |
| 505311801 | | 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 | |
| 505311802 | | PhD THESIS STUDY | 25 | 0+1 | - | C | Turkish | |
| 505311803 | | 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 |
| 505311802 | PhD THESIS STUDY | | 25 | 0+1 | - | C | Turkish |
| 505311803 | 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 |
| 505311802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 505311803 | 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 |
| 505311802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 505311803 | 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 |
| 505312613 | [Advance Techniques in Biotechnology](#EN39) | 7.5 | 3+0 | 3 | E | Turkish |
| 505311603 | [ADVANCED ENVIRONMENTAL BIOTECHNOLOGY](#EN35) | 7.5 | 3+0 | 3 | E | Turkish |
| 505312604 | [ADVANCED INDUSTRIAL BIOTECHNOLOGY](#EN19) | 7.5 | 3+0 | 3 | E | Turkish |
| 505312608 | [ANIMAL TOXINS AND VENOMIC](#EN26) | 7.5 | 3+0 | 3 | E | Turkish |
| 505312611 | [BIOTECHNOLOGY AND ENTRENTREPRENEURSHIP](#EN32) | 7.5 | 3+0 | 3 | E | Turkish |
| 505312607 | [ENZYME BIOTECHNOLOGY](#EN28) | 7.5 | 3+0 | 3 | E | Turkish |
| 505312612 | [EPIGENETICS](#EN38) | 7.5 | 3+0 | 3 | E | Turkish |
| 505312610 | [FUNCTIONAL FOODS](#EN40) | 7.5 | 3+0 | 3 | E | Turkish |
| 505311607 | [GENE THERAPY](#EN31) | 7.5 | 3+0 | 3 | E | Turkish |
| 505311604 | [INDUSTRIAL MICROORGANISMS AND SECONDER METABOLITES](#EN34) | 7.5 | 3+0 | 3 | E | Turkish |
| 505311602 | [NATIONAL-INTERNATIONAL BIOSAFETY REGULATIONS AND POLITICS OF BIOTECHNOLOGY](#EN37) | 7.5 | 3+0 | 3 | E | Turkish |
| 505312614 | [Protein Nucleic Acid Interaction Mechanisms](#EN42) | 7.5 | 3+0 | 3 | E | Turkish |
| 505312615 | [STOCHIOMETRY IN BIOTECHNOLOGICAL PROCESSES](#EN41) | 7.5 | 3+0 | 3 | E | Turkish |
| 505311605 | [Proteomic and Bioinformatic](#EN36) | 7.5 | 3+0 | 3 | E | Turkish |
| 505312605 | [RNA INTERFERENCE TECHNOLOGY](#EN22) | 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** | **BIOTECHNOLOGY and BIOSAFETY (MSc)** |  | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505312602 | **TITLE** | ADVANCED ENVIRONMENTAL BIOTECHNOLOGY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The scope of this course will be included the environmental biotechnology. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide understanding of the importance of microorganisms of biodiversity and the ecosystem the by the students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will contribute to prepare for professional life by providing knowledge on the importance of microorganisms in biotechnology and the flow of production processes. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Understanding the importance of environmental biotechnology  Sort of environmental biotechnologically relevant microorganisms  To understand the biotechnological treatment process  Examplify the treatment process of microorganisms  To explain the production of biotechnological treatment process on a commercial scale  Understanding the environmental biotechnologically importance of microorganisms. | | | | | | | |
| **TEXTBOOK** | | | | | Atlas, R. M., Bartha, R. (1997) Microbial Ecology Fundamentals and Applications Wesley Longman Inc | | | | | | | |
| **OTHER REFERENCES** | | | | | Madigan MT and Martinko JM. Brock Mikroorganizmaların Biyolojisi (2006) (Çeviri Edit: Çökmüş C) Palme Yayıncılık, Ankara.Prescott, L. M., Harley, J. P., Klein, D. A. (1996) Microbiology Wm. C. Brown Publishers England Biotechnology Procedures and Experiments Prescott, L. M., Harley, J. P., Klein, D. A. (1996) Microbiology Wm. C. Brown Publishers England | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Scope to environmental biotechnology |
| 2 | Microbial evolutiın and interactions of microorganisms |
| 3 | Adaptation of microorganisms in environment |
| 4 | Adaptation of microorganisms in environment |
| 5 | Microbial habitats |
| 6 | Midterm Examination 1 |
| 7 | Cycles of biogeochemistry |
| 8 | The roles of microorganisms in waste treatment |
| 9 | Microbial interactions with xenobiotics and inorganic pollutants |
| 10 | Biotrasnformation, bioremediation |
| 11 | Midterm Examination 2 |
| 12 | Roles of microorganisms in recovery of metals, energetics and biomass production |
| 13 | Microbial controls of toxic substant |
| 14 | Toxicity |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 8** | have professional and social ethics | | |  | |  |  |
| **LO 9** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 10** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 11** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 12** | communicate orally and in writing Using a foreign language in the European Language Portfolio | | |  | |  |  |
| **LO 13** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 14** | develop a positive attitude towards lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Dr. Pınar Aytar | **Date:** | | 15/05/2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505312604 | **TITLE** | ADVANCED INDUSTRIAL BIOTECHNOLOGY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 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 (√)]** | | | | | | |
| X | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The scope of this course will be included the phylogeny and diversity of Bacteria and its ındustrial application. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide understanding of the importance of Domain Bacteria as part of biodiversity and the ecosystem the by the students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will contribute to prepare for professional life by providing knowledge on the importance of microorganisms in biotechnology and the flow of production processes. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Understanding the importance of biotechnology  Sort of biotechnologically relevant microorganisms  To understand the biotechnological production process  To create the metabolites of microorganisms  To explain the production of biotechnological products on a commercial scale  Understanding the biotechnologically importance of microorganisms and its enzymes | | | | | | | |
| **TEXTBOOK** | | | | | Microbial Biotechnology; Fundamentals of Applied Microbiology. Glazer AN and Nikaido H. 2007. Cambridge University Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | Madigan MT and Martinko JM. Brock Mikroorganizmaların Biyolojisi (2006) (Çeviri Edit: Çökmüş C) Palme Yayıncılık, Ankara.Mikrobial Biotechnology; Fundamentals of Applied Microbiology. Glazer AN and Nikaido H. 2007. Cambridge University Press. Biotechnology Procedures and Experiments Handbook. Harisha S. 2007. Infinity Science Press LLC.Handbook of Fungal Biotechnology. Ed: Arora DK. 2004. Marcel Dekker, Inc | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Microbial Biotechnology |
| 2 | History of microbial biotechnology, the important microbial processes |
| 3 | Microbial growth and substrates |
| 4 | Fermentation |
| 5 | Strain engineering; Mutation, Recombinant DNA technology, Genetic engineering |
| 6 | Midterm Examination 1 |
| 7 | Bacterial Metabolites and product improvement |
| 8 | Fungal Metabolites and product improvement |
| 9 | Fermentation models for primer and seconder metabolites |
| 10 | Product chracterisation |
| 11 | Midterm Examination 2 |
| 12 | Scale up: pilot scale |
| 13 | Scale up: industrial scale |
| 14 | Selected plant and specifications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 8** | have professional and social ethics | | |  | |  |  |
| **LO 9** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 10** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 11** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 12** | communicate orally and in writing Using a foreign language in the European Language Portfolio | | |  | |  |  |
| **LO 13** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 14** | develop a positive attitude towards lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Semra İLHAN | **Date:** | | 15/05/2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505302517 | **TITLE** | MICROBIAL BIOTECHNOLOGY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The scope of this course will be included the phylogeny and diversity of Bacteria | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide understanding of the importance of Domain Bacteria as part of biodiversity and the ecosystem the by the students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will contribute to prepare for professional life by providing knowledge on the importance of microorganisms in biotechnology and the flow of production processes. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Understanding the importance of biotechnology  Sort of biotechnologically relevant microorganisms  To understand the biotechnological production process  Examplify the metabolites of microorganisms  To explain the production of biotechnological products on a commercial scale  Understanding the biotechnologically importance of microorganisms. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | Madigan MT, Martinko JM, Parker J, and Clark DP, (2009). Brock Biology of Microorganisms. Pearson Prentice Hall.Willey M, Sherwood LM., Woolverton CJ, (2007). Prescott, Harley, and Klein’s microbiology. 1088 p. McGraw- Hill College.http://www.textbookofbacteriology.net/ | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Scope to Microbial Biotechnology |
| 2 | History of microbial biotechnology, the important microbial groups and processes |
| 3 | Growth substrates |
| 4 | Fermentation equipment |
| 5 | Strain improvement; Mutation, Recombinant DNA technology, Genetic engineering |
| 6 | Midterm Examination 1 |
| 7 | Primery Metabolites |
| 8 | Secondery Metabolites |
| 9 | Lactic acid fermentations |
| 10 | Fungal products |
| 11 | Midterm Examination 2 |
| 12 | Microbial Polysaccharides and Polyesters |
| 13 | Other Biotechnological Products |
| 14 | Immobilize Enzyms and Cells |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 8** | have professional and social ethics | | |  | |  |  |
| **LO 9** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 10** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 11** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 12** | communicate orally and in writing Using a foreign language in the European Language Portfolio | | |  | |  |  |
| **LO 13** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 14** | develop a positive attitude towards lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ahmet Çabuk | **Date:** | | 15/05/2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505312606 | **TITLE** | Proteomic and Bioinformatic |

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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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 25 |
| Report | | | | |  | |  |
| Other (Seminar) | | | | | 1 | | 25 |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The content of this course includes how to obtain proteomic information by classical instrumental analysis and development of this information by the means of information technologies. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To gain finding proteomic data from bioinformatic databases, using the knowledge, analyzing and storing, the sequence comparison and alignment, using similarity searching applications. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | For development and automation of biotechnology and information technology they will learn advantage of proteomics and bioinformatics resources | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Ability to achieving proteomic knowledge  2.To understand the working methods of protein in biotechnology  3.Scanning of bioinformatic databases  4.To understand organization of databases and in proteomic studies finding and using different datas  5.Using computer and information technologies for effective utilization of genomic and proteomic data  6.Prepare a strategic plan for protein studies  7. Using proteomic and bioinformatics information for built phylogenetic relationships. | | | | | | | |
| **TEXTBOOK** | | | | | N. Gautham, "Bioinformatics", Oxford University, Alpha Science 2006. ISBN 1-8426-5300-8 | | | | | | | |
| **OTHER REFERENCES** | | | | | Ignacimuthu, S. "Basic bioinformatics", Harrow : Alpha Science Int., 2005. ISBN 1-8426-5231-1Jean-Michel Claverie, Cedric Notredame "Bioinformatics for dummies"2nd Ed. Wiley Publishing,Inc., 2007. ISBN 978-0-470-08985-9.D.Voet, G.Voet, "Biochemistry" 3rd Ed. Wiley Int. Ed., (Chapter 7-4.) 2004. ISBN 0-471-19350-X.S.Hubbart, A. Jones“Proteom Bioinformatics” Humana press, 2010.ISBN 978-1-60761-443-2www.expasy.orgwww.ncbi.nlm.nih.gov/blastwww.ncbi.nlm.nih.gov/Genbank/http://srs.ebi.ac.uk/http://www.genome.jp/kegg/http://www.brenda-enzymes.org/Actual publications and review articles from international journals | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Proteomics: Introduction, sample taking,preparation,and problems |
| 2 | 2D Gel Electrophoresis |
| 3 | Mass Spectroscopy of Peptides and Proteins, finger print analysis |
| 4 | Protein chips |
| 5 | Microsequencing and purification strategy |
| 6 | Midterm Examination 1 |
| 7 | Introduction to proteome bioinformatics |
| 8 | Bioinformatic tools and its uses |
| 9 | Use of proteomic databases; PDB, UniProtKB, PIR, PRF, |
| 10 | Use of Nucleotide sequence databases; GenBank, EMBL, DDBJ ve EBI. |
| 11 | Midterm Examination 2 |
| 12 | Sequence scanning and analysis |
| 13 | Similarity comparison |
| 14 | Determination of the phylogenetic proximity |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Doç. Dr.Figen Caliskan | **Date:** | | 15/05/2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505312605 | **TITLE** | RNA INTERFERENCE TECHNOLOGY |

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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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | To provide basic information about gene silencing, RNA interference and non-coding RNAs. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To flash on the world of non-coding RNA which has got an important role in gene silencing that is an important area of research in the development of new treatment methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | With emerging technologies in molecular biology in the field of development and many new ones are added to our knowledge. RNA that is not code issue is one of the issues going on in the last period. Up to date, we have also known that there are 34 different RNA mechanisms, there are 340 of RNA known. Recently, RNAi has been discovered, and then we know interferens miRNA forms of RNA, siRNA, and dsRNA were added as concepts. Continuing research on this subject and information is increasing every day. Therefore, this matter is very contemporary, the course will be the subject matter is broad. Another issue arising with the discovery of RNA interferensin in the treatment of the disease can be targeted based on gene silent about the so-called upgrading. This revolutionary innovation in science subjects for the examination will be enlightening. | | | | | | | |
| **TEXTBOOK** | | | | | Understanding Biotechnology by A. Borém, F.R. Santos, D. E. Bowen (2003) | | | | | | | |
| **OTHER REFERENCES** | | | | | Andrew Z. Fire and Craig C. Mello The Nobel Prize in Physiology or Medicine The Nobel Assembly at Karolinska Institutet October 2006. Krishnarao Appasani RNA Interference Technology - From Basic Science to Drug Development Edited by, Andrew Fire, Marshall Nirenberg CUP GeneExpression Systems, Inc., Massachusetts March 2005. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Discovery of RNA interferense |
| 2 | Interferens RNA (RNAi). |
| 3 | Non coding small RNAs |
| 4 | MicroRNA |
| 5 | siRNA |
| 6 | Midterm Examination 1 |
| 7 | Transkripsiyonal genes |
| 8 | Transposon and Transgenes |
| 9 | Post-transcriptional gene silent |
| 10 | dsRNA, Dicer |
| 11 | Midterm Examination 2 |
| 12 | RNAi-like mechanisms. |
| 13 | RNAi treatment and in the future. |
| 14 | Non coding RNAs in molecular biology and medicine in the place. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Doç. Dr. Didem Turgut Coşan | **Date:** | | 15/05/2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505312601 | **TITLE** | NATIONAL-INTERNATIONAL BIOSAFETY REGULATIONS AND POLITICS OF BIOTECHNOLOGY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The scope of this course will be included biosafety and regulatıons. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide understanding of the importance of biosafety regulatıons by the students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will contribute to prepare for professional life by providing knowledge on the importance of biosafety and biodiversty. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Understanding the importance of biosafety  Understanding the importance of laws and regulatıons of biosafety  To understand the biosafety process  Examplify the laws and regulations of biosafety  To comparison of the national and international laws of biosafety | | | | | | | |
| **TEXTBOOK** | | | | | Biyogüvenlik ve Biyoçeşitlilik Ders Notları, ESOGÜ Biyoloji Bölümü, ESKİŞEHİR | | | | | | | |
| **OTHER REFERENCES** | | | | | Biosafety and bioethics, Joshi, R., 2006, Delhi.Biyoteknoloji; Uluslar arası eğilimler ve görüşler. Bull. A. Geoffrey. H. B. (1987). İstanbul. İstanbul Üniversitesi. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Importance of laws and biosafety |
| 2 | Biodiversity convention nd biosafty protocol |
| 3 | Internatıonal regulations |
| 4 | Turkey become party to an agreement in international conventions and protocols |
| 5 | Turkey become party to an agreement in international conventions and protocols |
| 6 | Midterm Examination 1 |
| 7 | Historical aspects of local regulations and development stage of biosafety in Turkey |
| 8 | Law regulations in Turkey. |
| 9 | Local regulations and laws in Turkey |
| 10 | Local regulations and laws in Turkey |
| 11 | Midterm Examination 2 |
| 12 | Future of biosafety laws |
| 13 | New biotechnological products and biosfety, law regulations |
| 14 | New biotechnological products and biosfety, law regulations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 8** | have professional and social ethics | | |  | |  |  |
| **LO 9** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 10** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 11** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 12** | communicate orally and in writing Using a foreign language in the European Language Portfolio | | |  | |  |  |
| **LO 13** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 14** | develop a positive attitude towards lifelong learning. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | |  | | | |

**Signature**:

**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:** | | 14.06.2016 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Animal Toxins and Venomic |

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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 (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Study strategies and biothecnological benefit of venom producing animals (scorpions, snakes, spiders, bees, ants, conus, sea anemones). | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The purpose of this course; venom studies which is a new area of toxicology to facilitate the flow of information to the students, give to information about using of venoms in biotechnological research. Moreover, to gain knowledge on using of bioinformatics based on “natural library” which is generated by animal venom proteome (venomic). | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Animal toxins (zootoxin) are bioactive components of complex mixtures.  In this context, students will gain ability to use of venom for development of new pharmacological molecule due to their high selectivity of the target in biotechnological research. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To gain an overview of venom producing animals and their secretions  2. To know purpose and benefits of the use of venom and apply in industrial environments  3. To gain ability of apply and assciate interdisciplinary of information obtained from the results of biochemical and molecular experiments of venom studies  4. To gain a new perspective on their professional activities using the sources of the natural wealth of our country,  5. To use the sources of the current experimental methods and bioinformatics capability for developing of biotechnological innovations | | | | | | | |
| **TEXTBOOK** | | | | | Harve Rochat and Marie-France Martin-Eauclaire (eds)(2000). Animal Toxins: Facts and Protocols. Birkhauser Verlag AG, P. O. Box 133, CH-4010 Basel, Switzerland. 384pp. | | | | | | | |
| **OTHER REFERENCES** | | | | | Andrea Giuliani and Andrea C.Rinaldi (2010). Antimicrobial Peptides: Methods and Protocols (Methods in Molecular Biology), Humana Press. 412 pp.Steven Foster, Roger Caras, (1998) Ed. By Roger Tory Peterson. Peterson Field Guide to Venomous Animals & Poisonous Plants, Houghton-mifflinActual publications and review articles from international journals | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to venom producing animals (scorpions, snakes, spiders, bees, ants, conus, sea anemones), collecting strategy from nature and housing in laboratory |
| 2 | Source of venom peptides, purification, characterzation by biochemical and molecular methods |
| 3 | Venoms and its enzymatic activities (lipolytic, proteolytic (caseinolytic, gelatinolytic), phospholipases and fibrinolytic |
| 4 | Arthropoda venoms and its anti-tumoral activities |
| 5 | Venoms and its antimicrobial effects |
| 6 | Midterm Examination 1 |
| 7 | Venoms and their uses as pesticide |
| 8 | Anti-malarial and multiple sclerosis properties of venoms |
| 9 | Scorpion toxins and acting on ion channels (Sodium and potassium) |
| 10 | Scorpion toxins and acting on ion channels (cloride and calcium) |
| 11 | Midterm Examination 2 |
| 12 | Immunological properties of venom toxins |
| 13 | Venom peptidlerin aminoasit ve nükleotid dizilerinin ApE programı uygulamaları ve Biyoinformatik veri tabanlarında dizi karşılaştırma ve benzerlik analizi;  Application of plazmid editor program (ApE) and BLAST with venomic sequences (protein and DNA) |
| 14 | Application of MEGA5 software and building phylogenetic tree with venom peptides |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 8** | have professional and social ethics | | |  | |  |  |
| **LO 9** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 10** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 11** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 12** | communicate orally and in writing Using a foreign language in the European Language Portfolio | | |  | |  |  |
| **LO 13** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 14** | develop a positive attitude towards lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Assoc.Prof.Dr. Figen ÇALIŞKAN | **Date:** | | 17/11/2016 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | CURRENT APPROACHES IN MICROBIAL ECOLOGY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 2 | |  |  | | | 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 (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | This course will cover culture dependent and independent techniques for identification of microorganisms after recognition of the ecology of microorganisms controlling the feeding, multiplication and spread of microorganisms, habitat types and distributions of microorganisms, interactions of microorganisms with each other and their surroundings. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is very important to use culturally-dependent and culturally-independent techniques as complementary qualities in order to accurately demonstrate the diversity of microorganisms. This necessitates learning of modern approaches in addition to traditional approaches, especially with the development of molecular methods | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Increase the potential of the information obtained by providing more accurate and clearer identification of microbial diversity in possible biotechnological applications. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Explains the different metabolisms in the microbial world. Explain the concept of bioenergetics. Explains the basic physiological properties of bacteria. Defines molecular microbial ecology. | | | | | | | |
| **TEXTBOOK** | | | | | Osborn AM., Smith CJ., Molecular Microbial Ecology, 2015, Taylor & Francis GroupMadigan, M.T.; Martinko, J.M.; Parker, J.: “Brock Biology of Microorganisms”, 8 th Edition, Prentice Hall, Inc., New Jersey, (1997) 532-928 | | | | | | | |
| **OTHER REFERENCES** | | | | | - | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition of microbial ecology |
| 2 | Culture dependent methods at microbial ecology |
| 3 | Isolation of nucleic acid |
| 4 | Polymerase chain reaction and types |
| 5 | Terminal restriction fragment length polymorphism, denaturing gel electrophoresis, temperaturegradient gel electrophoresis |
| 6 | Midterm Examination 1 |
| 7 | FISH technique and types |
| 8 | 16S rRNA clonning library establishment |
| 9 | Direct epifluorescence technique, electrical impedans technique, stable isotope probing |
| 10 | Metagenomic |
| 11 | Midterm Examination 2 |
| 12 | Real time PCR technique, HRM analysis, quantitative analyses |
| 13 | Bioinformatic for microbial ecology |
| 14 | New generation sequencing technologies |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 8** | have professional and social ethics | | |  | |  |  |
| **LO 9** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 10** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 11** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 12** | communicate orally and in writing Using a foreign language in the European Language Portfolio | | |  | |  |  |
| **LO 13** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 14** | develop a positive attitude towards lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. Dr. Pınar Aytar Çelik | **Date:** | | 16/11/2016 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | ENZYME 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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In this course; industrial enzymes will be recognized using microbial sources. The production methods of the relevant enzyme on industrial scale will be taught, purification techniques will be emphasized. Finally, you will have an idea about the application areas. The differences in application of enzymes obtained from mesophilic and extremophilic microorganisms will be emphasized | | | | | | | |
| **COURSE OBJECTIVES** | | | | | - Learning industrial production methods of enzymes used in biotechnology.  - Identification of microbial enzymes and their application areas  - Understanding of enzyme purification methods | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Determination of suitable enzyme in biotechnological applications and determination of required properties, production in pure form. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | - will improve knowledge and skills in microbiological origin enzymology;  -will be able to produce a solution proposal for the problems that may be encountered in relation to these issues, | | | | | | | |
| **TEXTBOOK** | | | | | Palmer T., Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2001, Horwood PublishingBisswanger H., Practical Enzymology, 2004, Wiley-VCH | | | | | | | |
| **OTHER REFERENCES** | | | | | Teal AR., Wymer PEO, Enzymes and their role in Biotechnology, 1994, Biochemical Society | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Enzyme Biotechnolgy |
| 2 | Parameters affecting enzyme activity |
| 3 | Classification of enzymes |
| 4 | Enzyme kinetics |
| 5 | Enzim purification |
| 6 | Midterm Examination 1 |
| 7 | Microbial enzymes |
| 8 | Extremozyms |
| 9 | Commerciaaly valuable enzymes |
| 10 | Industrial enzyme Production methods |
| 11 | Midterm Examination 2 |
| 12 | Enzyme immobilization |
| 13 | Industrail Use of enzymes |
| 14 | Trends of biotechnological applications of microbial enzymes |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. Dr. Pınar Aytar Çelik | **Date:** | | 16/11/2016 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | MICROBIAL POLYMERS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 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 (√)]** | | | | | | |
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| **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** | | | | | Microorganisms that are producers of microbial polymers will be introduced. The production steps of the classified polymers will be explained in detail. The living conditions of microorganisms during the production phase will be emphasized, the techniques will be discussed in detail and the usage areas of the polymers obtained will be discussed. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is aimed to plan and teach the processes from the production of microbial polymers aimed at achieving interdisciplinary cooperation to the industrial use. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | With this course, polymer producer microorganisms will be recognized. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Describe what is meant by the definition of "microbial polymer" and distinguish it from common materials,  2. Biology and medicine will learn the properties of polymers that can be used and why they are important,  3. Describe the interactions between polymer and tissue,  4. Learn how to modify the biopolymer in nanoscale according to the desired purpose,  5. Describe the applications of biopolymers in nanostructures, | | | | | | | |
| **TEXTBOOK** | | | | | R.M. Johnson, L.Y. Mwaikambo and N. Tucker, Biopolymers, Shrewsbury, U.K. : Rapra Technology, 2003 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Ratner B. D., Hoffman A. S., Schoen F. J. Lemons J. E., Biomaterials Sci: An Int. to Mater. in Medicine, 2nd edn. Elsevier Acad Press, 2004. 2. Hari Singh Nalwa, “Handbook of Nanostructured Biomaterials and Their Appl. in Nanobiotechnology”, American Scientific Publishers, 2005. 3. Rehm, B.H.A., Microbial Bionanotechnology, hofizon bioscience, 2006 4. Steinbüchel A., Marchessault R.H., Biopolymers for Medical and Pharmaceutical applications, Wiley ICH, 2005 5. Rehm B.H.A., Microbial production of Biopolymers and polymer precursor, Caister Academic Press, 2009. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Polymer producer microorganisms, Bacteria |
| 2 | Polymer producer microorganisms, Fungus |
| 3 | Polymer producer microorganisms, Alg |
| 4 | Importance of precursors at production of microbial polymers |
| 5 | Economy effect of biopolymers, market share |
| 6 | Midterm Examination 1 |
| 7 | Microbial polymer synthesis can be carried out using cellulose, hemicellulose, starch, exopolysaccharides |
| 8 | Microbial polymer synthesis, polyhydroxyalkonate, levan, microbial surface active substances |
| 9 | Microbial polymer synthesis, polylactic acid, hyaluronic acid |
| 10 | Commercially available microbial polymers |
| 11 | Midterm Examination 2 |
| 12 | Uses of microbial polymers |
| 13 | Pharmaceutical microbial polymers |
| 14 | Microbial polymer production from waste |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 8** | have professional and social ethics | | |  | |  |  |
| **LO 9** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 10** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 11** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 12** | communicate orally and in writing Using a foreign language in the European Language Portfolio | | |  | |  |  |
| **LO 13** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 14** | develop a positive attitude towards lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | PROF. DR. AHMET ÇABUK | **Date:** | | 06.04.2017 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | BIOTECHNOLOGY AND ENTRENTREPRENEURSHIP |

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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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | This course will be aimed at the creation and development of entrepreneurial cultures in the field of biotechnology, and will assess the considerations that will be taken in the process of product disposal and commercialization. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Within the scope of this course, the concept of bio-entrepreneurship, adoption of innovative approaches and knowledge transfer on technology management, biotechnological product development strategies, examination of bio-entrepreneurship models, legal regulations on bio-entrepreneurship, national and international incentive funds, patenting, licensing will be assesed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Establishment and development of entrepreneurial cultures in biotechnological applications | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | - What is bio-entrepreneurship? Evaluation of biological processes in innovation, technology management and product acquisition strategies  - Acquisition of knowledge on the commercialization of biotechnological products  - Acquisition of information on intellectual property rights  - Follow up the regulations to be observed during the application of biotechnological products to the market  - Being knowledgeable about existing models of bio-entrepreneurship, applying techniques to present business models for new product strategies | | | | | | | |
| **TEXTBOOK** | | | | | Handbook of Bioentrepreneurship, 2008, Editors: Patzelt, Holger, Brenner, Thomas (Eds.), Springer-Verlag New York | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Awareness about entrepreneurship, innovation and sustainable development |
| 2 | Project concept, project cycle process |
| 3 | Project management and business applications such as risk management and change management |
| 4 | Bioentrentrepreneurship concept and characteristics of Bioentrentrepreneur |
| 5 | Intellectual property rights and licensing processes |
| 6 | Midterm Examination 1 |
| 7 | Examples of bio-entrepreneurs in life sciences |
| 8 | Bioentrentrepreneurship and new business idea development process |
| 9 | Considerations at bioentrentrepreneurship |
| 10 | Patent and utility model processes |
| 11 | Midterm Examination 2 |
| 12 | National and international supports |
| 13 | Angel investors, the protection and product right, the concept of trade secret |
| 14 | Internationalization of biotechnological product |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ahmet ÇABUK | **Date:** | | 06/04/2017 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | GENE THERAPY |

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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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (seminar) | | | | | 1 | | 20 |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition & history of Gene Therapy, Transformation&transduction&conjugation concepts, Gene transfer tools: non-viral vectors, viral vectors, Detailed examination of viral vectors, Diseases targeted in gene therapy, Unsuccessful trials in Gene Therapy Application and products available in the market with success, Ethics and safety information in genetic therapy applications information will be given. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is aimed to create basic information about Gene Therapy and to provide information about the use of this technology today. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Be competent at theoretical and practical knowledge in the field. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Please write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | 1. A Guide to Human Gene Therapy. Author – Roland Herzog, Sergei F Zolotukhin Year 2010, World Scientific Publishers | | | | | | | |
| **OTHER REFERENCES** | | | | | 1-Gene Therapy. Author – Giacca Mauro Year 2010, Springer Verlag Italia Publishers (Available from Internet)2-Prof. Dr. Salih Sanlioglu, Gen Therapy Lecture Notes | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition & history of Gene Therapy |
| 2 | Transformation&transduction&conjugation concepts |
| 3 | Gene transfer vehicles: non-viral vectors |
| 4 | Gene transfer vehicles: viral vectors (Retrovirus,Lentivirus) |
| 5 | Gene transfer vehicles: viral vectors (Adenovirus,Adeno-Associated Virus (AAV), Herpes Simplex Virus) |
| 6 | RNA Interference |
| 7 | Midtearm Exam 1 |
| 8 | DNA Integration Vectors - Transposons and Integrase |
| 9 | Products available on the market with unsuccessful trials and success in Gene Therapy Application |
| 10 | Ethics and safety information in genetic therapy applications |
| 11 | Midtearm Exam 2 |
| 12 | Diseases targeted in gene therapy (Gene Therapy for Obesity, Diabetes and Duschene Muscular Dystrophy) |
| 13 | Diseases targeted in gene therapy (Cancer Gene Therapy and Gene Therapy for Autoimmune Disorders) |
| 14 | Presentations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Asst. Prof.Sedef Hande AKTAŞ | **Date:** | | 19.04.2022 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | BIOTECHNOLOGY AND ENTRENTREPRENEURSHIP |

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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 (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | This course will be aimed at the creation and development of entrepreneurial cultures in the field of biotechnology, and will assess the considerations that will be taken in the process of product disposal and commercialization. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Within the scope of this course, the concept of bio-entrepreneurship, adoption of innovative approaches and knowledge transfer on technology management, biotechnological product development strategies, examination of bio-entrepreneurship models, legal regulations on bio-entrepreneurship, national and international incentive funds, patenting, licensing will be assesed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Establishment and development of entrepreneurial cultures in biotechnological applications | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | - What is bio-entrepreneurship? Evaluation of biological processes in innovation, technology management and product acquisition strategies  - Acquisition of knowledge on the commercialization of biotechnological products  - Acquisition of information on intellectual property rights  - Follow up the regulations to be observed during the application of biotechnological products to the market  - Being knowledgeable about existing models of bio-entrepreneurship, applying techniques to present business models for new product strategies | | | | | | | |
| **TEXTBOOK** | | | | | Handbook of Bioentrepreneurship, 2008, Editors: Patzelt, Holger, Brenner, Thomas (Eds.), Springer-Verlag New York | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Awareness about entrepreneurship, innovation and sustainable development |
| 2 | Project concept, project cycle process |
| 3 | Project management and business applications such as risk management and change management |
| 4 | Bioentrentrepreneurship concept and characteristics of Bioentrentrepreneur |
| 5 | Intellectual property rights and licensing processes |
| 6 | Midterm Examination 1 |
| 7 | Examples of bio-entrepreneurs in life sciences |
| 8 | Bioentrentrepreneurship and new business idea development process |
| 9 | Considerations at bioentrentrepreneurship |
| 10 | Patent and utility model processes |
| 11 | Midterm Examination 2 |
| 12 | National and international supports |
| 13 | Angel investors, the protection and product right, the concept of trade secret |
| 14 | Internationalization of biotechnological product |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ahmet Çabuk | **Date:** | | 04.05.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505311606 | **TITLE** | Instrumental Analysis in 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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | | 1 | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (Seminar) | | | | | 1 | | 25 |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | This course is includes using devices in biotechnology laboratories and current applications of the instrumental analysis, methods and principles. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to provide students with information about the basic techniques which is used in biotechnology laboratories, furthermore learn analytical separation techniques required for biotechnological studies and provide the ability for evaluating the outcomes of planning, operation | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | At the end of this course, students will learn concepts of current analytical and instrumental techniques, steps of isolation and characterization of biological materials from the sources. In addition, they will learn according to the sample choose of bio-analytical methods which are uses of determine of the amount of component, gain skills to solve encountered problems using of the principles of the analytical chemistry. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.To gain knowledge of the basic concepts of modern analytical and instrumental techniques in the field of biothecnology  Learning strategy and the stages of purification and characterization of  instrumentel analysis  3. To gain selection skills of bio-analytical chemistry methods for determination of sample component  4. To learn the basic principles and mechanisms of instrumental techniques  5. To learn application areas of instrumental techniques on industrial | | | | | | | |
| **TEXTBOOK** | | | | | Douglas A. Skoog, F. James Holler, Stanley R. Crouch, " Principles of instrumental analysis", Philadelphia : Saunders College Pub., 2007. ISBN 0-03-002078-6. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Keith Wilson and John Walker, " Principles and techniques of biochemistry and molecular biology", Cambridge : Cambridge University Press, 2005. ISBN 0-521-53581-6.2.Edmond de Hoffmann, Vincent Stroobant, " Mass spectrometry : principles and applications", Hoboken, N.J. : J. Wiley, 2007. ISBN 978-0-470-03310-4. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic equipments of biotechnology laboratories; utilities of instrumental techniques in clinical and industrial areas |
| 2 | Chemical preparations before analysis (buffers,reactives,spesific dyes for identification) and preparation of the strategic plan of analysis |
| 3 | standardization, instrument calibration, validation methods and applications of the ISO 17025 standard on Biotechnology laboratories, |
| 4 | Mass Spectrometry Principles and its biotechnological applications |
| 5 | Optical spectroscopy and analysis methods of biomaterials |
| 6 | Midterm Examination 1 |
| 7 | Chromatographic techniques in biotechnology: principles, clinical & industrial examples |
| 8 | Chromatographic techniques in biotechnology: principles, clinical & industrial examples |
| 9 | Electrophoretic techniques, principles and applications on biotechnology |
| 10 | Electrophysiological techniques, principles and applications on biotechnology |
| 11 | Midterm Examination 2 |
| 12 | Current combined techniques of biotechnology laboratories |
| 13 | Micro-array analysis of; proteins N-terminal and C-terminal sequencing, cDNA preparation and Gene Sequencing |
| 14 | Immunological identification techniques |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Doç. Dr. Figen Çalışkan | **Date:** | | 04.05.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | INDUSTRIAL MICROORGANISMS AND SECONDER METABOLITES |

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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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The scope of this course will be included the seconder metabolites and its ındustrial application. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide understanding of the importance of seconder metabolites by the students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will contribute to prepare for professional life by providing knowledge on the importance of microorganisms in biotechnology and the flow of production processes. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Understanding the importance of seconder metabolites  Sort of seconder metabolites  To understand the microbiological production process  To create the metabolites of microorganisms  To explain the production of seconder metabolites on a commercial scale | | | | | | | |
| **TEXTBOOK** | | | | | Biotechnology Procedures and Experiments Handbook. Harisha S. 2007. Infinity Science Press LLC. | | | | | | | |
| **OTHER REFERENCES** | | | | | Madigan MT and Martinko JM. Brock Mikroorganizmaların Biyolojisi (2006) (Çeviri Edit: Çökmüş C) Palme Yayıncılık, Ankara.Handbook of Fungal Biotechnology. Ed: Arora DK. 2004. Marcel Dekker, Inc. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Specific function of seconder metabolites |
| 2 | Function of seconder metabolites |
| 3 | Bioactive seconder metabolites |
| 4 | Bioactive seconder metabolites |
| 5 | Diversity of biyosynthetics |
| 6 | Midterm Examination 1 |
| 7 | Bacterial seconder metabolites and product improvement |
| 8 | Fungal seconder metabolites and product improvement |
| 9 | Production strategies of seconder metabolites |
| 10 | Production strategies of seconder metabolites |
| 11 | Midterm Examination 2 |
| 12 | Characterisation of seconder metabolites |
| 13 | How many microbial metabolites may be discovered in the future? |
| 14 | Selected plant and specifications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ahmet Çabuk | **Date:** | | 04.05.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | ADVANCED ENVIRONMENTAL 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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The scope of this course will be included the environmental biotechnology. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide understanding of the importance of microorganisms of biodiversity and the ecosystem the by the students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will contribute to prepare for professional life by providing knowledge on the importance of microorganisms in biotechnology and the flow of production processes. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Understanding the importance of environmental biotechnology  Sort of environmental biotechnologically relevant microorganisms  To understand the biotechnological treatment process  Examplify the treatment process of microorganisms  To explain the production of biotechnological treatment process on a commercial scale  Understanding the environmental biotechnologically importance of microorganisms. | | | | | | | |
| **TEXTBOOK** | | | | | Atlas, R. M., Bartha, R. (1997) Microbial Ecology Fundamentals and Applications Wesley Longman Inc | | | | | | | |
| **OTHER REFERENCES** | | | | | Madigan MT and Martinko JM. Brock Mikroorganizmaların Biyolojisi (2006) (Çeviri Edit: Çökmüş C) Palme Yayıncılık, Ankara.Prescott, L. M., Harley, J. P., Klein, D. A. (1996) Microbiology Wm. C. Brown Publishers England Biotechnology Procedures and Experiments Prescott, L. M., Harley, J. P., Klein, D. A. (1996) Microbiology Wm. C. Brown Publishers England | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Scope to environmental biotechnology |
| 2 | Microbial evolutiın and interactions of microorganisms |
| 3 | Adaptation of microorganisms in environment |
| 4 | Adaptation of microorganisms in environment |
| 5 | Microbial habitats |
| 6 | Midterm Examination 1 |
| 7 | Cycles of biogeochemistry |
| 8 | The roles of microorganisms in waste treatment |
| 9 | Microbial interactions with xenobiotics and inorganic pollutants |
| 10 | Biotrasnformation, bioremediation |
| 11 | Midterm Examination 2 |
| 12 | Roles of microorganisms in recovery of metals, energetics and biomass production |
| 13 | Microbial controls of toxic substant |
| 14 | Toxicity |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Doç. Dr. Pınar Aytar ÇElik | **Date:** | | 04.05.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Proteomic and Bioinformatic |

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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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 25 |
| Report | | | | |  | |  |
| Other (     ) | | | | | 1 | | 25 |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The content of this course includes how to obtain proteomic information by classical instrumental analysis and development of this information by the means of information technologies. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To gain finding proteomic data from bioinformatic databases, using the knowledge, analyzing and storing, the sequence comparison and alignment, using similarity searching applications. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | For development and automation of biotechnology and information technology they will learn advantage of proteomics and bioinformatics resources | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Ability to achieving proteomic knowledge  2.To understand the working methods of protein in biotechnology  3.Scanning of bioinformatic databases  4.To understand organization of databases and in proteomic studies finding and using different datas  5.Using computer and information technologies for effective utilization of genomic and proteomic data  6.Prepare a strategic plan for protein studies  7. Using proteomic and bioinformatics information for built phylogenetic relationships. | | | | | | | |
| **TEXTBOOK** | | | | | N. Gautham, "Bioinformatics", Oxford University, Alpha Science 2006. ISBN 1-8426-5300-8 | | | | | | | |
| **OTHER REFERENCES** | | | | | Ignacimuthu, S. "Basic bioinformatics", Harrow : Alpha Science Int., 2005. ISBN 1-8426-5231-1Jean-Michel Claverie, Cedric Notredame "Bioinformatics for dummies"2nd Ed. Wiley Publishing,Inc., 2007. ISBN 978-0-470-08985-9.D.Voet, G.Voet, "Biochemistry" 3rd Ed. Wiley Int. Ed., (Chapter 7-4.) 2004. ISBN 0-471-19350-X.S.Hubbart, A. Jones“Proteom Bioinformatics” Humana press, 2010.ISBN 978-1-60761-443-2www.expasy.orgwww.ncbi.nlm.nih.gov/blastwww.ncbi.nlm.nih.gov/Genbank/http://srs.ebi.ac.uk/http://www.genome.jp/kegg/http://www.brenda-enzymes.org/Actual publications and review articles from international journals | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Proteomics: Introduction, sample taking,preparation,and problems |
| 2 | 2D Gel Electrophoresis |
| 3 | Mass Spectroscopy of Peptides and Proteins, finger print analysis |
| 4 | Protein chips |
| 5 | Microsequencing and purification strategy |
| 6 | Midterm Examination 1 |
| 7 | Introduction to proteome bioinformatics |
| 8 | Bioinformatic tools and its uses |
| 9 | Use of proteomic databases; PDB, UniProtKB, PIR, PRF, |
| 10 | Use of Nucleotide sequence databases; GenBank, EMBL, DDBJ ve EBI. |
| 11 | Midterm Examination 2 |
| 12 | Sequence scanning and analysis |
| 13 | Similarity comparison |
| 14 | Determination of the phylogenetic proximity |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Doç. Dr. Figen Çalışkan | **Date:** | | 04.05.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | NATIONAL-INTERNATIONAL BIOSAFETY REGULATIONS AND POLITICS OF 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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The scope of this course will be included biosafety and regulatıons. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide understanding of the importance of biosafety regulatıons by the students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will contribute to prepare for professional life by providing knowledge on the importance of biosafety and biodiversty. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Understanding the importance of biosafety  Understanding the importance of laws and regulatıons of biosafety  To understand the biosafety process  Examplify the laws and regulations of biosafety  To comparison of the national and international laws of biosafety | | | | | | | |
| **TEXTBOOK** | | | | | Biyogüvenlik ve Biyoçeşitlilik Ders Notları, ESOGÜ Biyoloji Bölümü, ESKİŞEHİR | | | | | | | |
| **OTHER REFERENCES** | | | | | Biosafety and bioethics, Joshi, R., 2006, Delhi.Biyoteknoloji; Uluslar arası eğilimler ve görüşler. Bull. A. Geoffrey. H. B. (1987). İstanbul. İstanbul Üniversitesi. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Importance of laws and biosafety |
| 2 | Biodiversity convention nd biosafty protocol |
| 3 | Internatıonal regulations |
| 4 | Turkey become party to an agreement in international conventions and protocols |
| 5 | Turkey become party to an agreement in international conventions and protocols |
| 6 | Midterm Examination 1 |
| 7 | Historical aspects of local regulations and development stage of biosafety in Turkey |
| 8 | Law regulations in Turkey. |
| 9 | Local regulations and laws in Turkey |
| 10 | Local regulations and laws in Turkey |
| 11 | Midterm Examination 2 |
| 12 | Future of biosafety laws |
| 13 | New biotechnological products and biosfety, law regulations |
| 14 | New biotechnological products and biosfety, law regulations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | | 04.05.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advance Techniques in 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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | For the researchers working on various biological systems, a full knowledge of molecular biology techniques and applications is a must for the accomplishment of observations at the molecular level. This theoretical course includes concept of The History, Description, Purpose and Usage of Biotechnology, Biotechnologic Products, Procedures, Basic Biotechnology and Biomolecule Design, Biotechnology and Biomarkers, Biotechnological Transformation and Transfection, Clinic Approaches and Ethic Principles of Medical Biotechnology, Basic Biotechnology Laboratories and Safety and Status of Medical Biology in Turkey | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To transpose what is need to know about medical biotechnology, which shows a wide spread from industry to medicine and has an importance of growing day by day and to have knowledge about this actual subject. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Derste öğrenilen teorik bilglierin laboratuvar çalışmalarında ve ARGE'de kullanılmasıdır. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | We aim to give information about Biotechnology which is the most popular subject in our present day. Biotechnologic procedures which is used various study of biology will help us treating various problem in every areas which is from medicine to industry and there are too many studies. Knowledge about the usage and function of medical biotechnology, many researches continues in this area, is important for science. | | | | | | | |
| **TEXTBOOK** | | | | | Understanding Biotechnology by A. Borém, F.R. Santos, D. E. Bowen (2003) | | | | | | | |
| **OTHER REFERENCES** | | | | | BBAD\_Ders Notları | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The Classical and Modern Biotechnology |
| 2 | Necessary Tecniques for Basic Biotechnology Laboratory |
| 3 | Biotechnological Products and Procedures |
| 4 | Basic Biotechnology, Biomarkers and Biomolecules |
| 5 | Biopolymeric Materials in Biotechnology and their Transfection |
| 6 | Cell and Tissue Engineering in Biotechnology |
| 7 | Biotechnological Gene Transfer |
| 8 | Midterm Examination |
| 9 | Priciples of Treatment with non-coding RNA Technology and its Application |
| 10 | CRISPR Application in Biotechnology |
| 11 | Treatment with Inhibition of Biotechnology and Gene Expression |
| 12 | Biotechnology and OMICs Technologies |
| 13 | Biotechnology and Bioinformatics |
| 14 | Seperation Process in Biotechnology |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Res. Asis. Dr. Belma NURAL YAMAN | **Date:** | | 13.11.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | EPIGENETICS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 0 | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) |  |
| **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 | | | | |  | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In this course; Historical development of epigenetics, Epigenetic processes, Epigenetic inheritance mechanisms and processes, organisms used in epigenetic studies, the role of epigenetics in metabolism and psychology studies, Epigenetic related diseases and treatment approaches; topics will be included | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide students with scientific knowledge about the mechanisms of epigenetics and the purposes of using these mechanisms, their relationship with diseases and treatment approaches. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will contribute to the students who will specialize in Genetics and Biotechnology to improve their undergraduate and graduate knowledge about gene regulation and behavior. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To comprehend epigenetic processes and mechanisms of inheritance  2. To obtain information about organisms used in epigenetic studies  3. To evaluate the relationship between epigenetic processes and diseases  4. To learn epigenetic control and treatment approaches | | | | | | | |
| **TEXTBOOK** | | | | | Armstrong, L. 2013. Epigenetics. Garland Science, Taylor-Francis Group. Ny and London.Carlberg, C. ve Molnar, F. 2018. Human epigenomics. Springer Nature Singapore. | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition and historical development of epigenetics and ethics |
| 2 | Epigenetics processes |
| 3 | Epigenetic mechanisms of inheritance |
| 4 | DNA methylation and demethylation |
| 5 | DNA acetylation and histone modifications |
| 6 | Gene exspression |
| 7 | Organisms used is epigenetic studies 1 |
| 8 | Midterm Examination |
| 9 | Organisms used is epigenetic studies 2 |
| 10 | Psychology and epigenetics |
| 11 | Epigenetics and diseases 1 |
| 12 | Epigenetics and diseases 2 |
| 13 | Epigenetic controls |
| 14 | Epigenetics and experimental models |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | R.A. Dr. Ebru Ceren FİDAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | FUNCTİONAL FOODS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | ENGLISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Classification and descriptions of functional foods, new customer preferences, product and using aims, ingredients, functional foods and health, GMO functional foods, current legislations, process methods, place in markets. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | In this course it is aimed to give students information about functional foods, their classification, effect on health and product technology. Also they would get about special type of ingredients which used in functional foods, marketing strategies, their place in the world markets and their legislation. Reading essays will provide students with the skills of reviewing and evaluating the extra sources in terms of different views | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Probiotic bacteria, Prebiotics, Phytosterols, Carotinoids, Flavonoids and other secondary plant materials, Product designs, Functional product marketing, | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Öğretim Yöntemleri Ölçme Yöntemleri  1 - Comprehend classification and descriptions of functional foods 1 - 2 - 3 - A - B - C -  2 - Comprehend the required proporties in a functional foods 1 - 2 - 3 - 14 - A - B - C -  3 - Comprehend the functional food groups according to aim of use and product 1 - 2 - 3 - 14 - A - C -  4 - Comprehend functional foods benefit and their relation to health 1 - 2 - 3 - A - C -  5 - Comprehend current legislations of functional foods | | | | | | | |
| **TEXTBOOK** | | | | | Wildman, R.E.C. (Edited) “Handbook of Nutraceuticals and Functional Foods” CRC Pres, Boca Radon (2001)Functional Foods and Biotechnology (Eds. K.Shetty, G.Paliyath, A.L.Pometto,R.E. Levin) Taylor & Francis Group, 2007 | | | | | | | |
| **OTHER REFERENCES** | | | | | Fonksiyonel Gıdalar Editör Prof.Dr. Gökhan BAYSAL(2018) | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Classification and Descriptions of Functional, the Role of New Customer Preferences on Functional Foods |
| 2 | Functional Food Groups Based on Process and Application Aims |
| 3 | Used ingredients in Functional Foods Process |
| 4 | Functional Foods Related Health |
| 5 | Functional Foods Related Life Style |
| 6 | Midterm Examination 1 |
| 7 | Functional Food Types |
| 8 | Functional Cereal Products |
| 9 | Functional Candy |
| 10 | Functional Dairy Products |
| 11 | Midterm Examination 2 |
| 12 | Bioavailability of Nutrients in Functional Foods |
| 13 | Functional Foods in the Market, New Functional Product Designs |
| 14 | The Current Legal Regulations of Medical and Functional Foods |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Ass.Prof. Aysel GÜLBANDILAR | **Date:** | | 11.11.2019 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505312614 | **TITLE** | Protein Nucleic Acid Interaction Mechanisms |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) |  |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Structure of Nucleic Acids and Proteins, DNA Topology, Interaction in Replication, Interaction in Transcription, Control in Transcription, Regulation of Metalloproteins, Binding of Proteins to DNA Motifs | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To be taught the interaction of proteins with nucleic acids | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Gaining the ability to overcome the problems encountered in molecular biology in biotechnology, to understand the mechanisms, to interpret, to make changes | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To be taught the three-dimensional control mechanisms in living things, to understand the regulation of DNA and RNA, the interactions of proteins and nucleic acids  2. To be learned the concepts of biochemistry and molecular biology.  3. Understanding the regulation of DNA and RNA  4. Understanding the interactions of proteins and nucleic acidsminimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | Genes V Benjamin Lewin, 1994, Oxford UniversityPress• LehningerPrinciples of Biochemistry David L. Nelson, Michael M. Cox, Third Edition, 2000, WorthPublishers | | | | | | | |
| **OTHER REFERENCES** | | | | | Ders Notları | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Structure of Nucleic Acids |
| 2 | Structure of Protein |
| 3 | Editing DNA Geometry |
| 4 | Interaction in Replication |
| 5 | Interaction in Replication-2 |
| 6 | Interaction in Transcription |
| 7 | Interaction in Transcription-2 |
| 8 | Midterm |
| 9 | Control in Transcription |
| 10 | Control in Transcription 2 |
| 11 | Eukaryotic Transcription |
| 12 | Regulation of Transcription |
| 13 | DNA Binding Motifs |
| 14 | Regulation of Metalloproteins |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Res. Ass. Dr. Belma NURAL YAMAN | **Date:** | | 04.11.2022 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **BIOTECHNOLOGY and BIOSAFETY (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505312615 | **TITLE** | STOCHIOMETRY IN BIOTECHNOLOGICAL PROCESSES |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) |  |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
|  | | X | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Unit systems Parameters / Calculation of Mass Balance / Reactive Systems / Combustion Reactions / Single Phase Systems (Liquid and Solid State, Ideal Gases, Real Gases) / Multiphase Systems / Energy Balances (Kinetic and Potential Energy, Energy Balances of Closed and Open Systems | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To have knowledge about unit systems (Metric, S.I., English Unit Systems) to be used in basic science and engineering branches within the scope of biotechnology. 2. To be able to solve chemical processes by using process parameters such as mass, volume, chemical content, pressure and temperature to be used in biotechnological processes. 3. To have the necessary basic knowledge to create mass balances in biotechnological processes. 4. To be able to solve sample problems of mass and energy balances. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To be able to apply unit systems in biotechnological processes to be used, to strengthen problem solving skills by using related equations. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have knowledge about different unit systems and conversion to each other.  2. To have knowledge about chemical processes using different parameters.  3. To have information about industrial examples where mass and energy balances used in biotechnology can be used.  4. To analyze and analyze problem solving techniques with the help of graphics in multivariate systems | | | | | | | |
| **TEXTBOOK** | | | | | Sinai Endüstride Kullanılan Kütle ve Enerji Denklikleri | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Class |
| 2 | Unit Systems |
| 3 | Unit Systems-2 |
| 4 | Combustion Reactions |
| 5 | Salt Cake |
| 6 | Physical Processes |
| 7 | Gase Laws |
| 8 | Midterm |
| 9 | Evaporation and Vapor Pressure |
| 10 | Solutions and Crystallization |
| 11 | Mass Equations |
| 12 | Mass Equations 2 |
| 13 | Energy Equaitons |
| 14 | Energy Equaitons 2 |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE BIOTECHNOLOGY and BIOSAFETY PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | use theoretical and practical knowledge with biotechnology education. | | |  | |  |  |
| **LO 2** | analyze concepts and ideas related to biotechnology by scientific methods and interpret and find solutions to them. | | |  | |  |  |
| **LO 3** | identify problems in health, food, agriculture, environment and industry and gain skills about these problems in the context of sustainable processes. | | |  | |  |  |
| **LO 4** | gain skills to work with the interdisciplinary team as a leader. | | |  | |  |  |
| **LO 5** | gain awareness of working environment safety and quality management. | | |  | |  |  |
| **LO 6** | discuss about biosafety issues related to biotechnology applications as the owner with detailed information. | | |  | |  |  |
| **LO 7** | gain skills of using high-level mental processes such as creative and critical thinking, initiative and decision-making as a researcher, producer and entrepreneur and capable person. | | |  | |  |  |
| **LO 8** | contribute to manpower in native biotechnology industry. | | |  | |  |  |
| **LO 9** | have professional and social ethics. | | |  | |  |  |
| **LO 10** | gain abilities of following, reading comprehension, writing and interpreting by using advanced scientific developments and information technology related to their fields. | | |  | |  |  |
| **LO 11** | gain transferring of knowledge and experience in the field as a written, oral and visual skills. | | |  | |  |  |
| **LO 12** | gain testing skill observed knowledge by using information technology. | | |  | |  |  |
| **LO 13** | communicate orally and in writing using a foreign language in the European Language Portfolio. | | |  | |  |  |
| **LO 14** | contribute to the projects with social responsibility by considering national priorities. | | |  | |  |  |
| **LO 15** | develop a positive attitude for lifelong learning. | | |  | |  |  |
| **Prepared by :** | | | Res. Ass. Dr. Belma NURAL YAMAN | **Date:** | | 04.11.2022 | | | |

**Signature**: