**CHEMISTRY 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](#EN79) | 7.5 | 3+0 | 3 | **C** | Turkish |
| 501501533 | [HISTORY OF SCIENCE AND CHEMISTRY](#EN2) | 7.5 | 3+0 | 3 | **C** | Turkish |
|  | Elective Course-1 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-2 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Total of I. Semester | 30 |  | 12 |  |  |
| **II. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 501502530 | [LITERATURE REVIEW IN CHEMISTRY](#EN1) | 7.5 | 3+0 | 3 | **C** | Turkish |
|  | Elective Course-3 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-4 | 7.5 | 3+0 | 3 | E | Turkish |
| 501502001 | 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 |
| 501501702 | MSc THESIS STUDY | | 25 | | 0+1 | - | **C** | Turkish |
| 501501703 | 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 | |
| 501501702 | | MSc THESIS STUDY | 25 | 0+1 | | - | **C** | Turkish | |
| 501501703 | | 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 |
| 501501522 | [ADVANCED COORDINATION CHEMISTRY](#EN15) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501534 | [ADVANCED COORDINATION POLYMERS](#EN80) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502527 | [ADVANCED ELECTROCHEMISTRY](#EN40) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502531 | [ADVANCED FUNCTIONAL POLYMERS](#EN81) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501506 | [ADVANCED POLYMER CHEMISTRY I](#EN5) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502505 | [ADVANCED POLYMER CHEMISTRY II](#EN28) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502532 | [ADVANCED X-RAY ANALYSIS TECHNIQUES](#EN82) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502528 | [ALTERNATIVE POWER SOURCES](#EN41) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502503 | [AN INTRODUCTION TO MEDICINAL CHEMISTRY](#EN27) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501501 | [ANALYSIS METHODS](#EN3) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502534 | [Applications of Metal-Organic Frameworks](#EN83) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501524 | [BASIC REACTIONS IN ORGANIC SYNTHESIS I](#EN17) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502520 | [BIOTRANSFORMATION REACTIONS](#EN43) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501536 | [Biochemistry of Fungicidal Action](#EN88) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501511 | [CATHODIC PROTECTION AND INHIBITORS](#EN8) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501532 | [CHARACTERIZATION OF THE BIOSORPTION PROCESS](#EN73) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502542 | [Chemical Safety](#EN97) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502521 | [CHESMISTRY OF NATURAL COMPOUNDS](#EN36) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501509 | [CHROMATOGRAPHIC METHODS](#EN77) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501505 | [CORROSION CHEMISTRY](#EN4) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501510 | [DATA ANALYSING IN CHEMISTRY](#EN7) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501530 | [ELECTROCHEMICAL SURFACE COATINGS](#EN24) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502540 | [Electrophilic Cyclization Raactions](#EN85) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501539 | [Enzyme Technology](#EN87) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502517 | [ENZYMES AND THEIR INDUSTRIAL APPLICATIONS](#EN33) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501531 | [HETEROGENEOUS ELECTRODE PROCESSES](#EN25) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502538 | [Isolation of Natural Products](#EN89) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501538 | [Metals in Biochemistry](#EN91) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502539 | [Methods of Enzymatic Analysis](#EN86) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501508 | [MODERN TECHNIQUES IN ANALYTICAL CHEMISTRY I](#EN6) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502510 | [MODERN TECHNIQUES IN ANALYTICAL CHEMISTRY II](#EN29) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501518 | [MOLECULAR SYMMETRY AND GROUP THEORY](#EN13) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502526 | [MOLECULLAR SPECTROPHOTOMETRY AND ANALYTICAL APLICATIONS](#EN19) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501512 | [NAMED ORGANIC REACTION MECHANISM I](#EN9) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502512 | [NAMED ORGANIC REACTION MECHANISM II](#EN10) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502535 | [Nanochemistry](#EN92) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502524 | [NMR SPECTROSCOPY](#EN38) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502541 | [Organic materials; Design and Synthesis](#EN93) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501525 | [PERICYCLIC REACTIONS](#EN18) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502507 | [PHASE EQUILIBRIA](#EN75) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502518 | [POLYMERIC MATERIALS IN CORROSION](#EN34) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502537 | [Purification of Biomolecules](#EN94) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502536 | [Retrosynthesis](#EN96) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501529 | [SAMPLE PREPARETION TECHNIQUES IN ANALYTICAL CHEMIST](#EN23) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501517 | [SELECTED TOPICS IN ANALYTICAL CHEMISTRY I](#EN12) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501527 | [SELECTED TOPICS IN PHYSICAL CHEMISTRY](#EN21) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502519 | [SELECTIVE TOPICS IN ANALYTICAL CHEMISTRY II](#EN35) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502515 | [SEPARATION METHODS](#EN32) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501535 | [Special Topics in Biochemistry](#EN84) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501504 | [SPECTROSCOPIC METHODS I](#EN78) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501523 | [STATISTICS FOR ANALYTICAL CHEMISTS-I](#EN16) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502525 | [STATISTICS FOR ANALYTICAL CHEMISTS-II](#EN39) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501520 | [STRUCTURE AND FUNCTIONS OF PROTEINS](#EN14) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502513 | [SURFACE ACTIVE MATERIALS AND THEIR PHYSICAL CHEMISTRY](#EN31) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502511 | [SURFACE CHEMISTRY](#EN30) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502529 | [SURFACE PRETREATMENT AND COATING TECHNIQUES](#EN42) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502533 | [Symmetry with a Chemical Approach](#EN95) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501528 | [SYNTHESIS TECNIQUES AND ORGANIC ANALYSIS](#EN22) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501515 | [THE CHEMISTRY OF HETEROCYCLIC AROMATIC COMPOUND](#EN11) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501537 | [The Synthesis and Characterizations OF METAL-ORGANIC FRAMEWORKS](#EN90) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501526 | [THEORETICAL ORGANIC CHEMISTRY I](#EN20) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502501 | [THEORETICAL ORGANIC CHEMISTRY II](#EN26) | 7.5 | 3+0 | 3 | E | Turkish |
| 501502523 | [THERMAL ANALYSIS TECHNIQUES](#EN37) | 7.5 | 3+0 | 3 | E | Turkish |
| 501501513 | [THERMODYNAMICS OF SOLUTIONS](#EN76) | 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** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Literature Review in Chemistry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | |  | | | | | | | |
| **COURSE OBJECTIVES** | | | | |  | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Please write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 |  |
| 2 |  |
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| 4 |  |
| 5 |  |
| 6 | Midterm Examination 1 |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |
| 11 | Midterm Examination 2 |
| 12 |  |
| 13 |  |
| 14 |  |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Proff.Dr. İsmail KIRAN | **Date:** | 02.06.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | History of Science and Chemistry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | |  | | | | | | | |
| **COURSE OBJECTIVES** | | | | |  | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Please write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | Kimya Tarihi, Zeki TEZ, Nobel Yayın Dağıtım,2000. | | | | | | | |
| **OTHER REFERENCES** | | | | | Crosland, Maurice P. Historical studies in the language of chemistry. Cambridge, Harvard University Press, 1962. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to the history of science |
| 2 | First Scientists |
| 3 | Primeval history of chemistry |
| 4 | Important discoveries in Pyhsics, Chemistry and Biology |
| 5 | Chemistry - Alchemy |
| 6 | Midterm Examination 1 |
| 7 | Chemistry before industrial revolution |
| 8 | Chemistry after industrial revolution |
| 9 | Progress in Chemistry at 17th and 18 th century |
| 10 | Progress in Chemistry at 19th and 20th century |
| 11 | Midterm Examination 2 |
| 12 | History of Chemistry Nobels |
| 13 | History of Chemistry Nobels |
| 14 | History of Chemistry Nobels |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof.Dr. İsmail KIRAN | **Date:** | 03.06.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501501 | **TITLE** | ANALYSIS METHODS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Chemical analysis, classical and instrumental analysis, analysis of various minerals | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to teach fundamental principles of the clasical and istrumental analysis to students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will gain to ability to conduct mineral analysis by classical and instrumental methods to students | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To understand basic principles of analysis methods  2. To classify analysis methods  3. To apply classical analysis methods to different samples.  4. To apply instrumental methods to different samples. | | | | | | | |
| **TEXTBOOK** | | | | | Analitik Kimyanın Temelleri I-II, KILIÇ-KÖSEOĞLU ( Skoog-West-Holler), Bilim Yayıncılık, Ankara | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Fundamentals of Analytical Chemistry, Holt-Sounders, Japan2. Enstrümantal Analiz İlkeleri, KILIÇ-KÖSEOĞLU-YILMAZ (Skoog- Holler-Nieman), Bilim Yayıncılık, Ankara | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction, Chemical Analysis |
| 2 | Preparation of Analyte for Analysis |
| 3 | Classical Analysis Methods |
| 4 | Gravimetric Analysis |
| 5 | Titrimetric Analysis |
| 6 | Midterm Examination 1 |
| 7 | Colorimetry |
| 8 | Thermogravimetric Analysis |
| 9 | Differential Thermal Analysis |
| 10 | Differential Scanning Calorimetry |
| 11 | Midterm Examination 2 |
| 12 | Calorimetry |
| 13 | Analysis of Silicate Minerals |
| 14 | Analysis of Coal |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | PROF. DR. SİBEL AKAR | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501505 | **TITLE** | Corrosion Chemistry |

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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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 60 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Principles of corrosion, chemical thermodynamics and electrochemical thermodynamic principles in corrosion studies, electrochemical kinetic principles in corrosion studies, types of corrosion, corrosion protection methods | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to give information about principles, measurement and preventions methods of corrosion | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Principles, measurement and prevention methods of metalic corrosion which is one of the main problems of industry will be learned | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To know application of chemical thermodynamic to corrosion  To understand application of electrochemical thermodynamic to corrosion  To know electrochemical kinetic  To apply electrochemical kinetic to corrosion | | | | | | | |
| **TEXTBOOK** | | | | | Denny A. Jones, Principles and Prevention of Corrosion, Second. Ed. Prentice –Hall USA 1996. | | | | | | | |
| **OTHER REFERENCES** | | | | | Winston Revie, Herber H. Uhling, Corrosion and Corrosion Control, 4th Edition, Wiley, 2008. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition of corrosion and electrochemical nature of aqueous corrosion |
| 2 | Electrode potentials and parameters effecting on electrode potentials |
| 3 | EMF series and uses inspection of corrosion of metals |
| 4 | Potential-pH (Pourbaix) diagrams |
| 5 | Inspection of corrosion by Pourbaix diagrams and their limitations |
| 6 | Midterm Examination 1 |
| 7 | Electrochemical polarization (activation polarization, concentration polarization and resistance polarization) |
| 8 | Studying corrosion process using electrochemical kinetic equations with graphical methods |
| 9 | Corrosion rate measurements (Lineer polarization, Tafel extrapolation) |
| 10 | Electrochemical impedance spectroscopy (EIS) and other new methods for corrosion rate measurements |
| 11 | Midterm Examination 2 |
| 12 | Forms of corrosion (Uniform corrosion, pitting corrosion , stress corrosion cracking, crevice corrosion) |
| 13 | Atmospheric corrosion and elevated temperature corrosion |
| 14 | Fundamental principles of corrosion protection methods |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Gözen Bereket | **Date:** | 7/05/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501506 | **TITLE** | Advanced Polymer Chemistry I |

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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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction, general definitions, classifications, stereochemistry of polymers, thermal properties and morphology, the polymerization types, polymerization systems and features; bulk, solution, solid state, interfacial polymerization, suspension polymerization ,emulsion polymerization, dispersion polymerization, structural polymer type and their synthesis (block copolymer, graft, homopolymer, gel), classification according to the solubility and examination of the solution behavior, Determination of the molecular weight of the polymer (NMR and GPC) | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to understand the details of the polymerization process. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | They will come to a position to be able to synthesize polymers. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. They may have a general knowledge about polymers,  2. They will have extensive knowledge about the structure and architecture of the polymer,  3.Be able to understand the types of polymerization,  4.They can determine the molecular weight of the polymer. | | | | | | | |
| **TEXTBOOK** | | | | | Saçak, M. 2004. Polimer Kimyası, Gazi Kitabevi, Ankara. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.Sperling, H. 2006. Introduction to Physical Polymer Science, Fourth edition, John Wiley&Sons Inc., USA2.Hiemenz, P.C. 2007. Polymer Chemistry, Second Edition, CRC Press, USA. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction, general definitions, classifications |
| 2 | Stereochemistry of polymers, thermal properties and morphology |
| 3 | The polymerization type and kinetics of the condensation polymerization |
| 4 | The kinetics of chain polymerization, examples of the polymer chain, chain transfer reactions |
| 5 | Polymerization systems and features; bulk, solution, solid state, interfacial polymerization |
| 6 | Midterm Examination 1 |
| 7 | Suspension polymerization and examples |
| 8 | Emulsion polymerization and examples |
| 9 | Dispersion polymerization and examples |
| 10 | Structural polymer type and their synthesis (block copolymer, graft, homopolymer, gel) |
| 11 | Midterm Examination 2 |
| 12 | Structural polymer type and their synthesis (block copolymer, graft, homopolymer, gel) |
| 13 | Classification according to the solubility and examination of the solution behavior |
| 14 | Determination of the molecular weight of the polymer (NMR and GPC) |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Vural Bütün | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501508 | **TITLE** | Modern Techniques in Analytical Chemistry I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | PHYSICAL PROPERTIES OF SUBSTANCE AND RAY-ABSORPTION LAWS - COLORIMETERS ANALYSIS - POLAROGRAPHIC ANALYSIS-  REFRACTIVE ANALYSIS- POTENTIOMETRIC MEASUREMENTS-  CONDUCTIMETRIC MEASUREMENTS-CHROMATOGRAPHY. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to teach mean principles of various modern instrumental methods | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will provide to understand the instrumental analysis methods commercially used in industry and research laboratories. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To understand mean principles of instrumental analysis methods,  2. To apply electrochemical analysis methods,  3. To apply refractometric analysis methods,  3. To learn use area of chromatographic methods. | | | | | | | |
| **TEXTBOOK** | | | | | Skoog, D.A., West, D.M., Holler , F.J. (1998) Enstrumental Analiz İlkeleri, Bilim Yayıncılık | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Gündüz, T. (1999) İnstrumental Analiz Ders Kitabı, Gazi Büro Kitabevi2. Yıldız, A., Genç, Ö, Bektaş, S. (1997) Enstrumantal Analiz Yöntemleri, Hacettepe Üniversitesi Yayınları. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Physical Properties of Substance and Ray |
| 2 | Absorption Laws |
| 3 | Colorimetric Analysis |
| 4 | Polaroggraphic Analysis |
| 5 | Refractive Analysis |
| 6 | Midterm Examination 1 |
| 7 | Potentiometric measurements |
| 8 | Analytical application of potentiometric measurements |
| 9 | Conductometric Measurements |
| 10 | Analytical application of conductometric measurements |
| 11 | Midterm Examination 2 |
| 12 | Chromatography |
| 13 | Column Chromatography |
| 14 | Analytical application of column chromatography |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof.Dr.Sibel AKAR | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **EPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501510 | **TITLE** | Data Analysing in Chemistry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | To be capable of explaining the experimental and presenting those results with suitable tables and graphic. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Numbers, Significant Numbers, Some Mathematics, Complex Equalities, Logarithm, Numerical to calculate, Experimental finding to presented, Graphic to draw, To acquire function from experimental values, Experiment faults, mistakes errors, Fault and varieties, Effect to result of experiment faults, Comment of result, To find table, Differential, Integral | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To be capable of analysing the experimental results. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To be capable of explaining the experimental and presenting those results with suitable tables and graphic. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. An awareness of the necessity of explaining the experimental and presenting those results from the chemistry viewpoint.  2. An awareness of the necessity of explaining the experimental and presenting those results with suitable tables and graphic  3. To explain and application of To be capable of analysing the experimental results.  4. To explain and application of explaining the experimental and presenting those results with suitable tables and graphic | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture Notes | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Numbers, Significant Numbers, Some Mathematics |
| 2 | Complex Equalities |
| 3 | Logarithm |
| 4 | Numerical to Calculate |
| 5 | Experimental Finding to Presented |
| 6 | Midterm Examination 1 |
| 7 | Graphic to Draw |
| 8 | To Acquire Function from Experimental Values |
| 9 | Experiment Faults Errors, Fault and Varieties |
| 10 | Effect to Result of Experiment Faults. |
| 11 | Midterm Examination 2 |
| 12 | Comment of Result |
| 13 | To find value from graphic, analytical relation, table |
| 14 | Comment of Function |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Yrd.Doç.Dr. Arzu PINARBAŞI | **Date:** | 4.5.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501511 | **TITLE** | Cathodic Protection and Inhibitors |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Corrosion, Mechanism and electrochemical nature of corrosion, Classification of corrosion, Methods of corrosion inhibition, Coatings and inhibitors, Types of inhibitors, Anodik inhibitors, Cathodic inhibitors, Inorganic inhibitors, Organic inhibitors, Vapor-phase inhibitors, Inhibition mechanism of inhibitors, Anodic protection, Cathodic protection | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the basic concept about corrosion and inhibition | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To provide the ability to design and conduct experiments as well as to analyse and interpret data that is related with corrosion | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of this module students will be able to:•Gain knowledge about corrosion,Identify methods of corrosion inhibition, Coatings and inhibitors, Define and classify the types of inhibitors, Gain knowledge about inhibition mechanism of inhibitors, Gain knowledge about cathodic protection and application, Apply the content of this course on current subject, Design and conduct experiments as well as to analyze and interpret data | | | | | | | |
| **TEXTBOOK** | | | | | Üneri, S. (1998). Korozyon ve Önlenmesi. Ankara: Poyraz Ofset | | | | | | | |
| **OTHER REFERENCES** | | | | | Yalçın, H. & Koç, T. (1998). Mühendisler İçin Korozyon. Ankara : Nitelik | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Corrosion and corrosion mechanism |
| 2 | Clessification of corrsion, uniform corrosion, local corrosion |
| 3 | Crevice and stress corrosions |
| 4 | Galvanic and intergranular corrosion |
| 5 | Corrosion protection, coatings and inhibitors |
| 6 | Midterm Examination 1 |
| 7 | Anodic inhibitors |
| 8 | Cathodic inhibitors |
| 9 | Inorganic inhibitors |
| 10 | Organic inhibitors |
| 11 | Midterm Examination 2 |
| 12 | Inhibition mechanism of inhibitors |
| 13 | Anodic protection |
| 14 | Cathodic protection |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Aysel Yurt | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501512 | **TITLE** | Named organic reaction mechanism I |

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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 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Aldol reax, Arndt-Eistert synth., Baeyer- Villiger oxidation, Beckmann rearrangment, Benzilic acid rearrangement, Hofmann rearrangement, Curtis rearrangement, Lossen rearrangement, Schimidt rearrangement, Claisen condensation, Diels-alder reaction, Cannizaro reaction, 1,3- Dipolar cycloaddition, Haloform reaction, Kolbe schimidt reaction | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the subjects given in the course content to students | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Teach the reaction mechanisms and gain synthesis skills | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learning to analyze the mechanism of the reaction ,to understand the importance of mechanisms, to improve the synthesis skills and examine the problems encountered in this process and gain the skills analysis | | | | | | | |
| **TEXTBOOK** | | | | | March’ s advanced organic chemistry, Michael B. Smith, Jerry March, 1992 | | | | | | | |
| **OTHER REFERENCES** | | | | | Organic chemistry T.W. Graham Solomons, 1996 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Aldol reaction |
| 2 | Arndt-Eistert synthesis |
| 3 | Baeyer- Villiger oxidation |
| 4 | Beckmann rearrangement |
| 5 | Benzilic acid rearrangement |
| 6 | Midterm Examination 1 |
| 7 | Hofmann rearrangement |
| 8 | Curtis rearrangement |
| 9 | Lossen rearrangement |
| 10 | Schimidt rearrangement |
| 11 | Midterm Examination 2 |
| 12 | Claisen condensation |
| 13 | Diels-alder reaction, Cannizaro reaction |
| 14 | 1,3- Dipolar cycloaddition, Haloform reaction, kolbe schimidt reaction |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assistant Professor Handan CAN SAKARYA | **Date:** | 28/04/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501512 | **TITLE** | Named organic reaction mechanism II |

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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 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | barton reax, bucheree reaction, favorskii rearrangement, meerwein-ponndorf-verley reduction, michael reaction, perkin reaction, pinacol rearrangement, reformatsky reaction, sandmeyer reaction, skraup quinolin synthesis, vilsmeier reaction, wagner-meerwein rearrangement, robinson anulasion, rosenmund reduction, stork enamine reaction | | | | | | | |
| **COURSE OBJECTIVES** | | | | | to teach students the topics covered in the course content | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | to gain the ability the assessing of the experiments data with the theory of reaction mechanisms | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Learning to analyze the mechanism of the reaction ,to understand the importance of mechanisms, to improve the synthesis skills and examine the problems encountered in this process and gain the skills analysis | | | | | | | |
| **TEXTBOOK** | | | | | March’ s advanced organic chemistry, Michael B. Smith, Jerry March, 1992 | | | | | | | |
| **OTHER REFERENCES** | | | | | Organic chemistry T.W. Graham Solomons, 1996 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Barton reaction |
| 2 | Bucherer reaction |
| 3 | Favorskii rearrangement |
| 4 | Meerwein-ponndorf-verley reduction |
| 5 | Michael reaction |
| 6 | Midterm Examination 1 |
| 7 | Perkin reaction |
| 8 | Pinacol rearrangement |
| 9 | Reformatsky reaction |
| 10 | Sandmeyer reaction |
| 11 | Midterm Examination 2 |
| 12 | Skraup quinolin synthesis, vilsmeier reaction |
| 13 | Wagner-meerwein rearrangement, robinson anulasion |
| 14 | Rosenmund reduction, stork enamine reaction |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assistant Professor Handan CAN SAKARYA | **Date:** | 28/04/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501515 | **TITLE** | The Chemistry of Heterocyclic Aromatic Compound |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The structure, nomenclature, physical properties, general synthesis method, reactions of heterocyclic compounds | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To be learning of information about cyclic compounds containing one or more heteroatoms. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learning heterocyclic compounds, they can be used in the fields of chemistry. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To obtain information about heterocyclic compounds.  2. Realize of the importance of heterocyclic compounds from the chemistry and industrial viewpoint.  3. Learn the synthesis of heterocyclic compounds.  4. To synthesize novel heterocyclic compounds may propose method. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Gupta R.R., Kumar M., Gupta V., Heterocyclic chemistry, Springer ,19982. Joule J.A., Mills K., Heterocyclic chemistry, Wiley, 2010 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.Quin L.D, Tyrell J.A., Fundamentals of heterocyclic chemistry : importance in nature and in the synthesis of pharmaceuticals ., Wiley 2010 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition of Heterocyclic Compounds |
| 2 | Structure, nomenclature of the five-membered heterocyclic compounds |
| 3 | Structure, nomenclature of the six-membered heterocyclic compounds |
| 4 | Structure, nomenclature of the adjacent ring heterocyclic compounds |
| 5 | General properties of heterocyclic compounds |
| 6 | Midterm Examination 1 |
| 7 | General synthesis of heterocyclic compounds |
| 8 | General synthesis of heterocyclic compounds |
| 9 | General synthetic methods and application of heterocyclic compounds |
| 10 | Reactions of heterocyclic compounds |
| 11 | Midterm Examination 2 |
| 12 | Reactions of heterocyclic compounds |
| 13 | Reactions of heterocyclic compounds |
| 14 | Reactions and applications of heterocyclic compounds |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc.Dr. Funda Tay | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501517 | **TITLE** | Selected Topics in Analytical Chemistry I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Mathematical Methods Used in Equilibrium Calculations; Mass Balances; Charge Balances- Proton Condition; Strong Acids and Bases Weak Acids and Bases; Buffer Solutions and Their Logarithmic Concentration Diagrams; Hydrolysis of Salt of Weak Acids and Bases; Polyprotic Acids and Bases: Logarithmic Concentration Diagrams of Solutions of Polyprotic Salts; Mixture of Two Weak Monoprotic Acids and Multiple Buffer Systems; Solubility of Salts of Polyprotic Acids; Precipitation and Solubility: Separation of Compounds by Precipitation; Precipitation Titrations; Solubility of Salts of Weak Monoprotic Acids | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To give students the ability of analytical methods and calculations. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. Gain the supplement knowledge to basic chemistry  2. Synthesis the knowledge on science with the content of this course  3. Analyze and estimate the data in the related scientific problem  4. Learn and distinguish the content and type of knowledge on science  5. Gain ability on research and learn scientific method  6. Gain the ability to attain balance between oral, written and applied scientific activities  7. Get professional qualification on this course and gain ability to follow the knowledge in contemporary issues  8. Apply the content of this course on current subject  9. Design and conduct experiments as well as to analyze and interpret data  10. Use techniques, skills, and modern tools necessary for practice in chemistry  11. Get information about definition, formulation and solution of problems  12. Gain ability on teamwork | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Provides knowledge of chemistry.  2.Will be able to analyze the data.  3.Design and implement experiments.  4.Recognize and solve problems related to the field. | | | | | | | |
| **TEXTBOOK** | | | | | Ç. Ed. SOMER, G. Analitik Kimya, , Gazi Büro Kitabevi, Ankara | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.GÜNDÜZ, T. (1997) Kantitatif Analiz Ders Kitabı, , Bilge Yayıncılık, Ankara2.Harris, D.C. (1994) Analitik Kimya, Çev.Editörü:Güler Somer,Gazi Büro Kitapevi3.Gündüz, T. (1989) Kalitatif Analiz Ders Kitabı, Bilge Yayımcılık4. Skoog, D.A., West, D.M., Holler , F.J. (1996) Fundamentals of Analytical Chemistry | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Mathematical Methods Used in Equilibrium Calculations; mass; Load Balances; Proton Condition |
| 2 | Strong Acids and Bases; Weak Acids and Bases |
| 3 | Buffer Solutions and Their Logarithmic Concentration Diagrams |
| 4 | Hydrolysis of Salts of Weak Acids and Bases |
| 5 | Polyprotic Acids and Bases |
| 6 | Midterm Examination 1 |
| 7 | Polyprotic Salt of the solution; Logarithmic Concentration Diagrams of Two Weak Acid Mixture Monoprotic and Multiple Buffer Systems |
| 8 | Resolution of Polyprotic Acid Salt |
| 9 | Crash and Resolution |
| 10 | Precipitation and Separation |
| 11 | Midterm Examination 2 |
| 12 | Precipitation titrations |
| 13 | Solubility of Salts of Weak Acid Monoprotic |
| 14 | Application |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc.Prof.Dr.Ebru Birlik Özkütük | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501518 | **TITLE** | Molecular Symmetry and Group Theory |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) |  |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Symmetry operations and point groups, representations of groups, character tables and irreducible representations, relationship of group theory to quantum mechanics. Their applications on molecular orbital theory, crystal field theory, hybrid orbitals, molecular vibrations | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to provide a systematic treatment of symmetry in chemical systems within the  mathematical framework known as group theory | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. Assign the symmetry elements of molecules  2. Assign the point group symmetry to compounds using the Flow Diagram  3. Some applications of group theory that will be covered:  i) Predicting whether a given molecule will be chiral, or polar.  ii) Examining chemical bonding and visualising molecular orbitals.  iii) Investigating the vibrational motions of the molecule | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Please write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | Cemal Kaya, Duran Karakaş, Moleküler Simetri, Palme yayıncılık, 2010. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. F. A. Cotton, ‘Chemical Applications of Group Theory’, Third Edition, 1990, A Wiley-Interscience Application.2. A. Vincent, “Molecular Symmetry and Group Theory” Second Edition, 2001, John Wiley & Sons.3. R.L. Carter, “Molecular Symmetry and Group Theory” First Edition, 1998, John Wiley & Sons.4. A. M. Lesk, “Introduction to Symmetry and Group Theory for Chemists” Second Edition, 2001, John Wiley & Sons. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The concept of symmetry and symmetry elements |
| 2 | Symmetry operations |
| 3 | Point groups |
| 4 | Matrix representation of symmetry operations |
| 5 | Creation of character tables |
| 6 | Midterm Examination 1 |
| 7 | Reduction of reducible representation |
| 8 | Polarity and Chirality according to symmetry |
| 9 | Determination of hybrization type |
| 10 | Drawing the molecular energy diagrams (AB type molecules) |
| 11 | Midterm Examination 2 |
| 12 | Drawing the molecular energy diagrams (AB2 and AB3 type molecules) |
| 13 | Drawing the molecular energy diagrams (Coordination compounds) |
| 14 | Determination of molecular vibrations (IR) |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Okan Zafer YEŞİLEL | **Date:** | 04.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501520 | **TITLE** | Structure and Functions of Proteins |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 3 | | 0 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | No | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Amino acids and their structural properties, Peptide structure, Three dimensional structure of proteins, Proteins folding, Denaturation of proteins, Protein-Ligand interactions, Oxygen binding proteins, Hemoglobine-oxygen interaction, Immune system and immunoglobulins, Actin, myosin and molecular motors. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to give the information to students about the information of protein structures and their importance. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | By the end of this course, students will be able to obtaine detailed information about protein structures and their importance | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Comprehension of the protein structures Protein yapıları tanıma tanıma  2. Evaluation of the protein ligand interactions  3. Protein ligant etkileşimlerini değerlendirme  3. Evaluation of the protein functions  4. Comprehension of the functions of proteins in living system | | | | | | | |
| **TEXTBOOK** | | | | | 1. D.L.Nelson, M.M. Cox, Lehninger Biyokimyanın ilkeleri, Palme yayıncılık, Ankara, 2005 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. P. C. Champe, R. A. Harvey, Lippincott’s Illustrated reviews serisinden: Biyokimya, Nobel, İstanbul,19972. E.E. Keha, Ö.İ. Küfrevioğlu, Biyokimya, Şafak yayınevi, Erzurum 1997 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Amino acids and their structural properties. |
| 2 | Peptide structure. |
| 3 | Three dimensional structure of proteins. |
| 4 | Proteins folding. |
| 5 | Denaturation of proteins. |
| 6 | Midterm Examination 1 |
| 7 | Protein-Ligand interactions. |
| 8 | Oxygen binding proteins. |
| 9 | Hemoglobine-oxygen interaction. |
| 10 | Immune system and immunoglobulins. |
| 11 | Midterm Examination 2 |
| 12 | Immune system and immunoglobulins. |
| 13 | Actin, myosin and molecular motors. |
| 14 | Actin, myosin and molecular motors. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Tamer AKAR | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501522 | **TITLE** | Advanced Coordination Chemistry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **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** | | | | | Definition of advanced concepts in coordination chemsitry, the history of coordination chemistry, nomenclature of coordination chmesitry, isomerism, Bond theory in coordination chemistry; 18-electron theory, valance bond theory, crystal field theory, molecular orbital theory, the application of coodination chemistry | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Describe the coordination chemistry of transition elements in general  Explain the bod formation of coordination compounds  Aiming to explain the structure, bonds, magnetic and spectroscopic properties of transition mteal compounds | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Gain skill to recognize the coordination compounds and explain the structure using various technique. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Know the advanced concepts related to the coordination chemsitry of transition elements  Make an interpretation related to the structures of metal complexes using advanced coordination chemistry information  Dtermine the the structures and compositions of various complexes  Be able to use the coordination chemsitry information in various field such as environment, health, analyical chemsitry and biochemsitry.  Produce a solution combinig knowledge and creativity in coordination chemistry and related fields.  Contribute to the interdisciplinary studies using coordination chemistry information. | | | | | | | |
| **TEXTBOOK** | | | | | T. GÜNDÜZ T., Koordinasyon Kimyası, Gazi Yayın evi, 1998. | | | | | | | |
| **OTHER REFERENCES** | | | | | D. F Shriver and P. W. Atkins, Anorganik Kimya. Çeviri: S. Özkar, A. Gül, B. Çetinkaya ve Y. Gök. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The basic concepts in coordination chemistry |
| 2 | Historical foundations of coordination chemistry, the theory of Werner |
| 3 | Nomenclature of coordination compounds |
| 4 | Bond theories, 18-electron theory in coordination chemistry |
| 5 | Valance bond theory |
| 6 | Midterm Examination 1 |
| 7 | Crsytal field theory |
| 8 | The calculation of CFSE (KAKEand KAYE ) |
| 9 | The factors affecting CFSE |
| 10 | Jahn-Teller Theory |
| 11 | Midterm Examination 2 |
| 12 | Molecular orbital theory |
| 13 | Sigma donor and pi donor and acceptor ligands |
| 14 | The application areas of coordination compounds |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Okan Zafer YEŞİLEL | **Date:** | 04.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501523 | **TITLE** | STATISTICS FOR ANALYTICAL CHEMISTS-I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Importance of statistics, Selection of analytical method, Errors in chemical analysis, Precision and accuracy, Bias, Standart deviation, Variance, Confidence limit, Significance tests. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Aim of this course is to gain ability to statistically evaluate data to student. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will be gained ability to statistically evaluate the analysis results obtained form industry and research. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To understand some statistical terms commonly used for analytical chemists.  2. To make basic statistical calculations.  3. Application and interpretation of significance tests.  4. Use ability of statistical tables. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Kimyacılar İçin İstatistik, Turgut Gündüz, Gazi Kitabevi, 1998. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Kantitatif Analiz Ders Kitabı, Turgut Gündüz, Gazi Kitabevi, 7. Baskı, 2003.2. Analitik Kimya Temelleri, Douglas A. Skoog, Donald M. West, F. James Holler (Çeviri Editörleri: Esma Kılıç, Fitnat Köseoğlu), Bilim Yayıncılık, 1. Cilt.3. Analitik Kimyacılar İçin İstatistik ve Kemometri, J.C. Miller, J.N. Miller (Çev: Ahmet Uyanık), İlke Yayınevi, 5. Baskı, 2008. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Description and importance of statistics. |
| 2 | Selection of analytical method. |
| 3 | Errors in chemical analysis. |
| 4 | Precision parameters. |
| 5 | Accuracy parameters. |
| 6 | Midterm Examination 1 |
| 7 | Confidence limits. |
| 8 | Student-T test and its applications. |
| 9 | Student-T test and its applications. |
| 10 | F-test. |
| 11 | Midterm Examination 2 |
| 12 | Cochran test. |
| 13 | Q-test, Tn-test. |
| 14 | Interval test and its calculation. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | PROF. DR. SİBEL AKAR | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501524 | **TITLE** | Basic Reactions in Organic Synthesis I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 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** | | | | | Basic concepts in organic mechanism reactions. Nucleophilic substitution, elimination and addition reactions and mechanisms. Teaching a novel method of synthesis, which is synthesis design approach, and the basic reactions related to synthesize organic molecules. Mechanism of this type reactions is important for able to understand of organic chemistry. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to teach to the students basic reactions in organic synthesis and help us to develop new reactions and reagents. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students will be able to apply a novel synthetic method of synthesis design  method to the related basic reactions to an industrial or scientific synthetic process. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Gain knowledge about basic reactions of organic synthesizes and comprehends synthesis of different organic compounds. Students examines reactions as mechanistic. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Balcı, M. Reaksiyon Mekanizmları, (2008), TüBA, Ankara.2. Grossman, R.B, The Art of Writing Reasonable Organic Reaction Mechanism, Springer-Verlag, 2002 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.A Guided Inquiry Based Organic Chemistry (2. Ed) Houghton Mifflin Harcourt Publishing Company, Boston, New York, 20092. A Guide book to Mechanism in Organic Chemistry (8. Ed) P. Sykes. Longman Scientific &Technical, New York, 1986. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Reactive intermediates of products |
| 2 | Basic concepts of reaction mechanisms |
| 3 | Nucleophilic substitution reaction mechanisms |
| 4 | Nucleophilic substitution reaction SN1 |
| 5 | Nucleophilic substitution reaction mechanisms SN2 |
| 6 | Midterm Examination 1 |
| 7 | elimination reactions and mechanisms |
| 8 | elimination reactions E1 |
| 9 | elimination reactions E2 |
| 10 | addition reactions and mechanisms |
| 11 | Midterm Examination 2 |
| 12 | Electrophilic addition reactions |
| 13 | Diens addition reactions |
| 14 | Synthesis of different organic compounds |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Y.Doç.Dr. Müjgan Yaman Özkütük | **Date:** | 28/04/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501525 | **TITLE** | Pericyclic Reactions |

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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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | No | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The nomenclature, properties and classification of pericyclic reactions. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To be learning of information about pericyclic compounds. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The student will gain recognation and classification of pericyclic reactions. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Performing the reactions of Pericyclic compounds.  2. Analysis pericyclic compounds  3. To understand the rules of Pericyclic compounds.  4. Knows pericyclic reactions | | | | | | | |
| **TEXTBOOK** | | | | | Pericyclic Reactions, Ian Fleming, Oxford University Press, USA, 1998 | | | | | | | |
| **OTHER REFERENCES** | | | | | Organik Kimya Reaksiyon Mekanizmaları, Metin Balcı, 2008Organik Kimya, R.J. Fessenden, J.S. Fessenden, 2001 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to pericyclic reactions |
| 2 | The nomenclature of pericyclic reactions |
| 3 | The structure and properties of pericyclic reactions |
| 4 | Woodward Hoffmann Rules |
| 5 | Frontier orbitals (HOMO-LUMO |
| 6 | Midterm Examination 1 |
| 7 | The closure of frontier orbitals ( Conrotatory-Disrotatory) |
| 8 | Classification of pericyclic reactions, thermal electrocyclic reactions |
| 9 | Photochemical elecrocyclic reactions |
| 10 | Correlation Diagrams, Symmetry operator |
| 11 | Midterm Examination 2 |
| 12 | Cycloaddition reactions, suprafacial and antrafacial interaction. (2+2)cyclic addition |
| 13 | (4+2) cyclic addition , Diels Alder reactions |
| 14 | Sigmatropic addition |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Murat Duran | **Date:** | 07.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501526 | **TITLE** | Molecullar Spectrophotometry and Analytical Aplications |

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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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Principles of spectrophotometry, separation and preconcentration methods, spectrophotometric methods, spectrophotometric reagents. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to learn to students of spectrophotometric determination methods, with a good precision and sensitivity, almost all elements present in small and trace quantities in any materials. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | UThe students should be able to carry out to determine various organic and inorganic substances with the spectrophotometric methods widely used in industry and research laboratories. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. The student will learn theory of molecular spectrophotometry, purpose of use and practical solutions.  2. The student will gain ability of preparation of the samples.  3. The student apply the theoritical knowledge.  4. The student evaluate the analysis results. | | | | | | | |
| **TEXTBOOK** | | | | | Marczenko Z., Balcerzak M. (2000) Separation, Preconcentration and Spectrophotometry in Inorganic Analysis, Elsevier, Tokyo. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Skoog, D.A., West, D.M., Holler , F.J. (1996) Fundamentals of Analytical Chemistry2. Harris, D.C. (1994) Analitik Kimya, Çev.Editörü:Güler Somer,Gazi Büro Kitapevi | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Separation and preconcentration of elements |
| 2 | Separation and preconcentration of elements |
| 3 | Principles of spectrophotometry |
| 4 | Principles of spectrophotometry |
| 5 | Principles of spectrophotometry |
| 6 | Midterm Examination 1 |
| 7 | Spectrophotometric methods |
| 8 | Spectrophotometric methods |
| 9 | Spectrophotometric methods |
| 10 | Spectrophotometric reagents |
| 11 | Midterm Examination 2 |
| 12 | Spectrophotometric reagents |
| 13 | Spectrophotometric reagents |
| 14 | Spectrophotometric reagents |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Tufan GÜRAY | **Date:** | 27/04/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501526 | **TITLE** | THEORETICAL ORGANIC CHEMISTRY I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Drawing molecules,preparing Z-matrix,Molecualr mechnanic methods(MM2,MM3),semiemprical methods (AM1,MNDO,PM3,PM5,PM6 HartreeFock and DFT methods,MP2 methods,explanation of basis sets, using of RAM and CPU , Introduction to calculation | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is learning the theoretical calculation methods which are useful for investigation of the properties of organic molecules and reactions | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The student will gain the interpretation skill on industrial field | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.The students will learn the drawing of the organic molecules for preparing calculation data  2. The students will learn calculation methods,  3.The students will analysis of the calculation methods,  4.The students will apply the calculation methods, | | | | | | | |
| **TEXTBOOK** | | | | | 1.. Exploring Chemistry and electronic structure methods 2nd. Edition (James B.Foresman,Elen Frisch)2. Frontier Orbitals and Organic Chemical Reactions (Ian Fleming,1985) | | | | | | | |
| **OTHER REFERENCES** | | | | | Gaussian03W,ChemOffice,Gaussview programları | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Drawing molecules with Chemdraw |
| 2 | Drawing molecules with Chemdraw |
| 3 | Preparing Z-Matrix |
| 4 | Molecular Mechanic Methods- |
| 5 | Examples |
| 6 | Midterm Examination 1 |
| 7 | Semi-emprical methods |
| 8 | Semi-empric methods |
| 9 | Examples |
| 10 | Examples |
| 11 | Midterm Examination 2 |
| 12 | HF method |
| 13 | DFT methods |
| 14 | DFT methods |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc.Prof.Dr.Taner ARSLAN | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501527 | **TITLE** | Selected Topics in Physical Chemistry |

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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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction and the usage of the physical chemistry literature, investigation and criticizing some of typical papers from physical chemistry journals, this course is designed to give students a sound background in theoretical and experimental phsical chemistry and to develop their ability to identify and solve problems in physical chemical research. Literatüre and goals of physıcal chemistry. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The subjects related to the students interest will be studied | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Investigate some of typical papers from physical chemistry literature.  Gain the supplement knowledge to basic advanced physical chemistry. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | Journals related with physical chemistry. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Advanced thermodynamic and thermochemistry |
| 2 | Statistically thermodynamic |
| 3 | Equilibrium chemistry |
| 4 | Comparison of thermodynamic properties of mixtures and electrolyte solutions |
| 5 | Events on solid surfaces |
| 6 | Midterm Examination 1 |
| 7 | Dynamic electrochemistry |
| 8 | Macromolecules and colloids |
| 9 | Examination of papers about physical chemistry |
| 10 | Examination of papers about physical chemistry |
| 11 | Midterm Examination 2 |
| 12 | Examination of papers about physical chemistry |
| 13 | Examination of papers about physical chemistry |
| 14 | Examination of papers about physical chemistry |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Evrim HÜR | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501528 | **TITLE** | SYNTHESIS TECNIQUES AND ORGANIC ANALYSIS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction , General methods for purification of organic compounds , Organic analysis, Reaction of functional groups of organic compounds, Drying and cleaning of organic solvents, Organic preparates. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main purpose of this course, understanding of the basic principle of organic synthesis and understanding of the mechanisms of these reactions. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The student will gain the interpretation skill on industrial field. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Knowledge on the synthesis techniques and organic analysis. | | | | | | | |
| **TEXTBOOK** | | | | | 1) Furniss, B.S., Practical Organic Chemistry (Fifth Edition), New York, 1991.2) Advanced Organic Chemistry, Fourth Edition - Part A: Reaction and Synthesis by Francis A. Carey and Richard J. Sundberg , 2001 Springer; 4th edition. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1) Strategic Applications of Named Reactions in Organic Synthesis by Laszlo Kurti and Barbara Czako , Academic Press; 1 edition 20052) The Vocabulary and Concepts of Organic Chemistry by Milton Orchin, Roger S. Macomber, Allan R. Pinhas, and R. Marshall Wilson ,Wiley-Interscience; 2 edition 20053) Sharp J.T., Practical Organic Chemisrty; Chapman & Hall, London, 1991.4) Organic Chemistry, S.Ege, P.C. Heath and Company, 1999. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | General methods for purification of organic compounds , |
| 3 | Organic analysis, |
| 4 | Reaction of functional groups of organic compounds, |
| 5 | Drying and cleaning of organic solvents, |
| 6 | Midterm Examination 1 |
| 7 | Organic preparates (Reaction of aldehydes and ketones with alcohols) |
| 8 | Reaction of carboxylic acids and anhydrides with alcohols in acids media) |
| 9 | Organic preparates (Reaction of anhydrides and chlorides of carboxylic acids with carboxylic acids) |
| 10 | Organic preparates ( Reaction of carbon nucleophiles with carboxylic acid ester) |
| 11 | Midterm Examination 2 |
| 12 | Organic preparates ( Reaction of aldehydes and ketones with ketones as CH- acid), |
| 13 | Organic preparates ( Reaction of carbon nucleophiles with carbon dioxide) |
| 14 | Organic preparates (Preparation of acid chlorides) |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assist. Prof. Dr. Murat GÜNDÜZ | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501529 | **TITLE** | Sample Preparetion Techniques in Analytical Chemist |

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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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Sampling and drying of sample or the determination of moisture content. Fragmentation and solvation of analytical sample. Errors during fragmentation and solvation of especially refracter substance or in the case of trace amounts of analyte. General methods for the fragmentation of solid and liquid samples for obtaining aqueous solution of analyte . | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to learn to students the importance of correct sampling from a sample and factors to need attention for sampling. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Use techniques, skills, and modern tools necessary for practice in chemistry | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. The student will learn the sample preparation.  2. The student will learn the details of the sample collection.  3. The student apply the theoritical knowledge.  4. The student evaluate the analysis results. | | | | | | | |
| **TEXTBOOK** | | | | | Mitra S. (2003) Sample Preparation Techniques in Analytical Chemistry, John Willey & Sons, Inc., New Jersey, USA. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Fritz J.S.(1999) Analytical Solid-Phase Extraction, John Willey & Sons, Inc., Canada.2. Skoog, D.A., West, D.M., Holler , F.J. (1996) Fundamentals of Analytical Chemistry | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Sampling |
| 2 | Humidity in samples |
| 3 | Preparation of the analysis of samples |
| 4 | Wet digestion methods |
| 5 | Microwave digestion technique |
| 6 | Midterm Examination 1 |
| 7 | Dry ashing technique |
| 8 | Extraction and enrichment in sample preparation |
| 9 | Principle of extraction |
| 10 | Liquid-liquid extraction |
| 11 | Midterm Examination 2 |
| 12 | Solid phase extraction |
| 13 | Solid phase micro extraction |
| 14 | Headspace extraction |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Tufan GÜRAY | **Date:** | 27/04/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501530 | **TITLE** | Electrochemical Surface Coatings |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | - | - | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) |  |
| **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 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Electrochemistry, electrolytic-coating, forming, polishing and Metal Processing, Alkali and Alkaline Earth Metals Extraction and Purification, electrolytic metal Synthesis, metal Coating by Electrolytic Technique, Electrolytic Oxidation and Reduction, Coating onNon-Conductive Materials , electrolytically Coating with organic substances (with polymers) | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to teach purification of metals and metal coating on conductive and/or nonconductive surfaces and basic information on this subject. By this way, students gain a professional qualification and current researches related to monitoring and interpretation of the scientific method and research skills. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Coatings are very common in industrial applications. basic information on this subject provide the ability to design and conduct experiments as well as to analyse and interpret data that is obtained by electrochemical methods | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | At the end of course, the student will be able to;  1) define the properties of metals and metal coatings.  2) explain the electrolytic metal isolation  3) design and conduct experiments as well as to analyse and interpret data obtained by electroytic metal coating  4) design and conduct experiments as well as to analyse and interpret data obtained by coating with organic compounds | | | | | | | |
| **TEXTBOOK** | | | | | 1) Metal kaplama ve elektrokimyasal teknolojiler, A.S. Saraç, Çağlayan Kitabevi , 1995, 2) Surface coatings, M. Rizzo and G. Bruno, editors., Hauppauge, N.Y. : Nova Science Publishers , 2009 | | | | | | | |
| **OTHER REFERENCES** | | | | | Electrochemistry,C.M.A.Brett& A.M.O Brett, Oxford Science Publications, 1993 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic electrochemistry |
| 2 | Electrode reactions |
| 3 | Electrolytic-plating, forming, polishing and Metal Processing |
| 4 | Alkali and alkaline earth metals Extraction and Purification |
| 5 | Electrolytic Synthesis of Metals |
| 6 | Midterm Examination 1 |
| 7 | Electrolytic Plating Technique with metals as |
| 8 | Plating baths |
| 9 | Coating with metals applications |
| 10 | Electrolytic Oxidation and Reducible the |
| 11 | Midterm Examination 2 |
| 12 | Non-Conductive Coating on Substances |
| 13 | Electrolytically with organic substances (with polymers) Coating |
| 14 | Organic coating applications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Aysel Yurt | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502501 | **TITLE** | THEORETICAL ORGANIC CHEMISTRY II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Reading the calculation results on a choosen moleculeThe investigation of the HOMO,LUMO orbital energies,total energy values,charges and geometrical parameters,IR results,negative frequency ,optimization and single point calculation,hard and sof acid bas theory and application of calculation and NMR results | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is learning the evaluation of calculation result | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The student will gain the interpretation skill on industrial field | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.The students will evaulate the calculation results.  2. The students will verify the calculation results,  3.The students will compare the calculated and spectroscopic datas,  4.The students will find the best fitted calculation methods, | | | | | | | |
| **TEXTBOOK** | | | | | 1.. Exploring Chemistry and electronic structure methods 2nd. Edition (James B.Foresman,Elen Frisch)2. Frontier Orbitals and Organic Chemical Reactions (Ian Fleming,1985) | | | | | | | |
| **OTHER REFERENCES** | | | | | Gaussian03W,ChemOffice,Gaussview programları | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Reading the calculation results |
| 2 | The investigation of the HOMO,LUMO orbital energies |
| 3 | The investigation the energie values |
| 4 | The investigation the energie values |
| 5 | Examples |
| 6 | Midterm Examination 1 |
| 7 | Optimization |
| 8 | Single Point Calculation |
| 9 | IR calculation |
| 10 | Examples |
| 11 | Midterm Examination 2 |
| 12 | NMR calcualtion |
| 13 | Examples |
| 14 | Examples |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc.Prof.Dr.Taner ARSLAN | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502503 | **TITLE** | AN INTRODUCTION TO MEDICINAL CHEMISTRY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Basic chemistry lectures must be succeeded. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Classification of drugs, Drugs and the medicinal chemist, Protein structure, Drug action at enzymes, Drug action at receptors, Drugs acting on nucleic acids, Drug development, Pharmacodynamics, Quantitative structure-activity relationship (QSAR), Antibacterial agents, The peripheral nervous system, The opium analgesics and Cimetidine-a rational approach to drug design. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Course objectives are; Increasing the basic knowledge of students planning to work in drug industry by providing information to them about cell, protein and nucleic acid structures and how a lead compound can be found and then turned into an effective drug in drug industry. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Making students to be able to understand the basis of drug, their action on cells and how drug molecules developed. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Having information about drug structure and their action  2. Having information about how an effective drug candidate can be found and turned into an affective drug.  3. Gaining ability for using information for interdisciplinary studies.  4. Gaining ability for interdisciplinary study.  5. Gaining ability to analyze problems in relation to basic sciences by using modern techniques and experimental methods. | | | | | | | |
| **TEXTBOOK** | | | | | Patrick G.L., (1995). An Introduction to Medicinal Chemistry. Oxford University Press, New York. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Mann J., (1992). Murder, Magic and Medicine. Oxford University Press, New York.2. Samnes, P.G., (1990). Comprehensive Medicinal Chemistry Pergamon Press, USA.3. Silverman, R., (1992). The Organic Chemistry of Drug Design and Drug Action. Academic Press, USA. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Classification of drugs |
| 2 | Drugs and the medicinal chemist |
| 3 | Protein structure |
| 4 | Drug action at enzymes |
| 5 | Drug action at receptors |
| 6 | Midterm Examination 1 |
| 7 | Drugs acting on nucleic acids |
| 8 | Drug development |
| 9 | Pharmacodynamics |
| 10 | Quantitative structure-activity relationship (QSAR) |
| 11 | Midterm Examination 2 |
| 12 | Antibacterial agents |
| 13 | The peripheral nervous system |
| 14 | The opium analgesics and Cimetidine-a rational approach to drug design |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Proff. Dr. İsmail KIRAN | **Date:** | 08.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502505 | **TITLE** | Advanced Polymer Chemistry II |

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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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction, general definitions, overview of condensation and addition polymerizations, living polymerization chemistry, living anionic and cationic polymerization, living radical polymerization methods, GTP, RAFT, ATRP, ROMP, NMRP, RAFT. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to plan molecular weight and structure of polymer before polymer synthesis, and to teach narrow molecular weight distribution polymerization techniques and characterized. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To contribute individuals who have knowledge about living polymerization techniques | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Plan molecular weight and structure of polymer and make necessary calculations,  2. Perform narrow molecular weight distributed and controlled polymer synthesis,  3. Determine living polymerization tecnique appropriated to monomer,  4. Get an opportunity to apply living polymerization tecniques.  5. They can characterized the synthesized polymer | | | | | | | |
| **TEXTBOOK** | | | | | Handbook of Radical Polymerization, Ed. K. Matyjaszewski and T. Davis, Wiley Interscience, Canada, 2002. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Handbook of Polymer Synthesis, H.R. Kricheldorf, O. Nuyken, G. Swift, 2nd Ed. Marcel Denkel, New York. 2005 2. Developments in Block Copolymer Science and Technology. Edited by IW Hamley, Wiley Press, UK, 2004. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Controlled and living polymerization |
| 2 | Living anionic and cationic polymerization |
| 3 | Living radical polymerization methods |
| 4 | Group transfer polymerization (GTP) |
| 5 | Atom transfer radical polymerization (ATRP) and examples |
| 6 | Midterm Examination 1 |
| 7 | Reversible Addition-Fragmentation chain Transfer (RAFT) and examples |
| 8 | Nitroxide mediated radical polymerization (NMRP) and examples |
| 9 | Ring opening polymerization (ROMP) and coordination polymerization |
| 10 | Polymer characterization methods (GPC, NMR, UV-Vis, FT-IR) |
| 11 | Midterm Examination 2 |
| 12 | Polymer characterization methods(DSC, TG, DTA) |
| 13 | Polymer characterization methods (TEM ve SEM) |
| 14 | Solution behaviors of polymers (DLS, SLS, UV, ZETA) |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Vural Bütün | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502510 | **TITLE** | Modern Techniques in Analytical Chemistry II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | PREPARING SAMPLES-ULTRAVİOLET SPECTROSCOPY-INFRARED SPECTROSCOPY- ATOMIC ABSORPTION SPECTROSCOPY-HIGH PERFORMANCE LIQUID CHROMATOGRAPHY-WATER ANALYSIS | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to gain information and ability to analyze various samples using modern analysis techniques to students | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will provide to students to understand and apply various instrumental analysis methods | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To understand mean principles of instrumental analysis methods,  2. To apply ultraviolet and infrared spectroscopic methods,  3. To apply atomic absorption spectroscopic method,  4. To learn methods used for water analysis. | | | | | | | |
| **TEXTBOOK** | | | | | Skoog, D.A., West, D.M., Holler , F.J. (1998) Enstrumental Analiz İlkeleri, Bilim Yayıncılık | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Gündüz, T. (1999) İnstrumental Analiz Ders Kitabı, Gazi Büro Kitabevi2. Yıldız, A., Genç, Ö, Bektaş, S. (1997) Enstrumantal Analiz Yöntemleri, Hacettepe Üniversitesi Yayınları. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Sample preparation |
| 2 | Ultraviolet (UV) Spectroscopy |
| 3 | Ultraviolet (UV) Spectroscopy |
| 4 | Application of Ultraviolet Spectroscopy in Analytical Chemistry |
| 5 | Infrared Spectroscopy |
| 6 | Midterm Examination 1 |
| 7 | Infrared Spectroscopy |
| 8 | Application of Infrared Spectroscopy in Analytical Chemistry |
| 9 | Atomic Absorption Spectroscopy |
| 10 | Atomic Absorption spectroscopy |
| 11 | Midterm Examination 2 |
| 12 | Application of Atomic Absorption in Analytical Chemistry |
| 13 | High-Performance Liquid Chromatography |
| 14 | High-Performance Liquid Chromatography |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof.Dr.Sibel AKAR | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502511 | **TITLE** | Surface Chemistry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) |  |
| **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 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Surface tension, Factors that affect the surface tension, Surface energy, Surface pressure, Diffusion coefficient, Classification of surface films, Electrical double layer, Properties of solid surfaces, Surface activity, Surface active compounds and their properties, Adsorption and adsorption isotherms, Adsorption of gases on solids, Adsorption solids from solution | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the surface properties and mechanism of adsorption | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To provide the ability to design and conduct experiments as well as to analyse and interpret data that is related with surface chemistry | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of this module students will be able to:•Gain knowledge about surface tension, surface pressure and surface films, Identify the properties liquid-liquid interface, Gain knowledge about surface activity,Gain knowledge about properties of solid surface, Identify the properties of solid-liquid and solid-gas interface, Design and conduct experiments as well as to analyze and interpret data | | | | | | | |
| **TEXTBOOK** | | | | | 1. Üneri, S. (1993). Asıltılar Kimyası. Ankara: Ankara Üniversitesi Yayınları .2. Atıcı, O. (1991). Yüzey Aktif Maddeler. İstanbul : İTÜ Matbaası | | | | | | | |
| **OTHER REFERENCES** | | | | | Sarıkaya,Y. (2002). Fizikokimya. Ankara: Gazi Kitabevi. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Surface tension, Surface energy |
| 2 | Methods of surface tension measurement |
| 3 | Factors that affect the surface tension |
| 4 | Surface pressure, Diffusion coefficient |
| 5 | Classification of surface films |
| 6 | Midterm Examination 1 |
| 7 | Electrical double layer |
| 8 | Surface activity and surface active compounds |
| 9 | Properties of surface active compounds |
| 10 | Classification of surface active compounds |
| 11 | Midterm Examination 2 |
| 12 | Types of adsorption |
| 13 | Adsorption isotherms, |
| 14 | Adsorption of gases on solids, |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Aysel Yurt | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502513 | **TITLE** | Surface Active Materials and Their Physical Chemistry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | Gain a background on the solution properties of surface active materials. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Surface Actives, General Properties, Phase Interfaces, classification of surface active materials, capilarity and capilarity factors,surface activity, critical micelle concentration, craft point, Liquid-liquid and liquid-solid interfaces, surface films,superficial properties of solutions, Adsorption thermodynamics,enthalpy, isotherm, isobar, isocor | | | | | | | |
| **COURSE OBJECTIVES** | | | | | At the end of this course the students should be able to, recognize a wide range of surface active materials, describe their solution properties by using some functions such as surface tension and viscosity | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Gain a background on the solution properties of surface active materials. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. An awareness of the necessity of surface activities from the chemistry viewpoint.  2. An awareness of the necessity of surface activities in the Phiysical chemistry.  3. To explain and application of phase equilibria.  4. To explain and application the principles of solution | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture Notes | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Surface Actives |
| 2 | General Properties |
| 3 | Phase Interfaces |
| 4 | Classification of Surface Active Materials |
| 5 | Capilarity and Capilarity Factors |
| 6 | Midterm Examination 1 |
| 7 | Surface Tension and Determination Methods |
| 8 | Surface Tension Relation With Other Physical Properties |
| 9 | Surface Activity |
| 10 | Critical Micelle Concentration |
| 11 | Midterm Examination 2 |
| 12 | Craft Point |
| 13 | Craft Point |
| 14 | Surface Films |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Yrd.Doç.Dr. Arzu PINARBAŞI | **Date:** | 4.5.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502515 | **TITLE** | SEPARATION METHODS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Chemical analysis, classical and instrumental separation methods. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to teach fundamental principles of the classical and instrumental separation methods to students. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will gain to ability to apply classical and instrumental separation methods to students. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To understand basic principles of separation methods  2. To classify analysis methods  3. To apply classical separation methods to different samples.  4. To apply instrumental separation methods to different samples. | | | | | | | |
| **TEXTBOOK** | | | | | Fundamentals of Analytical Chemistry, A. Skoog- M. West, Hold- Saunders, Japan | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. İnstümental Analiz, Turgut GÜNDÜZ, Bilge Yayıncılık, Ankara2. Enstrümantal Analiz İlkeleri, KILIÇ-KÖSEOĞLU-YILMAZ, Bilim Yayıncılık, Ankara | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction, Chemical Analysis, Classification of Separations |
| 2 | Chemical Reactions Using for Separations |
| 3 | Separations with Precipitation |
| 4 | Distillation, Extraction |
| 5 | Ion-exchange |
| 6 | Midterm Examination 1 |
| 7 | Chromatography |
| 8 | Paper Chromatography, Thin Layer Chromatography |
| 9 | Column Chromatography |
| 10 | Gas Chromatography |
| 11 | Midterm Examination 2 |
| 12 | High Pressure Liquid Chromatography |
| 13 | Gas-Liquid Chromatography |
| 14 | Electrogravimetric Separations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | PROF. DR. SİBEL AKAR | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502517 | **TITLE** | Enzymes and Their Industrial Applications |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 3 | | 0 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | No | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition and classification of enzymes, Action of Enzymes, Kinetics of enzymes and mechanism, Regulator enzymes, Industrial enzymes | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to give the information to students about the information of enzymes and their importance in industrial applications. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | By the end of this course, students will be able to obtain detailed information about enzymes and their industrial applications. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Comprehension of the importance of enzymes.  2. Comprehension of the enzyme actions.  3. Analysis of the enzyme kinetic.  4. Evaluation of the enzymes in industrial point. | | | | | | | |
| **TEXTBOOK** | | | | | 1. A. Telefoncu, Enzimoloji, Ege Üniversitesi, İzmir, 1997. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. A. Telefoncu, Biyoteknoloji, Ege Üniversitesi, İzmir, 19952. D.L.Nelson, M.M. Cox, Lehninger Biyokimyanın İlkeleri, Palme yayıncılık, Ankara, 20053. P. C. Champe, R. A. Harvey, Lippincott’s Illustrated reviews serisinden: Biyokimya, Nobel, İstanbul | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition and classification of enzymes |
| 2 | Mechanism and kinetics of enzyme catalysis |
| 3 | The inhibition, control and regulation of enzymatic reactions |
| 4 | Regulator enzymes |
| 5 | Enzyme technology |
| 6 | Midterm Examination 1 |
| 7 | Recombinant enzyme production |
| 8 | Isolation of enzymes |
| 9 | Enzyme purification methods |
| 10 | Industrial enzymes |
| 11 | Midterm Examination 2 |
| 12 | Carbohydrates |
| 13 | Proteases |
| 14 | Lypases |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Tamer AKAR | **Date:** | 27.04.2014 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502518 | **TITLE** | Polymeric Materials in Corrosion |

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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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Corrosion inhibition by surface coating, some application methods | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to inform students about the information of corrosion control with polymeric material. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of this module students will be able to obtaine detailed information about corrosion control with polymeric material. | | | | | | | |
| **TEXTBOOK** | | | | | E. Ghali, “Corrosion Prevention and Protection”, John Wiley & Sons, Limited, United Kingdom Jun 2006. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Ooij Van “Corrosion Control of Metals by Organic Coatings”, CRC Press UK, 2004.2. Peter Zarras , John D. Stenger-Smith, Yen Wei, “Electroactive Polymers for Corrosion Control”, American Chemical Society, 2003.3. Gordon Wallace, “Conductive Electroactive Polymers: Intelligent Materials Systems”, CRC Press, 2003.4. James Racicot, “Investigations of Conductive Polymer Coating for Corrosion Protection of Aluminum Alloys”, Storming Media, US, 1997.5. G. Wranglen, “An Introduction To Corrosion and Protection Of Metals”, Chapman and Hall, NY 1985.6. Zeno W. Wicks, Frank N.Jones, S.Peter Pappas, “Organic Coatings”, Second Ed. Wiley, 19997. J.J. Licari, L.A Hughes, “Handbook of Polymer Coatings for Electronics - Chemistry, Technology and Applications”, William Andrew Publishing/Noyes (2nd Edition), 1990.8. L.L. Sherier, R.A.Jarman, G.T. Burstein, “Corrosion”, 3rd Edt. Butterworth-Heinemann Ltd., Oxford, 1994.9. E. Michael, Lyons, “Electroactive Polymer Electrochemistry”, Plenium Press, NY, 1996.10. M.G. Fontana, Corrosion Engineering, 3rd Edt. McGraw Hill, NY, 1987.11. B.G. Clubley “Chemical Inhibitors for Corrsion Control”, Royal Society of Chemistry, 1990.12. D.L.Piron “The Electrochemistry of Corrosion” NACE International, 2nd Edt. 1994. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Corrosion inhibition by surface coating |
| 2 | Preparation of metal surface before coating |
| 3 | Applications methods, some basic definitions |
| 4 | Metallic coating |
| 5 | Organic coating |
| 6 | Midterm Examination 1 |
| 7 | Polymeric coating |
| 8 | Properties of polymeric coatings |
| 9 | Preparation from monomers |
| 10 | Natural synthetic rubber, other elastomers |
| 11 | Midterm Examination 2 |
| 12 | Recent applications |
| 13 | Recent applications |
| 14 | Recent applications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Evrim HÜR | **Date:** | 29.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502519 | **TITLE** | Selective Topics in Analytical Chemistry II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Electroanalytic methods, chromatographic methods, spectroscopic methods | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To give the ability of analytical methods to students | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Gain the supplement knowledge to basic chemistry, gain ability on research and learn scientific method, apply the content of this course on current subject | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Provides knowledge of chemistry.  2.Will be able to analyze the data.  3.Design and implement experiments.  4.Recognize and solve problems related to the field. | | | | | | | |
| **TEXTBOOK** | | | | | Ç. Ed. SOMER, G. Analitik Kimya, , Gazi Büro Kitabevi, Ankara | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.GÜNDÜZ, T. (1997) Kantitatif Analiz Ders Kitabı, , Bilge Yayıncılık, Ankara2. Harris, D.C. (1994) Analitik Kimya, Çev.Editörü:Güler Somer,Gazi Büro Kitapevi3. Gündüz, T. (1989) Kalitatif Analiz Ders Kitabı, Bilge Yayımcılık4. Skoog, D.A., West, D.M., Holler , F.J. (1996) | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Electroanalytical methods |
| 2 | Voltammetr |
| 3 | Potentiometry |
| 4 | Amperometry |
| 5 | Coulometry and electrogravimetry |
| 6 | Midterm Examination 1 |
| 7 | Chromatographic methods |
| 8 | Gas chromatography |
| 9 | Liquid chromatography |
| 10 | Application |
| 11 | Midterm Examination 2 |
| 12 | Spectroscopic methods |
| 13 | Atomic spectroscopy |
| 14 | Molecular spectroscopy |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc.Prof.Dr.Ebru Birlik Özkütük | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502521 | **TITLE** | CHESMISTRY OF NATURAL COMPOUNDS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Biochemistry I and II must be succeded. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction, Fatty acids and their derivatives, Polyketides, Terpenoids and steroids, Phenols, lignans and flanonoids biosynthesis, Alkaloids. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim is to provide an insight into the biosynhesis of naturally occuring compounds. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Making students to be able to understand the basis of biosynthetic principles for the formation of naturally occuring compounds. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To know the structure of natural products.  2. To differentiate the structure of natural products and name them.  3. To analyze the structure of natural products and classify them.  4. To gain ability to comment on the possible metabolic pathways for the biosynthesis of natural compounds. | | | | | | | |
| **TEXTBOOK** | | | | | John Mann, Chemical Aspects of Biosynthesis, W.H.Freeman Spectrum, Oxford, 1995. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. P. Manitto, Biosynthesis of natural products, Ellis Harwood, Chichester, UK, 1981.2. K. B. G. Torssell, Natural Product Chemistry, Wiley, Chichester, UK, 1983. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | Fatty acids and their derivatives |
| 3 | Fatty acids and their derivatives |
| 4 | Polyketides |
| 5 | Polyketides |
| 6 | Midterm Examination 1 |
| 7 | Terpenoids |
| 8 | Terpenoids |
| 9 | Steroids |
| 10 | Phenols biosynthesis |
| 11 | Midterm Examination 2 |
| 12 | Lignans biosynthesis |
| 13 | Flanonoids biosynthesis |
| 14 | Alkaloids |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Proff. Dr. İsmail KIRAN | **Date:** | 08.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502523 | **TITLE** | Thermal Analysis Techniques |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **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** | | | | | Thermogravimetric analysis (TG) and applications, differential thermal analysis (DTA) and applications, differential scanning calorimetry (DSC) and applications | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Recognize TG, DTG, DTA, DSC thermal analysis methods and various materials, learning of applications to determinate the characteristic properties of the temperature-dependent behavior , gain knowledge and skill on interpretation of outputs of the device | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The students will have advance knowledge about thermal analysis and its applications | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Know the methods of thermal analysis  It will be had information on the interpretation of the thermal curves  Understand how to do calculations on the thermal curves  Learn how to find thermal curves of unknown materials using known material. | | | | | | | |
| **TEXTBOOK** | | | | | Enstrümantal Analiz İlkeleri / Douglas A. Skoog - F. James Holler - Timothy A. Nieman 2007/1.Baskı - | | | | | | | |
| **OTHER REFERENCES** | | | | | Thermal Analysis (T.Hatakeyama, F.X. Quinn-John Wiley&Sons)Handbook of thermal analysis and calorimetry 1, Michael BROWN, South Africa | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The principles and definition of thermal analysis |
| 2 | Thermal analysis methods (TG, DTG, DTA and DSC) and definitions |
| 3 | TG analysis |
| 4 | DTG analysis |
| 5 | DTA analysis |
| 6 | Midterm Examination 1 |
| 7 | DSC analysis |
| 8 | The meaning of TG, DTG, DTA curves and factors affecting curves |
| 9 | Interpretation of thermal analysis curves |
| 10 | Simultaneous TG, DTG and DTA curves and their interpretation |
| 11 | Midterm Examination 2 |
| 12 | Application areas of DSC |
| 13 | DSC curves and its interpretation |
| 14 | The interpretation of thermal analysis curves |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Okan Zafer YEŞİLEL | **Date:** | 04.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502524 | **TITLE** | NMR SPECTROSCOPY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | This will include the determination of characteristic chemical structure of organic compound by 1H- 13C-NMR and two dimensional NMR spectroscopy techniques. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to teach the students the theoreotical information and all the new techniques in NMR spectroscopy. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The student will gain the interpretation skill on industrial field | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To teach the students the theory of NMR spectroscopy, To teach them how to solve NMR problems, To inform them about the new techniques in NMR spectroscopy | | | | | | | |
| **TEXTBOOK** | | | | | 1.Organik Kimyada Spektroskopik Yöntemler; E., Erdik, Gazi Kitabevi Tic. Ltd.Şti ISBN 975-7313-04-1, 2. Baskı, 1998. 2-Nükleer Manyetik Rezonans Spektroskopisi, M. Balcı, Metu Pres, ISBN 975-7064-23- 8, 1. Baskı, 2000. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Modern Nükleer Magnetik Rezonans Spektroskopisi ve Uygulamaları ;K.Yelekçi, Marmara Üniversitesi Yayınları No: 516 ISBN 975-400-064-6, 1991. 2- NMR Spectroscopy, H. Günther, John Wiley & Sons. Inc., Second Edition, ISBN 0471 – 951999- 4, 1995. 3- Basic One- and Two-Dimentional NMR Spectroscopy, H. Friebolin, Wiley-VCH Verlag GmbH, Third Revised Edition, ISBN 3-527-29513-5, 1998. 4- Spectrometric Identification of Organic Compounds, R.M. Sılvertein, F.X. Webster,D.J.Kiemle, John Wiley & Sons Inc., ISBN 0-471-39362-2, Seventh Edition, 2005. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | Spin coupling and spin systems in 1H-NMR spectroscopy |
| 3 | Higher-order 1H-NMR spectra |
| 4 | Becoming simple of complex 1H-NMR spectra |
| 5 | Double resonance, spin tickling |
| 6 | Midterm Examination 1 |
| 7 | 13C-NMR spectrocopy |
| 8 | Two dimensional NMR techniques |
| 9 | INADEQUATE, INEPT, DEPT |
| 10 | J- specroscopy, COSY |
| 11 | Midterm Examination 2 |
| 12 | HETCOR, HMQC |
| 13 | NOE, NOESY, HMBC (COLOC) spectra |
| 14 | NOE, NOESY, HMBC (COLOC) spectra |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assist. Prof. Dr. Murat GÜNDÜZ | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502525 | **TITLE** | STATISTICS FOR ANALYTICAL CHEMISTS-II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Analytical method selection, Method validation, Validation parameters, Calibration methods, Regression and Correlation, Nonparametric methods, Experimental design and optimization, chemometry. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Aim of this course is to gain ability to make analytical method validaton, calibration and regression analysis to student. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will be gained ability to statistically evaluate the analysis methods used in industry and research. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To understand some statistical terms commonly used for analytical chemists.  2. To make experimental design.  3. To classify the design methods,  4. Application of method validation. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Analitik Kimyacılar İçin İstatistik ve Kemometri, J.C. Miller, J.N. Miller (Çev: Ahmet Uyanık), İlke Yayınevi, 5. Baskı, 2008. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. 1. Kantitatif Analiz Ders Kitabı, Turgut Gündüz, Gazi Kitabevi, 7. Baskı, 2003.2. Analitik Kimya Temelleri, Douglas A. Skoog, Donald M. West, F. James Holler (Çeviri Editörleri: Esma Kılıç, Fitnat Köseoğlu), Bilim Yayıncılık, 1. Cilt.3. Kimyacılar İçin İstatistik, Turgut Gündüz, Gazi Kitabevi, 1998. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Analytical method selection, |
| 2 | Method validation, |
| 3 | Validation parameters |
| 4 | Calibration methods |
| 5 | Calibration methods |
| 6 | Midterm Examination 1 |
| 7 | Regression and correlation, |
| 8 | Regression and correlation, |
| 9 | Nonparametric methods, |
| 10 | Nonparametric methods, |
| 11 | Midterm Examination 2 |
| 12 | Experimental design and optimization, |
| 13 | Experimental design and optimization, |
| 14 | Chemometry |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | PROF. DR. SİBEL AKAR | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502528 | **TITLE** | Alternative Power Sources |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | - | - | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The basic concepts of energy and energy terminology, solar energy, biomass energy, biodiesel energy, wind power energy, bio fuels, fuel cells, energy of boron | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to teach basic information and also its application on this subject. By this way, students gain a professional qualification and current researches related to monitoring and interpretation of the scientific method and research skills. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The main aim of the course is to teach basic information and also its application on this subject. By this way, students gain a professional qualification and current researches related to monitoring and interpretation of the scientific method and research skills. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | At the end of course, the student will be able to;  1) defines alternative energy sources.  2) make comments on the application of energy sources.  3) describe and review the advantages and disadvantages.  4) compare alternative energies with other sources. | | | | | | | |
| **TEXTBOOK** | | | | | 1) Alternatif Enerji Kaynakları, M.Acaroğlu, Atlas Yayın Dağıtım, Ankara, 2003.2) Electrochemical technologies for energy storage and conversion. Volume 1, Ru-Shi Liu, Lei Zhang, Xueliang Sun, Hansan Liu, Jiujun Zhang, Weinheim, Germany : Wiley-VCH , 20123) Electrochemical systems, Newman, John S. ; Karen E. Thomas-Alyea, Hoboken, N.J. : J. Wiley , 2004 | | | | | | | |
| **OTHER REFERENCES** | | | | | Electrochemistry,C.M.A.Brett&A.M.O.Brett, Oxford Science Publications, 1993 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The basic concepts of energy and its terminology |
| 2 | Solar energy |
| 3 | Solar energy applications |
| 4 | Biomass energy |
| 5 | Biomass energy heat and power plants |
| 6 | Midterm Examination 1 |
| 7 | Biogas energy |
| 8 | Alternative fuels used in the engine |
| 9 | Wind energy |
| 10 | Biodiesel fuels |
| 11 | Midterm Examination 2 |
| 12 | Fuel cells |
| 13 | Fuel cells |
| 14 | Boron energy |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Aysel Yurt | **Date:** | 27.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502529 | **TITLE** | Surface Pretreatment and Coating Techniques |

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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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Pretreatment of metal surfaces (cleaning vs). Electrolyesis and Faraday's law. Coatings of metal surfaces by galvanostatic, potentiostatic and potentiodynamic methods. Sol-gel coatings. Coatings of metal surfaces with conducting and non-conducting polymers. Coatings of metal surfaces with metal oxides. Current applications. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to inform students about the information of Pretreatment and coatings of metal surfaces. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Gain basic knowledge for technological and industrial applications | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Gain knowledge about  1. Materials coating  2. Surface pretreatment of the materials before coating  3. Basic concepts of electrolysis | | | | | | | |
| **TEXTBOOK** | | | | | Fizikokimya (Yüksel Sarıkaya) | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Techniques and Mechanisms in Electrochemistry, P.A. Christensenand A. Hamnett2. Galvano Teknik( M.Nafiz Maraş)3. Technical Handbook4.Papers and rewievs | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Electrolysis and Faraday's law |
| 2 | Problem solving about Electrolysis and Faraday's law |
| 3 | Pretreatment for metal surfaces (cleaning vs) |
| 4 | Coatings of metal surfaces by galvanostatic methods |
| 5 | Coatings of metal surfaces by potentiostatic methods |
| 6 | Midterm Examination 1 |
| 7 | Coatings of metal surfaces by potentiodynanic methods |
| 8 | Coatings of metal surfaces by sol-gel method |
| 9 | Coatings of metal surfaces with conducting polymers |
| 10 | Coatings of metal surfaces with non-conducting polymers |
| 11 | Midterm Examination 2 |
| 12 | Current applications |
| 13 | Current applications |
| 14 | Current applications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Evrim HÜR | **Date:** | 29.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502612 | **TITLE** | BIOTRANSFORMATION REACTIONS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Biochemistry I and II must be succeded. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction, Hydrolytic reactions, The formation of C-C bonds  Redox reactions, Microbial hydroxylation and related reactions, Biosynthetically-directed biotransformations, The biotransformation of drugs. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To provide an introduction to the subject involving the use of both isolated enzyme systems and whole organisms. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Making students to be able to understand the basis of biotransformations reactions and to use biotechnological processes in the laboratory. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To identifying the biological reaction types.  2. To gain ability to comment on the possible biological reaction mechanisms.  3. To gain ability to choose the right biotechnological tools.  4. To analyz the types of enzym systems to find the best system for industrial aplications and use them. | | | | | | | |
| **TEXTBOOK** | | | | | An Introduction to Biotransformations in Organic Chemistry, James R Hanson, W.H.Freeman Spectrum, Oxford, 1995. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Biyoteknoloji: Temel prensipler ve Uygulamalar, Azmi Telefoncu ve Nurdan Kaşıkara Pazarlıoğlu, Ege Üniversitesi Basımevi, Bornova, İzmir. 2012.2. Biotransformations in Preparative Organic Chemistry, H.G.Davies, R.H.Green, D.R.Kelly and S.M.Roberts, Academic Pres, London, 1989.3. Biotransformation of Non-steroidal Cyclic Compound, K.Kieslich, Georg Thieme, Berlin, 1976. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | Hydrolytic reactions |
| 3 | The formation of C-C bonds |
| 4 | Redox Reactions |
| 5 | Redox Reactions |
| 6 | Midterm Examination 1 |
| 7 | Microbial hydroxylation and related reactions |
| 8 | Microbial hydroxylation and related reactions |
| 9 | Biosynthetically-directed biotransformations |
| 10 | Biosynthetically-directed biotransformations |
| 11 | Midterm Examination 2 |
| 12 | The biotransformation of drugs |
| 13 | The biotransformation of drugs |
| 14 | The biotransformation of drugs |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Proff. Dr. İsmail KIRAN | **Date:** | 08.05.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501511603 | **TITLE** | Radiation Chemistry |

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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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 60 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Interaction of high energy radiation especially  rays by matter, molecular product and radical products produce in radiolysis of water and their reactions with matter, radiation dose units and measurments | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to understand mechanism of interaction of high energy radiation with matter and,usage of high energy radiation in sterilization, polymerisation, and elucidation of reaction mechanism | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | After this course it will be possible to have idea about harmful effects of high energy radiation when used in different purposes and also learn kinds of chemical change to which irradiation can give rise | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To understand interaction of matter and higj energy beam  To know reactions of radicalic species with matter  To know radiation dose units  To understand dose measuring methods | | | | | | | |
| **TEXTBOOK** | | | | | A.J. Swallow, Radiation Chemistry an Introduction, London Chapman, 1974. | | | | | | | |
| **OTHER REFERENCES** | | | | | J. W. T. Spinks, An Introduction to Radiation Chemistry, Third Edition 1990. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Source of radiation |
| 2 | Process taking place during absorption of and  rays in matter (photoelectric effect, Compton scattering, pair production) |
| 3 | Interaction of fast electrons with matter |
| 4 | Interaction of energetic heavy particles with matter |
| 5 | Radiation dose units (rad, roentgen, other units, yield ) |
| 6 | Midterm Examination 1 |
| 7 | Methods of absorbed dose measurement (calorimetry, chemical methods, solid state methods, ionization in gas) |
| 8 | Production of short lived intermediates in activation and ionization and their reactions |
| 9 | Production of radials and molecular products during radiolysis of water by  rays |
| 10 | Yield of radials and molecular products produced during radiolysis of water |
| 11 | Midterm Examination 2 |
| 12 | Polymerization initiated by  ray radiolysis and radiolysis of polymers |
| 13 | Radiolysis of substance s of biological interest (carbonhydrates, amino acids ) |
| 14 | Radiolysis of lipids and proteins |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Gözen BEREKET | **Date:** | 7/5/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | CHARACTERIZATION OF THE BIOSORPTION PROCESS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TÜRKÇE |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 3 | | 0 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | NO | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Possible Biosorbent-pollutant interactions, The form of the pollutants in aquatic madia, Intrumantal characterization of biosorbents, Kinetic modelling of the biosorption process, Isotherm modelling of the biosorption process, Biosorption thermodynamics. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To clarify the effective mechanisms played a role in the biosorption process and to provide information about detailed characterization of biosorbents. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Mechanism in a biotechnological method will be described with chemical approach. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Comprehension of the pollutant-biosorbent interaction.  2. Evaluation of the biosorption mechanism.  3. Detailed analysis of biosorbents.  4. Analysis of the biosorption process. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Kılıç E., Köseoğlu F., Yılmaz H.,1998. Enstrümental Analiz İlkeleri, Bilim Yayıncılık | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Yıldız A., Genç Ö., Bektaş S., 1997, Enstümental Analiz Yöntemleri, Hacettpe Üniv. Yayınları2. Volesky B., 1990, Biosorption of Heavy Metals, CRC press, Boca Raton FL.3. Current SI-SCI expanded papers in the field. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Functional groups in biosorption. |
| 2 | The possible biosorbent-pollutant interactions. |
| 3 | SEM anaysis in biosorption process. |
| 4 | EDX anaysis in biosorption process . |
| 5 | IR anaysis in biosorption process. |
| 6 | Midterm Examination 1 |
| 7 | IR anaysis in biosorption process. |
| 8 | Determination of the isoelectric point of biosorbents. |
| 9 | BET anaysis in biosorption process. |
| 10 | AFM anaysis in biosorption process. |
| 11 | Midterm Examination 2 |
| 12 | Kinetic modelling of biosorption process. |
| 13 | Isotherm modelling of biosorption process. |
| 14 | Biosorption thermodynamics. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Tamer AKAR | **Date:** | 15.04.2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502507 | **TITLE** | PHASE EQUILIBRIA |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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** | | | | | Vapor- Liquid Equilibria, Activity Coefficients, Effect of Temperature on Vapor- Liquid Equilibria, Vapor- Liquid Equilibria at High Pressures, Liquid- Liquid Equilibria, Solubilities of Solids in Liquids, Aqueous Soltions of Electrolytes | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Discussing the concepts of phase equilibria and its basis. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learning phase equilibria of the systems and related phsicochemical properties. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of this module students will be able to:  1.Understand the fundamental aspects of Thermodynamics of Vapor – Liquid Equilibria Understand the fundamental aspects of Thermodynamics of Vapor – Liquid Equilibria  2.Learn the concept of “Activity Coefficients " Learn the concept of “Activity Coefficients “ Learn the concept of “Activity Coefficients “ Learn the concept of “Activity Coefficients “  3.Make calculations on Binary Vapor – Liquid Equilibria Make calculations on Binary Vapor – Liquid Equilibria  4.Know the effects of Temperature and Presure on Binary Vapor – Liquid Equilibria Know the effects of Temperature and Presure on Binary Vapor – Liquid Equilibria  5.Understand the Solubilities of Gases in Liquids Understand the Solubilities of Gases in Liquids  6.Learn the basis of Liquid – Liquid Equilibria Learn the basis of Liquid – Liquid Equilibria  7.Know the Fundamentals of Solubilities of Solids in Liquids Know the Fundamentals of Solubilities of Solids in Liquids  8. Understand the behaviour of Aqueous Solutions of Electrolytes Learn the concept of “Activity Coefficients “ | | | | | | | |
| **TEXTBOOK** | | | | | The Properties of Gases and Liquids ( R.C. Reid, J.M. Prausnitz, B.E.Poling ) | | | | | | | |
| **OTHER REFERENCES** | | | | | Text books of Physical Chemistry | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Vapor- Liquid Equilibria |
| 2 | Vapor- Liquid Equilibria |
| 3 | Activity coefficients |
| 4 | Effect of Temperature on Vapor- Liquid Equilibria |
| 5 | Examples |
| 6 | Midterm Examination 1 |
| 7 | Vapor- Liquid Equilibria at High Pressures |
| 8 | Vapor- Liquid Equilibria at High Pressures |
| 9 | Liquid- Liquid Equilibria |
| 10 | Liquid- Liquid Equilibria |
| 11 | Midterm Examination 2 |
| 12 | Solubilities of Solids in Liquids |
| 13 | Aqueous Soltions of Electrolytes |
| 14 | Examples |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Necmettin CANER | **Date:** | 21/08/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501501513 | **TITLE** | THERMODYNAMICS OF SOLUTIONS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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** | | | | | Thermodynamic Relations, Enthalpy, Internal Energy and Entropy, Mixtures and Solutions, The First Law and the Mixtures, The Adiabatic Saturation Process, Real Mixtures and Solutions, Partial Molar Proı  perties, Change in Poperties upon Mixing, The Ideal Solutions, Activity | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aims of this course are to investigate mixing and solvation by their thermodynamic aspects. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Understanding the basic thermodynamic properties of solutions | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of this module students will be able to:  1.Understand and interpret the behaviours of the solutions by using their thermodynamic properties. Understand and interpret the behaviours of the solutions by using their thermodynamic properties.  2.Know the basis of ideal and non –ideal mixing Know the basis of ideal and non –ideal mixing Know the basis of ideal and non –ideal mixing  3.Learn the Partial Molar Properties of Solutions Learn the Partial Molar Properties of Solutions  4.Understand Changes in Properties upon Mixing Understand Changes in Properties upon Mixing  5. Learn the Thermodynamic Property Relation for Variable Composition Learn the Thermodynamic Property Relation for Variable Composition Learn the Thermodynamic Property Relation for Variable Composition Learn the Thermodynamic Property Relation for Variable Composition Learn the Thermodynamic Property Relation for Variable LearThermodynamic P  6. Know the ideality of Solutions and Activity | | | | | | | |
| **TEXTBOOK** | | | | | Fundamentals of Classical Thermodynamics ( G.V.Wylen, R.Sonntag, C.Borgnakke) | | | | | | | |
| **OTHER REFERENCES** | | | | | Text books of Physical Chemistry | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Thermodynamic Relations |
| 2 | Thermodynamic Relations |
| 3 | Enthalpy, Internal Energy and Entropy |
| 4 | Mixtures and Solutions |
| 5 | Examples |
| 6 | Midterm Examination 1 |
| 7 | The First Law |
| 8 | Adiabatic Processes |
| 9 | Real Mixtures and Solutions |
| 10 | Examples |
| 11 | Midterm Examination 2 |
| 12 | Partial Molar Proıperties, |
| 13 | The Ideal Solutions |
| 14 | Activity |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Necmettin CANER | **Date:** | 21/08/2015 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | CHROMATOGRAPHIC METHODS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | ENGLISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 60 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | NO | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition of chromatography, Chromatography mechanisms, Adsorption Chromatography, Partition Chromatography, Ion exchange Chromatography, Gel permeability Chromatography, Thin layer chromatography, Paper chromatography, Column chromatography, and it will also be provided in a variety of qualitative and quantitative analysis using chromatographic techniques in the laboratory | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach Thin layer chromatography, paper chromatography, column chromatography to students | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Chromatographic methods of separation and purification of components in mixtures will be taught to students. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To comprehend the fundamental mechanisms of chromatographic sepa ration  To comprehend which chromatography to use of Thin layer Chromatography, Paper chromatography, Column Chromatography to separate different mixtures. It will be provided by applied which is more efficient. | | | | | | | |
| **TEXTBOOK** | | | | | Poole, C.F. (2003)The Essence of Chromatograpy(1st ed.) Amsterdam: Elsevier…Skoog, D.A., Holler, F.J. ve Nieman T.A. (1998) Principles of Instrumental Analysis (5th ed.) Philadelphia: Saunders College Pub. (Çev. Editörleri. E. Kılıç, F. Köseoğlu, H. Yılmaz). Entrümental Analiz İlkeleri. Ankara: Bilim Yayıncılık | | | | | | | |
| **OTHER REFERENCES** | | | | | Erdik,E. (1987 ), Denel Organik Kimya, ANKARA, A.Ü.Yayınları | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition and history of chromatography |
| 2 | Classification of chromatography and its mechanisms, adsorption chromatography(mechanism) |
| 3 | Partition chromatography(mechanisms) |
| 4 | Ion exchange and molecular elimination chromatographies(mechanisms) |
| 5 | Paper chromatography |
| 6 | Midterm Examination 1 |
| 7 | Display of the experiments in the laboratory of paper chromatography |
| 8 | Thin layer chromatography |
| 9 | Preparation of materials in a laboratory environment to be used in thin layer chromatography |
| 10 | Display of the experiments in the laboratory of thin layer chromatography |
| 11 | Midterm Examination 2 |
| 12 | Column chromatography |
| 13 | Preparation of materials in a laboratory environment to be used in column chromatography |
| 14 | Display of the experiments in the laboratory of column chromatography |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Yrd. Doç. Dr. Kamuran GÖRGÜN | **Date:** | 06/05/2016 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | SPECTROSCOPIC METHODS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | ENGLISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 2 | | 60 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | NO | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The definition of spectroscopy. UV, IR, NMR and mass spectrometric methods and the granting of the assignment structure. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The definition of spectroscopy. It aims to provides the methods which are UV, IR, NMR | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | It provides to the students to learn the applications of spectroscopic analysis and structure determinaton methods in the the chemistry, drug, and active organic compounds industry and in research | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | UV, IR, NMR and mass spectrometric analysis is achieved with the application of the teaching method using the structure determination | | | | | | | |
| **TEXTBOOK** | | | | | Ender Erdik, Spectroscopic Methods in Organic Chemistry, 2008, Gazi Kitabevi. | | | | | | | |
| **OTHER REFERENCES** | | | | | C. N. Banwell, Fundementals of Molecular Spectroscopy, Mcgraw- Hill Book Company Ltd, 1994Skoog D.A., Holler F.J., Crouch S.R., Principles of Instrumental Analysis, 6th Edition, Brooks Cole 2003. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Spectroscopy |
| 2 | Ultraviolet (UV) and visible spectroscopy |
| 3 | Electronic Transition types |
| 4 | Effect of conjugation |
| 5 | Ultraviolet spectrometer |
| 6 | Midterm Examination 1 |
| 7 | Factors affecting the ultraviolet spectrum |
| 8 | Infrared spectroscopy (IR) |
| 9 | Factors affecting the Infrared spectroscopy (IR) |
| 10 | 1H nuclear magnetic resonance (1H NMR) |
| 11 | Midterm Examination 2 |
| 12 | Coupling constatns of 1H |
| 13 | 13C nuclear magnetic resonance (13C NMR) |
| 14 | Mass Spectrometer |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Yrd. Doç. Dr. Kamuran GÖRGÜN | **Date:** | 06/05/2016 |

**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** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced X-ray Analysis Techniques |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Crystalline solids, Single and powder crystal coordination compounds, Purification methods, Crystal obtaining methods, X-ray diffraction methods, Single crystal structure analysis | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the crystallization techniques in laboratory environment, To teach the X-ray diffraction methods used in structural characterization of crystalline solids, To be able to solve the crystal structures of coordination compounds. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To provide students with information about how to analyze structures of single and powder crystal compounds by X-ray diffraction analysis. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. The students will have knowledge about crystalline solids.  2. The students will be able to comment on the structure of coordination compounds.  3. The students will understand single crystal formation techniques.  4. The students will be determine the three-dimensional structure of the compounds by evaluating the collected data by X-ray single crystal diffraction method. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Modern X-Ray Analysis on Single Crystals: A Practical Guide; Luger Peter, De Gruyter, Berlin, 2013.2. Understanding single-crystal x-ray crystallography; Bennett Dennis Warren, Wiley-VCH, Weinheim, 2010. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Crystal structure analysis: principles and practice; Blake Alexander J., Clegg William, Oxford University Press, Oxford, 2009.2. The basic of crystallography and diffraction; Hammond Christopher, International Union of Crystallography, New York, 2001.3. X Işınları Kristalografisi;Kabak Mehmet, Bıçaklar Kitabevi, Ankara, 2004. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Crystalline solids and their properties |
| 2 | Coordination compounds and their properties |
| 3 | Methods of synthesis of coordination compounds |
| 4 | Crystallization techniques in laboratory |
| 5 | Properties of X-rays |
| 6 | Midterm Examination 1 |
| 7 | X-ray diffraction methods |
| 8 | Introduction of the single crystal and powder X-ray diffraction devices |
| 9 | Introduction of the programs required for single crystal structure solution |
| 10 | Use of Wingx, Shelx, Ortep, Sir, Mercury programs |
| 11 | Midterm Examination 2 |
| 12 | Use of Olex2, Superflip, Encifer, Publcif programs |
| 13 | Structure analysis of single crystal compounds and creation of crystal information file (cif) |
| 14 | Structure analysis of single crystal compounds and creation of crystal information file (cif) |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assist. Prof. Dr. Hakan ERER | **Date:** | 10.11.2017 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Functional 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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | |  |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition of functional polymers and structure of polymer molecules, controlled and advanced polymerization techniques such as anionic polymerization, ATRP synthesis of functional polymers, functionalization methods, initiator techniques, graft and block-graft copolymers, star polymers, branched systems, dendritic polymers | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to teach students the functional polymers and synthesis methods of these polymers. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To contribute to the development of individuals with knowledge about functional polymers. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students  1. Allows to research a subject related to functional polymers.  2. Allows the properties and functions of the polymers to be related to the molecular structure.  3. It enables the functional polymers to carry out ideas about the synthesis methods.  4. It enables to learn and apply controlled polymerization methods. | | | | | | | |
| **TEXTBOOK** | | | | | Prof. Dr. Turgay Seçkin, Polimer Kimyası Fonksiyone Yaklaşım ve Uygulamaları, Seçkin Yayıncılık | | | | | | | |
| **OTHER REFERENCES** | | | | | Pakemoto, K. & Ottenbrite, R.M. & Kamachi, M. (1997). Functional Monomers and Polymers. NY: Marcel Dekker.Polimer Kimyası (M. Saçak, Gazi yayınları | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition of functional polymers and structure of polymer molecules |
| 2 | Synthesis of functional polymers (General methods) |
| 3 | Controlled polymerization reactions, anionic polymerization |
| 4 | Controlled polymerization reactions, Atom Transfer Radical polymerization |
| 5 | ATRP components, ATRP variables |
| 6 | Midterm Examination 1 |
| 7 | Advanced polymerization reactions |
| 8 | Functionalization methods, initiator techniques, graft and block-graft copolymers |
| 9 | Star polymers, branched systems, dendritic polymers |
| 10 | Functional dentrimers and their properties |
| 11 | Midterm Examination 2 |
| 12 | The grafting of highly branched polymer and multi-surface functionalization |
| 13 | Ring opening polymerisation, radicalic, anionic and cationic ring opening polymerisation |
| 14 | Ring opening metathesis polymerization (ROMP) and functional polymers obtained by ROMPx |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Yrd. Doç. Dr. Cansel Tuncer | **Date:** | 10.11.2017 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Coordination Polymers |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Coordination polymers, Synthesis methods of coordination polymers, Characterization methods of coordination polymers, Application areas of coordination polymers. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To give information about the chemistry and application areas of coordination polymers. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To be able to synthesize coordination polymers by various methods and to acquire the ability to characterize their structures by various methods. To gain the ability to develop coordination polymers according to their application areas. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. The students will have knowledge about coordination polymers.  2.The students will have information about the synthesis methods of coordination polymers.  3.The students will understand the characterization methods of coordination polymers.  4.The students will have information about the applications of coordination polymers. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Coordination Polymers: Design, Analysis and Application, Stuart R. Batten, Suzanne M. Neville and David R. Turner, 2009, RSC Publishing.2. Design and Construction of Coordination Polymers, Edited by Mao-Chun Hong and Ling Chen, 2009, John Wiley & Sons, Inc. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Metal-Organic Frameworks, Materials Modeling towards Potential Engineering Applications, Edited by Jianwen Jiang, Pan Stanford Publishing, 2015, Taylor & Francis Group.2. Functional Metal-Organic Frameworks: Gas Storage, Separation and Catalysis, Volume Editor: Martin Schröder, 2010, Springer.3. Topology of interpenetration, Stuart R. Batten, CrystEngComm, 2001, 3, 67-72. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definitions and Terminology |
| 2 | Historical development of coordination polymers |
| 3 | Synthesis methods of coordination polymers |
| 4 | Structural properties of coordination polymers |
| 5 | Characterization methods of coordination polymers |
| 6 | Midterm Examination 1 |
| 7 | Characterization methods of coordination polymers |
| 8 | Topological properties of coordination polymers |
| 9 | Interpenetrated coordination polymers |
| 10 | Porosity and storage of hydrogen (H2), methane (CH4) and carbon dioxide (CO2) in porous coordination polymers |
| 11 | Midterm Examination 2 |
| 12 | Luminescence and chemical sensor applications of coordination polymers |
| 13 | Magnetic properties of coordination polymers |
| 14 | Catalysis applications of coordination polymers |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Hakan ERER | **Date:** | 04.04.2018 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Applications of Metal-Organic Frameworks |

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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 | | | | |  | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Using MOFs in application areas such as gas adsorption / separation, luminescence sensor, catalysis, paint adsorption /degradation, and presentation of the maximum amounts obtained with MOFs in literature. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To have knowledge about various application areas of metal-organic frameworks and to be able to apply them | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain the ability to determine application areas of MOFs in the light of literature for the newly synthesized MOFs in laboratuar. To gain the ability to performing these application areas | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Can interpret the pore properties of metal-organic frameworks  2. Can think about the application area by anlayzing the structure of MOF  3. Can realize various application areas with new MOFs. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Bu, Xian-He, Zaworotko, Michael J., Zhang, Zhenjie, Metal-Organic Framework: From Design to Applications, Springer.2. Leonard R. MacGillivray, Metal-Organic Frameworks: Design and Application, Wiley, ISBN: 978-0-470-19556-7 August 2010 368 Pages. | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Determination of the porosity of MOFs and PLATON analysis |
| 2 | Ways to remove solvent molecules in pores and determination of structure stability in MOFs |
| 3 | The surface areas of MOFs (BET and LANGMUIR) |
| 4 | Carbon Dioxide (CO2) Storage in MOFs |
| 5 | Storage of methane (CH4), hydrogen (H2), acetylene and ethylene in MOFs |
| 6 | Midterm Examination 1 |
| 7 | Selective gas adsorption in MOFs (flue gas = CO2/N2, landfill gas = CO2/CH4) |
| 8 | The detection of votalite organic compounds and metal ions with MOFs |
| 9 | The detection of nitro-aromatic compounds and antibiotic with MOFs |
| 10 | Biomedical applications of MOFs |
| 11 | Midterm Examination 2 |
| 12 | Catalysis applications of MOFs |
| 13 | Applications of dye adsorption/degradation with MOFs |
| 14 | Energy applications of MOFs (cell, supercapacitor) |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Mürsel ARICI | **Date:** | 10.11.2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Special Topics in Biochemistry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Importance of Biochemistry; Microbes, Bugs and Viruses; Stimulants and Their Biological Activity;Natural Perfume Compounds; Biosynthesis of Natural Perfume Compounds; Biotechnological Processes and Their Importance; Environmental Biotechnology and Its Importance; Biodegradation and Its Importance; Fungal Biotransformation Reactions and Their Importance; Compounds Produced by Fungal Biotransformastions; Fungal Biotransformation of Terpenes; Recombinant DNA Technology | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To provide an introduction to biochemistry, its importance and applications in various fields | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Making students to be able to understand the importance of biochemistry, to gain ability about its applications in various fields and to prepare research projects by using this knowledge. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To gain knowledge about biochemistry  2. To gain knowledge about biochemical applications.  3. To gain ability to make comments on biochemical proceses and their applications.  4. To gain ability to be able to carry out scientific research in biochemistry. | | | | | | | |
| **TEXTBOOK** | | | | | Lehninger Biyokimyanın İlkeleri, Y. Murat Elçin (Çev. Editörü), Palme Yayıncılık, Ankara, 2013. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Microbes, Bugs and Wonder Drugs, Balkwill, F. and Rolph, M, 1st Edition, Cambridge University Press, Cambridge, U.K, 1995. 2. Common Fragrance and Flavor Materials, Surburg, H. and Panten, J., Wiley &VCH Verlag, Weinheim, Germany, 2006. 3. Microbial Enzymes and Biotransformations, Barredo, J.L., Humana Pres, New Jersey, USA, 2005. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Importance of Biochemistry |
| 2 | Microbes, Bugs and Viruses |
| 3 | Microbes, Bugs and Viruses |
| 4 | Stimulants and Their Biological Activity |
| 5 | Natural Perfume Compounds |
| 6 | Biosynthesis of Natural Perfume Compounds |
| 7 | Biotechnological Processes and Their Importance |
| 8 | Environmental Biotechnology and Its Importance |
| 9 | Biodegradation and Its Importance |
| 10 | Fungal Biotransformation Reactions and Their Importance |
| 11 | Compounds Produced by Fungal Biotransformastions |
| 12 | Fungal Biotransformation of Terpenes |
| 13 | Fungal Biotransformation of Terpenes |
| 14 | Recombinant DNA Technology |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. İsmail KIRAN | **Date:** | 28.04.2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Electrophilic Cyclization Raactions |

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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 | | | | |  | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | NA | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The aim of this course is provided various aspects of the kinetics and mechanisms of electrophilic cyclization reactions and gained more knowledge of the mechanisms of chemical reactions and learn new generation organic compounds. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Learning electrophilic cyclization and their mechanism for biological applications for the formation of new organic compounds. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Synthesis new organic compounds by using electrophilic cyclization reactions for biological applications. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Synthesis, characterization, applications, evaluation | | | | | | | |
| **TEXTBOOK** | | | | | Advanced Organic Chemistry; Reaction Mechanisms; Reinhard Bruckner; Elsevier, 2002 | | | | | | | |
| **OTHER REFERENCES** | | | | | Reaksiyon Mekanizmaları; Metin Balcı; Türkiya Bilimlar Akademisi Kitapları; 2008.The Investigation of Organic Reactions and Their Mechanisms; Editör: Howard Maskill; Blackwell Publishing Ltd; 2006Organik Reaksiyonlar; Ender Erdik;Gazi Kitapevi; Ekim 2011. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Concepts of Organic Chemistry |
| 2 | Organic İntermediates |
| 3 | Reactive Intermediates |
| 4 | Carbocations |
| 5 | Metal Catalysis |
| 6 | Lewis Asid Catalysis |
| 7 | Cyclization reactions |
| 8 | Introduction of Electrophilic cyclization reactions |
| 9 | Electrophilic cyclization reactions |
| 10 | Synthesis of heteroaromatic compounds |
| 11 | Synthesis of heterocyclic compounds |
| 12 | Iodocyclization reactions |
| 13 | Applications of green chemistry |
| 14 | New generation organic compounds |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Arif KIVRAK | **Date:** | 11.11.2021 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Methods of Enzymatic Analysis |

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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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The importance of enzymatic analysis, principles of enzymatic analysis, basic techniques of enzymatic analysis, determination of enzyme activities, advanced enzymatic methods, sample preparation for enzymatic analysis, improvoment,modification and development of new methods applications of methods of enzymatic analysis. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to give a knowledge of enzymatic analysis principles and applications of enzymatic analysis methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | o gain the ability to use enzymes at industrial level, evaluate, compare and interpret scientific research results, prepare a project and presentation on a subject in the field of enzyme technology. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Please write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | J.V.Passonneau, O.H.Lowry “Enzymatic Anaysis-A Practical Guide” The Humana Press Inc.(1993) | | | | | | | |
| **OTHER REFERENCES** | | | | | H. U. Bergmeyer, “ Methods of Enzymatic Analysis” , VCH Pub, (1984) | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The importance of enzymatic analysis, Principles of enzymatic analysis. |
| 2 | Basic techniques of enzymatic analysis |
| 3 | Determination methods of analyte concentration |
| 4 | Determination methods of analyte concentration |
| 5 | Determination methods of enzme activity |
| 6 | Determination methods of enzme activity |
| 7 | Advanced methods of enzymatic analysis |
| 8 | Mid-term exam |
| 9 | Sample preparation for enzymatic analysis |
| 10 | Improvoment, modification and development of new methods |
| 11 | Applications of methods of enzymatic analysis |
| 12 | Homework presentation |
| 13 | Homework presentation |
| 14 | Homework presentation |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Dr. Özge ÖZŞEN BATUR | **Date:** | 16.11.2021 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Enzyme Technology |

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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 | | | | |  | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction to enzyme technology, structure and functions of enzymes, principles of enzyme catalysis, basics of enzyme kinetics, production and purification of industrial enzymes, industrial applications of enzymes, recent developments in enzyme technology. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is aimed to give the basic concepts and applications of enzyme technology. It is aimed to gain the ability to apply enzymes in related research areas by examining their usability and biochemical aspects. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain the ability to use enzymes at industrial level, evaluate, compare and interpret scientific research results, prepare a project and presentation on a subject in the field of enzyme technology. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To be able to specify and classify enzymes, to determine and evaluate the factors affecting enzyme activity, to gain knowledge and skills about enzyme production and purification. | | | | | | | |
| **TEXTBOOK** | | | | | K. Buchholz, V. Kasche, U.T. Bornscheuer, Biocatalysis and Enzyme Technology, Wiley VCH, 2005. | | | | | | | |
| **OTHER REFERENCES** | | | | | M. Chaplin, C. Bucke, Enzyme Technology, Cambridge University Press 1990.H.A. Kirst, W.K. Yeh, M.J. Zmijewski, Enzyme Technologies for Pharmaceutical and Biotechnological Applications Marcel Dekker 2001A.S. Bommarius, B.R. Riebel, Biocatalysis Wiley VCH, 2004. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to enzyme technology; definition, aims and historical development |
| 2 | Enzymes; introduction to enzymology, structure, classification and naming of enzymes |
| 3 | General characteristics of enzymes, enzyme catalysis, enzyme activity and activity units, factors affecting enzyme activity |
| 4 | Enzyme kinetics; single substrate kinetics, Michaelis Menten equation, Lineweaver Burk diagram, determination of kinetic values |
| 5 | Production and purification of enzymes, selection of enzyme isolation and techniques |
| 6 | Production and purification of enzymes; enzyme sources and the selection of the source |
| 7 | Production and purification of enzymes; Advantages of microbial enzyme production |
| 8 | Production and purification of enzymes; chromatographic methods in enzyme purification, large scale industrial chromatography |
| 9 | Production and purification of enzymes; enzyme formulation |
| 10 | Economic importance of enzymes and general usage areas |
| 11 | Use of enzymes in biotransformations, food, feed, detergent, textile, leather industries and medical field |
| 12 | Enzyme immobilization; immobilization overview, enzyme immobilization methods |
| 13 | Industrial applications of immobilized enzymes |
| 14 | Recent developments in enzyme technology and the future of enzyme technology |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Dr. Öğr. Üyesi Özge ÖZŞEN BATUR | **Date:** | 14.06.2021 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Biochemistry of Fungicidal Action |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Chemical control of deterioration by fungi, Measurement of fungitoxicity, Fungitoxic barriers, Migration of fungicide to sites of action, Reaction of fungicides with cellular constituents, Effects of fungicides on enzymes, Structure-activity relationship, Action of fungus on fungicide | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To provide an introduction about fungicidal action and its biochemical principles | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Making students to be able to understand the basis of fungicidal action and use this knowledge to design fungicide | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To gain knowledge about fungicidal action  2. To gain ability to comment on the possible biological mechanisms of fungicidal action  3. To gain ability to make comments on the fungicidal action on enzymes  4. To gain ability for the design of fungicide | | | | | | | |
| **TEXTBOOK** | | | | | Chemistry of Fungicidal Action, R. J. Lukens, e-book (https://doi.org/10.1007/978-3-662-11311-0) | | | | | | | |
| **OTHER REFERENCES** | | | | | Fungicides, Odile Carisse, e-book (Doi: 10.5772/555), 2010 [eBook (PDF) ISBN: 978-953-51-4540-0] | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Chemical control of deterioration by fungi |
| 2 | Measurement of fungitoxicity |
| 3 | Fungitoxic barriers |
| 4 | Fungitoxic barriers |
| 5 | Migration of fungicide to sites of action |
| 6 | Migration of fungicide to sites of action |
| 7 | Migration of fungicide to sites of action |
| 8 | Reaction of fungicides with cellular constituents |
| 9 | Reaction of fungicides with cellular constituents |
| 10 | Effects of fungicides on enzymes |
| 11 | Effects of fungicides on enzymes |
| 12 | Structure-activity relationship |
| 13 | Action of fungus on fungicide |
| 14 | Action of fungus on fungicide |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. İsmail KIRAN | **Date:** | 28.04.2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Isolation of Natural Products |

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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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The importance of natural products, their application areas, the acquisition of secondary metabolites from natural sources (plant or microbial) and their structure, the production and purification of industrially important and commercial natural substances, semi-synthesis and biotransformation studies from bioactive secondary metabolites, and the formation of advanced chemical pools and to reveal / increase biological effects / reduce toxic effects / predict metabolism products; Optimization, properties and important functions of large scale production of high value added secondary metabolites. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is aimed to have knowledge about the structure, types, isolation from various sources, use of natural products. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Giving information about the structure, isolation and usage of natural products. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. The student learns the chemistry and classification of natural substances.  2. The student will have knowledge about the production and isolation of secondary metabolites from natural sources commercially.  3. The student knows the intended use of natural products used in institutions.  4. The student will have knowledge about optimization of the production of secondary metabolites on a large scale. | | | | | | | |
| **TEXTBOOK** | | | | | Natural Production Isolation, Sarker, Satya D., Springer, 2005. | | | | | | | |
| **OTHER REFERENCES** | | | | | -Bioactive Natural Products: Detection, Isolation, and Structural Determination, Steven M. Colegate, Russell J. Molyneux, CRC press, 2007.-Chemistry of Natural Products, Sujata V. Bhat,B.A. Nagasampagi,Meenakshi Sivakumar, Springer 2005. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | An Introduction to Natural Products |
| 2 | An Introduction to Natural Products |
| 3 | Information about secondary metabolites |
| 4 | Learning about the biological effects of secondary metabolites |
| 5 | Acquisition of secondary metabolites from natural sources (vegetal) and elucidation (isolation) of their structures |
| 6 | Acquisition of secondary metabolites from natural sources (microbial) and elucidation of their structures (isolation) |
| 7 | Information on biotransformation studies of natural products |
| 8 | Information on biotransformation studies of natural products |
| 9 | Production and purification of commercial natural products used in industry |
| 10 | Production and purification of commercial natural products used in industry |
| 11 | Development of methods for isolation of natural products |
| 12 | Development of methods for isolation of natural products |
| 13 | Selection of a suitable methodology of a natural product |
| 14 | Optimization of large scale production of secondary metablites from natural products, their properties and important functions. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Dr. Öğr. Üy. Özge ÖZŞEN BATUR | **Date:** | 10.11.2020 |

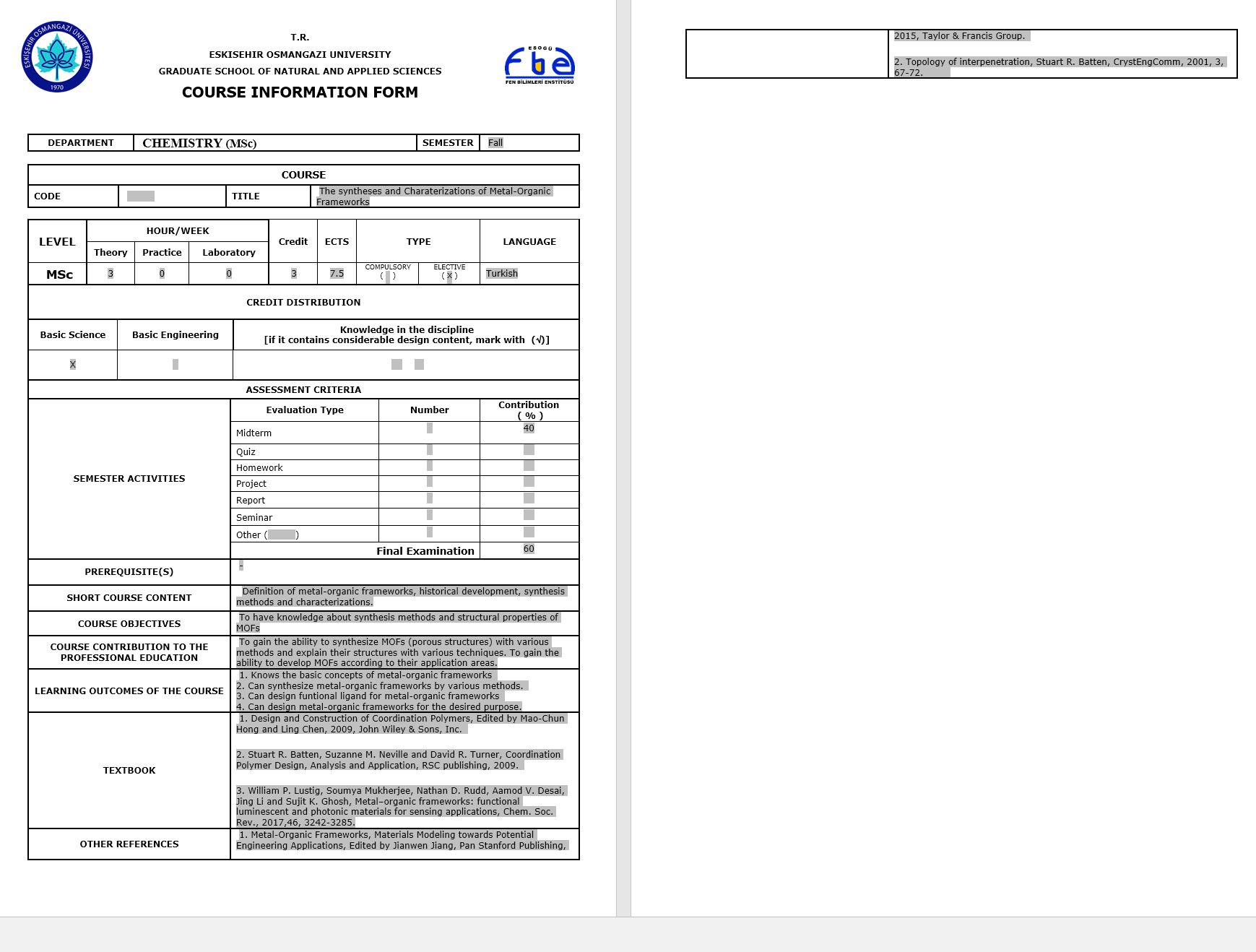
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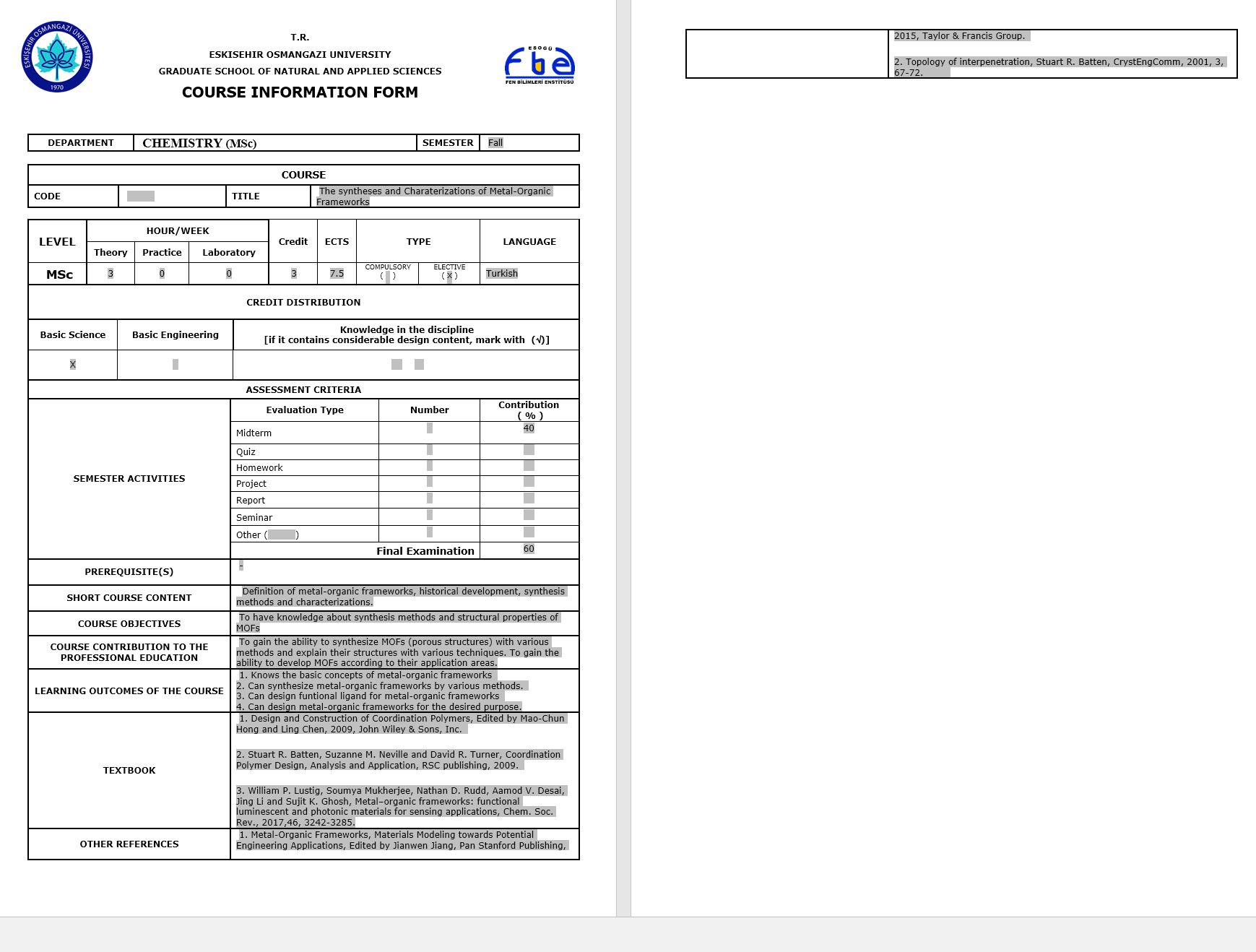
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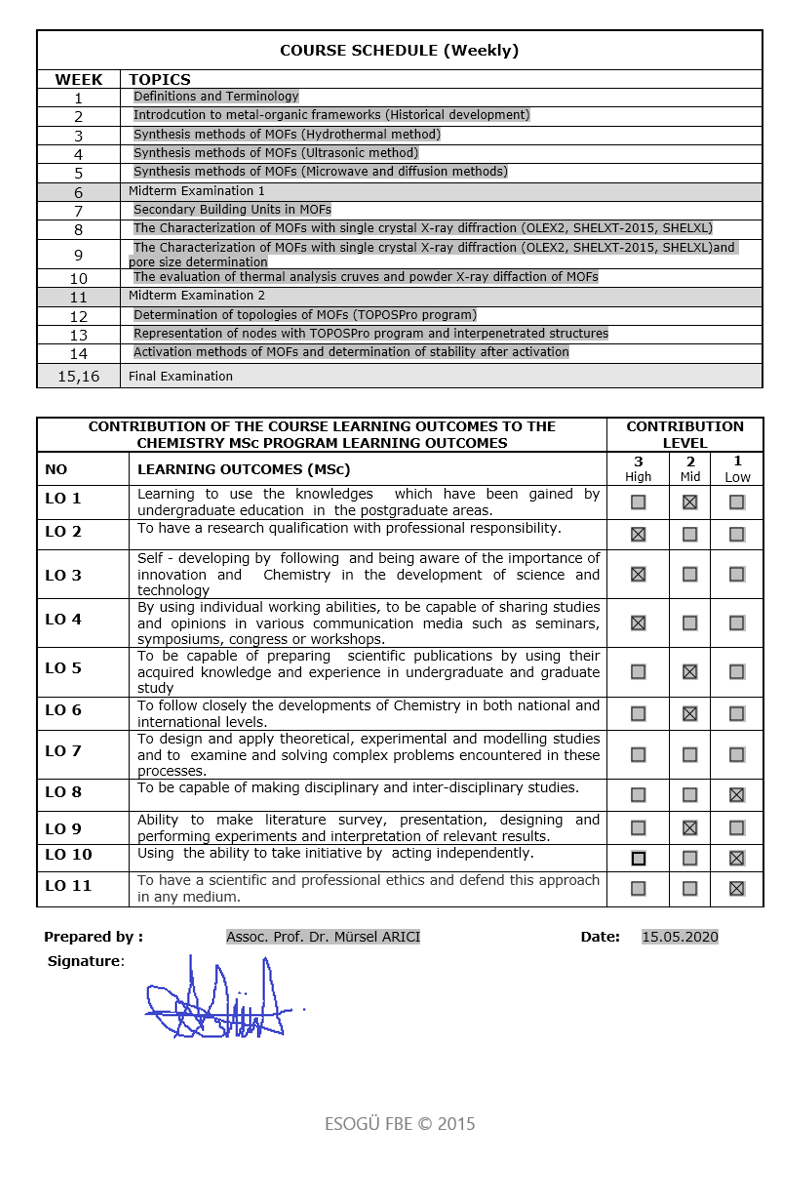
**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**







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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Metals in Biochemistry |

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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 | | | | |  | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Required Metals For Life  Trace Elements  Heavy metals  Effects of Metals on Living Organisms | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To be able to comprehend the functions and effects of metals on living organisims | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To comprehend the importance of some metals in the Periodic Table on metabolism. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To learn the concepts of trace elements and heavy metals.  To be able to comprehend the effects of metals on metabolism. | | | | | | | |
| **TEXTBOOK** | | | | | 1.Bhattacharya, P. K., 2005, Metal Ions in Biochemistry, Alpha Science International Limited, p.217. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Volesky, B., 1990, Biosorption of heavy metals, Florida, CRC press.2. Ası, T., 1995, Tablolarla Biyokimya Cilt:1, Nobel Tıp Kitapevleri, 282s. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction and sources of Metals |
| 2 | Relationship between Metal-Organism |
| 3 | Calsium and magnesium |
| 4 | Sodium and potassium |
| 5 | Trace elements |
| 6 | Iron and zinc |
| 7 | Copper and cobalt |
| 8 | Manganese and molybdenum |
| 9 | Selenium and chromium |
| 10 | Heavy metals |
| 11 | Lead and cadmium |
| 12 | Mercury and arsenic |
| 13 | Nickel, aluminum and tin |
| 14 | Other metals |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Dr. Öğr. Üyesi Sema ÇELİK | **Date:** | 14.06.2021 |

**Signature**:

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Nanochemistry |

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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 | | | | |  | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction to Nanoscience and Nanotechnology, the effects of nanoscale on physical and chemical properties, and production, characterization and applications of nanomaterials. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To investigate the properties and behavior of materials in nanoscale under the light of basic science, to have knowledge about the production, characterization and applications of nanomaterials. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To be able to recognize nanoscale materials that form the basic part of the nanotechnological products which become very common in our daily lives, to have knowledge about their production and characterization methods, and to be able to develop new products by examining their common and unique application areas. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have knowledge about the properties of materials in nanoscale.  2. Can create new application fields for nanoscale materials considering their physical and chemical properties.  3. Can produce and characterize novel nanoscale materials, and develop new application fields for them.  4. Can develop new research and application areas for different nanomaterials with similar properties. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Geoffrey A Ozin, André Arsenault, Nanochemistry: A Chemical Approach to Nanomaterials, Royal Society of Chemistry.2. Murty, B.S., Shankar, P., Raj, B., Rath, B.B., Murday, J., Textbook of Nanoscience and Nanotechnology, Springer. ISBN 978-3-642-28030-6. | | | | | | | |
| **OTHER REFERENCES** | | | | | Şakir Erkoç, Nanobilim ve Nanoteknoloji, ODTÜ Bilim ve Toplum Kitapları Dizisi, ISBN 978-9944-344-28-9. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Nanoscience and Nanotechnology |
| 2 | The effects of nanoscale on pyhsico-chemical properties |
| 3 | Fabrication methods of nanoscale materials |
| 4 | Characterization of Nanomaterials I |
| 5 | Characterization of Nanomaterials II |
| 6 | Properties of Nanomaterials I |
| 7 | Properties of Nanomaterials II |
| 8 | Midterm 1 |
| 9 | Carbon based nanomaterials |
| 10 | Inorganic based nanomaterials |
| 11 | Application areas of nanomaterials I |
| 12 | Application areas of nanomaterials II |
| 13 | Impacts of nanomaterials on health and environmental |
| 14 | Nanoscience and its future applications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Assist. Prof. Recep Yüksel | **Date:** | 17.11.2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Organic materials; Design and Synthesis |

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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 | | | | |  | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | NA | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Recently, the design and synthesis of organic structure used at organic solar cells (OSC) and organic field effect transistors have gained quite importance. Especially, organic materials including strong electron donor groups in their structures are used at organic solar cells and show good performances. In addition, organic materials are used for the formation of conducting polymers, sensors and their different applications. During this courses, organic materials and their applications will be discussed. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Learning new methods for the synthesis of novel organic materials, and improve their knowledge for the design og new generation organic materials. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Increase the organic chemistry practice to synthesis of new materials. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Please write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | Design and Strategy in Organic Synthesis; Stephen Hanessian, Simon Giroux, Bradley L. Merner ; Wiley; 2013. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Advanced Organic Chemistry; Reaction Mechanisms; Reinhard Bruckner; Elsevier, 20022. Design and Strategy in Organic Synthesis; Stephen Hanessian, Simon Giroux, Bradley L. Merner ; Wiley; 20133. Principles of Polymer Design and Synthesis; Su, Wei-Fang; Springer; 2013.4. Organic Photovoltaics: Concepts and Realization; Christoph J. Brabec, Springer; 2004. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic Concepts |
| 2 | Basic concepts of organic reactions |
| 3 | Named organic reactions |
| 4 | Catalysts in Organic Reactions |
| 5 | Designing Organic Materials |
| 6 | Methods for the synthesis of Organic Materials |
| 7 | Basic Concepts in Organic Solar cells |
| 8 | Designing Organic Solar Cells |
| 9 | Functional groups in Organic Solar Cells |
| 10 | Sensors |
| 11 | Organic Sensors |
| 12 | Organic Polymer materials |
| 13 | Application of Organic Materials |
| 14 | Novel organic materials |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Arif KIVRAK | **Date:** | 11.11.2021 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Purification of Biomolecules |

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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 | | | | |  | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction to biomolecules,structures of carbohydrates, lipids, proteins, enzymes and nucleic acids, characteristics of bioseparation and purification techniques and general strategy,purification and characterization of biomolecules | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Developing knowledge and skills about biomolecules and purification methods | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Student knowledge about biomolecules and gain the ability to apply techniques to purification of biomolecules | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | to recognize biomolecules, to apply bioseparation and purification techniques, to purify biomolecules purposefully and illuminate their structure | | | | | | | |
| **TEXTBOOK** | | | | | 1. Chemistry of Biomolecules: An Introduction, Richard J. Simmonds, Royal Society of Chemistry, 1992 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Telefoncu, A., Salkinow, J., Zihnioğlu, F. ve Kılınç, A., Biyokimyada Temel ve Modern Teknikler, Ege Üniversitesi, İzmir, 20002. Lehninger Biyokimyanın temel İlkeleri. Çeviri Editörü: Nedret Kılıç. Ankara:Palme yayıncılık, 2011 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Overview of biomolecules |
| 2 | Carbohydrates |
| 3 | Lipids |
| 4 | Proteins |
| 5 | Enzymes |
| 6 | Characteristics of bioseparation and purification techniques and general strategy |
| 7 | Extraction and pre-separation techniques |
| 8 | Filtration and centrifugation techniques |
| 9 | Chromatographic methods |
| 10 | Spectroscopic applications |
| 11 | Purification and characterization of carbohydrates |
| 12 | Purification and characterization of lipids |
| 13 | Purification and characterization of proteins |
| 14 | Purification and characterization of enzymes |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Dr. Öğr. Üyesi Sema ÇELİK | **Date:** | 17.11.2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502XXX | **TITLE** | Symmetry with a Chemical Approach |

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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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction to symmetry, symmetry operations, point groups, reducible representations and charts, mulliken symbols and symmetries of atomic orbitals, molecular vibrations, symmetry of molecular vibrations (use of symmetry in IR and raman spectroscopy) molecular orbitals and energy diagrams, symmetry in determining polar and chiral molecules and hybrid orbitals , molecular orbital approximation, electronic transitions and selection rules, term level diagrams and ligand field transitions in complexes. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the concepts of symmetry, molecular symmetry. To provide the students with knowledge about the use of character tables obtained by applying group theory to symmetry operations and the applications of group theory in chemistry. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To be able to explain the various properties of molecules by using molecular symmetry. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Explain the terms of symmetry.  2. Uses molecular symmetry in determining molecular geometries.  3. Determine the point groups of molecules.  4. Determining the chiral properties and dipole moments of molecules makes use of group theory.  5. Analysis of raman and infrared spectra using group theory does.  6. Draw molecular orbital diagrams using symmetry. | | | | | | | |
| **TEXTBOOK** | | | | | Ölmez, H., İçbudak, H., (2014), *Kimyasal Yaklaşımla Simetri Ve Grup Teoriye Giriş* , MKM Yayıncılık. | | | | | | | |
| **OTHER REFERENCES** | | | | | Kaya, C., Karakaş, D., Moleküler Simetri, (2010), Palme Yayıncılık. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Symmetry, Symmetry Operations |
| 2 | Point Groups |
| 3 | Matrix Representation of Symmetry Operations |
| 4 | Reducible Notations and Character Tables |
| 5 | Mulliken Symbols and Symmetries of Atomic Orbitals |
| 6 | Symmetry in Identifying Polar and Chiral Molecules |
| 7 | Determining Hybridization Type |
| 8 | Midterm |
| 9 | Huckel Molecular Orbital Approach |
| 10 | Drawing Molecular Orbital Energy Diagrams |
| 11 | Electronic Transitions and Selection Rules |
| 12 | Electronic Transitions and Selection Rules |
| 13 | Term Level Diagrams and Ligand Field Transitions in Complexes |
| 14 | Molecular Vibrations |
| 15 | Symmetry of Molecular Vibrations (IR, Use of Symmetry in Raman Spectroscopy) |
| 16,17 | Semester final exam |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Okan Zafer YEŞİLEL | **Date:** | 17.11.2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Retrosynthesis |

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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 | | | | |  | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction to disconnection technique, single and double groups of disconnection techniques, alcohol, carbonyl, Diels-Alder reactions, rearrangement reactions, 1,3- and 1,5-difunctional compounds, disconnection of cyclic compounds, disconnection of 3, 5 and 6 membered cyclic compounds . | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The synthesis of the target molecule from simple starting materials will be taught using the retrosynthetic analysis method. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | In the synthesis of organic synthesis, will learn synthesis pathways for the molecule to be synthesized. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To analyze the target organic molecule.  To apply the technique of fragmentation.  To synthesize complex molecules from simple molecules.  To evaluate various ways of synthesis. | | | | | | | |
| **TEXTBOOK** | | | | | Designing Organic Syntheses; A Programmed Introduction to the Synthon Approach. Stuart Warren, 1978, Wiley. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Organic Synthesis: The Disconnection Approach, Warren, S. and Wyatt, P. Second edition, 2008, Wiley.2. Workbook for Organic Synthesis, The Disconnection Approach, Warren, S.1982, Wiley.5) Writing Reaction Mechanism in Organic Chemistry, Miller, A. and Solomon P.H. Elsevier 1999, Science & Technology Books. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to disconnections |
| 2 | One-Group C-X Disconnections. |
| 3 | Two-Group C-X Disconnections. |
| 4 | One-Group C-C Disconnections (Alcohols) |
| 5 | One-Group C-C Disconnections (Carbonyl compounds) |
| 6 | Two-Group Disconnections I (Diels-Alder Reactions) |
| 7 | Two-Group Disconnections II (1,3-Difunctionalised Compounds and alpha,beta-unsaturated Carbonyl Compounds) |
| 8 | Two-Group Disconnections III (1,5-Difunctionalised Compounds Michael addition and Robinson annulation) |
| 9 | Two-Group Disconnections IV (1,2-, 1,4-, 1,6- functional compounds)) |
| 10 | Disconnection Strategy of Carbonyl groups |
| 11 | Rearrangements Strategy in Synthesis |
| 12 | Disconnection Strategy of Ring Synthesis |
| 13 | Disconnections of three and five-membered Rings. |
| 14 | Disconnections of six-membered Rings. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
| **LO 10** | Using the ability to take initiative by acting independently. |  |  |  |
| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Doç. Dr. Murat DURAN | **Date:** | 09.09.2020 |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **CHEMISTRY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501502542 | **TITLE** | Chemical Safety |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 0 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( . ) | 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 | | | | | 0 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | NA | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In the Chemical Safety; detail information about chemicals, chemical hazards and toxic substances and labeling of chemicals will be given. International and National standarts for chemical will be discussed by using examples. Within the scope of the course, detailed information about possible risk including hazards chemicals will be explained and displayed during semester. Moreover public healthy and enviromental effects of chemical will be shown. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to learn which safety and security conditions are required in the transportation, storage and use of chemicals in laboratories or production. In addition, it is a course that aims to be aware of the dangers that chemicals may cause and to know how to take precautions accordingly. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Within the scope of the course, they will learn the chemicals which are used in chemical plants, and they will take detailed information about the dangerous chemicals. They will also gain experience for chemicals, and analysis all possible risks. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To be gain knowledge about dangerous chemicals, and its possible risks.  Chemical safety and safety analysis will be learned.  Regulations on the use of chemicals in synthesis and production will be learned.  To be informed about the possible dangers of chemicals for public health and environment. . | | | | | | | |
| **TEXTBOOK** | | | | | Handbook of Chemicals and Safety, T.S.S. Dikshith, Edition1st Edition, First Published2010 | | | | | | | |
| **OTHER REFERENCES** | | | | | • Journal of Chemical Health and Safety • EPA Rules, Regulations and Legislation• OSHA Occupational Exposures to Hazardous Chemicals in Laboratories | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | Classification of Chemicals |
| 3 | Toxic elements and compounds |
| 4 | Transport of hazardous chemicals |
| 5 | Labeling of Hazardous Chemicals |
| 6 | Laboratory Safety |
| 7 | Design of Laboratory |
| 8 | Chemical waste |
| 9 | Chemical Waste Disposal Methods |
| 10 | International Safety Rules |
| 11 | National Safety Rules |
| 12 | Nuclear Threats and Conservation |
| 13 | Chemicals and Public Health |
| 14 | Chemicals and environmental safely |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE CHEMISTRY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Learning to use the knowledges which have been gained by undergraduate education in the postgraduate areas. |  |  |  |
| **LO 2** | To have a research qualification with professional responsibility. |  |  |  |
| **LO 3** | Self - developing by following and being aware of the importance of innovation and Chemistry in the development of science and technology |  |  |  |
| **LO 4** | By using individual working abilities, to be capable of sharing studies and opinions in various communication media such as seminars, symposiums, congress or workshops. |  |  |  |
| **LO 5** | To be capable of preparing scientific publications by using their acquired knowledge and experience in undergraduate and graduate study |  |  |  |
| **LO 6** | To follow closely the developments of Chemistry in both national and international levels. |  |  |  |
| **LO 7** | To design and apply theoretical, experimental and modelling studies and to examine and solving complex problems encountered in these processes. |  |  |  |
| **LO 8** | To be capable of making disciplinary and inter-disciplinary studies. |  |  |  |
| **LO 9** | Ability to make literature survey, presentation, designing and performing experiments and interpretation of relevant results. |  |  |  |
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| **LO 11** | To have a scientific and professional ethics and defend this approach in any medium. |  |  |  |

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| **Prepared by :** | Prof. Dr. Arif KIVRAK | **Date:** | 3.11.2022 |

**Signature**: