**BIOTECHNOLOGY AND BIOSAFETY MSc 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](#EN24) | 7.5 | 3+0 | 3 | **C** | Turkish |
| 505302501 | [LABORATORY SAFETY](#EN1) | 7.5 | 3+0 | 3 | **C** | Turkish |
| 505302502 | [BIOSTATISTICAL METHODS](#EN5) | 7.5 | 3+0 | 3 | **C** | Turkish |
|  | Elective Course-1 | 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-2 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-3 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-4 | 7.5 | 3+0 | 3 | E | Turkish |
| 505302001 | 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 |
| 505301702 | MSc THESIS STUDY | | 25 | | 0+1 | - | **C** | Turkish |
| 505301703 | SPECIALIZATION FIELD COURSE | | 5 | | 3+0 | - | **C** | Turkish |
|  | | Total of III. Semester | 30 |  | |  |  |  | |
| **IV. Semester** | | | | | | | | | |
| Code | | Course Title | ECTS | T+P | | Credit | C/E | Language | |
| 505301702 | | MSc THESIS STUDY | 25 | 0+1 | | - | **C** | Turkish | |
| 505301703 | | SPECIALIZATION FIELD COURSE | 5 | 3+0 | | - | **C** | Turkish | |
|  | | Total of IV. Semester | 30 |  | |  |  |  | |
|  | | TOTAL OF SECOND YEAR | 60 |  | |  |  |  | |

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| **Elective Courses** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 505301505 | [ADAPTATION AND TYPES OF CELL DEATH](#EN32) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301504 | [Advanced Biomaterials](#EN41) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301501 | [ANTIMICROBIALS AND RESISTANCE MECHANISMS](#EN3) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302521 | [Antimicrobials and Resistance Mechanisms](#EN33) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301506 | [BASIC BIOCHEMISTRY](#EN34) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302506 | [BASIC BIOCHEMISTRY](#EN6) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302507 | [BIOCHEMICAL REACTION ENGINEERING](#EN7) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302510 | [BIOENGINEERING TECHNOLOGIES](#EN9) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302512 | [BIOREFINERY TECHNOLOGIES](#EN10) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301507 | [Biochemical Reaction Engineering](#EN35) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302522 | [Chemical Biological Radiological Nuclear Defense and Safety](#EN40) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302518 | [CURRENT APPROACHES IN MICROBIAL ECOLOGY](#EN26) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302514 | [ELECTRON MICROSCOPY AND PREPARATION TECHNIQUES](#EN14) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301509 | [Electron Microscopy and Preparation Techniques](#EN37) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301502 | [EXTREMOPHILIC MICROORGANISMS AND BIOTECHNOLOGICAL IMPORTANCES](#EN13) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302523 | [Good Manufacturing Practice](#EN31) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302511 | [INTRODUCTION TO BIOENGINEERING](#EN8) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301508 | [Introduction to Bioengineering](#EN36) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302517 | [MICROBIAL BIOTECHNOLOGY](#EN20) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301503 | [MICROBIAL POLYMERS](#EN28) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302504 | [PHYSICOCHEMICAL PROCESSES](#EN16) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301510 | [Physicochemical Processes](#EN38) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302508 | [PLACE OF EMBRYOLOGY IN BIOTECHNOLOGY](#EN11) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302509 | [PLACE OF HISTOLOGY IN BIOTECHNOLOGY](#EN12) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302505 | [POLITICS IN BIOSAFETY AND BIODIVERSITY](#EN4) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302520 | [RECOMBINANT DNA TECHNOLOGY](#EN42) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301511 | [Waste Management](#EN39) | 7.5 | 3+0 | 3 | E | Turkish |
| 505302503 | [WASTE MANAGEMENT](#EN17) | 7.5 | 3+0 | 3 | E | Turkish |
| 505301512 | [Water and Wastewater Treatment Technologies](#EN30) | 7.5 | 3+0 | 3 | E | Turkish |

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**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** | 505302501 | **TITLE** | LABORATORY SAFETY |

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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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The importance of laboratory safety; general rules in the lab, risk factors in the lab; safety work with chemical substances; the disposal of waste chemicals; laboratory accidents and precautions; first aid, occupational diseases; the personal safety and hygiene in the laboratory; fire safety; biosafety in the laboratory; laboratory biosafety levels; legal regulations in the country. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach basic principles of work safely in the laboratory, providing knowledge to students about risks and dangers in the lab, safety working rules, personal protective equipment etc. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students learn chemical, physical and biological risks in the lab environment, learn how to take precautions against those risks, work safely in the lab. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Obtain basic information about lab safety.  Recognize the risks that may occur in the lab.  Explain the importance of safety in the lab.  Gain knowledge about waste disposal.  5. Explain the importance of biosafety in the lab. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | Yeni Mevzuat Işığında İş Sağlığı ve Güvenliği Temel Bilgileri, RİSK MED Akademi Yayınları, 2012/1. Dizdar E.N., (2008). İş Güvenliği, Murathan Yayınevi. Merck Laboratuvar El Kitabı, 2007. Laboratory biosafety manual, Third Edition, World Health Organization, Geneva, 1994. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The importance of lab safety, the definition of occupational health and safety, general rules in the laboratory, rules that must be followed in the use of laboratory instruments/equipment |
| 2 | The lab of risk factors; physical, chemical and biological risks |
| 3 | Safe operation of chemical substances; chemical material safety data sheet (MSDS), chemical material safety information card, label hazard symbols |
| 4 | The safe storage of chemicals; general rules of the hazardous substances deposition; waste disposal. |
| 5 | Laboratory accidents and measures, first aid measures |
| 6 | Midterm Examination 1 |
| 7 | Occupational diseases |
| 8 | Personal hygiene and safety in the laboratory; personal protective equipment |
| 9 | Fire safety; fire extinguishers, fire extinguisher types, proper use of fire extinguisher |
| 10 | Laboratory safety measures; ventilation, gas and fire detectors, eyes shower, emergency shower etc. |
| 11 | Midterm Examination 2 |
| 12 | Biosafety in the laboratory; risk groups, risks and safety of microorganisms. |
| 13 | Laboratory biosafety levels, disinfection, sterilization, contaminations , biological waste management |
| 14 | Lab safety and biosafety-related institutions, legal regulations in our country |
| 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. Belgin Karabacakoğlu | **Date:** | | 15/05/2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

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**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 505302516 | **TITLE** | ADAPTATION AND TYPES OF CELL DEATH |

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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 | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | | 1 | | 30 |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Plants as nutrients are consumed for their changes due to environmental conditions and the effects of these altered foods will be examined in the cells. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | We consume nutrients to the cells of the molecular-level learning will be affected. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Air pollution and industrial solid, liquid and gas waste that occur in plants by examining the effects will be evaluated in terms of molecular biology. These effects may bring about changes in the cell and will be defined in terms of damage. In addition to these changes in cell adaptation responses will be evaluated. In addition to these changes, cell death mechanisms will be examined. These are; programmed cell death which is known apoptosis; Autophagy which is known cell death by using lysosomes and yhe last one is necrosis which is known physical and chemical changes affecting in environmental factors. Today, mechanisms of cell death are grouped under three main headings. In this course, the mechanisms of adaptation to other types of cell death mechanisms and the information will be given about the damage they create. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | Alberts, B., Bray, J., D., Lewis, Raff, M., Roberts, K., Wartson, J., D. : Molecular Biology of The Cell, Third Edition, Gurland Puplishing, Inc. New York London 1994.Basaran A.: Tıbbi Biyoloji Ders Kitabı., Güneş&Nobel Kitabevleri, Genişletilmiş 7. Baskı, 2005.Bray, A., Raff L., Watson, R.: Molecular Biyology of the Cell., Newyork, London, 2002.Cooper, G.M.: The Cell, Dara-Farber Cancer Instıtute School. North America, 1997.Güneş H.V.: Moleküler Hücre Biyolojisi, Güneş Kitabevi, Genişletilmiş 2. Baskı, 2007.Pollard, T.D., Earnshaw, W.C.: Cell Biology, London, New-York, St-Louis, Sydney,Toronto, 2002. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | What are natural plant nutrients? |
| 2 | Types of Cell Death Mechanisms |
| 3 | Effect of domestic and industrial waste water on morphological deformations in plants. |
| 4 | Effects of air pollution and industrial pollution types like solid, liquid and gas on plants |
| 5 | Effects of accumulation heavy metal on changes in ruderal and culture plants. |
| 6 | Midterm Examination 1 |
| 7 | Consequential damages resulting when cell death have seen |
| 8 | Cell damage caused and mechanisms. |
| 9 | Tissue damage caused and mechanisms. |
| 10 | Chemical damage, kinds of chemical damage. |
| 11 | Midterm Examination 2 |
| 12 | Reversible damage. |
| 13 | Cellular adaptation for damage |
| 14 | Heterophagy. Autophagy. Natural plant nutrients and autophagy. |
| 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. 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** | 50531501 | **TITLE** | Antimicrobials and Resistance Mechanisms |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 |  | 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 | | 60 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Antibiotics and antibiotic susceptibility testing, mechanisms of the development of bacterial resistance to antibacterial agents, antiviral agents, antifungal agents, antiparasitic agents and their mechanisms of action, biofilm production, new biotechnological drugs | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Descriptions of effect mechanisms of antimicrobials, to learn the mechanisms of action of antimicrobials and resistance mechanisms of microorganisms to antimicrobials | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Sufficient knowledge of science and engineering subjects; an ability to use and apply theoretical and practical knowledge on this areas. Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students can define the mechanisms of action of antibiotics  Students can describe the development of bacterial resistance to antibacterial agents  Students can define the mechanisms of action of antimycotic drugs  Students can define antimicrobial susceptibility testing. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Lippincott’s Illustrated Reviews. Ed. RA Harvey, PC Champe.2. Medical Microbiology Ed. PR Murray, KS Rosenthal, MA Pfaller | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture notes | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to the antimicrobials |
| 2 | Basic classes of antibiotics |
| 3 | Measurement of antimicrobial activity |
| 4 | Antibacterial agents: mechanism of action-1 |
| 5 | Antibacterial agents: mechanism of action-2 |
| 6 | Midterm Examination 1 |
| 7 | Mechanisms of resistance microorganisms develop to antibiotics-1 |
| 8 | Mechanisms of resistance microorganisms develop to antibiotics-2 |
| 9 | Antiviral and antiparasiter agents and their effect mechanisms |
| 10 | Antifungal agents and their effect mechanisms |
| 11 | Midterm Examination 2 |
| 12 | Biotechnological drugs |
| 13 | Biofilms and resistance mechanisms |
| 14 | Antimicrobials of importance in the future |
| 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 :** | | | Doç. Dr. İlknur Dağ | **Date:** | | 26.08.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 505302505 | **TITLE** | POLITICS IN BIOSAFETY AND BIODIVERSITY |

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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 biodiversity of living things. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide understanding of the importance of biosafety and biodiversity 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 together with biosafety and biodiversity  To understand the biosafety process  Examplify the application of biosafety  To explain the interaction with biosafety and biodiversity | | | | | | | |
| **TEXTBOOK** | | | | | Biyogüvenlik ve Biyoçeşitlilik Ders Notları, ESOGÜ Biyoloji Bölümü, ESKİŞEHİR | | | | | | | |
| **OTHER REFERENCES** | | | | | Biosafety and bioethics, Joshi, R., 2006, Delhi. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Historical aspect of biosafety |
| 2 | Economics of biodiversity |
| 3 | Interactions of sustainable biodiversity and biosafety |
| 4 | Interactions of sustainable biodiversity and biosafety |
| 5 | Component of biosafety |
| 6 | Midterm Examination 1 |
| 7 | Biosafety and transgenic plants |
| 8 | Biosafety and transgenic animals |
| 9 | Biosafety and transgenic microorgansims |
| 10 | Biotechnological process and biosafety |
| 11 | Midterm Examination 2 |
| 12 | Future of biosafety |
| 13 | New biotechnological products and biosfety |
| 14 | New biotechnological products and biosfety |
| 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:** | | 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** | 505302502 | **TITLE** | Biostatistical Methods |

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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 | | | | | 1 | | 15 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 35 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition of probability and basic terms, Random variables and probability functions, some discrete and continuous distributions, definitions of statistics and basic terms, descriptive statistics, data analysis,sampling and sampling distributions, confidence intervals, tests of hypotheses, one way analysis of variance,linear regression and correlation analysis. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The basic aim of the course is to introduce the basics of probability and statistics, probability distributions, statistical methods and their applications, especially in biology, chemistry and medicine. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The student will be able to use probability and statistical knowledge and methods in the professional studies. In this context, the student will ;  Learn the basics of probability,  Learn and be able to apply some important discrete and continuous probability distributions  Learn basics of statistics,  Be able to gather data and analyze them,  Infer about the population from where the data were gathered,  Learn and apply the testing of hypotheses procedure,  Learn Analysis of Variance and multiple comparisons,  Learn and apply Linear Regression and Correlation Analysis | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Knowledge related to the basics of probablity and statistics, able to apply important probability distributions and statistical methods. | | | | | | | |
| **TEXTBOOK** | | | | | ÖZDAMAR, K. (2011) : PASW ile Biyoistatistik; Kaan Kitabevi, Eskişehir. | | | | | | | |
| **OTHER REFERENCES** | | | | | • DEVORE, J. L. (2004): Probability and Statistics for Engineering and the Sciences, Thomson;• BELLE, Gerald van [et al.] (2004): Biostatistics : a methodology for the health sciences; / 2.Basım, J. Wiley, NJ• ER, F., PEKER, K. Ö., (H. Sönmez, ed.) (2009) Biyoistatistik / , Anadolu Üniversitesi Yayınları No: 1932, Eskşişehir• VITTINGHOFF, E. [et al.] (2005) :.Regression methods in biostatistics : linear, logistic, survival and repeated measures models , Springer, NY• HERITIER, S. [et. al] (2009) : Robust Methods in Biostatistics; J. Wiley, Chichester, UK• Standard Normal, F, Binomial probability tables; | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basics of probability |
| 2 | Random variables, probability and probability density functions and Distribution functions |
| 3 | Some important discrete distributions |
| 4 | Some important continuous distributions |
| 5 | Basics of statistisc |
| 6 | Midterm Examination 1 |
| 7 | Descriptive statistics |
| 8 | Sampling Distributions and Confidence intervals |
| 9 | Basics of tests of hypothesis |
| 10 | Single sample hypothesis tests |
| 11 | Midterm Examination 2 |
| 12 | Double sample hypothesis tests |
| 13 | Linear Regresion and Correlation |
| 14 | Anaylsis of Variance |
| 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. Nimetullah Burnak | **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** | 505302506 | **TITLE** | BASIC BIOCHEMISTRY |

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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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In this course basic nomenclature, structure and function of aminoacids, peptides, proteins, enzymes, coenzymes, nucleic acids, carbohydrates and lipids will be covered. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To gain information about the structure and function of the biomolecules as well as the chemical mechanism of basic process in the living organism | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | At the end of this course students would gain knowledge about the structure and function of the biomolecules by gaining analytical thinking ability and they will gain new insight on the importance of biochemistry in biology. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Gaining molecular insight on chemical structure of the living  Gaining knowledge about importance water and minerals  Describing how structure of bio molecules and functional groups effect the physical features of the living being  Describing structure and function of the amino acids  Learning how amino acids effect the function of proteins  Linking protein structure to its function  Learning the kinetics of enzymatic reactions  Naming the structure and function of nucleic acids  Naming and charecterizing carbohydrates  Describing the chemical structure and function of lipids | | | | | | | |
| **TEXTBOOK** | | | | | P.C.Champe, R.A.Harvey Ed. Lippincott’s Illustrated Reviews: “Biochemistry”, Turkish Translation.: E.Ulukaya, Nobel Medical Book Store, (2007). | | | | | | | |
| **OTHER REFERENCES** | | | | | Keha E.E.,Kührevioğlu I., " Biochemistry", (2004). Nelson, D.L. and Cox, M.M. (2004). Lehninger Principles of Biochemistry. Chapter 1-13), Worth Publishers, Wisconsin, USA (in Turkish version: Palme yayıncılık: Ed. Kılıç N.). Gözükara E., Biochemistry, Ankara (1990) | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Biomolecules, chemical compounds, functional groups, configuration and confirmation), aquarious solutions |
| 2 | Aminoacids in proteins |
| 3 | O in amino acids and nonstandart amino acids not |
| 4 | 3D structure of proteins |
| 5 | Characterization of protein structure |
| 6 | Midterm Examination 1 |
| 7 | General features of enzymes and their nomenclature, enzymatic reactions, mechanism of catalysis |
| 8 | Monosacharides, polysacharides |
| 9 | Glycolipids, glycoproteins |
| 10 | Covalent structure of nucleic acids |
| 11 | Midterm Examination 2 |
| 12 | Characterizing lipids and their function |
| 13 | Biomembranes, lipoproteins |
| 14 | Classifying vitamins and analyzing their chemical structure and function |
| 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 :** | | | Asso Prof.Dr. Adnan Ayhancı | **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** | 505101503 | **TITLE** | Biochemical Reaction Engineering |

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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 | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction to fermentation technology, fermentation techniques and processes used in biotechnology, bioreactors, continuous production, sterilization, automatic control and Bioreactors, aerobic and anaerobic processes, BOD and COD, biomass production kinetics, substrate consumption, product formation, biological reactor design, control systems, product purification method, the advantages and economy of bioprocesses by other processes. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Investigation the biological production processes, determine the characteristics of the process. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The ability to have knowledge about the biochemical reaction engineering and bioprocesses  To be informed about our problems and to identify enzymes and enzyme kinetics  Fermenter design | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Processes and products used in the field of biotechnology and food to be informed about Gain A Knowledge Of Contemporary Issues | | | | | | | |
| **TEXTBOOK** | | | | | Türker M., Biyoreaksiyon Mühendisliği, Su vakfı yayınları , 2005 Kargı F., Çevre Mühendisliğinde biyoprosesler, D.E.Ü. Müh. Fak. Basım Ünitesi,izmir,1995 Bailey J. E. And Ollis D. F. , Biochemical Engineering Fundamentals., McGraw-Hill, Edition, New York, 1986 Pekin B., Biyokimya Mühendisliği, Ege Üni. İzmir,1983 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to fermentation technology |
| 2 | Fermentation techniques and processes used in biotechnology |
| 3 | Bioreactors |
| 4 | Continuous production |
| 5 | Sterilization |
| 6 | Midterm Examination 1 |
| 7 | Automatic control and Bioreactors |
| 8 | Aerobic and anaerobic processes |
| 9 | Kinetics of biomass production, substrate consumption, product formation |
| 10 | Biological reactor design, control systems, |
| 11 | Midterm Examination 2 |
| 12 | Product purification method |
| 13 | Advantages over other processes and economy of bioprocesses |
| 14 | Homework and presentation |
| 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 :** | | | Asistant Prof. Dr. Macid Nurbaş | **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** | 505302511 | **TITLE** | Introduction to Bioengineering |

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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 | | 60 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Biomedical engineering, bioengineering and historical overview, anatomy and physiology, electrical signals in biological systems, biosensors, bioinstrumentation, principles of biosignal processing, biomechanics, fundamental biotechnology. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to obtain introductory knowledge and explore fundamental fields of bioengineering, understand and investigate related concepts. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Obtaining introductory knowledge on bioengineering fields of study and its interdisciplinary nature. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | General knowledge on bioengineering related fields and concepts,  Ability to apply and associate interdisciplinary knowledge,  Ability to understand and solve natural sciences related problems,  Ability to work interdisciplinary,  Ability to analyze natural sciences related problems by using modern experimental setups and technology. | | | | | | | |
| **TEXTBOOK** | | | | | Enderle J., Blanchard S., Bronzino J., (2005). Introduction to Biomedical Engineering. Academic Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | Saterbak A., (2007). Bioengineering Fundamentals. Prentice Hall. Webster J.G., (2009). Medical Instrumentation: Application and Design. Wiley. Boal D. (2002). Mechanics of the Cell. New York: Cambridge Pres. Fung Y.C., (1993). Biomechanics: Mechanical Properties of Living Tissues. Springer. Alberts B., et.al. (2002). Molecular Biology of the Cell. Garland Science. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Biomedical engineering, bioengineering and historical overview, |
| 2 | Anatomy and Physiology; Cellular organization, tissues, major organ systems and homeostasis, |
| 3 | Electrical signals in biological systems; Historical perspective, neurons, cell membrane and its modeling, biophysical approaches, |
| 4 | Biosensors; biopotentials and their measurements, |
| 5 | Biosensors; biopotentials and their measurements, |
| 6 | Midterm Examination 1 |
| 7 | Bioinstrumentation; Basic instrumentation systems and their principles, |
| 8 | Bioinstrumentation; Basic instrumentation systems and their principles, |
| 9 | Principles of biosignal processing, |
| 10 | Biomechanics; Fundamental mechanical properties of biological systems, |
| 11 | Midterm Examination 2 |
| 12 | Fundamental biotechnology; basic techniques, medical applications, |
| 13 | Fundamental biotechnology; medical applications, |
| 14 | Fundamental biotechnology; interdisciplinary, |
| 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 :** | | | Asst.Prof. Sertaç Eroğlu | **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** | 505302510 | **TITLE** | Bioengineering Technologies |

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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 | | 60 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Biomaterials, tissue engineering, principles of genetic engineering, introduction to medical imaging, biomedical optics and lasers. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to study introductory knowledge and explore fundamental bioengineering technologies, understand and investigate related concepts. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Obtaining introductory knowledge on bioengineering fields of study and its interdisciplinary nature. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | General knowledge on bioengineering related fields and technologies, Ability to apply and associate interdisciplinary knowledge, Ability to understand and solve natural sciences related problems, Ability to work interdisciplinary, Ability to analyze natural sciences related problems by using modern experimental setups and technology. | | | | | | | |
| **TEXTBOOK** | | | | | Enderle J., Blanchard S., Bronzino J., (2005). Introduction to Biomedical Engineering. Academic Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | Saterbak A., (2007). Bioengineering Fundamentals. Prentice Hall. Boal D. (2002). Mechanics of the Cell. New York: Cambridge Pres. Fung Y.C., (1993). Biomechanics: Mechanical Properties of Living Tissues. Springer. Cho Z.H., et al., (1993). Foundations of Medical Imaging. Wiley. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Biomaterials; classification, biological effects and biocompatibility, |
| 2 | Biomaterials; mechanical properties and testing, |
| 3 | Tissue engineering; tissue dynamics, stem cell technology, tissue and environment interaction, |
| 4 | Tissue engineering; tissue dynamics, stem cell technology, tissue and environment interaction, |
| 5 | Principles of genetic engineering, |
| 6 | Midterm Examination 1 |
| 7 | Introduction to medical imaging; roentgen, computerized tomography, |
| 8 | Introduction to medical imaging; computerized tomography, ultrasound, |
| 9 | Introduction to medical imaging; magnetic resonance and nuclear imaging, |
| 10 | Introduction to medical imaging; magnetic resonance and nuclear imaging, |
| 11 | Midterm Examination 2 |
| 12 | Biomedical optics and lasers; fundamentals of optics, interaction of light and matter, |
| 13 | Biomedical optics and lasers; light propagation in tissues, photothermal effects of lasers, |
| 14 | Biomedical optics and lasers; light propagation in tissues, photothermal effects of lasers, |
| 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 :** | | | Asst.Prof. Sertaç Eroğlu | **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** | 505302512 | **TITLE** | Biorefinery Technologies |

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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 | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Principles and introduction, petrol refinery and its production, the lignocellulosic biorefinery, sugar based biorefinery, biological and thermochemical processes, green biorefineries, biomass, biomass conversion: processes and technologies, biobased products, biorefinery economy, political end environmental aspects of biorefineries. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Examination of biological and chemical processes in order to obtain value-added chemicals from biomass and wastes instead of oil as a fossil resource is the main goal of this course. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Definiton of various raw materials biorefinery systems,  Information about biorefinery products,  Learn the biomass and conversion processes,  Definition of economy, politics and environments impacts of biorefineries | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learn the oil refinery and its product,  Define the biorefinery resources,  Learn the conversion processes,  Evaluate the economical, political and environmental impacts of biorefinery | | | | | | | |
| **TEXTBOOK** | | | | | Kamm, B., Gruber, P. R., Kamm M. (Editors), Biorefineries - Industrial Processes and Products: Status Quo and Future Directions, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2006 | | | | | | | |
| **OTHER REFERENCES** | | | | | Demirbaş, A., Biorefineries for Biomass Upgrading Facilities, Springer, 2010. Clark J., Deswarte F., (Editors), Introduction to Chemicals from Biomass, John Wiley & Sons, Ltd., 2008 Pandey, A. (Editor), Handbook of Plant-Based Biofuels, CRC Press, | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Principles and introduction, petrol refinery and its production, |
| 2 | the lignocellulosic biorefinery, |
| 3 | sugar based biorefinery, |
| 4 | biological processes, |
| 5 | thermochemical processes, |
| 6 | Midterm Examination 1 |
| 7 | green biorefineries, |
| 8 | biomass, biomass conversion: processes and technologies, |
| 9 | biobased products. |
| 10 | biorefinery economy,. |
| 11 | Midterm Examination 2 |
| 12 | political end environmental aspects of biorefineries |
| 13 | Student presentations |
| 14 | Student presentations |
| 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. H. Levent HOŞGÜN | **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** | 505302508 | **TITLE** | PLACE OF EMBRYOLOGY IN BIOTECHNOLOGY |

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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 (√)]** | | | | | | |
| 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** | | | | | Contrıbutıon of embryoology ın the bıotechnology fıeld | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Presentatıon of contrıbutıons of embryology ın the bıotechnology fıeld | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Knowıng basıc events and mechanısms of human embryonıc development | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learnıng basıc events and mechanısms of human embryonıc development | | | | | | | |
| **TEXTBOOK** | | | | | Embriyoloji ve doğum defektlerinin temelleri-before we are born 7. Baskı, çeviri editörü sevda müftüoğlu, güneş tıp kitabevleri, ankara, 2009. | | | | | | | |
| **OTHER REFERENCES** | | | | | İnsanın üremesi ve gelişmesi, meral tekelioğlu, ankara, 1995. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduce to human embryology |
| 2 | Development of male germ cells |
| 3 | Development of female germ cells |
| 4 | Fertilization and the factors influencing fertilization |
| 5 | Development of zygote, blastula, morula and blastocyst |
| 6 | Midterm Examination 1 |
| 7 | Implantation |
| 8 | Development of bilaminar and trilaminar embryonic discs |
| 9 | Basic events and mechanisms of embryology |
| 10 | Formation mechanisms of congenital defects |
| 11 | Midterm Examination 2 |
| 12 | Embryonic stem cells |
| 13 | Contributions of embryology to assisted reproductive technology therapies |
| 14 | Future of embryology |
| 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. Varol Şahintürk | **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** | 505302509 | **TITLE** | PLACE OF HISTOLOGY IN BIOTECHNOLOGY |

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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 (√)]** | | | | | | |
| 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** | | | | | Contrıbutıon of hıstology ın the bıotechnology fıeld | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Presentatıon of contrıbutıons of hıstolgy ın the bıotechnology fıeld | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Knowıng the cells and tıssues of human body | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learnıng the cells and tıssues of human body | | | | | | | |
| **TEXTBOOK** | | | | | HISTOLOGY, Mıchael Ross and Wojciech Pawlina, Sixth edition 2011, Wolters Kluwer/Lippincott Williams & Wilkins, Philadelphia, USA. | | | | | | | |
| **OTHER REFERENCES** | | | | | Histoloji ve Hücre Biyolojisi, Çeviri editörü: Ramazan Demir, Palme Yayıncılık, Ankara 2006. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic cytology |
| 2 | Cells of human body |
| 3 | Introduce to histology |
| 4 | Cover epithelium |
| 5 | Secretion and glands |
| 6 | Midterm Examination 1 |
| 7 | Connective tissue |
| 8 | Blood and bone marrow |
| 9 | Cartilage and bone |
| 10 | Muscular and nervous tissues |
| 11 | Midterm Examination 2 |
| 12 | Cell cultures |
| 13 | In vitro tissue production |
| 14 | Selected actual literatures |
| 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. Varol Şahintürk | **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** |  | **TITLE** | Extremophilic microorganisms and biotechnological importances |

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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 | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In the scope of this course, the topics related to microorganisms living extreme habitats and their biotechnological applications will be taken part. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to be known microorganisms living at extreme conditions, investigated them for potential biotechnological applications, and gained basic knowledge and skill to need. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Sufficient knowledge of science and engineering subjects related to industrial of extremophilic microorganisms applications ; an ability to use and apply theoretical and practical knowledge on these fields, an ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | The students classify extremophilic microorganisms phylogeneticallly.  The students define the methods isolation of extremophilic microorganisms  The students analyze the metabolism of extremophiles  The students know extremophilic microorganisms and importances of their biotechnological application potential | | | | | | | |
| **TEXTBOOK** | | | | | 1. Physiology and Biochemistry of Extremophiles, Charles Gerday and Nicolas Glansdorff, ASM Press, 20072. Extremophiles: Microbiology and Biotechnology, Roberto Paul Anitori, Horizon Scientific Press, 2012 | | | | | | | |
| **OTHER REFERENCES** | | | | | Reviews and publications related to corresponding field Madigan MT and Martinko JM. (2006), Brock, Biology of Microoroganisms. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Extreme habitats |
| 2 | Microbial diversity and importance |
| 3 | Analysis methods of microbial diversity |
| 4 | Analysis methods of microbial diversity |
| 5 | Extreme microorganisms and isolation methods |
| 6 | Midterm Examination 1 |
| 7 | Acidophilic microorganisms and biotechnological applications |
| 8 | Thermophilic microorganisms and biotechnological applications |
| 9 | Halophilic microorganisms and biotechnological applications |
| 10 | Alcaliphilic microorganisms and biotechnological applications |
| 11 | Midterm Examination 2 |
| 12 | Psychrophilic microorganisms and biotechnological applications |
| 13 | Barophilic microorganisms and biotechnological applications |
| 14 | Radiation-resistant microorganisms and other extremophilic microorganisms and biotechnological applications |
| 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 :** | | | Assis. 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** |  | **TITLE** | Electron Microscopy and Preparation Techniques |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 2 | | 1 |  | | | 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 | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The description of electron microscope, operating principles, types, techniques used in the ultrastructure studies, sample protocols, using chemicals and techniques developed in recent years. In addition, equipment of electron microscope laboratory, laboratory safety procedures and rules, sample preparation techniques for transmission (TEM) and scanning (SEM) electron microscope, the difficulties that occur during sample preparation, observation and evaluation of samples in TEM and SEM. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Electron microscopes are very powerful tools for visualising different samples such as cells, microorganisms, biopsy sample, metals, crystals and large molecules. This course is intended to train students in the understanding and application of transmission electron microscopy (TEM) and scanning (SEM) electron microscope in the different science areas. The students are trained in methods of sample preparation, the principles and operation of the electron microscopes and latest developments in this area. In addition, students will acquire the skills to analyse and present data, and be aware of the role, importance and relevance of electron microscope in scientific researchs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Sufficient knowledge of science and engineering subjects; an ability to use and apply theoretical and practical knowledge on this areas.  Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Use of theoretical and practical knowledge within the electron microscopy at a proficiency level. | | | | | | | |
| **TEXTBOOK** | | | | | Kuo J. (2007) Electron Microscopy: Methods and protocols (Methods in Molecular Biology) Humana Pres, USA. | | | | | | | |
| **OTHER REFERENCES** | | | | | John J. Bozzola,Lonnie Dee Russell. Electron microscopy: principles and techniques for biologists 1992 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The history and description of the electron microscope, types and application areas |
| 2 | Basic properties and operating principles of scanning (SEM) and transmission (TEM) electron microscopes |
| 3 | Electron microscope laboratories: preparation and laboratory safety procedures |
| 4 | Sample preparation for scanning electron microscope (SEM) |
| 5 | Sample drying techniques, mounting samples to stub, coating process and observation |
| 6 | Midterm Examination 1 |
| 7 | Sample preparation for transmission electron microscope (TEM), tissue process |
| 8 | Ultramicrotomes, study principles, glass knife makimg and using techniques |
| 9 | Preparation of blocks for semihtin sections, sectioning, staining and investigation |
| 10 | Ultrathin sections, common problems associated with ultrathin sectioning |
| 11 | Midterm Examination 2 |
| 12 | Staining of ultrahtin sections, staining techniques |
| 13 | Drying of grids and observation in TEM |
| 14 | The evaluation of electron microscopic images for research and diagnosis, Cryo electron microscope |
| 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 :** | | | Doç. Dr. İlknur Dağ | **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** |  | **TITLE** | Physicochemical Processes |

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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 | | | | | 1 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 45 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | General definitions of physicochemical processes, the aim of particle size enlargment and methods, solid-liquid seperation methods, general principles of froth floatation and methods, adsorbtion ve ion exchange processes | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach cleaning of fine wastes by physicochemical processes, such as coagulation, flocculation, sedimentation, filtration, floatation and industrial applications of these processes. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Understanding applications of physicochemical processes to fine wastes | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To learn general knowledge about fine wastes  2. To learn physicochemical processes which are applying to fine wastes  3. Ability to work effectively in inner or multi-disciplinary teams  4. To learn how to analyse problems with modern experimental methods and new technologies | | | | | | | |
| **TEXTBOOK** | | | | | Wills B. A., Mineral Processing Technology, 6th Edition, 1997, Camborne School of Mines, Cornwall, England | | | | | | | |
| **OTHER REFERENCES** | | | | | Somasundaran P., Fine Particles Processing, 1980, Las Vegas | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Properties of minerals and ores |
| 2 | General definitions of physicochemical processes |
| 3 | Particle size englargement methods |
| 4 | Coagulation, flocculation and agglomeration processes |
| 5 | Industrial applications of particle size englargement |
| 6 | Midterm Examination 1 |
| 7 | Dewatering methods |
| 8 | Sedimentation, thickeners |
| 9 | Filtration |
| 10 | Froth floatation |
| 11 | Midterm Examination 2 |
| 12 | Adsorption and ion exchange |
| 13 | Presentation of homeworks |
| 14 | Presentation of homeworks |
| 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 :** | | | Yrd.Doç.Dr. Derya ÖZ AKSOY | **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** | 505302503 | **TITLE** | Waste Management |

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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 | | | | | 1 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 45 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | General definitions of waste and waste management, physical, chemical, biological properties of solid, liquid and gas wastes and capturing and recycling of these wastes, evaluating the environmental impacts of wastes. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The result of increasing population of the World and daily growing technologies, solid, liquid and gas wastes do occur. The aim of this course is to teach capturing, handling and recycling of these wastes. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Understanding, the management of wastes which causes enviromental pollutions, the impacts of these wastes and , evaluating these impacts | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.To learn about water, air and soil pollution  2.To learn physical, chemical and biological cleaning technologies  3.Ability to work effectively in inner or multi-disciplinary teams  4.To learn how to analyse problems with modern experimental methods and new technologies | | | | | | | |
| **TEXTBOOK** | | | | | 1. Karpuzcu M., (1996), Çevre Kirlenmesi ve Kontrolü, Kubbealtı Yayınları, İstanbul, 19962. George T., Frank K., (2002), Handbook of Solid Waste Management, McGraw-Hill Handbooks, Quebecor/Martinsburg | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Tchobanoglous G., Theisen H., Vigil, S.S., (1993),Integrated Solid Waste Management, Singapore, McGraw Hill2. Mackenzie L D., Susan J M., (2004), Principles of Environmental Engineering and Science, McGraw-Hill | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | General definitions of waste and waste management |
| 2 | Sources of solid, liquid and gas wastes and varietiesi |
| 3 | Physical, chemical and biological properties of solid wastes |
| 4 | Handling, storing and recycling of solid wastes |
| 5 | Physical, chemical and biological properties of liquid wastes |
| 6 | Midterm Examination 1 |
| 7 | Handling, storing and recycling of liquid wastes |
| 8 | Physical, chemical and biological properties of gas wastes |
| 9 | Handling, storing and recycling of gas wastes |
| 10 | Handling, storing and recycling of hazardous wastes |
| 11 | Midterm Examination 2 |
| 12 | Environmental impact assessment (EIA) |
| 13 | Presentation of homeworks |
| 14 | Presentation of homeworks |
| 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. Sabiha KOCA | **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** | 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 (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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **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 (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 (√)]** | | | | | | |
|  | |  | | | |  | | | | | | |
| **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Water and Wastewater Treatment Technologies |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 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 | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The collection of wastewater through water supply and water treatment and its treatment and discharge to receiving environments after treatment is an important issue.The course will cover topics related to water and wastewater treatment. In addition to the treatment of water with basic processes such as coagulation, flocculation, precipitation, filtration, disinfection in water treatment, theoretical and practical information on the management of wastes generated during treatment; In wastewater treatment subjects, there are pre-treatment, primary and secondary treatment, tertiary treatment and waste management. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to give the basic properties of wastewater and the treatment techniques to be applied in different wastewater samples. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | It will contribute to the field of Environmental Biotechnology. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Can use the theoretical and applied knowledge gained during the course.  Comprehend the environmental problems and produce alternative solutions.  Analyze environmental problems and apply treatment technologies.  Can participate in interdisciplinary projects. | | | | | | | |
| **TEXTBOOK** | | | | | Su ve Atık Su Mühendisliği Çeviri Editörü: İsmail Toröz, Nobel Yayıncılık 2015.Atık Suların Arıtılması, Ahmet Samsunlu, Seçkin Kitabevi, 2018 | | | | | | | |
| **OTHER REFERENCES** | | | | | Environmental Biotechnology : Principles and Applications Rittmann, B.E., and McCarty, P.L., McGraw Hill, 2001.Applied Environmental Microbiology and Case Studies,prepared by M. Pirbazari, 2002. Prescott, L. M., Harley, 3 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Historical Evolution of Environmental Biotechnology |
| 2 | Properties of Water and Wastewater |
| 3 | Sampling and Storage Methods from Water and Wastewater |
| 4 | Treatment of Wastewater |
| 5 | Mechanical Treatment Methods |
| 6 | Chemical Treatment Methods |
| 7 | Biological Treatment, Biological Treatment Systems and Methods |
| 8 | Role of Microorganisms in Biological Treatment, Microbial Metabolism |
| 9 | Activated Sludge Method |
| 10 | Trickling Filters and Biodiscs |
| 11 | Anaerobic (Airless) Treatment |
| 12 | Final Sedimentation Pools |
| 13 | Advanced Waste Water Treatment Methods |
| 14 | Industrial Wastewater and Treatment Applications in the Laboratory |
| 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. Cansu FİLİK İŞÇEN | **Date:** | | 17/03/2022 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Good Manufacturing Practice |

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| **LEVEL** | **HOUR/WEEK** | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | |
| **MSc** | 3 | |  |  | |  |  | 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 | | | |  | | 20 |
| Project | | | |  | |  |
| Report | | | |  | |  |
| Seminar | | | |  | | 30 |
| Other ( ) | | | |  | |  |
| **Final Examination** | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | |
| **SHORT COURSE CONTENT** | | | | | it includes the basic concepts of quality management, quality assurance, good manufacturing practices (GMP), relevant guidelines and regulations for industrial production. | | | | | | |
| **COURSE OBJECTIVES** | | | | | Within the scope of this course, which is recommended as an elective for Master's Programs, the necessity of sterile production, Good Manufacturing Practices, quality management in the pharmaceutical industry, GLP and validation will be explained. | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have knowledge of the basic concepts, related guides and regulations related to quality management, quality assurance, good manufacturing practices (GMP) in industrial production. | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To be able to produce information about the requirements of drug production according to GMP by examining the relevant guides. 2. To be able to apply the knowledge and skills acquired regarding GMP and quality assurance in the pharmaceutical industry. 3. To have knowledge about international standards that can be integrated with GMP applications. 4. Comprehending good production techniques in the pharmaceutical industry. 5. To be able to write and apply experimental procedures as standard operational procedures. | | | | | | |
| **TEXTBOOK** | | | | | Good Manufacturing Practice Guidelines of the TURKISH MEDICINES AND MEDICAL DEVICES AGENCY (TITCK), Republic of Turkey Ministry of Health- | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Good Manufacturing Practices for Pharmaceuticals, Graham P. Bunn (Editor),2019 , CRC Pres SBN 13:9781498732062 | | | | | | |

1. Good Design Practices for GMP Pharmaceutical Facilities Second Edition G Edited by Terry Jacobs, AIA JacobsWyper Architects Philadelphia, PA, USA Andrew A. Signore, PE ISG-Institute for Strategic Growth Wayne, PA, USA
2. Current national and international Pharmacopea and regulations. (EMA ve ICH ve de PIC)
3. Current scientific manuscripts.

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Quality assurance, GMP, cGMP, GLP, ISO concepts, international (FDA, EMEA, WHO, ICH, PIC,) quality assurance practices |
| 2 | Pharmaceutical Quality System |
| 3 | The importance of GMP and basic requirements and definitions, its importance of GMP for our country in terms of PIC and PICs |
| 4 | Introduction and review of GMP guidelines (medicinal products for human use, Cosmetic) |
| 5 | Examination of the GMP guideline published by TITCK -1 |
| 6 | Examination of the GMP guideline published by TITCK -2 |
| 7 | Examination of the GMP guideline published by TITCK -3 |
| 8 | Examination of the GMP guideline published by TITCK -4 |
| 9 | Generation of document and control |
| 10 | Documentation types and specifications |
| 11 | Writing and registrating of Standard Operating Procedures |
| 12 | Staff training and qualification |
| 13 | Student seminar presentations-1 |
| 14 | Student seminar presentations-2 |
| 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:** 18.11.2021

**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** | ADAPTATION AND TYPES OF CELL DEATH |

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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 | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Plants as nutrients are consumed for their changes due to environmental conditions and the effects of these altered foods will be examined in the cells | | | | | | | |
| **COURSE OBJECTIVES** | | | | | We consume nutrients to the cells of the molecular-level learning will be affected. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Air pollution and industrial solid, liquid and gas waste that occur in plants by examining the effects will be evaluated in terms of molecular biology. These effects may bring about changes in the cell and will be defined in terms of damage. In addition to these changes in cell adaptation responses will be evaluated. In addition to these changes, cell death mechanisms will be examined. These are; programmed cell death which is known apoptosis; Autophagy which is known cell death by using lysosomes and yhe last one is necrosis which is known physical and chemical changes affecting in environmental factors. Today, mechanisms of cell death are grouped under three main headings. In this course, the mechanisms of adaptation to other types of cell death mechanisms and the information will be given about the damage they create. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | Alberts, B., Bray, J., D., Lewis, Raff, M., Roberts, K., Wartson, J., D. : Molecular Biology of The Cell, Third Edition, Gurland Puplishing, Inc. New York London 1994.Basaran A.: Tıbbi Biyoloji Ders Kitabı., Güneş&Nobel Kitabevleri, Genişletilmiş 7. Baskı, 2005.Bray, A., Raff L., Watson, R.: Molecular Biyology of the Cell., Newyork, London, 2002.Cooper, G.M.: The Cell, Dara-Farber Cancer Instıtute School. North America, 1997.Güneş H.V.: Moleküler Hücre Biyolojisi, Güneş Kitabevi, Genişletilmiş 2. Baskı, 2007.Pollard, T.D., Earnshaw, W.C.: Cell Biology, London, New-York, St-Louis, Sydney,Toronto, 2002. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | What are natural plant nutrients? |
| 2 | Types of Cell Death Mechanisms |
| 3 | Effect of domestic and industrial waste water on morphological deformations in plants. |
| 4 | Effects of accumulation heavy metal on changes in ruderal and culture plants. |
| 5 | Effects of accumulation heavy metal on changes in ruderal and culture plants. |
| 6 | Midterm Examination 1 |
| 7 | Consequential damages resulting when cell death have seen |
| 8 | Cell damage caused and mechanisms. |
| 9 | Tissue damage caused and mechanisms. |
| 10 | Chemical damage, kinds of chemical damage. |
| 11 | Midterm Examination 2 |
| 12 | Reversible damage. |
| 13 | Cellular adaptation for damage |
| 14 | Heterophagy. Autophagy. Natural plant nutrients and autophagy. |
| 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. Didem Turgut Coşan | **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Antimicrobials and Resistance Mechanisms |

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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 | | 60 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Antibiotics and antibiotic susceptibility testing, mechanisms of the development of bacterial resistance to antibacterial agents, antiviral agents, antifungal agents, antiparasitic agents and their mechanisms of action, biofilm production, new biotechnological drugs | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Descriptions of effect mechanisms of antimicrobials, to learn the mechanisms of action of antimicrobials and resistance mechanisms of microorganisms to antimicrobials | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Sufficient knowledge of science and engineering subjects; an ability to use and apply theoretical and practical knowledge on this areas. Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students can define the mechanisms of action of antibiotics  Students can describe the development of bacterial resistance to antibacterial agents  Students can define the mechanisms of action of antimycotic drugs  Students can define antimicrobial susceptibility testing. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Lippincott’s Illustrated Reviews. Ed. RA Harvey, PC Champe.2. Medical Microbiology Ed. PR Murray, KS Rosenthal, MA Pfaller | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture notes | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to the antimicrobials |
| 2 | Basic classes of antibiotics |
| 3 | Measurement of antimicrobial activity |
| 4 | Antibacterial agents: mechanism of action-1 |
| 5 | Antibacterial agents: mechanism of action-2 |
| 6 | Midterm Examination 1 |
| 7 | Mechanisms of resistance microorganisms develop to antibiotics-1 |
| 8 | Mechanisms of resistance microorganisms develop to antibiotics-2 |
| 9 | Antiviral and antiparasiter agents and their effect mechanisms |
| 10 | Antifungal agents and their effect mechanisms |
| 11 | Midterm Examination 2 |
| 12 | Biotechnological drugs |
| 13 | Biofilms and resistance mechanisms |
| 14 | Antimicrobials of importance in the future |
| 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. İlknur DAĞ | **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | BASIC BIOCHEMISTRY |

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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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In this course basic nomenclature, structure and function of aminoacids, peptides, proteins, enzymes, coenzymes, nucleic acids, carbohydrates and lipids will be covered. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To gain information about the structure and function of the biomolecules as well as the chemical mechanism of basic process in the living organism | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | At the end of this course students would gain knowledge about the structure and function of the biomolecules by gaining analytical thinking ability and they will gain new insight on the importance of biochemistry in biology. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Gaining molecular insight on chemical structure of the living  Gaining knowledge about importance water and minerals  Describing how structure of bio molecules and functional groups effect the physical features of the living being  Describing structure and function of the amino acids  Learning how amino acids effect the function of proteins  Linking protein structure to its function  Learning the kinetics of enzymatic reactions  Naming the structure and function of nucleic acids  Naming and charecterizing carbohydrates  Describing the chemical structure and function of lipids | | | | | | | |
| **TEXTBOOK** | | | | | P.C.Champe, R.A.Harvey Ed. Lippincott’s Illustrated Reviews: “Biochemistry”, Turkish Translation.: E.Ulukaya, Nobel Medical Book Store, (2007). | | | | | | | |
| **OTHER REFERENCES** | | | | | Keha E.E.,Kührevioğlu I., " Biochemistry", (2004). Nelson, D.L. and Cox, M.M. (2004). Lehninger Principles of Biochemistry. Chapter 1-13), Worth Publishers, Wisconsin, USA (in Turkish version: Palme yayıncılık: Ed. Kılıç N.). Gözükara E., Biochemistry, Ankara (1990) | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Biomolecules, chemical compounds, functional groups, configuration and confirmation), aquarious solutions |
| 2 | Aminoacids in proteins |
| 3 | O in amino acids and nonstandart amino acids not |
| 4 | 3D structure of proteins |
| 5 | Characterization of protein structure |
| 6 | Midterm Examination 1 |
| 7 | General features of enzymes and their nomenclature, enzymatic reactions, mechanism of catalysis |
| 8 | Monosacharides, polysacharides |
| 9 | Glycolipids, glycoproteins |
| 10 | Covalent structure of nucleic acids |
| 11 | Midterm Examination 2 |
| 12 | Characterizing lipids and their function |
| 13 | Biomembranes, lipoproteins |
| 14 | Classifying vitamins and analyzing their chemical structure and function |
| 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. Adnan Ayhancı | **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Biochemical Reaction Engineering |

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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 | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction to fermentation technology, fermentation techniques and processes used in biotechnology, bioreactors, continuous production, sterilization, automatic control and Bioreactors, aerobic and anaerobic processes, BOD and COD, biomass production kinetics, substrate consumption, product formation, biological reactor design, control systems, product purification method, the advantages and economy of bioprocesses by other processes. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Investigation the biological production processes, determine the characteristics of the process. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The ability to have knowledge about the biochemical reaction engineering and bioprocesses  To be informed about our problems and to identify enzymes and enzyme kinetics  Fermenter design | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Processes and products used in the field of biotechnology and food to be informed about Gain A Knowledge Of Contemporary Issues | | | | | | | |
| **TEXTBOOK** | | | | | Türker M., Biyoreaksiyon Mühendisliği, Su vakfı yayınları , 2005 Kargı F., Çevre Mühendisliğinde biyoprosesler, D.E.Ü. Müh. Fak. Basım Ünitesi,izmir,1995 Bailey J. E. And Ollis D. F. , Biochemical Engineering Fundamentals., McGraw-Hill, Edition, New York, 1986 Pekin B., Biyokimya Mühendisliği, Ege Üni. İzmir,1983 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to fermentation technology |
| 2 | Fermentation techniques and processes used in biotechnology |
| 3 | Bioreactors |
| 4 | Continuous production |
| 5 | Sterilization |
| 6 | Midterm Examination 1 |
| 7 | Automatic control and Bioreactors |
| 8 | Aerobic and anaerobic processes |
| 9 | biomass |
| 10 | Biological reactor design, control systems, |
| 11 | Midterm Examination 2 |
| 12 | Product purification method |
| 13 | Advantages over other processes and economy of bioprocesses |
| 14 | Homework and presentation |
| 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. Macid NURBAŞ | **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Introduction to Bioengineering |

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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 | | 60 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Biomedical engineering, bioengineering and historical overview, anatomy and physiology, electrical signals in biological systems, biosensors, bioinstrumentation, principles of biosignal processing, biomechanics, fundamental biotechnology. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to obtain introductory knowledge and explore fundamental fields of bioengineering, understand and investigate related concepts. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Obtaining introductory knowledge on bioengineering fields of study and its interdisciplinary nature. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | General knowledge on bioengineering related fields and concepts,  Ability to apply and associate interdisciplinary knowledge,  Ability to understand and solve natural sciences related problems,  Ability to work interdisciplinary,  Ability to analyze natural sciences related problems by using modern experimental setups and technology. | | | | | | | |
| **TEXTBOOK** | | | | | Enderle J., Blanchard S., Bronzino J., (2005). Introduction to Biomedical Engineering. Academic Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | Saterbak A., (2007). Bioengineering Fundamentals. Prentice Hall. Webster J.G., (2009). Medical Instrumentation: Application and Design. Wiley. Boal D. (2002). Mechanics of the Cell. New York: Cambridge Pres. Fung Y.C., (1993). Biomechanics: Mechanical Properties of Living Tissues. Springer. Alberts B., et.al. (2002). Molecular Biology of the Cell. Garland Science. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Biomedical engineering, bioengineering and historical overview, |
| 2 | Anatomy and Physiology; Cellular organization, tissues, major organ systems and homeostasis, |
| 3 | Electrical signals in biological systems; Historical perspective, neurons, cell membrane and its modeling, biophysical approaches, |
| 4 | Biosensors; biopotentials and their measurements, |
| 5 | Biosensors; biopotentials and their measurements, |
| 6 | Midterm Examination 1 |
| 7 | Bioinstrumentation; Basic instrumentation systems and their principles, |
| 8 | Bioinstrumentation; Basic instrumentation systems and their principles, |
| 9 | Principles of biosignal processing, |
| 10 | Biomechanics; Fundamental mechanical properties of biological systems, |
| 11 | Midterm Examination 2 |
| 12 | Fundamental biotechnology; basic techniques, medical applications, |
| 13 | Fundamental biotechnology; medical applications, |
| 14 | Fundamental biotechnology; interdisciplinary |
| 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. Sertaç Eroğlu | **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Electron Microscopy and Preparation Techniques |

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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 | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | he description of electron microscope, operating principles, types, techniques used in the ultrastructure studies, sample protocols, using chemicals and techniques developed in recent years. In addition, equipment of electron microscope laboratory, laboratory safety procedures and rules, sample preparation techniques for transmission (TEM) and scanning (SEM) electron microscope, the difficulties that occur during sample preparation, observation and evaluation of samples in TEM and SEM. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Electron microscopes are very powerful tools for visualising different samples such as cells, microorganisms, biopsy sample, metals, crystals and large molecules. This course is intended to train students in the understanding and application of transmission electron microscopy (TEM) and scanning (SEM) electron microscope in the different science areas. The students are trained in methods of sample preparation, the principles and operation of the electron microscopes and latest developments in this area. In addition, students will acquire the skills to analyse and present data, and be aware of the role, importance and relevance of electron microscope in scientific researchs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Sufficient knowledge of science and engineering subjects; an ability to use and apply theoretical and practical knowledge on this areas.  Ability to work effectively in inner or multi-disciplinary teams; proficiency of interdependence | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Use of theoretical and practical knowledge within the electron microscopy at a proficiency lev | | | | | | | |
| **TEXTBOOK** | | | | | Kuo J. (2007) Electron Microscopy: Methods and protocols (Methods in Molecular Biology) Humana Pres, USA. | | | | | | | |
| **OTHER REFERENCES** | | | | | John J. Bozzola,Lonnie Dee Russell. Electron microscopy: principles and techniques for biologists 1992 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The history and description of the electron microscope, types and application areas |
| 2 | Basic properties and operating principles of scanning (SEM) and transmission (TEM) electron microscopes |
| 3 | Electron microscope laboratories: preparation and laboratory safety procedures |
| 4 | Sample preparation for scanning electron microscope (SEM) |
| 5 | Sample drying techniques, mounting samples to stub, coating process and observation |
| 6 | Midterm Examination 1 |
| 7 | Sample preparation for transmission electron microscope (TEM), tissue process |
| 8 | Ultramicrotomes, study principles, glass knife makimg and using techniques |
| 9 | Preparation of blocks for semihtin sections, sectioning, staining and investigation |
| 10 | Ultrathin sections, common problems associated with ultrathin sectioning |
| 11 | Midterm Examination 2 |
| 12 | Staining of ultrahtin sections, staining techniques |
| 13 | Drying of grids and observation in TEM |
| 14 | The evaluation of electron microscopic images for research and diagnosis, Cryo electron microscope |
| 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. İlknur Dağ | **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Physicochemical Processes |

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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 | | | | | 1 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | General definitions of physicochemical processes, the aim of particle size enlargment and methods, solid-liquid seperation methods, general principles of froth floatation and methods, adsorbtion ve ion exchange processes | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach cleaning of fine wastes by physicochemical processes, such as coagulation, flocculation, sedimentation, filtration, floatation and industrial applications of these processes | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Understanding applications of physicochemical processes to fine wastes | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To learn general knowledge about fine wastes  2. To learn physicochemical processes which are applying to fine wastes  3. Ability to work effectively in inner or multi-disciplinary teams  4. To learn how to analyse problems with modern experimental methods and new technologies | | | | | | | |
| **TEXTBOOK** | | | | | Wills B. A., Mineral Processing Technology, 6th Edition, 1997, Camborne School of Mines, Cornwall, England | | | | | | | |
| **OTHER REFERENCES** | | | | | Somasundaran P., Fine Particles Processing, 1980, Las Vegas | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Properties of minerals and ore |
| 2 | General definitions of physicochemical processes |
| 3 | Particle size englargement methods |
| 4 | Coagulation, flocculation and agglomeration processes |
| 5 | Industrial applications of particle size englargement |
| 6 | Midterm Examination 1 |
| 7 | Dewatering methods |
| 8 | Sedimentation, thickeners |
| 9 | Filtration |
| 10 | Froth floatation |
| 11 | Midterm Examination 2 |
| 12 | Adsorption and ion exchang |
| 13 | Presentation of homeworks |
| 14 | Presentation of homeworks |
| 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 :** | | | Doç. Dr. Derya Öz Aksoy | **Date:** | | 04.05.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Waste Management |

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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 | | | | | 1 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 45 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | General definitions of waste and waste management, physical, chemical, biological properties of solid, liquid and gas wastes and capturing and recycling of these wastes, evaluating the environmental impacts of wastes | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The result of increasing population of the World and daily growing technologies, solid, liquid and gas wastes do occur. The aim of this course is to teach capturing, handling and recycling of these wastes | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Understanding, the management of wastes which causes enviromental pollutions, the impacts of these wastes and , evaluating these impacts | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.To learn about water, air and soil pollution  2.To learn physical, chemical and biological cleaning technologies  3.Ability to work effectively in inner or multi-disciplinary teams  4.To learn how to analyse problems with modern experimental methods and new technologies | | | | | | | |
| **TEXTBOOK** | | | | | 1. Karpuzcu M., (1996), Çevre Kirlenmesi ve Kontrolü, Kubbealtı Yayınları, İstanbul, 19962. George T., Frank K., (2002), Handbook of Solid Waste Management, McGraw-Hill Handbooks, Quebecor/Martinsburg | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Tchobanoglous G., Theisen H., Vigil, S.S., (1993),Integrated Solid Waste Management, Singapore, McGraw Hill2. Mackenzie L D., Susan J M., (2004), Principles of Environmental Engineering and Science, McGraw-Hill | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | General definitions of waste and waste management |
| 2 | Sources of solid, liquid and gas wastes and varietiesi |
| 3 | Physical, chemical and biological properties of solid wastes |
| 4 | Handling, storing and recycling of solid wastes |
| 5 | Physical, chemical and biological properties of liquid wastes |
| 6 | Midterm Examination 1 |
| 7 | Handling, storing and recycling of liquid wastes |
| 8 | Physical, chemical and biological properties of gas wastes |
| 9 | Handling, storing and recycling of gas wastes |
| 10 | Handling, storing and recycling of hazardous wastes |
| 11 | Midterm Examination 2 |
| 12 | Environmental impact assessment (EIA) |
| 13 | Presentation of homeworks |
| 14 | Presentation of homeworks |
| 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. Sabiha Koca | **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Chemical Biological Radiological Nuclear Defense and Safety |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 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 | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 0 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Öğrencilere biyolojik ajanı olarak kullanılan mikroorganizmaları, yaptıkları hastalıkları, biyosavunma terimini, geliştirilen teşhis ve tedavide kullanılacak teknikleri tanıtarak; dünyada ve ülkede biyosavunma politikalarını tartışmaktır | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is; Historical development of chemical warfare agents, classification of chemical warfare agents and their effects on the body, defense methods for chemical warfare agents and detection and identification of chemical warfare agents, definition of mass destruction weapons, their purpose, history, classification types, mechanisms of action and medical measures to be taken before exposure and exposure Treatment and follow-up processes to be applied afterwards, radiation sources, risks, detection methods, protection approaches in the light of basic concepts related to radiation and nuclear energy, national / international institutions / organizations and regulations related to the subject with emergency preparedness and intervention, in the literature on biological agents. Basic terms encountered, the diversity of biological agents that can be used as weapons and their scientific classification, basic information on the optimum conditions and methods for their development in nature and especially in laboratories, morphological / cytological or To gain a scientific point of view by providing knowledge on the physiological characteristics, the regulations of the weapons of mass destruction, what are the CBRN defense regulations and application principles in national and international law. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. To put forward questioning, innovative approaches  2. To gain original, independent and critical thinking skills and to develop theoretical concepts and tools  3.Developing strategies and / or products to reduce CBRN risks that pose a threat to national and international security | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | -To explain the concepts of Chemical, Biological, Radiological and Nuclear (CBRN) at an expert level and apply them in CBRN defense -To present questioning, innovative approaches -To apply Chemical, Biological, Radiological and Nuclear concepts to individual, social, economic, technological and ethical issues | | | | | | | |
| **TEXTBOOK** | | | | | Bioterrorism and Infectious Agents: A New Dilemma for the 21st Century I.W. Fong, Kenneth Alibek Springer Science & Business Media, 18 Mar 2010 - 273 sayfa2.Bioterrorism: Prevention, Prepardeness and Protection. 26 Apr 2007 by J.V. Borelli | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Classification of Biological Agents |
| 2 | Diseases caused by biological agents |
| 3 | Classification of Chemical Radiological and Nuclear Agents |
| 4 | -Chemical Defense and Security |
| 5 | -Biological Defense and Security |
| 6 | -Radiological / Nuclear Defense and Security |
| 7 | -National CBRN Legislation |
| 8 | Midterm |
| 9 | -International CBRN Legislation |
| 10 | -CBRN Defense Principles and Components |
| 11 | -Human Factors and CBRN Relationship |
| 12 | -Detection, Diagnostics and Laboratory Studies of CBRN War Agents |
| 13 | Decontomination of biological agents |
| 14 | Treatments to eliminate the effects of biological and chemical agents |
| 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 :** | | | Dr. Burçak ÇABUK | **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Biomaterials |

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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 (√)]** | | | | | | |
| 3 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction to biomaterials; Advanced characterisation techniques of biomaterials; New generation and smart biomaterials; Applications of new generation biomaterials. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Understanding the new generation biomaterials and characterisation techniques thereof; Having comprehensive knowledge in the advances in biomaterials; Getting knowledge in clinical applications of biomaterials. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1- Description and application areas of advanced technology biomaterials.  2-Learning of cell-biomaterial and tissue-biomaterial interactions.  3- Learning new generation biomaterial manufacturing techniques such as 3D biıprinting. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1- Educating scientists in fundamental science who know new generation and high technology biomaterials.  2- Understanding the cell and tissue interactions of new generation biomaterials.  3- Analysis of evaluating of biomaterials for human health.  4- Having literature knowledge in advanced biomaterials and their applications. | | | | | | | |
| **TEXTBOOK** | | | | | 1- Biomaterials Science, An Introduction to Materials In Medicine, Buddy D. Ratner, Allon S. Hoffman, Frederick J. Schoen, Jack E. Lemons, Elsevier Academic Pres, New York, 2004 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1-Biomaterials: Principles and Applications 1st Edition Joon B. Park, Joseph D. Bronzino, CRC Press, 2002 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Interduction to biomaterials and biomaterials chemistry |
| 2 | Classification of biomaterials: Polymeric, seramic, and metalic biomaterials; 2D, 3D and 4D materials. |
| 3 | Manufacturing techniques of advanced biomaterials: 3D bioprinting and micro/nano-lithography |
| 4 | Cells used in biomaterials technology: Somatic, Multipotent and Pluripotent stem cells |
| 5 | Cell-material interaction and mechanobiology |
| 6 | Cell-material interaction and mechanobiology |
| 7 | New generation hydrogels: Peptide, DNA and bioactive hydrogels |
| 8 | New generation hydrogels: Peptide, DNA and bioactive hydrogels-2 ARA SINAV |
| 9 | Nanobiomaterials |
| 10 | Self-assembling materials |
| 11 | Biomimetic materials |
| 12 | Tissue engineering applications of new generation biomaterials: Soft tissue engineering |
| 13 | Tissue engineering applications of new generation biomaterials: Hard tissue engineering |
| 14 | Having literature knowledge in new generation biomaterials |
| 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 :** | | | Asst. Prof. Burak Derkus | **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 (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | RECOMBINANT DNA TECHNOLOGY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 2 | | 2 |  | | |  | 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 | | 50 |
| Quiz | | | | | 2 | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 25 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | |  |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The lecture comprises basic knowledge on restriction endonuclease enzymes which are the necessary factors for the construction of recombinant DNA, primer design for the gene to be cloned, plasmid types and structures, polymerase chain reaction, ligase enzyme, transformation, transduction, sequence analysis and comparison with the genome database. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is aimed to give the basic knowledge of recombinant DNA technology and set up background for protein production, vaccine production, gene therap uses this technology. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | -To have information about recombinant DNA technology  -To provide background information for advanced analysis using recombinant DNA technology | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | -To have knowledge about the techniques used in recombinant DNA technology  -Ability to construct recombinant plasmid DNA | | | | | | | |
| **TEXTBOOK** | | | | | Gene Cloning&DNA Analysis -An Introduction. T.A.Brown, Blackwell Publishing, 2015.7th edition | | | | | | | |
| **OTHER REFERENCES** | | | | | Massachusetts Institute of Technology (MIT) Course materials, Recombinant DNA 1-4, Prof.Dr.Eric Lander | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Restriction endonuclease enzymes |
| 2 | Primer design for the gene to be cloned |
| 3 | Vectors (Non-viral vectors and viral vectors) |
| 4 | Plasmid types and structures-1 |
| 5 | Plasmid types and structures-2 |
| 6 | Midterm Examination 1 |
| 7 | Polymerase Chain Reaction |
| 8 | Polymerase Chain Reaction and gel imaging, "cornerstone articles" discussion |
| 9 | Application of the cleavage of plasmid with appropriate restriction endonuclease enzymes, "cornerstone articles" discussion |
| 10 | Ligation of the gene of interest to the plasmid vector and imaging application in gel, "cornerstone articles" discussion |
| 11 | Midterm Examination 2 |
| 12 | Cornerstone articles presentations |
| 13 | Transformation, transduction |
| 14 | Interpretation of sequence analysis results |
| 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 :** | | | Asst. Prof.Sedef Hande AKTAŞ | **Date:** | | 5.11.2019 | | | |

**Signature**: